May 15, 2020

William Hohenstein
Director, Office of Energy and Environmental Policy
US Department of Agriculture
1400 Independence Avenue, SW
Room 4059, South Building (Mail Stop: 3815)
Washington, DC 20250-0110

Dear Mr. Hohenstein,

Thank you for the opportunity to comment on USDA's approach to the forthcoming updates to the technical guidelines for *Quantifying Greenhouse Gas Emissions and Carbon Sequestration at the Entity-scale for Agriculture and Forestry* (Docket Number: USDA-2020-0002). The Ecosystem Service Market Consortium's (ESMC) mission is to advance ecosystem services markets that incentivize farmers and ranchers to improve soil health systems that benefit society. ESMC is a member-based not-for-profit organization launching a national scale ecosystem services market for agriculture to recognize and reward farmers and ranchers for their environmental services to society. ESMC members in our Public-Private-Partnership represent the spectrum of the agricultural sector supply chain with whom we are scaling sustainable agricultural sector outcomes, including increased soil carbon, reduced net greenhouse gases (GHG), and improved water quality and water use conservation. USDA conservation programs, research, technical assistance and science-based guidelines can play an instrumental role in our efforts.

ESMC's market will financially reward farmers and ranchers who voluntarily adjust crop and livestock production systems in ways that increase soil carbon sequestration and retention, improve water quality, conserve water use, and provide many additional ecosystem service outcomes, such as enhanced biodiversity and habitat conservation. ESMC's program allows producers to choose only those changes they desire to undertake, and as few or as many as they select, with the understanding that they will be paid based on outcomes. Regarding ESMC's program build-out, we have completed the assessment and design phases, and we are in a full testing phase of the program, in which pilot projects and member engagement are serving to refine the program prior to full market launch in 2022. ESMCs program will quantify ecosystem services impacts in a verified and certified program and monetize the impacts as ecosystem services credits or attributes of value to demand side buyers. Farmers and ranchers

are paid for desired outcomes, and the attributes or credits are sold in a national ecosystem services market to entities seeking to reduce their environmental impacts.

ESMC's comments on the technical guidelines for *Quantifying Greenhouse Gas Emissions and Carbon Sequestration at the Entity-scale for Agriculture and Forestry*, or "Blue Book", are made in the interest of advancing the science of GHG quantification for U.S. agriculture, as well as improving the applicability of criteria-based guidelines at scale. We seek to ensure that continued public investments in this important arena serve both public and private constituencies of USDA, many of whom are ESMC members, partners, collaborators and stakeholders. ESMC's success, like the success of any market-based and outcome-based program, relies upon the soundness and transparency of science underlying its quantification protocols and methodologies. Sound quantification protocols and methodologies allow for reliable, credible, transparent ecosystem service credit generation, which in turn engenders trust in market-based programs seeking to improve the GHG performance of US agriculture. ESMC supports the use of process-based GHG quantification models as the basis and the key to advanced, cost-effective quantification at scale. These models can be improved if the modeling community unifies behind standardized criteria for data to populate and run such models, including criteria for sampling and data collection, formatting, processing, sharing, and centralized and accessible storage. This is an essential leadership function that USDA can deliver for all public and private constituents to enhance the quality of GHG quantification efforts. ESMC encourages USDA not to select specific tools or models to utilize in estimating or measuring GHG emissions and emissions reductions and increased sequestration from agriculture, but instead to generate or standardize criteria that are applicable to the accurate and appropriate use of models or tools.

To this end, ESMC and our research arm, ESMRC, recommend that USDA work with stakeholders to invest in mutually beneficial research and technology development to revise the Blue Book guidance. With coordinated redevelopment of the Technical Guidelines and agreement on shared criteria and future research and development priorities, USDA and its stakeholders will be able to continuously improve quantification, monitoring, reporting, and verification methodologies as well as related tools, technologies and models, and ecosystem services from agriculture and working lands will be more accurately captured and monitored. While we understand that perhaps the underlying intent was to develop scenario tools for farmers and ranchers to understand how changes in management may impact GHG outcomes – and we think such a tools remains important to support farmer and rancher decision-making – we believe that by investing in the underlying elements that contribute to enhancements for that tool, as well as other tools and needs that constituents have in this space, USDA can ensure that the outcomes of the revision process are as impactful as possible, and have utility in improving GHG quantification outcomes for a range of needs.

