National Sustainable Agriculture Coalition

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RE: Comments on Development of Technical Guidelines and Scientific Methods for Quantifying GHG Emissions and Carbon Sequestration for Agricultural and Forestry Activities, 76 Fed. Reg. 9534 (February 18, 2011)

On behalf of the National Sustainable Agriculture Coalition, I am submitting these comments on USDA's proposal to develop technical guidelines and scientific methods for quantifying GHG emissions and carbon sequestration for agricultural and forestry activities, published on February 18, 2011. NSAC represents 40 family farm, rural development, and conservation organizations from around the U.S. that share a commitment to federal policy reform to advance the sustainability of agriculture, food systems, natural resources, and rural communities.

As USDA moves forward with the development of its guidelines and methods, we strongly encourage the Climate Change Program Office to engage stakeholders in an ongoing dialogue aimed at informing each step of the process.

1.1 How may USDA best improve upon existing greenhouse gas estimation guidelines for the agriculture and forestry sectors, while at the same time simplifying input requirements and enhancing the ease of use for individuals and entities?

NSAC is not aware of any publicly developed guidelines for estimating GHG emissions from agriculture. There are public models such as COMET-VR and very narrow estimation processes, such as those devised by the Chicago Climax Exchange (CCX). While these early efforts were driven by either the needs of academic modelers or by private sector interests, they were not created with any broad public input or review. These models apply only to a few of the diverse array of farming systems in the United States.

USDA can improve upon existing methods by including some of the key measures of soil quality associated with soil C and N dynamics. Given the variability in both field measures and model estimates, the use of models or tools should be improved by the inclusion of additional measures such as soil organic matter (SOM) – the more stable humus fraction – rather than just total soil C (Carbon), and soil structure (e.g. aggregate stability, bulk density) to account for greater permanence of protected soil C (Soil Association 2009). If SOM measures are beyond the scope of a practical user-friendly tool, then at least the physical indicators of increased SOM should be included. It is also important that the models be verified in terms of sequestration of soil C at subsoil levels and not just topsoil levels.

1.2 USDA intends to develop a standard set of methods for practice-, process-, farm- and entity-scale inventories, which could provide a technical basis for improved methods for current voluntary State and regional systems. Are there specific areas where a USDA guideline would be most useful to current State and regional systems? Are there limitations to using the proposed quantification tools in the context of State and regional systems?

The Environmental Protection Agency (EPA) currently provides quality methodologies for inventories of GHG emissions for the agriculture and forestry sectors. We recommend that rather than developing a new set of methods for inventories, USDA work with EPA to improve its established system.

2. Objectives. The guidelines will result in a methodology for an integrated emissions inventory at the entity scale for all agricultural (crop and livestock) and forest management activities, including (but not limited to) those listed below:

2.1 Cropland Agriculture

2.1.1 Crop, residue and soil management practices and technologies to increase carbon sequestration and reduce nitrous oxide emissions on mineral and cultivated wetland soils, including tillage systems, crop rotations, nutrient management, fertilizer technologies, liming, water management, cover crops, agroforestry, wetland restoration, residue removal and alternatives to biomass burning.

We recommend that USDA include the use of low-external input sustainable agriculture production systems, including certified organic production systems, as an agricultural management activity for both cropland and animal agriculture. These farming systems-based approaches achieve multiple climate benefits without being limited to single practices.

It is critical that any inventory created include, and even highlight, those systems approaches that present the greatest opportunities for emission reduction and sequestration potential. For instance, an extensive study using the DAYCENT model (a daily time step version of the CENTURY model) in California compared conventional and alternative cropping systems including organic for seven different crops (De Gryze, S., et al. 2010). Organic practices had the greatest potential to reduce GHG emissions (4577 + 272 kg CO2-eq x ha-1 x yr-1) followed by cover cropping (ranging from 750-2200 kg CO2-eq x ha-1 x yr-1) and then conservation tillage (ranging from 335-550 kg CO2-eq x ha-1 x yr-1).

USDA-ARS farming systems research in Maryland finds that when comparing the carbon footprint of organic, no till and conventional till grain systems, the organic systems had a lower overall carbon footprint. In a Soil Association review of 39 studies covering 100 comparisons of organic and non-organic farming, the former produced, on average 20-28% higher SOC. This was a conservative measure since SOC was generally measured only in the topsoil and studies show that organic production often leads to increases in subsoil SOC (Soil Association 2009).

Sustainable and organic production systems should be included as a major contributor to GHG sequestration.

