Customer Breakout Session I: Short Term & Long Term Research Priorities

Tuesday, May 13, 2008

Reducing Agricultural Emissions to the Atmosphere A

Group:	Reducing Agricultural Emissions to the Atmosphere A—Colorado Rm I
Facilitator:	Brian Wienhold
Recorder:	
Presenter:	Tom McDonald

Emissions of PM, GHG, VOCs, NH3, NOx, etc…

- **Quantification**
- **Methodologies**
- **Abatement**
- **Accuracy/precision/emission factor**
- **Modeling**

Adaptation of Ecosystems

- **Movement hardiness zones**
- **Alpine areas**
- **permafrost melting**

- **Adaptation versus abatement**
- **Which should we do?**

Biomass to Biofuel

- **Byproduct biomass**
- **Gasification**
- **Cellulosic ethanol**

Carbon balance/footprint/lifecycle analysis

- **Models**
- **Changes in management**
- **Ag can be a solution**
- **Ecosystem "boundaries"**
- **Whole GHG not just C**
- **Role of soil organisms**
- **Role of fertilizers**

Fire Issues

- **Emission factors**
- **Natural vs. prescribed**

Tech Transfer

- **Collaborations with other agencies**
- **Partners**

Scale Issues

- **Plot to landscape to watershed**
- **Results from regional vs. national application**

Strengths

- **Wide range of expertise**
- **Credibility**
- **Independent but work with collaborators**
- **CRADAs**
- **Deliver useable info to those who need it**
- **Willingness to cooperate**
- **Resources: facilities, expertise, base funding, infrastructure**

Reducing Agricultural Emissions to the Atmosphere B

Group:	Reducing Agricultural Emissions to the Atmosphere B—Colorado Rm II
Facilitator:	Al Rotz
Recorder:	Doug Karlen (computer); Greg Holt (chart)
Presenter:	Harold Reetz

1a) **For this component discussion, what are long-term problems that ARS needs to address with its research? Why?**

- Current inability to accurately assess what is and is not a problem – both emissions and sequestration – **short and long term**
- PM 2.5µ (fugitive dust) quantify accurately – unpaved roads; field operations; cotton gins – **short term**
- Emissions from pesticides, previous work was done on fumigants, need to quantify emissions; what application methods to reduce emissions; reactivity of emissions (Monster in CA – VOC), application methodology, equipment; -- **short term**
- N_2O emissions from fertilizer; CA assuming it is a source and convening sessions to determine how to reduce; need to quantify and if it is a problem and then determine mitigation strategies; -- **short and long-term**
- Need unbiased characterization of emissions from biofuels (e.g. biodiesel; biomass) – lifecycle analysis – **short term**
- NOx emissions from biodiesel; what are emissions? If NOx is increased, what can be done? Changing engines or modification of fuels will take time, – **short and long term**
- Sequestration – impact of perennials; above ground as well as below ground; especially in CA; storage in perennial vegetation – perennial wood; vegetation plantings to reduce dust; vegetation role in total sequestration; -- **short and long term**
- Practices for correcting EPA reference dispersion sampling methods (over-sampling problem) – **short and long term**
- No good particulate dispersion model at present; some work with cotton gins but CA CAFOs data does not match; high cost for dispersion credits; -- **short and long term**
- Need priority list for problems; After determining current levels of emissions, then must be able to establish priorities for education and mitigation; -- **short term (closely related to the first bullet) also long-term**
- Changing environment will require adaptation of our agricultural practices; temperature, climate zones, extreme events, -- changes are not likely to totally reverse; e.g. population is not going to go backwards; (both physical changes and regulatory changes) – **Long term**
- Regulations outstripping facts – need research to gather the facts; sequestration; environmental impacts; -- **short term**
- Communication and outreach phase must be fully integrated to get the information out into the field – this is increasing in importance all the time;

outreach is crucial even though Extension dying in many locations; -- **Short term**; telling story to non-agriculture

- Integrated systems research is difficult to link with specific hypothesis related research; No two watersheds are the same, publication of systems research can also be a problem if measured by traditional standards; life-cycle analysis -- **short and long term**
- "NP-206" included a "Discovery" option to classify research (e.g. NH_4 volatilization from feedlots)
- Energy efficiency research – achieve goals with fewer inputs; economics is very important part of this work; -- **short term**
- System research – challenge to get out of agronomic box and interact with economists and sociologists; need ways to facilitate networking with other agencies, disciplines, etc.
- Funding – energy to save facilities, prevents solving problems; ARS is who Air Quality task Force turns to for answers!