USDA'S revised Blue Book should set guidelines to guide publicly-funded academic and industry research to ensure the resulting data is standardized, accessible, and usable to any modeler or researcher. Further, the criteria and protocols governing data usage and data repositories

should be model-neutral to encourage the broadest possible uptake among model user communities and ensure that all parties benefit equally from public investments in agricultural research funding. Standardized and model-neutral data collection and storage protocols will further efforts under USDA's Agriculture Innovation Agenda to "create a comprehensive U.S. agriculture innovation strategy to align public and private research efforts" and "improve USDA data collection and reporting" on the "effects of conservation on natural resources."

1.c. Information on promising technologies and practices for greenhouse gas mitigation and/or quantification which may become viable in the future.

One of ESMC/ESMRC's primary goals throughout the pilot phase is to invest in the development of technologies that increase the accuracy and precision of GHG quantification and reduce the transaction costs associated with ecosystem service credit generation and verification. ESMC is constantly evaluating existing and emerging technologies for this purpose. In some of our pilot projects, ESMC is testing in situ spectrometers, and other soil carbon testing technologies, which can be deployed across the landscape and potentially increase the amount of granular data on soil carbon stocks at varying depths. In field carbon quantification tools offer the prospect of reduced transaction costs associated with lab analysis, a critical determinant in producer willingness to participate in ecosystem service markets. These tools also offer increased scalability and accuracy. Similarly, ESMC is investigating the potential use of next-generation flux towers to measure GHG fluxes at various spatial scales. Next-generation towers are in developmental and testing phases, can be produced for far less than traditional flux towers, allowing for their potential deployment at greater scale. Various public agencies and private organizations are also investing in the development and testing of a variety of in-ground sensors to measure CO_2 and other GHG fluxes, such as N_2O. With such sensors data can be pulled into models in real time to improve accuracy and outputs. ESMC looks forward to working with USDA to further coordinate the tracking, assessment, deployment and development of promising technologies, the implementation of which will provide more reliable data to understand agriculture's GHG impacts and improved GHG model calibration, validation and rigor.

2.a. Information to improve the rigor of the guidelines - datasets that could be used to test and validate current and future methods

USDA's technical guidelines rely on a mix of Tier 1, Tier 2, and Tier 3 methods. As measurement and modeling techniques and technologies continue to rapidly advance, ESMC is hopeful that Tier 2 and Tier 3 methods -- specifically process-based Tier 3 models -- will be more widely implemented in data-rich environments like the US, and the entity scale quantification of agricultural GHG emissions will become more accurate and robust. The transition to more accurate, higher tier methodologies relies upon the availability and sharing or pooling of robust and accessible research data for modelers to improve model performance across the landscape and across multiple production systems.

There is an abundance of high-quality, yet disparate datasets produced and maintained by USDA and other public agencies, and by university and extension researchers, industry trials and precision agriculture product development activities. Together, these data could be used to calibrate and validate process-based models across soil types, climates, and production systems. Much of this data, however, remains siloed due to interoperability issues, ignorance of its existence or relevance, skepticism about its quality, or restrictive use and accessibility rights.

One role for the USDA technical guidelines should be to encourage the development of an open-source, national research data set repository(ies) to enable calibration and validation of all processed-based GHG models. To this end, the technical guidelines should set transparent, standardized, and flexible criteria and protocols for data collection, formatting, storage, and access to ensure that modelers have access to consistent, harmonized, high-quality data to improve process-based models. These criteria and protocols should include, among other things, criteria and guidelines for soil sampling frequency, depth increments, and analysis requirements; for soil chamber placement, deployment timing, and measurement frequencies; and for data collection, formatting, entry, and quality control, including automation wherever and whenever possible to remove human error.

With agreed upon criteria and protocols in place, public agencies, industry, and academic researchers can provide and access data for the mutual benefit of the data repository and every end user, regardless of need. ESMC/ESMRC believes that the transparent development and dissemination of data collection protocols and criteria, which have been accepted by USDA, will result in a proliferation of high-quality data that public and private users and modelers can access to calibrate and validate the GHG process-based models of their choice. Moreover, clear protocols outlining data requirements will further guide the development of MRV technologies by providing a clear standard for the data requirements of end users.

ESMC/ESMRC's members and collaborators have approved the concept of developing such a repository, and through ESMRC technical working groups, have begun initial planning and development work to align on the concept and needs. ESMC/ESMRC's data repository efforts seek to establish criteria and protocols for data collection, handling, storage, and processing, as well as centralized access. We look forward to working with USDA and other federal and non-federal partners to support this critical function and provide mutual benefit to all who want to contribute to and pull from future data repositories.

