National Sustainable Agriculture Coalition

To: Marlen Eve, USDA Climate Change Program Office
From: Sophia Kruszewski, National Sustainable Agriculture Coalition
Date: November 15, 2013
RE: October 31, 2013 Meeting Follow Up

Dear Marlen,

Thank you again for taking the time to speak with us about our concerns that the GHG methods report, and any subsequent tool, properly consider and work for complex agricultural systems.

As we expressed in our 2011 and 2013 comments on this project, and again at our meeting, low-external input agricultural systems, including certified organic agriculture, have an important role to play in a changing climate. In addition to their ability to reduce GHG emissions and sequester carbon in the soil, these complex systems produce numerous co-benefits that will help farmers adapt to increasingly variable weather conditions. As such, we encourage you to integrate these systems and practices throughout the report, expand the suggested text box into a chapter, and/or include a dedicated resource appendix. To assist you in this, we have compiled citations and PDFs of studies and reports that assess the climate benefits of these systems, in addition to providing text below.

These documents and the text we submit to you today supplement and do not replace the information contained in our 2011 and 2013 docket comments.

GHG Sinks and Sources in Complex Agricultural Systems

Low-external input agricultural systems, including organic production systems, use soil management practices that offer the best opportunities to reduce GHG emissions, build soil organic carbon (SOC) and sequester atmospheric carbon. Among the soil management practices that have the greatest potential to sequester carbon are cover crops, perennial cropping, reduced synthetic fertilizer inputs, and conservation tillage.[1] Cover crops or green manures have been found to increase soil carbon 1.5 to 4 times as much as in land under cultivation.[2] Composting and adding organic amendments have also resulted in increased carbon storage in soils.[3] Notably, soil management practices used in combination offer the best methods to build soil organic matter and sequester carbon.[4]

Numerous studies show that organic agriculture offers great potential to sequester significant amounts of carbon.[5] A review of nine long-term studies found that organic systems improve key

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indicators of soil quality including SOC and nitrogen content.[6] A Central Valley study looking at alternative practices for seven different crops found that organic farming systems sequestered the most carbon.[7]

Studies reviewing the carbon sequestration potential of conservation tillage are mixed and sometimes contradictory. The potential for conservation tillage to increase carbon sequestration may grow with the use of additional soil management practices—including cover cropping, which can help build soil organic matter.[8] Research has shown that tillage increases CO2 emissions from soil. However, in spite of the fact that organic farming typically utilizes tillage for weed control and to incorporate cover crops, organic production appears to sequester greater net amounts of carbon compared to conventional systems. Data collected at Morrow Plots, the oldest continuous corn experimental site in the country, found that after 40 to 50 years of synthetic nitrogen fertilizer applications, the net soil carbon content declined despite the incorporation of large amounts of carbon from crop residues.[9]

It is critical to consider nitrous oxide (N_2O), a potent GHG, when examining the net GHG impact of farming systems. The use of nitrogen fertilizers and soil amendments — whether synthetic or organic — can result in N_2O fluxes after rainfall or heavy irrigation. Data suggests that N_2O emissions are much higher in conventional system after applications of synthetic nitrogen fertilizer compared to organic treatments, and that N_2O fluxes can be reduced by avoiding heavy irrigation after organic fertilizer application in the spring[10] or by using subsurface irrigation instead of furrow irrigation.[11]

Organic practices can reduce GHG emissions due, in large part, to the elimination of fossil fuel-based synthetic pesticides and fertilizers. A review of literature by the United Nations Food and Agriculture Organization found that organic agriculture production uses 30 to 50 percent less energy than comparable conventional systems.[12] Results from a 22-year study in the U.S. found that organic corn systems use inputs with 28 to 32 percent less embedded fossil fuel energy than conventional systems.[13]

R.L. Mulvaney, T.R. Ellsworth and C.W. Boast. 2007. The myth of nitrogen fertilization for soil carbon sequestration. Journal of Environmental Quality 36:1821-1823; Müller-Lindenlauf, M. 2009. Organic agriculture and carbon sequestration. FAO Natural Resources Management and Environment Department. Available at: ftp://ftp.fao.org/docrep/fao/012/ak998e/ak998e00.pdf.

