

Breakout Group Discussion Questions
**ARS Session: Synthesizing Customer Problems, Desired Products, and Measures of
Research Progress**

Wednesday May 14, 2008

Discussion Component/Topic: Emissions gases and particulates from agricultural operations

Breakout Session Facilitator: Al Rotz
Laptop Recorder: Laura McConnell
Flipchart Recorder: Cathleen Hapeman
Breakout Session Presenter: Mike Buser

Participants: Cathleen Hapeman, Al Rotz, Laura McConnell, Matt Smith, Scott Yates, Mike Buser, Greg Holt, Larry Wagner (WEPS), Russell McGee, John Tatarko, Brent Sheridan, Ted Zobeck

Expertise

Cotton Ginners, Almond Groves, Feedlots, WEPS, Fumigants, Soil Properties, Wind blown dust PM10, fugitive dust, pesticide transport, bioenergy

Goals: Prioritize research problems, identify products and progress metrics, inventory resources

1) List higher priority *problems* for ARS to address that *can* be addressed given available resources and expertise. Note which are short-term, which are long-term.

- Lack of complete understanding of the processes and mechanisms that affect the fate and transport of agricultural pollutants in the soil and atmosphere, including the processes and environmental (i.e., climatic) conditions controlling the emissions from soil into the atmosphere, including but not limited to:
 - sorption, transformation, volatility, OTHERS
 - effects of temperature, soil water content, soil type, organic matter, aging
 - erosion, drift, deposition, soil crusts, mechanical release
- Insufficient information (i.e., data) on the measurement of emissions of agricultural pollutants (i.e., particulate matter, pesticides, odors, and NH₃) into the atmosphere, including:
 - insufficient information on emissions factors and fluxes to assist stakeholders and regulators in creating scientifically defensible regulations
 - insufficient understanding of the spatial and temporal variations in emission factors and fluxes at regional and global scales
 - insufficient testing and evaluation of instruments and methodology that forms the basis for emission factors and flux measurements.

- Insufficient understanding of the complex integrated and synergistic processes and mechanisms affecting fate and transport of agricultural pollutants that would allow the development of highly accurate and reliable predictive tools to predict environmental fate and transport. Insufficient testing, verification and identification of weaknesses of existing models of the fate, transport and emission of agricultural pollutants.
- Lack of effective and cost-effective methods to mitigate/abate agricultural emissions to the atmosphere.

2a) What are the *research needs* of the problems that ARS can address?

Follow the Action Plan format of stating them in terms of Understand/Predict/Control.

- Creation of an ARS Air Quality Emissions Research Network to help research scientists leverage Agency expertise, information, methodology and tools. The collaborative effort needs to include:
 - Coordination and collaboration of efforts of modelers and those generating datasets to allow the evaluating and validating methods and models
 - Allowing for more efficient sharing of information and expertise
 - Potential centralization of the management of sampling equipment for larger scale and more comprehensive research and monitoring projects
 - Protocols for generating standardized datasets for model evaluation
 - Creating review committees for various aspects of emission
 - Identifying gaps in expertise and develop further partnerships
- Develop new and more reliable samplers and monitoring equipment. Standardize the protocols for existing and improved samplers. Develop automated sampling equipment where possible.
- Conduct new studies/experiment of the fate and transport of agricultural pollutants to fill in knowledge gaps and to provide information needed for new experimental and modeling technologies and methodologies.
- Develop, evaluate and improve models to accurately predict agricultural emissions.
- Develop new effective and inexpensive methods for mitigation/abatement of agricultural pollutants
- Impact on offsite/unintended receptors – Ag/Urban Interface and Urban effects on Agriculture
- Develop a new and peer-reviewed protocol to measure and characterize PM size fractions and other air quality related measurements.
- Assessment of the impact of fugitive PM on the regional environment

b) What lower priority problems should be addressed by ARS given additional resources?

- Populate NRCS databases on lifecycle analysis of PM10
- Regional transport scheme and PM2.5 for WEPS
- Problem: Potential lack of funding
- Visibility issues from smoke, dust, and Feedlots
- Make sure we are represented in these interagency working groups

- Burning issues – prescribed burning versus wildfires
- Include biofuels – examining emissions from different biofuels and effects of processing and examine resource management issues related to productions

3) What are types/forms of *solutions* to the problems (or *products* from the research) that can be developed? What can be used as indicators of progress towards solutions and products (Milestones)?

