SAES-224 Multistate Research Activity Accomplishments Report

Project Number and Title	NCERA003 Soil and Landscape Assessment, Function and Interpretation
Period Covered	October 2015-September 2017
Date of Report	February 10 2018
Annual Meeting Date	July 12, 2016, DeKalb County Farm Bureau, Sycamore, Ill.
Participants	Mickey Ransom, Kansas State Univ., Brian Slater, Ohio State Univ., Douglas Malo, South Dakota State Univ., Kevin McSweeney, Univ. of Illinois, Lee Burras, Iowa State Univ., David Lindbo, NRCS, Curtis Monger, NRCS, David Hoover, NRCS, Cathy Seybold, NRCS, Henry Ferguson, NRCS

Summary of Annual Meeting Minutes

NCERA-3 met prior to the North Central Soil Survey Conference at the DeKalb County Farm Bureau in Sycamore Illinois on July 12, 2016. Mickey Ransom provided an Administrative Adviser's report, noting that Ken Olson had retired from the position. NCERA-3 was selected as the regional winner of the 2016 Excellence in Multistate Research Award. Ken Olson and Jerry Miller drafted the award nomination at the regional level. Our committee was also nominated for the National Award; Jeff Jacobsen edited and assisted with the nomination, though we were not successful at the National level.

The membership of the committee was discussed. Due to retirements and changes at a number of Universities (e.g. Nebraska, Purdue, Wisconsin, Minnesota), it was clear that a new effort was needed to grow the membership and to involve new faculty members as positions are filled. Current members agreed to discuss NCERA-3 with colleagues including Alfred Hartemink (Wisconsin), Nick Jelinski (Minnesota), Randy Schaetzl (Michigan State), Mike Konen (Northern Illinois) and others.

In the context of high profile, real world applications of soil survey information that illustrate the value of the NCSS, various methods used for crop yield and productivity estimation in various States were discussed. It was agreed that more realistic yield estimates are needed, and that yield data needed to be populated in databases more consistently.

Kevin McSweeney led a discussion of potential regional field-based instructional experiences. Field experiences are currently limited, and recent efforts (e.g. by a SSSA committee) to develop these in our region have not been successful. Some examples exist from other regions, e.g. North Carolina, California. Local experience with study abroad programs (e.g. Iceland, Costa Rica) are evidence of the value of intensive multi-day field experiences. However, cost and effort required are major impediments that could be reduced with a regional cooperative approach. It was agreed that a survey could be used to gauge interest and ideas to be discussed at future NCERA-e meetings.

Dave Hoover provided a report on the National Soil Survey Center, and the NCSS. Comments were welcomed on the draft National Cooperative Soil Survey Strategic Plan. Major new directions relevant to the NCSS include: updating using DSM techniques, Ecological Units, Soil Health, Soil Biology, urban soil mapping, and major updates to Soil Taxonomy. Potential vacancies to be filled with a short application period would include the Director of the NSSC and the World Soil Resources Leader.

The possibility of a future joint meeting with our counterparts in the west was discussed.

Accomplishments

NCERA-3 members throughout the region are active in providing academic support for the National Cooperative Soil Survey Program, and advancing the science of functioning soil landscapes. Activities include research projects, teaching and mentoring of undergraduate and graduate students, and extension and outreach to a wide range or stakeholders, in addition to general support for ongoing soil survey activities in each state.

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.

NCERA-3 university cooperators continue to provide a significant role in coordination and planning of ongoing soil survey activities, mostly directed towards improvement and updates of accessible soil survey information in National databases. Updated information includes improvements to information about soil properties and interpretations important for land use and management decisions.

Examples of major accomplishments reported in 2016 include:

(1) Continued integration of experiment station and university laboratory pedon descriptions and soil property data into NRCS's national database.
(2) Updating and improving yield predictions and/or soil productivity indices for major crops in a number of States. These data are critical to management decisions and even taxation decisions in some states.
3) Measuring soil dynamic properties and gaining understanding of soil change under a variety of management scenarios.
(4) Development of new technologies for soil mapping (Digital Soil Mapping), soil morphology (Digital Soil Morphometrics), and Classification.
(5) Extending soil survey to urban and other highly managemed or disturbed environments.
(6) Evaluation of amendments such as biochar and gypsum as well as waste products and documenting how they affect pedology and land management.
(7) Contributions to the assessment of soil quality and soil health.

