T-AGG EXPERTS MEETING

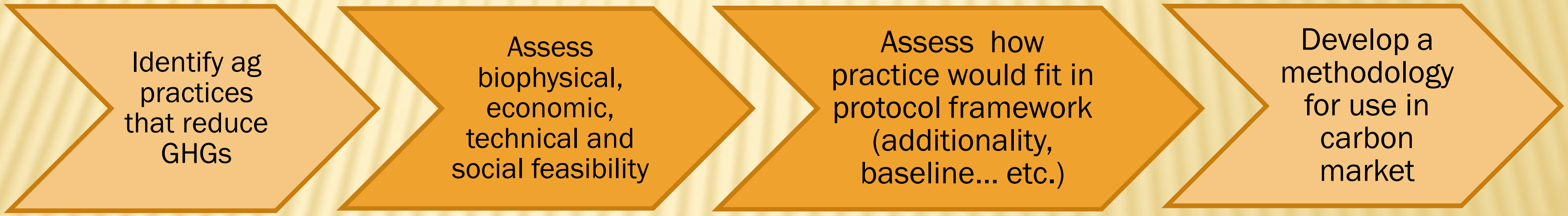
Lydia Olander Nicholas Institute, Duke University
T-AGG Experts Meeting, Chicago, IL
April 22-23, 2010

“Agricultural land management practices in the United States have the technical potential to contribute about 230 Mt CO_2e/yr of GHG mitigation by 2030 “

-Smith et al., 2008

T-AGG PURPOSE

Lay the scientific and analytical foundation necessary for building a suite of methodologies for high-quality greenhouse gas (GHG) mitigation for the agricultural sector



Focusing initially in the United States and beginning to assess opportunities and approaches for a similar effort abroad

PROCESS

Identify ag practices that reduce GHGs → Assess biophysical, economic, technical and social feasibility → Assess how practice would fit in protocol framework (additionality, baseline… etc.) → Develop a methodology for use in carbon market

- Coordinate and complete a transparent and scientifically founded review of GHG mitigation opportunities in the U.S.
- For the best of these opportunities, conduct the analytical assessments necessary to initiate development of high-integrity methodologies
- Gather expert and user input
- Produce technical reports with executive summaries for stakeholders and decision makers
- Outreach and engagement
- Similar process for international opportunities

INTRODUCE COORDINATING TEAM

- *Project Director*
  Lydia Olander - Director of Ecosystem Services Program, Nicholas Institute, Duke University
- *Research Director*
  Alison Eagle - Research Scientist, Nicholas Institute, Duke University
- *Research Advisor*
  Rob Jackson - Chair of Global Environmental Change at the Nicholas School and Professor in the Biology Department, Duke University
- *Research Advisor*
  Charles Rice - University Distinguished Professor of Soil Microbiology, Department of Agronomy, Kansas State University
- *Economic Advisor*
  Brian Murray - Director of Economic Analysis at the Nicholas Institute and Research Professor at the Nicholas School, Duke University
- *International Advisor*
  Peter McCornick - Director of Water Policy, Nicholas Institute, Duke University
- ***Others involved in reports:*** *Justin Baker, Karen Haugen-Koyzra, Neville Millar, Phil Robertson, Lucy Henry, Andrea Martin, John Fay, Ben Parkhurst*

ADVISORY GROUPS

Advisory Board

- **Elly Baroudy**, The BioCarbon Fund, World Bank (*represented by Neeta Hooda*)
- **Pradip K. Das**, New Technology Business Applications Director, Monsanto Co.
- **Ernest Shea**, 25x'25 Project Coordinator
- **Karen Haugen-Kozyra**, Climate Change Central
- **Eric Holst**, Environmental Defense Fund and Steering Committee for C-AGG
- **Bill Irving**, Chief - Program Integration Branch, Climate Change Division, USEPA
- **Carolyn Olson**, National Leader Climate Change Office of the Deputy Chief SSRA, USDA-NRCS
- **Keith Paustian**, Professor and Senior Research Scientist, NREL, Colorado State University

