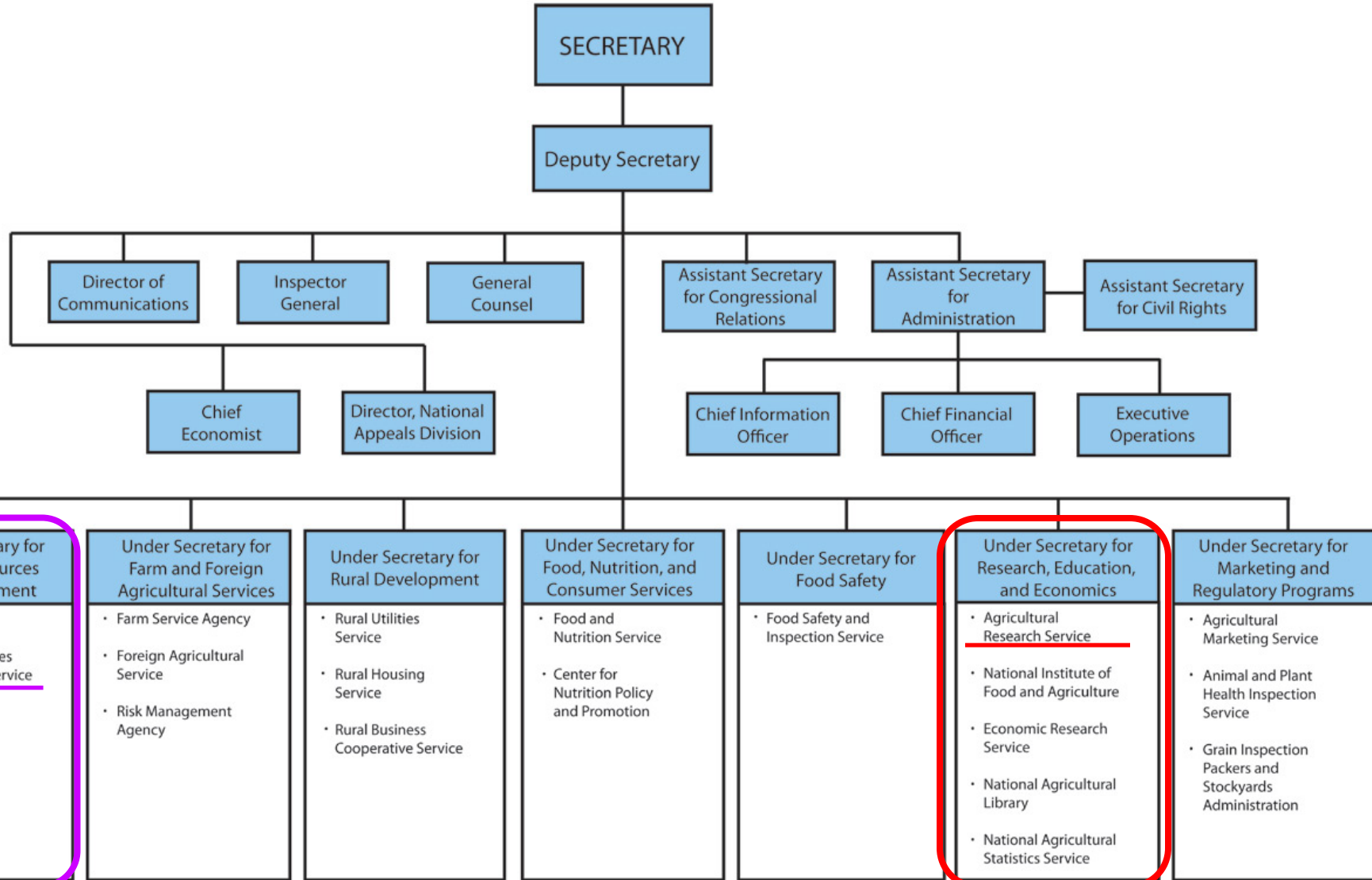


Introduction to Livestock GRACEnet and how ARS Research can be Transferred to NRCS

April Leytem
USDA-ARS, Kimberly, ID



United States Department of Agricultural



USDA - Agricultural Research Service

In-house research agency for the USDA.

Our job is finding solutions to agricultural problems that affect Americans every day, from field to table such as:

- Protecting crops and livestock from pests and disease.
- Improving the quality and safety of agricultural products.
- Determining the best nutrition for people from infancy to old age.
- Sustaining our soil and other natural resources.
- Ensuring profitability for farmers and processors.
- Keeping costs down for consumers.