2.1.4 Are there additional cropland activities, management practices or technologies to be accounted for to enhance completeness and comprehensiveness of the guidelines, estimation and reporting tools?

We recommend that, in an effort to enhance completeness and comprehensiveness, USDA include diversification and extensification of production systems in addition to management changes for specific crops. More complex and integrated production systems have the capacity to both increase production *and* lead to increased carbon sequestration. From a conservation standpoint, the cropping system is more important than the particular crop in the system.

Taking a whole-farm systems approach is likely to provide greater opportunities for GHG emission reductions and increased carbon sequestration. The inclusion of integrated cropping and livestock production systems would also enhance completeness and comprehensiveness.

2.2 Animal Agriculture

As a threshold issue, USDA should start by doing a full life cycle analysis for GHGs when comparing livestock and poultry production systems, especially pasture or grassland based systems versus confined animal feeding operations in which animal feed is primarily from grains produced in cultivated cropping systems. By ignoring the comprehensive analysis of the feed production side of livestock production, USDA could miss measuring the actual GHG emissions from the whole system.

2.2.1 Management practices and technologies to reduce methane emissions from enteric fermentation, including dietary modification, additives, feeding management, and reproductive management (genetic selection, gender differences, etc.).

Dietary modifications, feed additives, and other minor management changes will have little impact on GHG emissions from ruminant livestock production. Conversely, active promotion of grass-finished ruminant production and the general improvement of pasture management to increase the digestibility of forages will have a more substantial impact on methane emissions.

The Organic Center's dairy sector calculator (http://www.organic-center.org/) has been used to model four scenarios: 1) Intensive Conventional Management with rbST Treatment, Holstein Cows; 2) Conventional Management, Holsteins; 3) Intensive Organic Management, Holsteins and; 4) Pasture-based Organic Farm, Jersey Cows. The Center's chief scientist, along with co-authors, published a report summarizing the modeling results. The report states, "Manure methane losses are five to six-fold higher in Scenarios 1 and 2 because of greater reliance on anaerobic lagoon-based liquid/slurry storage systems. In terms of total methane emissions, Scenario 3 organic farms raising Holsteins produce about one- third less total methane per kg of Energy Corrected Milk, compared to Scenarios 1 and 2, and the Jersey cow and pasture-based

organic farms in Scenario 4 produce about one-half the total methane per kg of ECM."
(Benbrook et al. 2010)

2.2.2 Grazing land management practices and technologies to increase carbon sequestration and reduce nitrous oxide emissions, including rotational grazing and improved forage management.

There are fairly new and exciting research efforts in this area that can provide a hopeful path for GHG emission reduction from ruminant livestock production. Much of this research has been summarized in two publications, "Raising the Steaks" by the Union of Concerned Scientists, and "Sustainable Livestock Production and Climate Change" by the National Sustainable Agriculture Information Service (ATTRA). We recommend that USDA increase its focus on rotational grazing systems and improved forage management.

2.2.3 Manure management practices and technologies to reduce methane and nitrous oxide emissions, including digesters, lagoon management, land application practices, and composting.

As noted above, movement away from confinement feeding systems and expansion of grass-based finishing systems offers the greatest potential for long-term GHG emission reduction and carbon sequestration in the livestock sector. This should be stated clearly. Then, as a second best option, a program to utilize methane for on-farm energy production would certainly be more climate friendly than the do nothing option for confined feeding operations.

2.2.4 Are there additional grazing land and animal agriculture activities, management practices or technologies to be accounted for to enhance completeness and comprehensiveness of the guidelines, estimation and reporting tools?

See comments 2.2.1, 2.2.2 and 2.2.3 above.

2.3 Forests and Afforestation

We encourage USDA to examine the methods and inventories created by EPA. The methods and inventories are very good and could be used as a starting point. We recommend that USDA work with EPA to build upon and improve existing tools.

2.4 Are there sources of information relevant to the objectives of this project, which can be made available to the author teams? If so, please provide this information or the name and contact details for the correspondent.

ATTRA (http://attra.org/), the National Sustainable Agriculture Information Service, publications: Agriculture, Climate Change and Carbon Sequestration; and soon to be released Sustainable Livestock Production and Climate Change, Jeff Schahczenski, jeffs@ncat.org, 406-494-8636

Washington State University, Center for Sustaining Agriculture and Natural Resources, Climate Friendly Farming Program (http://csanr.wsu.edu/pages/CFF)

Wisconsin Integrated Cropping Systems Trial, University of Wisconsin-Madison, Agricultural Research Service, Michael Fields Agricultural Institute; www.wicst.wisc.edu.

