

SAES-224 Multistate Research Activity Accomplishments Report DRAFT 6-27-14

Project No. & Title NCERA003 Soil and Landscape Assessment, Function & Interpretation
Period Covered: October 2013 to September 2014
Date of Report: July 31, 2014
Annual Meeting Date: Sunday, June 1 - 2, 2014
Participants: Douglas Malo *SDSU*, , Kenneth R. Olson *UI*, Mickey Ransom *KSU*, Mark Kuzila *UNL*, Phillip Owens *PU*, Brian Slater *OSU*, Randall J. Miles *MU*, C. Lee Burras *ISU*. Jon Hempel *USDA NRCS*, Roy Vick *USDA NRCS*, Michael Jones *USDA NRCS*.

Brief Summary of Minutes of Annual Meeting

NCERA-3 met on June 1 and 2 in Agronomy Hall on the campus of Iowa State University. Ken Olson gave the administrative adviser's report, noting that NCERA-3 has been re-approved. He discussed the value of NCERA-3 work in providing pedological data relevant to Soil Organic Carbon studies coordinated by NC1178. He also identified potential funding opportunities for NCERA-3 through the NRCS Regional Conservation Partnership Program. Roy Vick provided a report on activities in NRCS – Soil Survey Division. The reorganization has largely been effected, and is continuing with regionalization of administrative structure. Budgets remain mostly level, with few support dollars, and less support available for cooperators and partners. There are positions for students/interns, however the process needs to be changed to allow for earlier release of position announcements. Mike Golden retired and Dave Smith is acting Director and Thomas Riensch is Acting Division Director. Jon Hempel (NRCS Liaison) provided a report of activities at the National Soil Survey Center. He emphasized the need for attention to the processes of Soil Taxonomy changes and updates including a more transparent and fluid process with better involvement of partners. NRCS resources in taxonomy are limited with Ken Scheffe being the only taxonomist. That makes the role NCERA-3 and regional subcommittees very important in the update of Soil Taxonomy. Interactions between the NRCS and NCERA-3 and regional subcommittees need to be more regular. Climate Hubs are an important initiative that need to have significant involvement from NCERA-3. Jon anticipates a call for NRCS RFI for soil survey related research. It is likely that deadlines will be short. Most state reported healthy teaching programs and increasing student numbers, together with diminishing faculty numbers and administrative support in most institutions. A need for clearer identification of extension activities in state reports was identified. Mickey Ransom reported on the "Simplified Key to Soil Taxonomy". A second edition of this monograph that may be titled "Illustrated Guide to Soil Taxonomy", will be released online soon. It includes new photographs and definitions of morphological horizons. The issue of state representation in NCERA-3 was discussed. Ken Olson will follow up with a direct invitation to a representative from the University of Wisconsin. The committee discussed possible representatives from Michigan and Minnesota. The next meeting will likely be in conjunction with the 2015 National Soil Survey Conference that is proposed for Duluth MN.

Objectives and Accomplishments

Objective 1: Coordinate activities and set priorities among the universities for the National Cooperative Soil Survey (NCSS), with increasing emphasis on interpretations and data base availability.

This task is one where NCERA-3 universities have consistently had significant accomplishments over the long term. For 2014, eight of the NCERA-3 universities reported updates and/or improvements in their respective state's cooperative soil survey databases and interpretations. Examples of better databases or interpretations include:

- (1) Integrating experiment station pedon descriptions and data into NRCS's national database. In many cases this includes hundreds of pedons.
- (2) Improving yield predictions and/or soil productivity indices for major crops.
- (3) Discovering and/or improving hydrology-morphology relationships.
- (4) Documenting natural and anthropogenic geochemistry of individual series as well as catenas.

- (5) Evaluating novel amendments such as biochar and documenting how they affect pedology and land management.
- (6) Identifying dynamic soil properties as well as their variability across soil map units and regions.
- (7) Documenting the effect on soils of flooding along the Mississippi and Ohio Rivers.

Objective 2: Identify and prioritize common needs for soil and landscape research by Major Land Resource Areas (MLRA) to foster cooperative research projects and minimize duplication, with emphasis on important processes.