Science Committee

- **John Antle**, Professor, Department of Agricultural Economics and Economics, Montana State University
- **Ron Follett**, Supervisory Soil Scientist, Soil and Plant Nutrient Research, USDA ARS
- **Cesar Izaurralde**, Fellow, Pacific Northwest National Laboratory, DOE and Adjunct Professor University of Maryland
- **Keith Paustian**, Professor and Senior Research Scientist, NREL, Colorado State University
- **Phil Robertson**, Professor of Ecosystem Science, W.K. Kellogg Biological Station and Department of Crop and Soil Sciences of Michigan State University

TIMING

- Experts meeting/ domestic drafts — *April 2010*
- Domestic Scoping — *Complete early summer 2010*
- Domestic Assessment(s) — *Complete Summer Fall 2010*
- International Scoping — *Initiate fall 2010*
- International Assessment(s) — *Complete Summer 2011*

End 2011

REPORTS

Scoping and Comparison

- Assess wide range of agricultural and land management practices
- Identify practices with greatest mitigation potential and viability
- Net GHG impact, economic and technical feasibility (lit review, economic models, data synthesis, expert input) by practice and geography

Practice Assessment

- Added depth on mitigation potential, scientific understanding, co-impacts, economic viability, social and technical barriers
- Assess data and options for baseline, additionality, leakage, reversal risk, measurement and monitoring.
- Provide recommendation of either (a) sufficiently well supported and feasible or (b) lacking important information or facing barriers

THIS MEETING

- Discuss the scoping assessment of agricultural practices for GHG mitigation
- Evaluate critical questions for the development of promising agricultural protocols or programs in the US
- Assess promising practices for international agriculture
- Engage additional expertise in the development of T-AGG reports

US SCOPING AND ASSESSMENT

Lydia Olander and Alison Eagle, Nicholas Institute, Duke University

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INTENT OF SCOPING AND PRIORITIZATION

- Provide a framework for comparison
- To select promising practices that T-AGG will focus upon for further assessment
- Provide a roadmap for future protocol/ methodology/program development

Physical and Economic Potential – High/Med/Low?

- Net GHG/ha, total ha available, and over what time frame
- Costs for management shifts (opportunity costs, capital costs, …)

Scientific Certainty – High/Med/Low?

- Is information (measurement and modeling) sufficient by practice, crop, and geography?
- Does directional certainty exist for net GHGs?

Possible Barriers – Addressable?

- Yield decline (affects production elsewhere and economic impact)
- Economic cost – break-even price too high?
- Technical barriers – monitoring, adoption, or production barriers
- Social barriers or negative community or farmer impacts
- Negative ecological impact
- Life cycle analysis – significant negative upstream or downstream GHGs

Implementation & Accounting Barriers – Addressable?

- Measurement, monitoring and verification – Are there good methods for measuring or modeling GHG outcomes on a project scale? and for verifying projects?
- Additionality – Can it be assessed sufficiently?
- Baseline – Are there viable approaches for setting baseline? Sufficient data?
- Leakage risk – Is there leakage risk (life cycle analysis)? Can it be accounted for?
- Reversal risk – Can risk be estimated? Can it be accounted for? Is it too high?

Significant Co-benefits?

May consider activity with lower GHG potential if it provides other social, economic or environmental co-benefits

p.15 in draft

		GHG Mitigation Activity
Cropland Management	CO_2	Conservation Tillage
		Crop residue retention
		Fallow management (i.e., outside of main crop)
		Shift between annual crops
		Shift from annual crops to include perennial crops
		Irrigation Improvements
		Reduce chemical inputs
		Management of organic soils
		Agro-forestry on cropland
		Application of organic soil amendments
		Create field buffers (e.g., windbreaks, riparian buffers)
	N_2O	Improved nitrogen use efficiency and reduced N fertilizer use
		Irrigation management
		Improved manure application methods
		Drainage of agricultural lands in humid areas
	CH_4	Rice, specifically water management
		Improved rice cultivars, less methane production and transport
Grazing Land Management	CO_2	Improved grazing (pasture) management
		Fertilization
		Irrigation management
		Changing species composition
		Fire management
	N_2O	Improve N use efficiency of fertilizer
	CH_4	Feed/grazing animal management
Land Use Change	CO_2 N_2O CH_4	Convert cropland to grazing land
		Convert cropland to natural landscape
		Restoration of degraded lands
		Avoid draining wetlands

p.17-18 in draft

METHODS: LITERATURE

Other GHG have not yet been included

EXAMPLE Table 4.
Estimates of Physical/Technical Offset Potential for Conservation Tillage, US

