Developing Science-Based Methods and Technical Guidelines for Quantifying Greenhouse Gas Sources and Sinks in the Forest and Agriculture Sectors

Climate Change Program Office
USDA Office of the Chief Economist

February 2012
Presentation Overview

1. Brief overview of the project
2. Recent project activities / accomplishments
   - “Review of Reviews”
   - “GHG Accounting Tools”
   - N2O Experts Workshop
3. Tool Design
4. Timeline and next steps
5. Update on relevant activities at USDA
Create a standard set of GHG quantification guidelines and methods for USDA and the public.

In accordance with Section 2709 of the 2008 Farm Bill:

- “USDA shall prepare technical guidelines that outline science-based methods to measure the carbon benefits from conservation and land management activities”

Focus on developing a comprehensive and user-friendly tool that can be used by land owners and managers, USDA and its stakeholders to estimate changes in GHG emissions and C sequestration at the local entity scale.

**Project Deliverables**

1. A comprehensive review of techniques currently in use for estimating carbon stocks and fluxes and GHG emissions from agricultural and forestry activities

2. A technical guidelines document outlining the preferred science-based approach and specific methods for conducting a farm- or forest-scale GHG estimation

3. An on-line computer tool that is consistent with the specific methods and the technical guidelines

More info: [www.usda.gov/oce/climate_change/techguide](http://www.usda.gov/oce/climate_change/techguide)
The entity - combining a landowner’s crop, livestock and forestry activities into one seamless GHG estimate.
Key Considerations

1. Maximize accuracy AND ease of use
2. Broadly useful to a diverse set of USDA Agencies and stakeholders
3. Quantify GHGs for the whole operation – completeness vs data availability
4. ONE method for any given activity, or a menu of methods requiring differing levels of input detail
5. Balance scientific rigor with broad applicability, national consistency and user friendliness
6. Integrate existing models or tools for GHG inventory and reporting

Guiding Principles

1. Transparency
2. Consistency
3. Comparability
4. Completeness
5. Accuracy
6. Cost effectiveness
7. Ease of use
Technical Guidelines Review Process
“Concentric Circles of Hell”

1. Technical Guidelines
2. CCPO
3. USDA
   - Oct 2011
4. InterAgency Tech.
   - April 2012
5. Scientific Experts
   - Aug / Sept 2012
6. Public Comment
   - Jan 2013
7. Full InterAgency
   - Spring, 2013
The Goals for the Resulting Online Tool:

- Estimate GHG emissions for a comprehensive array of management practices and technologies, providing a snapshot for the entire management entity as well as providing support for management decisions.
- Be easy to use, with data that land managers have readily available.
- Build upon the current state of the science.
- Integrate use of existing modeling tools as much as possible in order to maximize data and reporting consistency and transparency.
- Be transportable and scalable for use in local and sub-regional estimation, while remaining consistent with regional and national inventory efforts.
- Be flexible enough to handle estimation for the operation or for changes in specific practices within one sector of the operation.
What the TOOL will be used for:

Primary Intended Uses:

- Farm, ranch and forest land owners will use the TOOL to better understand the GHG impact of their management decisions.
- The TOOL will provide land owners and managers with knowledge and understanding to facilitate their entry into state or private registries or markets.
- USDA will use the TOOL to assess local (GHG) performance of conservation programs, practices and initiatives.

Other Possible Uses:

- Other USG Agencies may choose to use the TOOL for their GHG estimation and reporting needs.
- NGOs, crediting registries and other stakeholders can consider use of the TOOL, as-is or adapted to better fit their program needs.
- Evaluate and prioritize research needs and data gaps in order to improve GHG estimation precision and accuracy.
- Merge GHG estimation with estimation of other environmental benefits such as water quality.
Recent Activities: N$_2$O Cropping Practices Workshop

Objectives:

- Review options for quantifying N2O emissions from agricultural soils – building from the methods currently being applied at a national level in the US GHG Inventory;
- Discuss and identify effective practices for reducing N2O emissions, specified with respect to geographic regions, cropping systems, and/or other site-dependent factors; and
- Identify management practices or technologies for which more field measurements are needed and data sets with which process models can be further developed and evaluated.
Recent Activities: N$_2$O Cropping Practices Workshop

Final Considerations:

- Would leaving a practice out cause the farm or entity’s report to be incomplete?
- Does including a practice help USDA to promote good management practice and strategically set research agendas to future reduction of uncertainty?
- Do we have a thorough understanding of the relative change in emission reductions for a particular practice? Is there evidence that it won’t later be discovered that the direction of change is wrong?
- If one method is not suitable for the whole country for a given practice, consider using a detailed method where data exist and a more generalized method in the regions/soils/systems/etc. where processes are less understood.
- While the TOOL may be useful for valuing or validating offset credits within specific cropping systems or regions, this is not the primary objective for the TOOL at this time. Crediting agencies would need to assess the usefulness of the TOOL for their cropping systems, management practices and region.
Recent Activities: N$_2$O Cropping Practices Workshop