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[12] Ziesemer, J. 2007. Energy use in organic food systems. United Nations Food & Agriculture Organization. http://www.fao.org/docs/eims/upload/233069/energy-use-oa.pdf

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A study in Maryland by the USDA Agricultural Research Service found that an organic system helped reduce total GHG emissions while the no-till and chisel till systems contributed to it, even when adjusted for yield differences.[14] This was due primarily to greater carbon sequestration in the organic soils and secondarily to lower energy inputs. A Canadian study found that, on average, the organic production of corn, canola, soy and wheat consumed 39 percent of the energy and generated 77 percent of the GHGs compared to their conventional counterparts.[15]

Incorporating trees, shrubs or other types of woody vegetation into rangeland or farm landscapes can also sequester carbon in significant quantities.[16] Trees and plants absorb carbon dioxide and store it in the woody biomass above ground and in the root system. Planting hedgerows along the margins of farms and buffers in riparian zones can increase carbon sequestration.

In addition to cropland management and production, low-input practices can reduce GHGs from livestock production. Sustainable management of rangelands can be an effective tool for carbon sequestration and GHG emission reductions. Cattle grazing can increase above ground productivity of vegetation and species richness[17], which is frequently correlated with increased carbon in the soil.[18] Grazing has also been found to increase the rate of soil carbon sequestration.[19] Rotational grazing, a practice of intensively grazing and rotating livestock through paddocks, has the potential to increase carbon sequestration by 15 to 30 percent.[20] In a study modeling the impacts of various dairy and beef management practices it was estimated that intensive grazing and rotation through paddocks increased carbon sequestration by 10 percent, and increased to 15 to 30 percent when combined with improved production efficiency and no-till feed production.[21] Converting fields from conventionally-raised feedstock to perennial grasslands for grazing can sequester up to 3,400 pounds of carbon dioxide equivalent per acre each year.[22]

Grazing can also reduce the methane emissions generated by the digestive processes of livestock. Animals fed a diet of high quality forage may emit less methane.[23] While research comparing

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methane emissions from pasture versus feedlot finishing are still limited, evidence suggests that finishing cattle on pasture rather than on grain can reduce methane emissions.[24] These studies comparing the energy inputs required for different livestock management systems also suggest that conventional feedlot livestock require twice as much fossil fuel energy compared to grass-fed livestock due in large part to the use of synthetic fertilizers and pesticides used to produce the feed crops.[25]

Finally, nutrient management is an important factor to consider when comparison practices across agricultural systems. Manure waste lagoons or slurries produce methane and nitrous oxide[26] as the result of the anaerobic decomposition of manure. Methane emissions associated with livestock production can be reduced when manure is applied to the land instead of stockpiled or stored in large ponds or lagoons.[27] Because animal manure contains about 40 to 60 percent carbon, its application to land can increase the soil organic matter content and enhance soil carbon sequestration.[28] See our attached CIG Project recommendations (explained below) for more information on incorporating sustainable and organic practices into nutrient management for conservation agriculture.

Additional References

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- In a twelve-year California study of organic farming practices, carbon sequestration was improved by 36 percent with the use of green manures and animal manures even though tillage was increased compared to conventional systems.

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- An eight-year California study found that SOC increased 19 percent in organic and low input systems, as compared with 10 percent in conventional soils with synthetic fertilizers24.

Hepperly, P. 2004. Organic farming sequesters atmospheric carbon and nutrients in soils. Available at: http://www.strauscom.com/rodale-whitepaper/

- After 23 years, organic management practices increased soil carbon by 15 to 28 percent and increased soil nitrogen by 8 to 15 percent25.

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- A nine-year USDA study found that organic production sequestered more carbon than no-till systems at all soil depths up to 30 cm26

CIG Project Recommendations
During our meeting, we mentioned our involvement in a CIG project that is looking at better integrating sustainable and organic farming practices into NRCS working land conservation programs and practice standards. Since receiving the CIG award in 2010, NSAC, NCAT, and several other partner organizations have provided NRCS with recommendations for improving 40 national practices standards and 16 CSP conservation enhancement practices. To date, NRCS has reviewed half of the CSP recommendations and, of those, has adopted roughly 75% of the recommendations. NRCS has reviewed only five of the conservation practice standards so far, but has adopted roughly 65% of those reviewed. Upon NRCS's suggestion, we are converting the remaining 35% of these recommendations into a guidebook for NRCS field staff.