3.a. Information to improve the usability of the technical guidelines for customers

USDA must recognize that different customers, be it farmers or ranchers, consulting agronomists, ecosystem service market administrators, or university researchers, have different needs with respect to the use of agricultural data. USDA's criteria and guidelines should create measurement protocols rigorous enough to ensure that the data are sufficient for complex modeling, while remaining flexible enough to be implemented on both commercial and

experimental farms. This way, data repositories can incorporate data generated from both highly controlled experimental trials and commercial operations.

To illustrate the need for consistent protocols and criteria, consider the myriad of soil carbon sampling approaches, each of which require different sampling depths and stratification intervals. USDA should standardize soil carbon sampling requirements to ensure harmonized data among research efforts and data repositories. To do so, USDA must identify the key variables at play in GHG fluxes so that the protocols do not call for extraneous data to be collected. More concretely, USDA's protocols and criteria should attempt to promote an approach that takes into account the diversity among systems, since sampling requirements in deep-rooted tall-grass prairie systems will be quite different than more shallow-rooted row crop systems, while specialty crops systems may be yet different again. Over time, different sampling strategies will yield information to show where soil carbon is accumulating, whether soil carbon migrates or moves within the soil profile, and whether changes in soil carbon stocks at various depths can be detected and assessed for sources of impacts resulting in changes.

The Agriculture Research Service's Greenhouse gas Reduction through Agricultural Carbon Enhancement network (GRACEnet), and Nutrient Uptake and Outcomes network (NUOnet)networks, and the Agricultural Collaborative Research Outcomes System (AgCROS) "network of networks," are good examples of data repositories governed by data collection and formatting protocols, and ESMC/ESMRC envisions applying similar approaches for data repositories. However, ARS' customers for these networks may have different needs than ecosystem service market administrators or developers of precision agriculture decision support tools. As different data repositories meet different needs, so do the various models used by ecosystem service modelers. ESMC encourages USDA to adopt approaches that develop criteria and protocols that meet the needs of multiple, if not all, constituent users and ensure that the entire data collection and monitoring community can advance on equal footing.

3.b. Information to change or improve COMET-Farm to improve the implementation of the technical guidelines

Since different GHG models are often used for different purposes and fulfill different needs, USDA should not determine which model or tool is best, preferred, or "official" to the detriment of other models. USDA may have a preferred or selected model or tool for its own use, but public investments should be made to the benefit of all tools and models. To achieve this outcome, USDA should instead lay out transparent, science-based, and standardized data requirements and criteria which, if implemented correctly, will result in proper, transparent GHG accounting in which certainty/uncertainty can be calculated.

Certain GHG estimation tools and models are better suited to certain scenarios, and because of this many are currently in use across the agricultural sector today. In market-based programs where certainty (i.e., knowledge of both model structural and data certainty/uncertainty) and rigor are necessary, the use of models often prevail. Particularly where the models can be

populated with data from new sources such as sensors, and additional technologies in development and testing. By establishing criteria for models and improved quantification approaches, USDA can ensure the scientific rigor of all models. So long as different models and data repositories meet transparent and standardized criteria laid forth in future Blue Book protocols, they should be recognized as valid.

ESMC/ESMRC's programmatic ecosystem services market approach involves multiple R&D activities and related activities to improve field-and farm-scale process-based modeling across geographies and production systems. ESMC's approach provides site-specific accuracy based on a combination of modeling and site-specific data collection. With successive model runs and rounds of calibration and validation, data requirements will become less intensive, and the models more accurate.

USDA's current technical guidelines have struggled to develop an accurate or workable quantification approach to estimate N_2O emissions. Several modifications have been made to USDA's method since the initial release of the Blue Book in 2014; a hybrid approach that used models to derive expected emission rates and coupled it with scaling factors gave way to a different soil N_2O meta-model with structural uncertainty methods, and eventually an abandonment of the scaling factors. ESMC believes N_2O emissions and changes in emissions can be more accurately quantified and tracked at scale in the future if USDA commits to improving process-based models by increasing the availability and quality of data for model calibration and validation.

ESMC's goal is for Tier 3 modeling efforts to be feasible and universally applicable in such data-rich environments as the US agricultural sector today. To achieve this goal, ESMC/ESMRC, USDA and other stakeholders must collaborate to standardize data collection criteria and sharing protocols to increase data availability for model and tool calibration and validation, while also advancing harmonized criteria for quantification approaches that allow multiple tools and technologies to be utilized. ESMC and its members look forward to continued collaboration with USDA to measure and improve the understanding of GHG impacts from US agriculture.

Sincerely,

Debbie Reed
Executive Director
Ecosystem Services Market Consortium LLC (ESMC)
Washington, DC
dreed@ecosystemservicesmarket.org
Tel. (202)701-4298