- New datasets on flux rates, emission factors, and related transport properties (for models)
- New fate and transport models
- Evaluation and testing of existing datasets and models
- New mitigation methods
- Protocols for using sampling equipment
- Peer-reviewed research articles
- Guidance documents

4) What are strengths of ARS that make ARS uniquely suited to solving the problems and addressing the research needs of (1) and (2a)?

- Vital clearinghouse to assimilate information on emerging regulations – Focus on the Service aspect to producers. Act as intermediates.
- Can quickly assemble teams to address problems.
- Can take national view of problems.
- Knowledge base resources
- Provides credibility to data generated
- Unique expertise and equipment, infrastructure
- Longer term experiments – higher risk experiments
- Assist in training facilities at universities for producers – collaborates well with other entities

Title of Group: Adaptation to Global Change (non-cropping)

Breakout Session Facilitator: John Schmidt

Laptop Recorder: Michael Abbey

Flipchart Recorder: John Schmidt

Breakout Session Presenter: Jack Morgan

One Criteria to Consider - What does ARS do better than anyone else?

1) List higher priority *problems* for ARS to address that *can* be addressed given available resources and expertise. Note which are short-term, which are long-term.

- Lack of information on role of the impact of phenology in controlling response of agricultural species and populations to GCC, includes interaction with other species...see phenology notes John Schmidt group *short projects are population studies (phenology indicator species) leading to long term commitment i.e. change in time, climate gradients for like species – use multiple locations(on important species) Jake Weltzin of National Phenology Network/USGS Tucson*
- Carbon sequestration issues, carbon cycling, understand why things change as a result of CO₂ enrichment, rain (impact and mechanisms behind that impact) *short projects leading to long term commitment, economic impact*
- Plant Community Dynamics (focus of group present) *long term with short term steps such as using existing experiments species change as a function of CO₂, analyze*
 - Species change, invasives, biodiversity and global change (one way to characterize species, community dynamics), natural enemies
 - Strengths are continuing research, in plant pathology, genomics, limited external range CO₂ experiments outside of ARS, unique experimental facilities
- Water (including use, salinity, quality). Meteorology impacts like more intense hydrologic cycle, extreme events, weather patterns impact “all” areas. Nutrient management issues *short term projects that support long term discussion to discuss global change/how to build up to a regional change predictions,*
- Forage quality and impact on animals (above ground) *short term*
- Scaling issues/scaling results...how do we scale up in size and micrometeorological scale up to changes in atmosphere (increase in N...)

Additional Priorities:

- (general) need expertise of agricultural economists
- (Cross – cutting) scaling issues, modeling to assist with upscaling on spatial and temporal scale (ecosystem functions, impacts on production)
- (partnerships) Collaborate with ‘vehicles’ like Sustainable Sites Initiatives – way to get research into the public vernacular

2a) What are the *research needs* of the problems that ARS can address?

Follow the Action Plan format of stating them in terms of Understand/Predict/Control.

- Phenology (needs) how combined global change (CO₂, temperature, water) affects key plant species. Understanding the issues of scaling to seasonal carbon intake and spatial (may scale to ecosystem function)
- Carbon sequestration (needs)
- Plant Community Dynamics – (needs) Which plants are going to be winners/losers in Global Climate Change. Impacts value of rangeland/cropland. Need to understand sustainability of communities (resilience)
- Water – crop genomics to breed hardier crops, research into what are the better cover crops to prevent erosion
- Forage quality – information on species change and nitrogen cycle/understand other micronutrients impacts
- Scaling – take modelers and local scale models and adapt to “global change” aspects. Modeling as unique need in global change – ARS current experiments too localized to be of use without modeling
-

3) What are types/forms of *solutions* to the problems (or *products* from the research) that can be developed? What can be used as indicators of progress towards solutions and products (Milestones)?

- Phenology (solutions) more of a metric (identifying or quantifying) impact on ecosystem dynamics (partner with Phenology Network)
- Carbon sequestration (solutions) linking land use and management patterns to states models with dynamics on ground (in new area). Methodological opportunity for ARS on how we collect information. may have benefit in specific situations. Take knowledge of one state and apply it to its new state (best potential)
- Plant Community Dynamics – (solutions) develop of state and transition models that incorporate global change. Strengthening link between Fort Collins and Temple Texas to facilitate research *using existing experiments species change as a function of CO₂, analyze*
- Water - (solutions) ARS has people with expertise in crop strategies, rangeland, water cycles...combination of forecasting, measurement and modeling National Drought Mitigation lab in Lincoln already providing data (though more in short term prediction rather than global climate change perspective) In Lubbock, they are coming up with Sentinel Plants, they prestress a little bit sooner than others and give an indication that they need soil moisture, pests etc...impact on irrigation.
- Forage quality – (solutions) quantifying indicators

Greenhouse Gas Group

Breakout Session Facilitator: Jane Johnson

Laptop Recorder: Rod Venterea

Flipchart Recorder: Steve Del Grosso

Breakout Session Presenter: Tim Parkin

1) List higher priority *problems* for ARS to address that *can* be addressed given available resources and expertise. Note which are short-term, which are long-term.