Accomplishments tend to be highly state specific with several states reporting strong progress in a particular MLRA on a project jointly identified by the NRCS-MLRA offices and university personnel (e.g., evaluating benchmark catenas as impacted by modern farming practices, benchmark soil characterization and integration of pedon data into the national data base, P loading on soils, prairie to forest transition impacts on soils, developing Digital Soil Mapping Methods (DSM) for soil survey updates).

Objective 3: Priority research in pedology needs to include work at both smaller and larger scales of resolution than obtainable in soil surveys. Focus and pool regional resources in areas, such as wetland delineations.

Accomplishments in this area tend to be highly state specific only a few states reporting direct research that examines scale accuracy and/or precision (e.g., suitability of soil survey data/maps for salinity and drainage risk assessment and management decisions).

Objective 4: Develop the scientific foundation or databases needed for soil and landscape assessment and interpretations.

This is analogous to objective 1 in that each university has a strong history and continuing mandate to improve the science behind soil assessment and interpretations. Not surprisingly some states focused more on the science of soil as a cropping media (e.g., use of Digital Soil Mapping, DSM, methods for soil attribute prediction, effects of land use and management on soil carbon stocks) while other states reported more on soils as a component of the water cycle (e.g., evaluation of soil moisture sensors for monitoring hydrology and controlling wastewater application within onsite systems, site and soil evaluation methods and designs for onsite wastewater treatment). Yet other states focused more on the impacts of soil management and use (e.g., impacts of biochar and waste water additions on soil health, long-term tillage impacts on soil properties and crop yields).

Objective 5: Engage in research, education, and outreach activities regarding key soil processes and functions.

This is an area of excellence for the NCERA-3 universities. Each state reported noteworthy research, exceptional teaching of pedology and related areas including soil judging and meaningful outreach. Example successes include many refereed publications (see list below), thousands of student credit hours in soil science (all of the universities, see list below), and – in most states - one or more extension publication related to pedology.

Objective 6: Initiate and/or strengthen partnerships with ancillary disciplines and sciences to inform users and the general public about the importance of the soil resource and its synergisms with water and living organisms.

Accomplishments in Task 6 mirror those of Task 5 with the most significant challenge being growing demand in traditional partnerships coupled with decreasing university personnel makes it increasingly

difficult for NCERA-3 faculty to engage new segments of the public. Overall, though Task 6 is one of successful accomplishments (e.g., data driven agriculture for the smart-farm).

Impacts

The NCERA-3 universities continue to excel in pedology even as they have experienced reductions in faculty numbers and internal and external funding for research and extension. They continue to graduate students well qualified to work in soil survey and to make soil interpretations (see list of classes and number of students taught below). NCERA-3 faculty continue to engage users of soil information across the agricultural, environmental, and scientific sectors. They continue to publish meaningful research. During the last reporting period faculty published 41 peer reviewed paper, book chapters, and extension publications (see publication list below).

Peer Reviewed Articles 2013

1. Chintala, R., D. E. Clay, T.E. Schumacher, D.D. Malo, and J.L. Julson. 2013. Optimization of Oxygen parameters for analyzing carbon and nitrogen in biochar materials. *Analytical Letters* 46(3):532-538.
2. Chintala, R., J. Mollinedo, T.E. Schumacher, D.D. Malo, and J.L. Julson. 2013. Effect of Biochar on Chemical Properties of Acidic Soil. *Archives of Agronomy and Soil Science*. DOI:10.1080/03650340.2013.789870.
3. Ibrahim, M. and C.L. Burras. 2013. Distribution and origin of argillic horizons across Iowa – A novel hypothesis. *Soil Sci. Soc. Am. J.* 77:580-590. doi: 10.2136/sssaj2012.0044.
4. Morton, L.W. and K.R. Olson. 2013. Birds Point – New Madrid Floodway: Redesign, Reconstruction and Restoration. *J. Soil Water Conservation* 68: 35A-40A.
5. Olson, K.R., A. N. Gennadiyev, A. P. Zhidkin, M. V. Markelov, V.N. Golosov and J. M. Lang. 2013. Magnetic tracer methods to determine cropland erosion rates. *Catena*. 104:103-110.
6. Olson, K.R. and L W Morton. 2013. Restoration of 2011 Flood Damaged Birds Point– New Madrid Floodway. *J. Soil Water Conservation* 68: 13A-18A.
7. Olson, K.R. 2013. Soil organic carbon sequestration in U.S. cropland: Protocol development.
8. *Geoderma* 195-196: 201-206.
9. Olson, K.R., S.A. Ebelhar and J.M. Lang. 2013. Effects of 24 years of tillage on SOC and crop productivity. Special edition. *Soil Management for Sustainable Agriculture 2013*. *Applied and Environmental Soil Science* 2013 (1):1-10. <http://dx.doi.org/10.1155/2013/617504>
10. Olson, K.R. A. N. Gennadiyev, R. G. Kovach and J. M. Lang. 2013. The use of fly ash to determine the extent of sediment transport on nearly level western Illinois landscapes.