(8) Development of new techniques to measure soil change, across multiple scales from new remote sensing technologies for measuring tillage intensity to micromorphological analyses for measuring erosion impacts.

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.

University, NRCS and other cooperating agencies are working together in a number of states to develop better understanding of specific soil-landscape relationships to improve and update soil surveys. These projects include efforts to characterize benchmark soils and catenas, contributions to research on nutrient loading and development of calibrated P-indices, and Digital Soil Mapping. In a major education-focused project, state wide maps of a variety of soil features such as soil parent materials have been produced for a number of states in the east of the region and integrated into an online and tablet system for field use by students and others.

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 have continued to be highly state specific with 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, precision agriculture, and development of Soil Systems maps at broad scale).

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

Projects in all states aim to continue to improve the science behind soil assessment and interpretations. Continuing projects include new developments in Digital Soil Mapping, methods for more rapid and accurate soil attribute prediction, effects of land use and management on soil carbon stocks, evaluation of soil moisture sensors for monitoring hydrology and controlling wastewater application within onsite systems, effects of soil amendments on soil health, tillage impacts on soil properties such as soil compaction and on crop yields and product quality.

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

NCERA-3 members and universities continue to provide quality educational programs at undergraduate level. Each state reported noteworthy research, exceptional teaching of pedology and related areas including soil judging and meaningful outreach programs. Example successes include many refereed publications (see list below), thousands of student credit hours in soil science extension publication related to pedology.

In addition, members provided a wide range of services to new stakeholders and clients locally, regionally, nationally and internationally.

One notable example was the hosting of the 2016 National Soil Judging Contest at Kansas State University.

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.

NCERA-3 members continue to work with a broad range of other disciplines to enhance access to high quality information about the soil resource, and to help the public understand the value of the soil resource and to avail the valuable tools for aiding responsible decisions about natural resource management.

Publications

Peer reviewed

Veenstra, J.J. and C.L. Burras. 2015. Soil profile transformation after 50 years of agricultural land use. Soil Sci. Soc. Am. J. 79:1154-1162. Available at: https://dl.sciencesocieties.org/publications/sssaj/abstracts/79/4/1154doi:10.2136/sssaj2015.01.0027 . Reviewed September 13, 2015.

Ibrahim, M., E.A. Elnaka, C.L. Burras. 2015. Clay upward movement in sand columns under partially saturated conditions. Soil Sci. Soc. Am. J. 79:896-902. Available at: http://dx.doi.org/10.2136/sssaj2015.01.0005 . Doi:10.2136/sssaj2015.01.0005. Reviewed April 28, 2015.

Chendev, Y.G., T.J. Sauer, G. Hernandez Ramirez and C.L. Burras. 2015. History of East European Chernozem soil degradation: Protection and restoration by tree windbreaks in the Russian steppe. Sustainability 7:705-724. doi:10.3390/su7010705.

Chendev, Y.G., T.J. Sauer, A.N. Gennadiev, L.L. Novykh, A.N. Petin, V.I. Petina, E.A. Zazdravnykh and C. L. Burras. 2015. Accumulation of organic carbon in Chernozems (Mollisols) under shelterbelts in Russia and the United States. Eurasian Soil Sci. 48:43-53.

Papanicolaou, A.N., M. Elhakeem, C.G. Wilson, C.L. Burras, L.T. West, H. Lin, B. Clark and B.E. Oneal. 2015. Spatial variability of saturated hydraulic conductivity at the hillslope scale: Understanding the role of land management and erosional effect. Geoderma 233-234: 56-68. doi:10.1016/j.geoderma.2014.12.010.