b) <u>What period of time is considered long-term? (5,10,15 years..)</u>

- 5-years is "short term"; key problems identified – step A is what can be done in 5 yr;
- CA – highly regulated and what's short term for some is immediate (e.g. assessing emissions, then what needs to be done); No long-term for CA;
- A systems approach is needed in CA; Grapes – need system answer (e.g. do X and a, b, c are the expected problems)
- CA – fugitive dust (2.5µ) is source category without sufficient data to know if it's a true problem
- Long-term studies must be done at same time as short-term to provide records needed to show trends and changes;
- Agriculture does impact the environment, environmental changes were slow to occur and be recognized and will take time to reverse;
- GRACEnet foundation was laid in 2002; official PDRAM in 2006;
- Consensus – 5 year and less is "short-term" but must be integrated into long-term vision

2a) **<u>For this component discussion, what are short-term/immediate problems that ARS needs to address with its research?</u>**

(See 1a.)

3**) <u>What do you value as strengths of ARS that can be brought to bear on these problems?</u>**

- Presence across U.S.
- Competencies
- Communication with stakeholders

Best organization for long-term research; not focus of university researcher

Reducing Agricultural Emissions to the Atmosphere C

Group:	Reducing Agricultural Emissions to the Atmosphere C—Colorado Rm III
Facilitator:	Jane Johnson
Recorder:	Ann C. Kennedy; Jerry Hatfield
Presenter:	Bill Norman

- Need enhanced long-term research data sets (Time/ Space) to feed into models.
- Need for verification tools of C, C credits and GHG credits
- We need to understand whole profile, not just surface.
- What is potential for GHG sequestration under high yielding cropping system?
- Need coordination between modeling, sampling and emission controls for all PM emissions (eg. Cotton gins, CFO, tillage, equipment)
- Models to establish emission do not adequately predict air quality and property line
- Greater Understanding of Nitrous Oxide
- Increase understanding of Nitrogen use for N use efficiency.
- Need information on emissions on per unit output
- Need footprint for agricultural practices
- Expand Grace net
- How much do we put where, when, how.
- Better communication among ARS and other agencies and producer
- Need to make sure that research data are handed off to other agencies.
- Need to have product ---Decision support systems between ARS and NRCS
- Need to understand Animal Agriculture production and emissions
- Lab level scientists need to have leadership direct ties with producers and grassroots efforts. Industry partnering to developing solutions to critical issues

1a) For this component discussion, what are long-term problems that ARS needs to address with its research? Why?

Need for verification tools of C, C credits and GHG credits
There are standards and guidelines out there; ARS need to help with standards *quality* and improve the guidelines and expand on range of measurements

Policy makers and customers have concern about full profile analyzed for C
So do Ag production make a difference to full profile, can it be measured;
Need cohesive direction to establish C credit measurement standards; Not just carbon but also GHG

Some of the measurement question is communication problem-

Practice-based protocols need to be updated cant used model based approach at this point. **We need to understand whole profile, not just surface.**

What is potential for GHG sequestration under high yielding cropping system?
What is yield potential when we are sequestering C
High yields with lower product per unit output Can they be compatible.
Realistic field scale data not plot scale -Disconnect from plot to field scale
How to scale up??
USDA models cannot be used by utilities due to quality of model/data
Problem may not have confidence with quality of data
How to provide info with systems with greater confidence

Need coordination between modeling, sampling and emission controls for all PM emissions (eg. Cotton gins, CFO, tillage, equipment)
Emissions southeast cotton quantification and reduction and take to regulated community and

Models to establish emission do not adequate predict air quality and property line
Data do not equal model; Sampler methods over estimate PM10/2.5 (10 fold or higher) and producers will be on offense. Will increase those non-attainment areas
Sampling
Cotton/CFOs just an example of these problems.
Need right away- 0-5 years any further than that.
Confounding part… Communication with Fed EPA communicated well and they understand/ most the state agencies do not have the capability to distinguish.
Other industries fit the models better, so non-ag folks