11. Soil Science 178 (1): 24-28.
12. Olson, K.R. and L W Morton. 2013. Impacts of 2011 Len Small levee breach on private and public lands. J. Soil Water Conservation.68 (4): 89A-95A. .
13. Olson, K.R. and L W Morton. 2013. Soil and Crop Damages as a result of Levee Breaches on Ohio and Mississippi Rivers. Journal of Earth Sciences and Engineering 3 (3): 1-20.
14. Veum, K.S., K.W. Goyne, R.J. Kremer, R.J. Miles, and K.A. Sudduth. 2013. Biological indicators of soil quality and soil organic matter characteristics in an agricultural management continuum. Biogeochemistry DOI 10.1007/s10533-013-9868-7. Published online 01 June 2013.

Books and Peer-Reviewed Book Chapters 2013

1. Burras, C.L., M. Nyasmi and L. Michael Butler. 2013. Ch. 10. Soils, human wealth and health – a complicated relationship. In: E.C. Brevik & L.C. Burgess (Editors). Soils and Human Health. CRC Press/Taylor & Francis. p. 215-226.
2. Malo, D. 2013. Identifying Potential Iron Chlorosis Soils for Soybean Production. In Clay, D.E., C.G. Carlson, S.A. Clay, L. Wagner, D. Deneke, and C. Hay (eds). iGrow Soybean: Best Management Practices for Soybean Production. South Dakota State University, SDSU Extension, Brookings, SD

Outreach and Extension publications 2013

1. Burras, C.L., Y. Chendev, M. Ibrahim, B. Larabee and T. Sauer. 2013 Human-induced soil change in Iowa: Two contrasting examples.. Getting into Soil & Water 2013. Iowa Water Center & Soil & Water Conservation Club, Iowa State University, p. 18-21.

Extension Programs, Workshops, and Activities 2013

2. Burras, L. May 22, 2013. Implentation of CSR2 at Iowa State University. 86th Annual Soil Management & Land Valuation Conference, Iowa State University.
3. Burras, C. L., May 02, 2013. CSR2 – An updated method to calculate corn suitability ratings for Iowa soils. Iowa Real Estate Commission, Ankeny.
4. Burras, C.L. April 08, 2013. The Soils of Iowa – How should we think about them? Soil & Water Conservation Club, Iowa State University.
5. Burras, C.L. April 04, 2013. Soils – An introduction for gardeners. Iowa Federated Gardens Club, Iowa Arborteam, Luther. (Includes a 20 question examination).
6. Burras, C.L. March 12, 2013. CSR2 – Iowa’s new corn suitability rating. McGuire Auction Co., Inc. Customer Appreciation Day, Holstein.