Citation	Specific tillage type	Comments or Caveats	Physical Potential (t CO_2e/ha/yr)	Physical Potential (Mt CO_2e/yr) - national
(Follett, 2001)	conservation tillage			Low: 65.3 High: 131.0
(Franzluebbers and Follett, 2005)	no-till versus conventional	Calculated from estimates of five different regions	Range from -0.26 (northeast) to +1.76 (Corn Belt)	Mean: 95.1
(Six et al., 2004)	no-till versus conventional	254 SOC comparison datapoints, mostly USA, avg 20 yrs		Low: 28.5 High: 65.3
(Sperow et al., 2003)	no-till and reduced till	(L) no-till (50%), reduced till (50%) versus (H) no-till on all cropland		Low: 135.8 High: 172.5

Source: Calculated from source to common units; cropland area, if needed for national calculation and not in given reference, is from US agricultural census.

METHODS: MODELS

CENTURY and DayCENT model data were used to estimate regional and national biophysical potentials including net GHGs, as well as on site and upstream energy and fuel use, for specific agricultural practices where possible. These were scaled up using the structure of the FASOMGHG model.

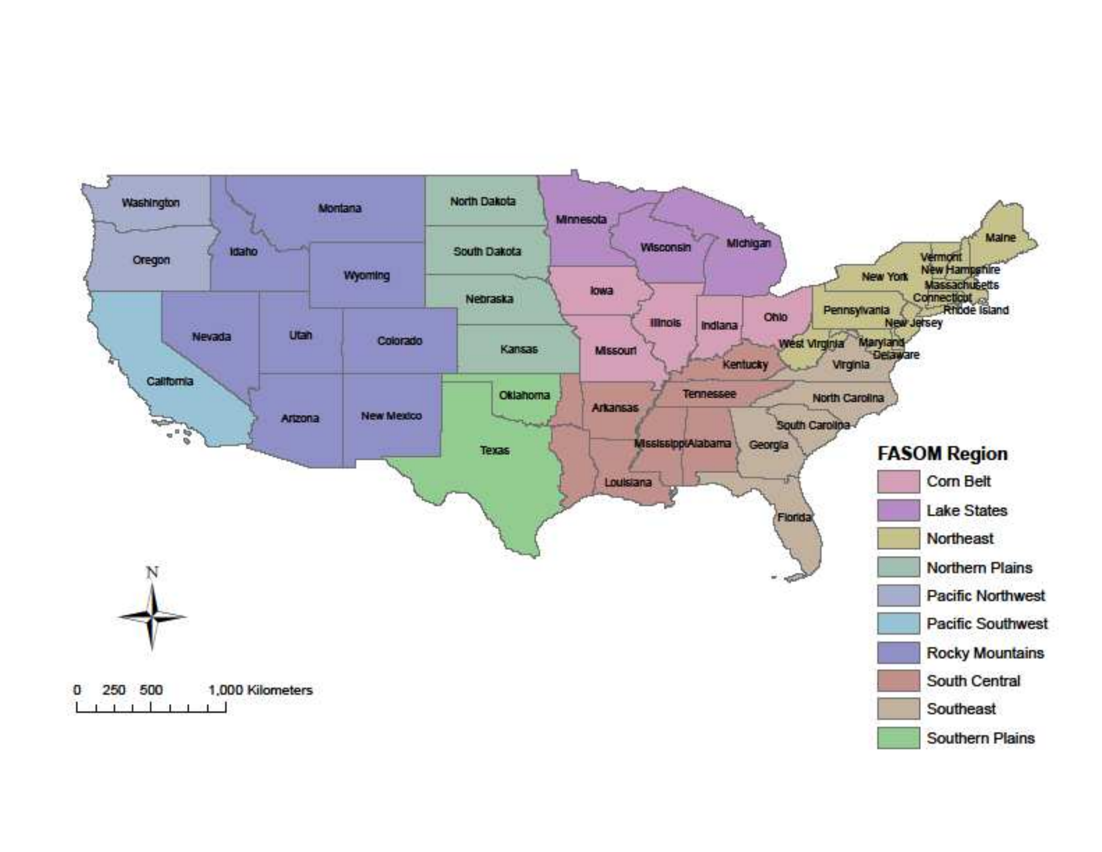

Figure 2. Representative map of FASOMGHG regions and sub-regions

BIOPHYSICAL GHG MITIGATION POTENTIAL

	Soil C	Land Emissions	Upstream & Process	Total	National
	---- t CO_2e/ha/yr ------				Mt CO_2e/yr
No-till, FASOMGHG	-1.00 (-5.61–0.43)	-0.04	-0.59	-1.63	-129.4
No-till, Literature	-1.13 (-2.61–0.26)	?	?	-1.13	-90.4
Improve/Reduce N	n/a	-0.54 (-1.42 – -0.02)	*-0.14**	*-0.68*	*-89.9*
Residue retention	-1.07	?	?	-1.07	-66.9
Winter cover crops	-1.29	?	?	-1.29	-76.6
Histosol to natural	-21.21	?	?	-21.21	-41.8

Note: negative means storage or emission reduction

***This comes from FASOMGHG**

Table 24: Net GHG Mitigation by Source (Mt CO_2e)

* primarily resulting from a shift in land use change, not a shift in management