ARS Need more data From Lubbock and Las Cruces Front burner

Greater Understanding of Nitrous Oxide
Increase understanding of Nitrogen use for N use efficiency.
Need information on emissions on per unit output
Form of N, Timing and placing of application but need data to put into equation
Not just Emissions but emissions per Output
Broader sense of Nitrous oxide and trade off of rate of N application, yield and environmental impact (0 to 5 yr)
ARS role, grace net good start possibly within this framework collect the Nitrous Oxide ;

Need footprint for agricultural practices
Need good data to defend ag; and Footprint and efficiencies production per land /water unit/ Fertilizer unit GHG emissions per N applied; also water quality and leachate/runoff; connect full life cycle of ag

Expand Grace net

How much do we put where, when, how. Timing, Source, rate placement, ARS well suited for this as they have long term research sites. What are the new technology.

Need connection back to productivity.
What technologies are available in the Nitrogen measurements C:N measurements and water

What crops and cropping systems need to come to the top of the list.

Need enhanced long-term research data sets (Time/ Space) to feed into models.

Better communication among ARS and other agencies and producer
Need to make sure that research data are handed off to other agencies.
Need to have product ---Decision support systems between ARS and NRCS
Interaction of ARS and EPA needs to continue and flourish.
Need greater coordination with ARS and regulators to understand the limit of the results, tradeoffs and solutions
Interaction with ARS and NRCS
International coordination

Show whole complex to illustrate tradeoffs and beneficiaries
Need caution with research that may end up in regulations; research needs to be tighter so Am I really helping famers.
Need solutions to problems in broader context
ARS needs to think about what options are for agriculture.

- **Need to understand Animal Agriculture production and emissions**
- **Lab level scientists need to have leadership direct ties with producers and grass roots efforts. Industry partnering to developing solutions to critical issues**

Dusty Findley-cotton
Bill Norman –cotton
Eric Lund- C measurement soil science technology
Robert Lascano Wind erosion
Bill Hohenstein Global Climate change- role of ag in reducing emissions
Cliff Snyder N program directors regional environmental issues / EPA rep
Laura McGinnis Information staff
Karamat Sistani
Ann Kennedy
Jane Johnson
Jerry Hatfield

Reducing Agricultural Emissions to the Atmosphere D

Group:	Reducing Agricultural Emissions to the Atmosphere D—Executive Rm. A
Facilitator:	Scott Yates
Recorder:	John Baker,
Presenter:	Jerry Snyder

1a) For this component discussion, what are long-term problems that ARS needs to address with its research? Why?

How can we reduce particulate emissions from soils, cattle feedlot. What are the contributions of agriculture to PM2.5 as compared to construction sites, internal combustion engines. Examining particulates to identify sources.

Are current sampling technologies designated by EPA adequately quantifying PM2.5 from agriculture? What fraction of PM2.5 is contributed by agriculture?

Ammonia emissions. A lot of basic research has been done, but the problem has not really been solved.

Research to look at temporal and spatial dynamics of emissions under different climate and production scenarios, landscape conditions, soil moisture conditions, agricultural practices. Avoid focusing on a "single number" for emission factors.

Standard measurements for establishing carbon sequestration on farms for average farmers to use for carbon trading. (sampling and analysis methods)

Economic incentives with respect to carbon sequestration in order to move towards grass fed beef rather than CAFOs.

Life cycle analysis of greenhouse gases for crop production systems comparisons in order to assess the best production systems to utilize. GHG emission mitigation measures.

Include economic impact assessments – examine the benefits of carbon sequestration under different production systems,

More efficient use of C and N resources. Developing systems that utilize C and N more efficiently so that they are not emitted to the atmosphere, i.e., legumes that will grow under dry land conditions. Capturing lost N. Innovative sources of N to reduce dependency on fertilizers.

Examining N loses holistically – all sources simultaneously to provide data to validate models.

How does rainfall deposition affect different farming zones with N and C.

Efficacy of aquifer recharge. Better coordination of

c) **What are types/forms of *solutions* to the long-term problems (or *products* from the research that would impact the problem)? Why?**

Publications written for the public, extension service, field days, government officials regarding research results – brochures, briefs, highlighting issues and findings provided widely to customers and stakeholders. Boiled down to one page. Putting agriculture in perspective with other sources of air pollution.