- Lack of system-specific GHG emissions factors and Carbon footprint analysis for conventional and alternative cropping systems, including biofuel production systems and potential GHG mitigation practices, under different climate and soil regimes.
- Lack of succinct and targeted information designed for customers regarding management impacts on GHG emissions.
- Lack of analysis of economic and social impacts of modifying management practices for GHG reduction.

2a) What are the *research needs* of the *problems* that ARS can address?

Follow the Action Plan format of stating them in terms of Understand/Predict/Control.

- Quantification of GHG emissions and comprehensive Carbon footprint analysis of conventional and alternative cropping systems, including biofuel production systems, under different climate and soil regimes.
- Quantification of the efficacy of GHG emission mitigation strategies, including reduced tillage and alternative fertilizer management practices.
- Portable and inexpensive methodologies for measuring temporal and spatial variability of GHG fluxes from cropping systems.
- Standardization of methods for quantifying soil C storage, both in terms of adopting new analytical technologies and method details such as establishing appropriate sampling depths, whether or not to include inorganic C? Bulk density measurement is problematic.
- Need for quantifiable verification of C sequestration (cap and trade).
- Additional GHG emissions data from greater variety of systems, for example rangeland sites and animal operations, livestock, and CAFOs.
- Understanding of process and mechanistic controls over N₂O emissions, e.g. interactions among soil/crop/fertilizer management which will aid improvement of models and development of mitigation strategies.
- Understanding and modeling of landscape scale processes, e.g. erosion-induced redistribution of soil and nutrients.
- Combine biogeochemical with hydrology/transport models.

b) What lower priority problems should be addressed by ARS given additional resources?

- see above

3) What are types/forms of *solutions* to the problems (or *products* from the research) that can be developed? What can be used as indicators of progress towards solutions and products (Milestones)?

- Improved process models
- Data base
- Synthesis paper based on current GRACEnet data
- Improved measurement technologies
- Regionally specific technical documents

4) What are strengths of ARS that make ARS uniquely suited to solving the problems and addressing the research needs of (1) and (2a)?

- Measurement expertise
- National infrastructure and network with regional focus/connections.

Global Change—Crops Group

Breakout Session Facilitator: Tim Gish
Laptop Recorder: Lisa Ainsworth
Flipchart Recorder: Brian Wienhold
Breakout Session Presenter: Jeff White

Discussion Component/Topic: (Reducing Emissions to the Atmosphere or Adapting to Global Change--Crops)

Long term:

What strategy does the US have for coping with climate change to ensure that we have adequate food, feed, fiber, and fuel supply?

What are the barriers, limitations and opportunities?

1. Understand the responses of integrated crop systems (including, but not limited to legume/non-legume, C₃/C₄, irrigated/rainfed, annual/perennial) for food, feed, fuel, and fiber to anticipated climate change

- **Quantity and quality changes in yield**
- **GHG emissions**
- **C sequestration potential**
- **Water & nutrient availability and consumption (uncertainty of water supply)**
- **Trophic level responses – i.e., pests & diseases, grazers, weeds**

2. Develop process based understanding to feed into models using data from multiple years and multiple locations

- **Consider spatial and temporal variations/dynamics**
- **Uncertainty**

3. Develop germplasm or identify genetic variation that is responsive to climate change

4. Validate and extend capacity and robustness of models for higher CO₂ and temperature

5. Identify and develop scalable methodologies (both experiments and models) for potential impacts and adaptation of agriculture to climate change, including identification of sustainable best management practices

- **Integrate data on different scales into recommendations for adapting agriculture to global change**

6. Modifications to agronomic management in terms of tillage, fertility, planting date

7. Sustainability of agronomic systems with increasing CO₂ and temperature

8. Uncertainty of water supplies with increasing CO₂ and temperature – watershed, interannual variation

Short term:

Meta-analyses of published literature

Effective communication to user audiences (e.g., 1 pagers for stakeholders with legislative talking points)

Everything is high priority

ARS has data available at different scales to integrate into holistic understanding of crop system responses to climate change

Gaps in knowledge: We do not have the capacity to predict specific climate changes in specific locations or assess variability and uncertainty in those projections