Miller, B.A. and C.L. Burras. 2015. Comparison of surficial geology maps based on soil survey and in-depth geological survey. Soil Horizons 56: doi:10.2136/sh14-05-0005 .

Brevik, E.C., A. Baumgarten, C. Calzolari, A. Jordan, C. Kabala, B.A. Miller and P. Pereira. 2016. Editorial: Historical perspectives and future needs in soil mapping, classification and pedologic modeling. Geoderma 264:253-255.

Brevik, E.C., C. Calzolari, B.A. Miller, P. Pereira, C. Kabala, A. Baumgarten, and A. Jordán. Soil mapping, classification, and pedologic modeling: History and future directions. Geoderma 264:256-274. doi: 10.1016/j.geoderma.2015.05.017.

Brevik, E.C., J.A. Homburg, B.A. Miller, T.E. Fenton, J.A. Doolittle, and S.J.Indorante. 2016. Selected highlights in American soil science history from the 1980s to the mid-2010s. Catena 146:128-146.

Chendev, Y.G., J.A. Hubbart, E.A. Terekhin, A.R. Lupo, T.J. Sauer and C.L. Burras. 2016. Recent afforestation in the Iowa River and Vorskla River Basins: A comparative Trends Analysis. Forests 7:278 doi:10.3390/f7110278 21 p. (available at http://www.mdpi.com/1999-4907/7/11/278/htm , reviewed November 20, 2016).

Miller, B.A., S. Koszinski, W. Hierold, H. Rogasik, B. Schröder, K. Van Oost, M. Wehrhan, and M. Sommer. Towards mapping soil carbon landscapes: issues of sampling scale and transferability. Soil and Tillage Research 156:194-208. doi: 10.1016/j.still.2015.07.004.

Miller, B.A. and R.J. Schaetzl. History of soil geography in the context of scale. Geoderma 264:284-300. doi: 10.1016/j.geoderma.2015.08.041.

Van Meter, K.J., N.B. Basu, J.J. Veenstra and C.L. Burras. 2016. The nitrogen legacy: Emerging evidence of nitrogen accumulation in anthropogenic landscapes. Env. Res. Letters 11: 1-12. DOI:10.1088/1748-9326/11/3/035014. (available at http://iopscience.iop.org/article/10.1088/1748-9326/11/3/035014 , reviewed March 21, 2016).

Jyoti , V., B. Saini-Eidukat, D. Hopkins, and T. M. DeSutter. 2015. Naturally elevated metal contents of soils in northeastern North Dakota, USA, with a focus on cadmium. J. of Soils and Sediments. 15(7): 1571-1583.

Sonmez, N.K. and Slater, B.K. 2016. Measuring intensity of tillage and plant residue cover using remote sensing. European Journal of Remote Sensing 49:121-135.

Massawe, B.H.J., S.K. Subburayalu, A.K. Kaaya, L. Winowiecki, and B.K. Slater (2017) Mapping numerically classified soil taxa in Kilombero Valley, Tanzania using machine learning. Geoderma 311, 143-148. doi: 10.1016/j.geoderma.2016.11.0200016-7061

Tirado-Corbalá, R., B.K. Slater, W.A. Dick, and D. Barker (2017) Alfalfa Responses to Gypsum Application Measured Using Undisturbed Soil Columns. Plants 6, 29; doi:10.3390/plants6030029.

Chapters

Burras, C.L. 2016. Soils and their effective management – a pedologist's perspective, Part 1: General ideas. Soil Fertility and Nutrient Management Shortcourse Notebook. 4 pages.

Burras, C.L. 2016. Soils and their effective management – a pedologist's perspective, Part 2: Iowa and the soils of Iowa. Soil Fertility and Nutrient Management Shortcourse Notebook. 6 pages.

Schaetzl, R.J. and B.A. Miller. 2016. Use of soil maps and surveys to interpret soil-landform assemblages and soil-landscape evolution. Ch. 15. p. 251-264. In: J.A. Zinck, G. Metternicth, G. Bocco, H.F. Del Valle (Eds.) Geopedology – An integration of geomorphology and pedology for soil and landscape studies.