Kellogg Biological Station Long-Term Ecological Research Program, Michigan State University, www.lter.kbs.msu.edu

Rodale Institute Farming Systems Trial, Rodale Institute, www.roadaleinstitute.org/fst

National Sustainable Agriculture Coalition. 2009. "Climate Change and Sustainable Agriculture" (http://sustainableagriculture.net/wp-content/uploads/2008/08/nsac_climatechangepolicypaper_final_2009_07_16.pdf)

"Soil Quality Management: Organic Agriculture and Resource Conservation. What conservationists need to know about organic growers" (http://soils.usda.gov/sqi/management/org_farm_2.html)

"Ready…Or Not? An Assessment of California Agriculture's Readiness for Climate Change." March 2011. California Climate and Agriculture Network. http://www.calclimateag.org/our-work/ready-or-not/

California Energy Commission. PIER program. "Climate Change Science: Impact and Adaptation (agriculture)." http://www.energy.ca.gov/publications/searchReports.php?pier_sub=GCC%20-%20Impact%20and%20Adaptation%20Studies%20-%20Ag%20and%20Forest

2.5 Are there opportunities to reduce GHG emissions and increase carbon sequestration in the agriculture and forestry sectors that should be reflected in the methods?

We cannot over-emphasize the need to take a production systems approach rather than a practice-by-practice approach.

The Natural Resources Conservation Service (NRCS) has made some progress in moving beyond the single practice focus to a systems approach. We recommend that the Climate Change Program Office examine the Conservation Stewardship Program and its use of bundled practices for cropland, forestry, pasture and rangeland (http://www.or.nrcs.usda.gov/programs/csp/csp_data/2011/2011_enhancements.ht). A number of studies (De Gryze et al. 2009, Soil Association 2009, and De Gryze et al. 2010) have shown that multi-practice-based systems lead to increased carbon sequestration and reduced GHG emissions.

In developing methods, it is also important to consider the permanence of soil C sequestration. Here it is important to recognize that not all soil carbon is created equal. Total soil C is divided into fractions ranging from plant litter to stable humus. While it is not generally feasible to measure the different soil C fractions, there are readily available and easy indirect measures of, for example, soil aggregate stability and bulk density. Such measures would indicate presence of more stable soil C. Soil structure is also relevant to soil water condition such that lower bulk densities are associated with better aeration. Enhanced aeration of the topsoil can mitigate N2O emissions; conversely, low aeration, which is often characteristic of no-till systems, may be associated with higher risk of N2O emissions (El-Hage Scialabba and Müller-Lindenlauf 2010).

Since one of the purposes of the tool is to assess soil C sequestration and GHG "resulting from current and future conservation programs and practices" it seems absolutely necessary to include the bundled practices including but not limited to bundled organic practices.

2.6 USDA intends to rely on engineering calculations, models, and observations as primary methodological approaches. How can USDA balance rigor while maintaining broad applicability, national consistency, and user friendliness?

A number of studies have shown that biological carbon sequestration rates are very sensitive to management, and can vary drastically from field to field as well as over time (Conant et. al., 2001; Dolan et. al., 2006; Hao et. al., 2002; Robertson et. al., 1993; Walter et. al., 2003). Also as we have noted, organic agriculture has garnered attention for its multiple environmental benefits, and some evidence has been published regarding carbon sequestration by such systems (Foereid and Høgh-Jensen, 2004). However, more research is needed to evaluate systems for optimal soil management, efficient fossil energy use and reduced synthetic nitrogen fertilizer and pesticide inputs in crop production.

While research using controlled trial plots has been useful in suggesting optimal soil management for improving soil carbon sequestration and limiting GHG emissions, this work needs to be supported by data collected from fully operational farms. The cost of repeated, detailed soil analyses means that the direct measurement and monitoring of soil organic carbon changes may be impractical for many producers. However, direct measurement and monitoring is very important given the limitation of trial plots to replicate actual farming systems.

The fallback approach of standard regional emission factors (EF) for a defined suite of management practices lacks accuracy and site specificity. Properly accounting for the net GHG impact of individual farms requires the inclusion of all significant GHG sources and sinks, along with, at minimum, operational energy use, livestock and manure management, and GHG emissions from fertilizer use and application, as well as sequestration in soils and biomass.