2a) For this component discussion, what are short-term/immediate problems that ARS needs to address with its research?

Improved communication with EPA and congress to get research results out more effectively as well as other federal and state agencies. Invite public officials, i.e., congressmen or staffers to workshops.

Cost benefit analysis- for recommendations generated by ARS scientists. Economics presented along with research findings. For example, costs associated with no-till to reduce PM emissions.

Better, more informative websites and improve technology transfer directly to farmers. For example CometVR is a good example of a helpful website.

Make Agriculture Research Publication – more usable information for farmers more focused on solutions. Take things that are completed and well constructed and put them out on the web for folks to use.

Adapting Agriculture to Global Changes A

Group:	Adapting Agriculture to Global Changes A—Conference Rm 727
Facilitator:	Greg Wilson
Recorder:	Rod Venterea
Presenter:	Alan Blaylock

1a) For this component discussion, what are long-term problems that ARS needs to address with its research? Why?

- Nutrient use efficiency and ecological impact
- Crop residue management
- Biomass harvesting relating to carbon cycling and soil quality
- Management practices for water use efficiency and consumption
- Sustainable bio fuel and bio mass practices
- Sustainability of small farms

Five years from now what is a success:

Establishing basis for C markets and total GHG accounting

Research support for sustainable bio mass crops protocols

Quantifying management gas emissions, with research basis for best practices

Carbon cycle input for soil sustainability

Communications:

- Information transfer.

b) What period of time is considered long-term? (5,10,15 years..)

- five years is short term

c**) What are types/forms of *solutions* to the long-term problems (or *products* from the research that would impact the problem)? Why?**

- Communications:

Technology transfer

How: Internet media, individual,

Who: Producer organizations, local commodity groups, CCA (train the trainers), other stakeholder organizations, NGO

What: Conferences, targeted to specific needs (who is it for and what is the message), Extension Fact sheets,

Adapting Agriculture to Global Changes B

Group:	Adapting Agriculture to Global Changes B—Conference Rm 927
Facilitator:	Michael Abbey
Recorder:	Dr. T. Scott Murrell, IPNI (smurrell@ipni.net)
Presenter:	Mr. Jeff Farnik, Colorado Conservation Tillage Assn.

1a**) For this component discussion, what are long-term problems that ARS needs to address with its research? Why?**

- The population increase of the world and feeding this population while protecting natural resources is a central problem
- How do we capture the CO2 in the atmosphere now or in the future by increasing yields?
- How do you produce enough food AND fuel?
- How are we going to save or build the soil resource to produce the food and energy?
- ARS primarily needs to provide the basic information that is used to make decisions. It may not necessarily have to target all audiences, just those that can use their information to create practical solutions.
- What are the implications of bringing marginal lands into production? Is there a threshold definition of what is marginal and shouldn't be brought back into production?
- What alternative feedstocks are there into bioenergy production and how should those crops be managed?
- ARS can tie together production knowledge with environmental impacts to address how best to manage crops to reach both environmental and production goals
- ARS is well positioned to conduct interdisciplinary research
- Issues of scale are well-suited to collaborative efforts by the ARS. For instance, how do we scale up CO2 measurement made with chambers in the field to the plot or field scale?
- ARS can address the long-term impacts of reduction in irrigation as water becomes more scarce
- By partnering with health agencies, economists, etc., can ARS do a better job of encompassing all the impacts of a given system?

b) What period of time is considered long-term? (5,10,15 years..)

- 5 years (1 vote). This is probably the most practical in regard to funding.
- 10-15 years (5 votes). This is one cycle in plant breeding, so longer-term must be considered.
- 20 years (1 vote)
- 50 years (2 votes). This would allow multiple cycles in plant breeding. In 50 years, cars may no longer be running on fossil or biofuels.

- 100 years (1 vote). This would require a temporal reference strip that could be used to monitor changes induced by newly available technologies over time.
- The time considered long or short term depends on the variable being measured. For instance, air quality may take much longer.
- Long term is 3 times the time constant of the system.
- There is a difference between short-term research based on specific questions and long-term studies aimed at monitoring impacts of specific management practices
- A system should be allowed to come to equilibrium.

c) What are types/forms of *solutions* to the long-term problems (or *products* from the research that would impact the problem)? Why?