Cropping Practices Considered

- N rate
- N timing and placement
- N formulation
- N inhibitors and additives
- Manure & compost
- Cover Crops
- Tillage
- Rice
- Land use change
- Irrigation
### Cropping Systems

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**Recent Activities:**
- N\textsubscript{2}O Cropping Practices Workshop
Recent Activities: N₂O Cropping Practices Workshop

About 20 leading N₂O emissions experts and modelers:
• Discussed the availability of data and the capability of models
• Evaluated the available estimation methods
• Recommended practices that could reasonably be estimated within the current objectives of the USDA tool
• Recommended a methodological approach for estimation

The outcome of the workshop is now being drafted for inclusion in the guidelines document.
Recent Activities: Background Report GHG Sources

Published in December

Report looks at many studies and reviews of studies for a wide variety of practices in agriculture and forestry management. Contains an extensive literature section as well as tables of ranges of GHG mitigation seen by practice from the literature.

Available for download from:
www.usda.gov/oce/climate_change/techguide
Recent Activities: Report of GHG Accounting Tools

Published Today!!

~35 GHG Calculators
~50 Guidelines and Protocols
~25 Models

Report contains basic highlights and capabilities of each as well as a brief fact sheet on each and hundreds of reference citations.

Available for download from: www.usda.gov/oce/climate_change/techguide
### Table 1: GHGs and Sources Addressed by Tools

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### Recent Activities:

#### Table 2: Comparison of Features of GHG Calculators

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$^*$ indicates a feature not available for this tool.
### Cool Farm Tool

**General Information**
- **Origin:** UK
- **Authors/Developers:** John Hillier and Pete Smith from the University of Aberdeen, and Christoph Walter et al. from Unilever
- **Year Published:** 2010
- **Tool Type:** GHG emissions calculator
- **Interface:** Open-source Excel document
- **Assessment level:** Farm level
- **Geographical coverage:** Global
- **Practices covered:** Cropland (grass, grass/clover, legume, wetland rice, other crops); Livestock (cows, pigs, buffalo, sheep, goat)
- **GHG covered:** CO₂, N₂O, CH₄

**Description**
Cool Farm Tool assesses GHG emissions and soil carbon sequestration changes in response to management activities.

**Main Purpose of Tool**
The tool is designed for farmers, supply chain managers and companies interested in quantifying their agricultural carbon footprint and finding practical ways of reducing it.

**Current Applications**
- Tool will be used by Unilever as part of its Metric Reporting requirements of its Sustainable Agriculture Code;
- The tool will also be used in a multi-company project on agricultural climate mitigation coordinated by the Sustainable Food Lab, including several multinational companies (e.g., PepsiCo). For list of projects: [http://sustainablefoodlab.org/index.php?option=com_content&view=article&id=117:gaca-home&catid=18&Itemid=53](http://sustainablefoodlab.org/index.php?option=com_content&view=article&id=117:gaca-home&catid=18&Itemid=53)

**Targeted Users**
Farmers, supply chain managers and companies

**General Methodology**
- Life Cycle Inventory emission factors, empirical model, IPCC Tier 1 and 2, and published equations
- Embodied GHG emissions in fertilizers: Ecoinvent LCI (www.ecoinvent.ch);
- N₂O emissions from fertilizer use: multivariate empirical model of Bouwman et al. (2002) - which is based on a global dataset of over 800 sites;
- NO and NH₃ to N₂O conversion factors cf. IPCC Tier 1 EF;
- N₂O from N leaching: IPCC;
- CO₂ emissions from liming and Urea: IPCC Tier 1 EF;
- Soil CO₂ emissions from land management changes: IPCC Tier 1 and Ogle et al. (2005);
- Soil C changes from organic amendments: equations cf. Smith et al., (1997, based on medium/long term data from EU15 countries);
- Pesticides: 1 coefficient based on Audsley (1997);
- Livestock: IPCC Tier 1 or Tier 2;
- Fuel use: model based on ASABE (2006) technical data; and
- Electricity: EF per country.