At a minimum, the field validations of current models need to be expanded to include organic production systems across crops, regions, and soil types.

2.7 What models and tools currently exist for farm- or entity-scale GHG inventory and reporting, and how might they be useful to the current project objectives? For each model noted, provide a source citation for information on the model.

A hybrid approach that uses limited direct measurement, emission factors (EF), and modeling for whole-enterprise GHG accounting offers a pragmatic solution when carefully and transparently implemented. The vast amount of spatial, agronomic and economic data available to the public from data sources such as the US Census of Agriculture, the USDA National Agricultural Statistics Service, the USDA Economic Research Service and the Conservation Technology Information Center make it possible to develop a model- and EF-based GHG accounting framework that is populated with a large amount of spatially-explicit data. This allows us to lessen the amount of data that is required from individual users to obtain GHG estimates.

However, farmers and ranchers need decision support tools to guide their management decisions. Agricultural economists have developed many decision aids that incorporate crop growth models, markets and cost factors to help farmers optimize their crop selections and management inputs. However, few decision tools are available to predict the GHG impacts of management changes. Available GHG estimation tools, such as Comet-VR1, the DNDC-based Greenhouse Gas Wizard2 or the EPA's Farmware3 either have limited scope or low sensitivity to specific site, crop or management factors. Furthermore, interfaces to the tools are often not intuitive and can be confusing to farmers. Our experiences at providing tools to farmers for GHG management suggest that a useful decision support tool must:

- be easy to use (convenient interface, minimal jargon);
- require minimal user inputs;
- be able to assess the impacts of multiple interrelated management methods;
- use well-documented and transparent methodologies which are scientifically validated;
- provide clear, understandable reports.
- Provide a complete result that accounts for all farm practice-associated GHG emissions (e.g. costs of production, transport and use of synthetic fertilizers and pesticides).

Farmers need a decision support tool that employs a transparent, scientifically validated GHG estimation approach that does not force them to pigeonhole their land management into one of a limited range of options. Such a tool also needs to provide reliable, repeatable, site-specific GHG emission or sequestration estimates to help producers make management decisions.

3. Criteria. There are several key criteria that USDA will rely on in preparing the GHG guidelines, including the following:

3.1 Transparency means that the assumptions and methodologies used for an inventory should be clearly explained to facilitate replication and assessment of the inventory by users of the reported information. The transparency of inventories is fundamental to the success of the process for the communication and consideration of information.

We concur that transparency is essential in the preparation of the GHG guidelines. Transparency should also include an ongoing process for broad public input to refine GHG tool methodologies and guidelines.

We also recommend that USDA develop an adaptive management process for improving the tool based on newly available data, including data that may identify practical measures of soil N or C, N_2O emissions and SOC, especially stable fractions of SOC.

3.3 Comparability requires that the estimates of emissions and sequestration being reported by one entity are comparable to the estimates being reported by others. For this purpose, entities should use common methodologies and formats for estimating and reporting inventories. Comparability is an important consideration in determining whether the guidelines specifies one method (for any technology or management practice) or allows users to select from a menu of methods.

We concur that comparability is a serious issue. USDA should ensure, however, that the tool is flexible enough to be accessible to all types of producers. Models and methodologies are often devised to estimate emissions and sequestrations based on the most simple and common systems of production. It is relatively easy, for example, to estimate sequestration and emissions from a continuous field corn system in Iowa. However, it may be difficult to do so for a more complex, Iowa crop rotation that integrates five different crops and livestock. Any common methodology will need to be designed to handle the complexity of these more resilient and sustainable systems.

3.4 Completeness means that an inventory covers all sources and sinks, as well as all greenhouse gases. Completeness also means full coverage of sources and sinks under the control of the entity. Completeness is an important consideration to be balanced with ease of use in reporting appropriately for an entity that may have a minor activity or an activity with severely limited data availability.

The tool should be able to accommodate both complex and simple production systems, as outlined in comment 3.3 above.

Based on this criterion, the tool should allow for the accounting of GHG emissions associated with the production, transport and use of synthetic fertilizers and pesticides.

3.5 Accuracy is a relative measure of the exactness of an emission or removal estimate. Estimates should be accurate in the sense that they are systematically neither over nor under true emissions or removals, as far as can be judged, and that uncertainties are reduced as far as practicable.

In accuracy, as well as completeness and comparability, the tool should be able to accommodate both complex and simple production systems, as outlined in comment 3.3 above.