- Collaboration with other agencies to scale up from individual measurements to a larger geography
- Interim reports, especially with long-term research, to keep people informed of progress toward a goal
- Locate groups that can be used to help get ARS research out to a wider audience
- Decision support tools
- New germplasm that is adapted to evolving environmental conditions
- Models that can be more easily adapted to end-user needs
- Databases where raw data and associated metadata can be warehoused and repurposed and re-analyzed in the future

2a) For this component discussion, what are short-term/immediate problems that ARS needs to address with its research?

- Need pertinent research information
- Need information to be more user-friendly
- Lack of funding needs to be addressed
- What effect is changing land use having on GHG emissions, especially with ethanol production?
- Address nutrient management and GHG emission interactions. We need to do a more thorough job of life cycle analyses of various management practices.
- Nitrogen efficiency – nutrient forms, timing, systems budgets. We need to look at multiple locations and years to capture variability.
- Use of sensors to adjust N during the season.

b) What are types/forms of *solutions* to the short-term/immediate problems (or *products* from the research that would impact the problem)?

- Use of sensors to adjust N during the season
- An introduction of whole-systems research into every study to acquire the ancillary data needed to capture all the dynamics in time and space. This will help adjust results to various spatial and temporal scales.

- Continually improving models to account for interactions among various cycles, such as carbon and nitrogen
- Improve models to provide some metrics of risk (agronomic, economic, environmental, logistical) that can be evaluated under different management scenarios
- Make stakeholders more aware of currently available communication opportunities

3) What do you value as strengths of ARS that can be brought to bear on these problems?

- Communication is not a barrier. It is easy to contact scientists
- Strong scientific expertise, particularly at the plot-scale
- Network of research efforts over larger spatial scales (GRACENET)
- Interpretive summaries are available and readable
- Modeling efforts
- Coordinated efforts among scientists
- Good collaboration between ARS scientists and university scientists

Adapting Agriculture to Global Changes C

Group:	Adapting Agriculture to Global Changes B—Grand Ballroom III
Facilitator:	Tim Gish
Recorder:	Bill Bernard, Lew Ziska
Presenter:	Ron Jirava

1a) For this component discussion, what are long-term problems that ARS needs to address with its research? Why?

b) What period of time is considered long-term? (5,10,15 years..)

Long term is anything longer than 5 years.

1. What are the future Ag/Water demands to climate change scenarios in the western US

2) What impact will carbon sequestration have on system tilling?

3) Develop large scale measuring methodologies to gauge the response of agriculture to climate change

4) Develop Plants to adapt to long term changes in the environment

5) What will climate do to traditional cropping systems

6) Data set for carbon sequestration that address economic impacts for producers

7) What are world food supply responses to carbon sequestration

8) water shed response to scenarios cc

9) Selecting crop lines to adapt to change (CO_2 draught, temp)

10) effect of cc on particulate matter

2a) For this component discussion, what are short-term/immediate problems that ARS needs to address with its research?

Short term

1) Effect of global climate change on food and feed quality

2) Meta-analysis of existing data on cc and carbon sequestration

3) Assimilation of existing data on cc in a form that is understandable to the general public and media (in summation)

4) Interpretative summary of ARS accomplishments on cc that is more user friendly with easy to understand graphics.

5) www.climateandfarming.org for basic ag information

6) Train, teach, transfer to end user.

7) Assessment of impacts of biofuels on air/water quality

8) Are C/N models accurate enough to work under CC scenarios

9) What ARS does well is that they publish but public domain articles are needed.

10) Repository of information in public domain with **links to interpretative summaries.**

What is ARS doing right?

Manufacturing /marketing

Partnership with industry (ARS/livestock)

Adapting Agriculture to Global Changes D

Group:	Adapting Agriculture to Global Changes B—Grand Ballroom IV
Facilitator:	John Schmidt
Recorder:	Dan Long, Craig Reeder, Hilda Diaz-Soltero
Presenter:	Hilda Diaz-Soltero

1a) For this component discussion, what are long-term problems that ARS needs to address with its research? Why?