Sample run – model is undergoing updates and will be rerun

Carbon price	$5/t$CO_2$e	$15/t$CO_2$e	$30/t$CO_2$e	$50/t$CO_2$e
Competing Agricultural and Forestry Mitigation Activities				
Forest Management	-80.99	-153.26	-219.90	-287.24
Forest Product C Storage	1.20	4.04	8.01	14.10
Bioenergy	-68.36	-170.38	-187.35	-212.43
Afforestation	-62.27	-143.60	-240.52	-360.54
Total Mitigation	**-210.42**	**-463.2**	**-639.76**	**-846.11**
T-AGG Agricultural Offset Priority Activities				
Reduced Agricultural Fossil Fuel Use	-0.39	-2.15	-5.37	-9.34
Changing Tillage Practices	-1.97	-8.67	-18.12	-26.68
Pasture C Sequestration*	18.71	32.57	34.31	33.44
Pasture N_2O Management*	-0.49	-0.87	-0.94	-0.93
Reduced N Use	-0.20	-0.33	-4.75	-10.48
Grain Drying	-0.28	-1.18	-2.37	-3.91
Irrigation Management	-0.08	-0.29	-0.49	-0.79
Reduced Chemical Use	-0.03	-0.25	-0.61	-1.14
Manure Management	-1.10	-3.15	-5.08	-6.61
Improved Enteric Fermentation	-7.28	-19.66	-30.71	-35.93
Residue Burning*	0.00	-0.02	-0.05	-0.09
Decreased Methane from Rice Cultivation*	-0.31	-1.17	-2.07	-3.35
Total Mitigation	6.58	-5.17	-36.25	-65.81
Total Mitigation without Pasture Conversion Emissions	**-12.13**	**-37.74**	**-70.56**	**-99.25**

HOW DO WE ASSESS SCIENTIFIC CERTAINTY?

- *Consistency of mitigation potential (directional certainty)*
- *Availability of data/research*
- *Quality of research (expert opinion)*

- NEED FEEDBACK

NEXT STEPS

- Completing assessment of potential
- Assessing other criteria (potential barriers)
  - Implementation barriers (e.g., data availability, measurement, verification, reversal risk, baseline)
  - Social, economic barriers
  - Co-effects
- Will need your input and review in future
  - Sufficient information in scoping documents?
  - Right information and approach for in depth assessments for selected practices?