3.7 Ease of use is a measure of the complexity of the user interface and underlying data requirements.

This is a real tension as noted above. The National Center for Appropriate Technology has experience with developing farmer user-interfaces for decision tools and has found that it is critical to use a process where farmers are active participants in the both the design and development of the interface.

Producers may already be familiar with some of the accounting and reporting mechanisms that will eventually be included in the tool. For example, farmers and ranchers across the country may be familiar with NRCS' comprehensive Soil Quality Indicators and sampling methods, which are similar to the measures of soil quality (including structure), Therefore, we recommend that these tools be used in analyses of C sequestration and GHG mitigation potential.

3.9 To the extent that there are tradeoffs, which criteria are more important than others in ensuring the usefulness of the project products for entity-scale estimation and reporting?

Key criteria should include:

- be easy to use (convenient interface, minimal jargon);
- require minimal user inputs;
- be able to assess the impacts of multiple interrelated management methods (e.g. grazing perennials, multi-crop rotation, and organic on a single piece of land);
- use well-documented and transparent methodologies which are scientifically validated;
- provide clear, understandable reports.

4. Expected outcomes and products. The project is expected to yield the following products.

The Climate Change Program Office should establish a process to integrate broad public input into each of the steps listed below. We recommend that the Office convene a stakeholder group with broad representation to participate in the development of the tool as the process moves forward.

4.1 A review of techniques currently in use for estimating carbon stocks and fluxes and GHG emissions from agricultural and forestry activities;

4.2 A technical guidelines document outlining the approach or approaches to conducting a farm-, ranch-, or forest-scale GHG estimation;

4.3 Specific methods for each source/sink category that are designed to be reliable and consistent with national inventory efforts;

4.4 A quantification where possible of uncertainties in estimation at the entity scale; and

4.5 A user-friendly tool that integrates multiple sources of entity-scale data to facilitate farm-, ranch-, and forest-scale quantification of greenhouse gas emissions and sequestration in a manner consistent with the methods and technical guidelines.

References:

De Gryze, S., et al. 2010. Simulating greenhouse gas budgets of four California cropping systems under conventional and alternative management. Ecological Applications, Vol. 20, No. 7, pages 1805-1819. October 2010.

Soil Association. 2009. Soil Carbon and Organic Farming: A review of the evidence on the relationship between agriculture and soil ccarbon sequestration, and how organic farming can contribute to climate change mitigation and adaptation. November 2009.

NRCS. 2010. Effects of conservation practices on cultivated cropland in the Upper Mississippi River Basin. USDA-NRCS, J.

Benbrook, C, C Carman, E A Clark, C Daley, W Fulwider, M Hansen, C Leifert, K Martens, L Paine, L Petkewitz, G Jodarski, F Thicke, J Velez and G Wegnerune. 2010. A Dairy Farm"s Footprint: Evaluating the Impacts of Conventional and Organic Farming Systems. The Organic Center.

Nadia El-Hage Scialabba* and Maria Mu ller-Lindenlauf 2010. Organic agriculture and climate change. Renewable Agriculture and Food Systems: 25(2); 158–169.

De Gryze, S, R Catala, R E. Howitt, and J Six. 2009. Assessment of greenhouse gas mitigation in California agricultural soils (California Climate Change Center Report Series Number 2008-004 CEC-500-2008-039). UC Davis.

Other indicators of soil quality (and how it functions, in this case, to sequester carbon, store and recycle N, reduce N2O emissions) as defined and used by NRCS/USDA Soil Quality Inst. (http://soils.usda.gov/sqi/concepts/concepts.html) could include biological, chemical and other physical measures:

Biological measures:
1) Active Soil Organic Matter: Particulate organic matter (POM) and light fraction (LF). POM particles are larger than other SOM and can be separated from soil by sieving. LF particles are lighter than other SOM and can be separated from soil by centrifugation.); Also decomposition rate (e.g. how fast cotton strips decompose).
2) Stabilized organic matter (humus), SOM
3) Potentially mineralizable nitrogen (PMN)

Physical measures: Infiltration Rate, Bulk Density, Aggregate stability (how well particles withstand external pressure), Soil slaking (how well particles or clumps withstand internal water pressure).

Thank you for the opportunity to comment on the Development of Technical Guidelines and Scientific Methods for Quantifying GHG Emissions and Carbon Sequestration for Agricultural and Forestry Activities. We hope you will incorporate our recommendations as you move forward in the process.

Sincerely,

Ferd Hoefner
NSAC Policy Director