- Relationship of agriculture to city dwellers; ARS research needs to relate to cities; land is the issue and how it is treated; green buildings program developed last 6-mo- farms must be a part of "Sustainable Sites Initiative".
- How do you prove you have made a difference in C sequestration? There is no answer- no data. This is needed to help SSI. What kind of plants and land sequester C the best? Trees, estuaries, we don't know. Open space design requires knowledge of what actions, materials, or resources are needed.
- Special interest groups do not know about ARS research. Framework used to establish climate change initiatives is done by special interests groups and have no idea of ARS framework of research. Huge disconnect between urban oriented special interest groups and agencies like ARS who have been researching global climate change and know how. Getting these two groups together is a big deal. States, local municipalities, and special interest groups don't know of ARS research capabilities that are uniquely qualified to answer GCC questions.
    - Seek good definition of multiple objectives. What is the best land and use: perennial grass a best solution. What are the community objectives for land use?
    - No one knows how to accurately measure fate of C in plant production systems.
    - Urban/rural link. Special interest groups do not know about what ARS is doing.
    - We don't know the appropriate land uses for C sequestration.
- Identify what we don't know what we need to know to make appropriate land use decisions. Warehousing and disseminating info to a broader audience. Under what conditions will SOM build up or decline, microbial populations change, influence C dynamics, or cause soil borne diseases with respect to elevated atmospheric C?
- What changes might occur to know how to protect soils?
- How do we store more scarce water and use it more efficiently?
- Information dissemination through climate change extension- would be good if they had connections with ARS.
- Impacts of potential climate change on ag and range systems, above and below ground systems. ARS is naturally good at this. Urge ARS to focus on empirical investigations and impacts, and model outcomes of this

(atmospheric circulation, phenophase and plant community composition shifts).

- Scaling up issues: predicting larger scales and extrapolation.
- What's the impact on soil quality attributes and agriculture of climate change from external effects of society at large?
- What are the critical weather thresholds on agricultural systems? Consider other things besides weather variability. Extract from ARS wheat are the critical weather thresholds now that would negatively effect production systems. Where can we grow particular crops? Climate sensitivities. Constantly re-adjust boundaries to climatic changes. Transitional periods are now occurring.
- What is the baseline from which we gage change? What is the natural range of spatio-temporal variability? How far have we departed?
- Biosystematics crisis. Lack trained scientists, lack of intellectual exchange.
- How has GCC affect interaction between crops and invasive species (i.e. aspects species biology, spread, ag systems, management).
- How will GCC affect the management of natural and agro-ecosystems? An example of this is global human relocation. What is the impact of interaction between crops and invasive species?
- How do we id strategies to adapt to GCC? I.e. cultivars of food plants that will strive (i.e. wild germplasm) in new conditions and deal with drought, etc.
- Loss of biodiversity important to natural systems and future ag systems. Research is needed to identify how a rise in atmospheric C will alter natural ecosystems. What do we need to do to maintain biodiversity? This is important for maintaining critical taxa for having future needed germ-plasm.
- Lack of understanding of multiple stressors.
- Lack of serious funds for ARS.
- Lack of data to verify GCC model predictions (soil quality, soil nutrient cycling, etc.) and produce cost-effective models.
- Food security.
- Integrated management data systems for ARS information easily available to public.
- Lack of information on role of phenology in controlling response of agricultural species and populations to GCC; includes interactions with other species (invasives, pests, disease, and plant pollinators).

b) What period of time is considered long-term? (5,10,15 years..)

- >5 years
- Out to 2050, but our understanding of 2050 must be defined much sooner to come up with adaptive strategies.
- 5 to 25 years.

c) What are types/forms of *solutions* to the long-term problems (or *products* from the research that would impact the problem)? Why?

- More funding of research based on better explanation/justification of needed research.
- Solution: inject $ and look for creative ways to reorganize universities to offer training of such scientists.
- We need a concerted effort to determine lines of evidence that indicate departures from natural variability.
- $ to researchers, collections, and bioinformatics; and re-energize university training.
- Create linkages between ARS research and scientists working in biosystematics. Plus, closer linkages with USFS and USGS (Interior Dep. Agencies: NPS, BLM, BREC).

Develop a nationwide phenology monitoring program focuses on important ag species including invasives, and other players to determine spatio-temporal patterns of phenology related to environmental variation and climate forcing as well as basic research on phenology-environment interactions