**Underlying Databases/Data Sources**
- None specified.

**Data Input by User**
- Crop management details (e.g., fertilizer type, amount; land use/tillage changes in the past 20 years; etc.);
- Livestock management details (e.g., animal type, numbers; etc.);

**Data Output**
- CO₂ eq emissions for the entire farm, split up by source and by GHG. Output is expressed as total emissions, emissions per unit of area, and emissions per unit finished product;
Recent Activities:
Report of GHG Accounting Tools

Some notes:
1. Effort was done “in-house”
   • Internet
   • Publications
   • Personal knowledge
2. This is a “snapshot”
3. Developed as background information

Both reports:
• Contain extensive bibliographies
• Are excellent assemblages of publicly available information
• Can be downloaded as pdf from our web site.
Timeline and Key Dates
Guidelines and Methods

- Selected Lead Authors
- Formed Inter-Agency Tech Advisory Group (Jan 2011)
- Published FR Notice for public input on technical considerations (Feb 2011)
- Invited key experts to join author teams (Jan 2011)
- Teams organized and 1st Draft underway (Feb 2011)
- First draft completed (Sept 2011)
- USDA review of first draft (Oct 2011)
- Select expert peer-reviewers (March 2012)
- Inter-Agency Tech. Adv Group review of second draft (April 2012)
- Third draft completed (Aug 2012)
- Expert Peer Review of third draft (Sept 2012)
- Fourth draft available for full USDA and Inter-Agency review (Jan 2013)
- Fifth draft released for developing version 2 of tool (Feb/Mar 2013)
- Fourth draft released for public comment (May/Jun 2013)
- Final Guidelines formatted and prepared for printing (Sept 2013)
Timeline and Key Dates
Tools and Training Products

- Full assessment and review of current research, GHG estimation tools and models (in support of the working groups) (Feb 2011)

- Develop plan for Tool needs assessment (Nov 2011)
  - Conduct needs assessment for tool inputs and reporting format (Jan – Mar 2012)
  - Design plan for online estimation tool based on Version 3 of Guidelines (June 2012)
  - First draft of the online estimation tool (Oct 2012)
  - Second draft of tool and first draft of training materials (May 2013)
  - Second draft training, estimation and reporting tool released for public comment, USDA, and Inter-Agency Tech Advisory Group Review (May 2013)
  - Final training, estimation and reporting tools published on the USDA web site (Sept 2013)
USDA Announces New Funding for Conservation Partners

Conservation Partners is a partnership between the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) (www.nrcs.usda.gov), the National Fish and Wildlife Foundation (NFWF) (www.nfwf.org) and other regional/initiative specific partners. The purpose of this program is to provide grants on a competitive basis to support field biologists and other habitat conservation professionals (ecologists, foresters, range cons, etc.) working with NRCS field offices in providing technical assistance to farmers, ranchers, foresters and other private landowners to optimize wildlife habitat conservation on private lands.

- This first funding round prioritizes the Northeast Forests, Upper Mississippi River Basin, Gulf Coast and Prairie Pothole regions.
- A second round of funding is scheduled for this spring to focus on the Lesser Prairie Chicken, the Bay Delta and other priority habitat areas.

More info at www.nfwf.org
USDA Announces Funding for Water Quality Markets
Seeks Proposals for Projects $10 Million Available for Projects Nationally

The Water Quality Trading Systems Conservation Innovation Grants (CIG) are seeking to stimulate the development and adoption of water quality trading markets.

“Our goal is to demonstrate that markets are a cost-effective way to improve water quality in places like the Chesapeake Bay watershed, and agricultural producers are critical to the function of these markets.”
-Agriculture Secretary Tom Vilsack-

- Support the completion of state water quality market rules and infrastructure needed to carry out water quality trading between point and non-point sources;
- Deploy and test tools and metrics needed for crediting and verifying the effectiveness of conservation practices on agricultural lands;
- Establish certification, registry and reporting systems; and
- Educate and reach out to agriculture and other sectors.
USDA Announces Funding for Water Quality Markets
Seeks Proposals for Projects $10 Million Available for Projects Nationally

**Funding for Water Quality Credit Trading**

**Chesapeake Bay Component - up to $5 million**
Chesapeake Bay Watershed: Includes the District of Columbia and parts of six States: New York, Pennsylvania, Delaware, Maryland, Virginia, and West Virginia.

**National Component – up to $5 million**
National 44 States, Caribbean Area (Puerto Rico and the Virgin Islands), and the Pacific Islands Area (Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands).

A key part of this effort is that USDA is looking to increase consistency and coordination between state trading programs, particularly in the Chesapeake Bay watershed. Proposals Due March 2nd.
Contact Information

USDA Project Manager:
Marlen Eve, USDA
Climate Change Program Office
meve@oce.usda.gov
202-401-0979

www.usda.gov/oce/climate_change/techguide

“Secretaries of Agriculture – 30 Leaders; 150 Years”