Attached is an example of one of the conservation practice standards we worked on that is particularly germane to your project – CPS #590, nutrient management – with an accompanying rationale document. I can forward others to you as well if you are interested.

Organic Farming Practice List
During the meeting, we also highlighted the organic farming practice lists currently available through NRCS as part of the Conservation Stewardship Program (CSP) Organic Crosswalk and the Environmental Quality Incentives Program (EQIP) Organic Initiative. The CSP Organic Crosswalk provides information on practices that a producer could implement under a CSP contract that would aid in the transition to organic certification. EQIP has a similar document available through its Organic Initiative.

CSP: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1097196.pdf
EQIP: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1075355.pdf

Life Cycle Analysis
We strongly urge you to go beyond the few sentences in the report that dismiss performing a life cycle analysis (LCA) on agricultural production practices.

If, as you indicated, the main purpose of the report is to help create a tool that gives farmers and ranchers the best available information to make decisions about how their farming practices result in GHG sinks and sources, then it is critical that the report provide a full and accurate assessment of the GHGs associated with various agricultural practices and systems. LCAs not only provide an unbiased comparison across various production practices and systems, but they also fall in line with recent USDA and Executive branch directives.

For example, in addition to the February 2013 report from your office that stressed the benefits of sustainable, low input practices in a changing climate (as noted in our 2013 comments), the President's recent directive – Executive Order 13653, Preparing the United States for the Impacts of Climate Change – further drives this point home.[29] It states that agencies shall:

> (i) **identify and seek to remove or reform barriers that discourage investments or other actions to increase the Nation's resilience** to climate change while ensuring continued protection of public health and the environment;

[29] 78 FR 66819 (Nov. 6 2013).

> (ii) **reform policies and Federal funding programs that may, perhaps unintentionally, increase the vulnerability of natural or built systems**, economic sectors, natural resources, or communities to climate change related risks;
>
> (iii) **identify opportunities to support and encourage smarter, more climate- resilient investments** by States, local communities, and tribes, including by providing incentives through agency guidance, grants, technical assistance, performance measures, safety considerations, and other programs.

Moreover, "agencies shall, where possible, focus on program and policy adjustments that promote the dual goals of greater climate resilience and carbon sequestration, or other reductions to the sources of climate change."[30]

We therefore recommend that, at the very least, the report include a text box comparing grass-finished or pasture-based livestock systems to confined systems, in which feed comes primarily from grains produced in cultivated cropping systems, to avoid unintentionally discouraging the adoption of climate-friendly practices and to support climate resilience in agriculture.

As a good example of using LCA to compare agriculture production systems, we analyze below a study that compared three different beef livestock-production methods in the Upper Midwest.[31] The beef-production strategies analyzed in the study included the following:

- Beef calves sent directly to feedlots after weaning, finished on grain in 303 days using growth hormone implants, and slaughtered at 637 kilograms (1,401 pounds). Growth hormone implants were applied upon arrival at the feedlot.
- Beef calves placed on wheat grain pastures (backgrounded), finished with grain in feedlots for a total of 450 days (300 days on wheat pastures and 150 days in feedlots), and also slaughtered at 637 kilograms. Growth hormones were also applied in the feedlot stage only.
- Beef calves finished wholly on managed pasture and hay. The cows finished on pasture in 450 days and were slaughtered at 505 kilograms (1,111 pounds) without the use of growth hormones at any stage of production. Sixty percent of the total feed came from pasture and 40% from hay.

The three processes were measured using the International Organization for Standardization (ISO) compliant life cycle analysis method. This method compiles an inventory of material and energy inputs and outputs at each stage of a product life cycle and quantifies how these flows contribute to specified resource use and emissions-related environmental impacts. The results may allow for a better assessment of where to reduce GHG emissions within a comparable supply chain as well as enhance the ability to compare resource efficiencies between production systems.

