LAND CORE

Advancing soil health policies & programs
that create value for farmers, businesses,
and communities.

July 15, 2019

Implementation Recommendations for USDA-NRCS Conservation Innovation Grants
Re: On-Farm Conservation Innovation Trials (OFT)

Attn: Kari Cohen

First and foremost, our sincere thanks to the agency for prioritizing On-Farm Conservation Innovation Trials and soil health outcomes verification, during the busy Farm Bill implementation period.

We appreciate The Recommended Soil Health Indicators and Associated Laboratory Procedures - Soil Health Technical Note No. 450-03, and acknowledge this document as an excellent starting point for outcomes verification.

However, in our continued work across a multitude of stakeholder groups, we have identified several key recommendations regarding *how best to collect and analyze* data for soil health outcomes verification.

These recommendations will further establish a standardized and replicable format for all soil health data collection to be consistent and interoperable. We deem these suggestions critical, not only to the OFT program's success, but also to the broader scale adoption of soil health conservation practices nationwide.

We recommend the following:

Soil health indicators:
While we recognize that grant recipients must select metrics best suited to the questions they are attempting to answer and that collecting data across any of the metrics included in Technical Note No. 450-03 will contribute to the expansion of knowledge regarding soil health and the overall impacts of management, we strongly encourage preference be given to applicants who agree to include, at minimum, the following analyses in their studies:

Total carbon
Bulk Density
Aggregate stability
Water infiltration rates
pH
Texture, and
One or more of the following: POXc, PMC, Active Protein, Enzyme Activity

Collection/sampling methodology:
Standardization of sampling approach is crucial to overcome field-scale variability of soil carbon and biological activity. Sampling approach (i.e. pit vs. core), sampling depth, sieve size, and oven-drying have all been found to impact accounting of soil carbon stocks, as well as other biological metrics (Fierer and Schimel 2002; Vadeboncoeur et al. 2012; Sun et al. 2015; Poeplau et al. 2017; Wade et al. 2018; Tautges and Chiartas 2019). We recommend that OFT grant recipients follow the attached sampling protocol, developed with attention to the latest approaches in the scientific literature, as well as those put forth by Cornell's Comprehensive Assessment of Soil Health and the Soil Health Partnership.

Lab calibration:
Of concern is the lack of lab calibration protocol outlined in the Technical Note, nor any indication as to how data quality by individual labs will be assessed to ensure each test is producing an "apples-to-apples" set of data.

P. 2 of the Technical Note recognizes this **"critical need for standardization"** along with appropriate proficiency testing. An effort to strengthen the public-private partnership between commercial soil test labs, land grant universities, and technical assistance providers is essential to the development and use of a national set of regionally appropriate interpretation functions used for on farm management decision making. Adherence to the standardized methods contained in the Technical Note is an important first step, but should incorporate the practice of cross-validating results to limit inter-laboratory variability (Wade et al. 2018).

Our chief recommendation is that a select subset of commercial and university analytical labs be designated (by region) for testing of all soil samples associated with OFT grant-funded projects. We recommend that a standardized training in soil health assessment protocols (as laid out by Soil Health Technical Note No. 450-03) be provided to these labs and that all technicians associated with these analyses complete an individual training with an NRCS appointed official. Selected labs must, at minimum, have a documented Quality Assurance/Quality Control program, follow ISO 17025 and ISO 9001 protocol, and participate in North American Proficiency Testing. When conducting analyses, we recommend that each lab utilize the following internal quality control system (Holstege et al. 2010):

- Analyze a blank with every set of samples submitted
- Conduct duplicate analysis on at least 10% of samples submitted to ensure precision
- Include at least one reference standard in each set of analyses (must fall inside control limits)
- Analyze at least one fortified sample with each sample set to verify accuracy

Additionally, we recommend that every 75th sample be sent to 2 commercial labs and 2 analytical labs (including designated lab), so as to provide external validation of results.

Having consistent calibration across labs is essential to yielding useful data that can be understood across a wide variety of production types and geographies. Longer term, it's also essential that we generate reliable data that will allow farmers to connect with a variety of market-based economic incentives, such as carbon markets and company supply chain integration.

Generating consistent data is also essential in order to create a predictive model of risk for agriculture and soil, allowing for the creation of preferential financial products like lower interest bank loans or crop insurance programs with lower premiums for farmers with good soil health.

Working with third-parties:
If bandwidth for lab calibration and other aspects of outcomes verification is a challenge, we recommend that the NRCS work with an independent third-party entity to help collect soil health samples in a consistent methodology, and to provide training and oversight to appointed labs.

Diverse applicants and awardees:
Lastly, we wish to reiterate our previous comments about the importance of ensuring that grant recipients represent a diversity of geographies, farm sizes and production types across the United States. Ensuring a larger number of diverse samples will make the program significantly more relevant from a data perspective.

Many thanks again for your attention on this matter. Please feel to reach out to us. We'd be delighted to work with you on this matter.

Regards,

Aria McLauchlan
Co-Founder & Executive Director
Land Core

Citations:

Adachi, M., Y.S. Bekku, A. Konuma, W.R. Kadir, T. Okuda, and H. Koizumi. 2005. Required sample size for estimating soil respiration rates in large areas of two tropical forests and of two types of plantation in Malaysia. For. Ecol. Manage. 210:455–459. doi:10.1016/j.foreco.2005.02.011

Davidson, E.A., K. Savage, L.V. Verchot, and R. Navarro. 2002. Minimizing artifacts and biases in chamber-based measurements of soil respiration. Agric. For. Meteorol. 113:21–37. doi:10.1016/S0168-1923(02)00100-4

Fierer, N., & Schimel, J. P. (2002). Effects of drying–rewetting frequency on soil carbon and nitrogen transformations. *Soil Biology and Biochemistry*, *34*(6), 777-787.

Holstege, D. (2010, October 07). UC Davis Analytical Laboratory Quality Manual. Retrieved July 10, 2019, from https://anlab.ucdavis.edu/media/pdf/qual-manual.pdf

Poeplau, C., Vos, C., and Don, A.: Soil organic carbon stocks are systematically overestimated by misuse of the parameters bulk density and rock fragment content, SOIL, 3, 61-66, https://doi.org/10.5194/soil-3-61-2017, 2017.

Sun, S. Q., Cai, H. Y., Chang, S. X., & Bhatti, J. S. (2015). Sample storage-induced changes in the quantity and quality of soil labile organic carbon. Scientific reports, 5, 17496.

Vadeboncoeur, M. A., Hamburg, S. P., Blum, J. D., Pennino, M. J., Yanai, R. D., & Johnson, C. E. (2012). The quantitative soil pit method for measuring belowground carbon and nitrogen stocks. *Soil Science Society of America Journal*, *76*(6), 2241-2255.

Wade, Jordon, et al. “Sources of Variability That Compromise Mineralizable Carbon as a Soil Health Indicator.” *Soil Science Society of America Journal*, vol. 82, no. 1, 2018, p. 243., doi:10.2136/sssaj2017.03.0105.