7. Burras, C.L. February 18, 2013. CSR2 – Iowa’s new corn suitability rating. Iowa Corn Crop Fair, Missouri Valley.
8. Burras, L. February 13, 2013. Iowa’s soils – origins, properties and productivity. Soil Fertility & Nutrient Management Short Course, Iowa State University Agribusiness Extension Education Program.
9. Burras, C.L. January 29, 2013. CSR2 – Iowa’s new corn suitability rating. Crop Advantage Series, Iowa State University Extension, Le Mars.
10. Burras, L. January 29, 2013. Soils – Master Gardener Training. Master Gardener Fall Lecture Series, Extension Building, Haber Road.
11. Burras, C.L. January 25, 2013. CSR2 – Iowa’s new corn suitability rating. Western Iowa No-Till Workshop, Walnut.
12. Burras, C.L. January 24, 2013. CSR2 – Iowa’s new corn suitability rating. Crop Advantage Series, Iowa State University Extension, Waterloo.
13. Burras, C.L. January 22, 2013. CSR2 – Iowa’s new corn suitability rating. Crop Advantage Series, Iowa State University Extension, Carroll.
14. Burras, C.L. January 21, 2013. CSR2 – Iowa’s new corn suitability rating. North Central Iowa Crop & Land Stewardship Clinic, Iowa Falls.
15. Burras, C.L. January 09, 2013. CSR2 – Iowa’s new corn suitability rating. Crop Advantage Series, Iowa State University Extension, Okoboji.
16. Burras, C.L. January 03, 2013. CSR2 – Iowa’s new corn suitability rating. Crop Advantage Series, Iowa State University Extension, Sheldon.
17. Decentralized Wastewater Treatment (CIDWT), March 2013. Consortium of Institutes for 2 day national train-the-trainer program, Nashville, TN,
18. NOWRA 2-day Installers Academy in New Jersey, May 2013
19. Flooding of Agricultural Lands. January and February 2013. Crop Management Conferences. Malta, IL, Champaign, IL, Springfield, IL, and Mt. Vernon, IL.
20. Basic Soil Morphology Training and Regional Onsite Soil Evaluation Workshops (2009-2013). Kentucky State Department of Health.
21. Soil pit stop; Importance of soils and soil properties. (2009-2013). Kansas Elementary School/Kids Field Day.
22. Soils and Onsite Wastewater Systems; Aeration Treatment Units; Media Filters; Effluent Distribution in Soils; Fundamentals of Drip Dispersal; Hydraulics and Onsite Wastewater

Systems; Operations and Maintenance; High Strength Waste; Selling the Onsite System to the Customer. (2009-2013) Missouri SmallFlows Organization.

23. Inspection and Evaluation of Onsite Wastewater Systems at Time of Sale, (2009-2013). Missouri Department of Health and Senior Services. Basic Soils; Media Filters; Drip Dispersal; Aeration Treatment Units; High Strength Waste; Soil and Site Installation Fundamentals. Iowa Onsite Wastewater Training Center. (2009-2013)
24. Soils and dispersal and treatment of wastewater in decentralized wastewater systems. (2009-2013). Northern Illinois, Central Illinois, Iowa, Kansas, Indiana, Kentucky; Tennessee, and Minnesota wastewater meetings

Teaching (2009-2013)

Course, Credit Hours, and Number of Students

Advanced Soil Genesis and Classification, 2-3 credits, 12 students
Advanced Soil Genesis, 3 credits, 22 students
Advanced Soil Genesis, Chungnam National University, South Korea, 3 credits, 22 students
Advanced Soil Judging, 1 credit, 15 students
Clay Mineralogy, 3 credits, 19 students
Earth's Natural Resources Systems, 3 credits, 32 students
Environmental Soil Management, 3 credits, 28 students
Environmental Soil Science, 3 credits, 60 Students
Field Experience: Interpretation of field soils, 2 credits, 11 students
Field Studies in Pedology, 2 credits, 5 students
Genesis of Soil Landscapes, 4 credits, 72 students
Great Plains Field Pedology, 4 credits, 45 students
Integrated Natural Resource Management, 3 credits, 259 students
Introduction to Soil Science, 3-4 credits, **1786 students**
Pedology, 3 credits, 14 students
Puerto Rico Soil and Land use Field Course, 2 credits, 7 students
Rural Real Estate Appraisal, 3 credits, 106 students
Soil and Water Conservation and Management, 3 credits, 197 students
Soil Evaluation, 1 credit, 52 students
Soil Formation and Transformations, 3 credits, 7 students
Soil Formation and Landscapes, 4 credits, 43 students
Soil Genesis and Classification, 3 credits, 65 students
Soil Genesis and Survey, 4 credits, 118 students
Soil Geography and Land Use, 3 credits, 120 students
Soil Mineralogy, 4 credits, 35 students
Soil Morphology, 3 credits, 26 students
Soil Profile Descriptions, 1 credit, 60 Students
Soils and Environmental Quality, 3 credits, 110 students
Soils Judging, 0 to 3 credits, 253 students
Watershed Hydrology, 4 credits, 7 students
Wetland Delineation, 3 credits, 31 students