The environmental impacts that were compared in the study include energy use, an ecological-footprint measure, GHG emissions, and eutrophying emissions (emissions that cause algal blooms in waterways). The research found that all of the above impacts per live-weight of beef produced were highest for pasture-finished beef and lowest for feedlot-finished beef.

However, this controversial result is because the grass-based system of production, being a less developed system, tends to produce smaller animals over a longer period of time. It seems nearly

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[30] 78 FR 66819, 66820 (Nov. 6 2013).

[31] Pellitier N., R. Pirog, and T. Rasmussen. 2009. Comparative Life Cycle Environmental Impacts of Three Beef Production Strategies in the Upper Midwestern United States. Agricultural Systems 103 (6): 380-389.

inevitable that GHG emissions due to enteric fermentation releases over the life of the animal on a per-pound basis of meat produced will be greater for a grass-based system. So just because GHG productivity is greater for feedlot-finished beef based on an elaborate modeling exercise, does it logically follow that all systems for cattle production should continue or shift to feedlot-finished beef in the Midwest—and the world? Perhaps, but only if climate productivity is the singular goal of all agricultural production and if there is little hope to modify grass-based beef systems so that they can better offset their current level of GHG emissions. New research is beginning to demonstrate that modification of pasture-finished beef production may be able to offset its current climate limitation.

Also, it is important to note that this study assumes equilibrium conditions in pasture-soil organic carbon changes across each system—which may be questionable, given recent research, which was recently summarized by a Union of Concerned Scientists report (citation below). In fact, this UCS report analyzes the Pelletier study and notes that if the researchers had assumed a small value of 0.4 milligrams of carbon sequestration per hectare per year in their study, the model they used would have shown that the grass-finished-based system would have resulted in 15% less GHG emissions per pound of beef produced than the grain feedlot system—reversing their controversial and widely publicized result. It seems that the productivity disadvantage of grass-finished beef in terms of both finish weight and time to slaughter can be turned into a climate advantage by promoting increased offsetting soil carbon sequestration in pastures.

Finally, the Pelletier study also assumes a uniform digestibility of the pasture feed received in both systems. As the UCS report clearly documents, feed that is easier for cattle to digest results in less release of methane through enteric fermentation. That means improved pasture management can adjust the mix of legumes, grasses, and forbs to lower the enteric fermentation of grass-finished systems of livestock production.

Significantly, this study also demonstrates more generally what may be called a "productivity" bias, implicitly asserting that producing more for less is the ideal outcome of any agricultural production system. This clearly strikes at the heart of the very notion of sustainability, which really considers productivity to be only one part of the equation—with environmental, economic, and community values being of at least equal importance.

By ignoring or discounting the LCAs or a comprehensive analysis of the feed production side of livestock and poultry production, USDA could miss measuring the actual GHG emissions from the whole system. The same issue arises in comparisons of energy use and GHG emissions. In many regions of the U.S., confined livestock and poultry systems must be cooled in the summer and/or heated in the winter. Many of these confined systems depend on fossil fuel sources for heating and cooling. The GHG emissions from these fuels should be included to provide an accurate comparison across practices and present farmers and ranchers will a full and fair assessment of management options.

Data are available that demonstrate the contrast between these two systems, among others, and it would be a shame for this valuable information, which could truly inform the practices farmers and ranchers elect to avoid or mitigate GHGs, to be omitted from the report.

Additional References

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Suddick, E., M. Ngugi, K. Paustein, J. Six. Monitoring soil carbon will prepare growers for a carbon trading system. 2013. California Agriculture, 67:3, pp. 162-171, available at http://ucce.ucdavis.edu/files/repositoryfiles/ca6703p162-112966.pdf

Gattinger, A. et al. 2012. Enhanced top soil carbon stocks under organic farming. Proceedings of the National Academy of Science, 109:44, pp. 18226 - 18231, available at http://www.pnas.org/content/109/44/18226.full.pdf

- letter: http://www.pnas.org/content/110/11/E984.full.pdf
- author reply: http://www.pnas.org/content/110/11/E985.full.pdf

We appreciate your consideration of this supplemental information and look forward to more opportunities to participate in the development of this report and any subsequent measurement tool.

Sincerely,

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