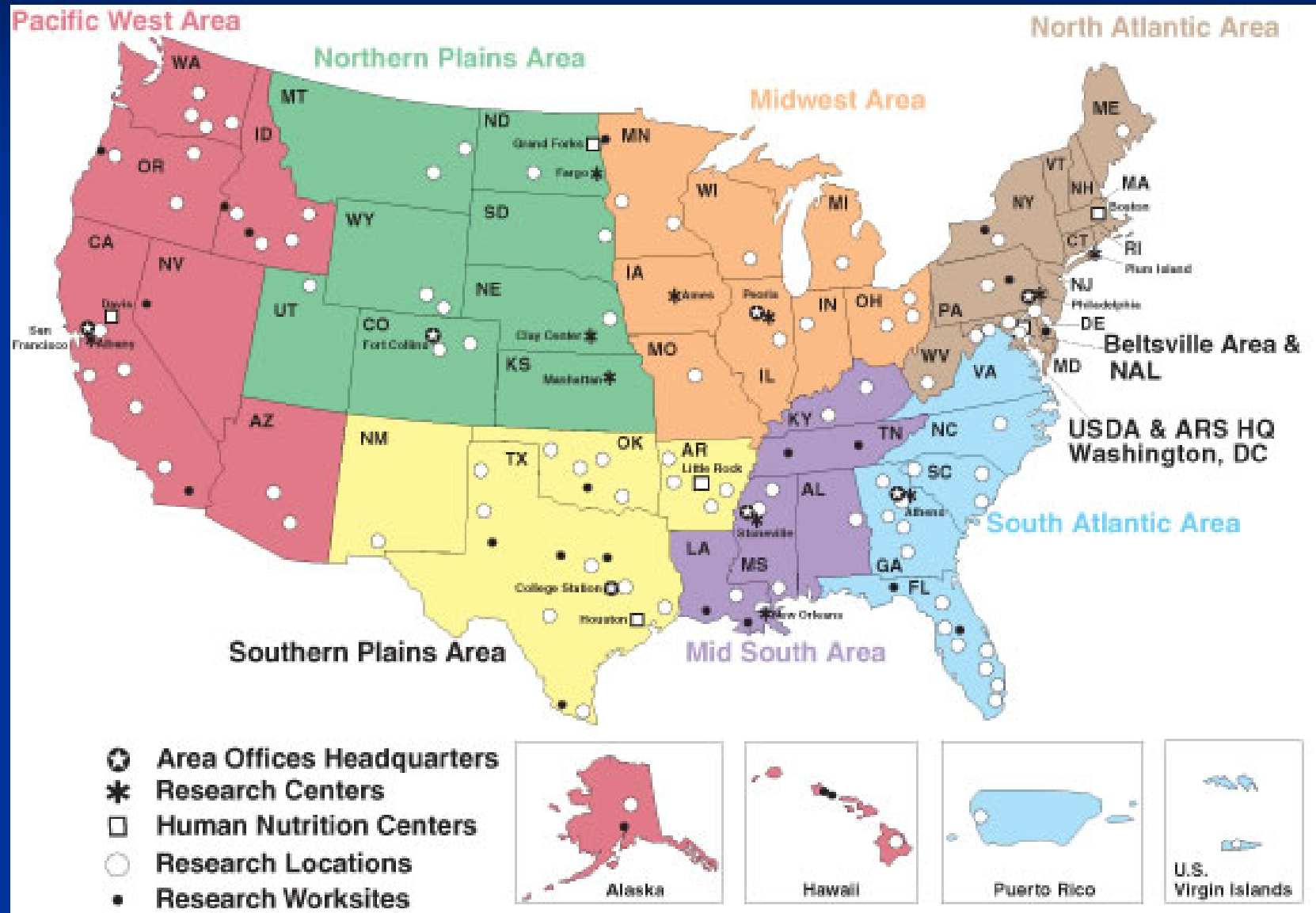
ARS National Programs

Animal Production & Protection	Crop Production & Protection	Nutrition, Food Safety & Quality	Natural Resources & Sustainable Agricultural Systems
<ul style="list-style-type: none">• Food Animal Production• Animal Health• Veterinary, Medical and Urban Entomology• Aquaculture	<ul style="list-style-type: none">• Plant Genetic Resources, Genomics and Genetic Improvement• Plant Biology & Molecular Processes• Plant Diseases• Crop Protection & Quarantine• Crop Production• Methyl Bromide Alternatives	<ul style="list-style-type: none">• Human Nutrition• Food Safety (animal and plant products)• Quality & Utilization of Agricultural Products	<ul style="list-style-type: none">• Water Availability and Watershed Management• Climate Change, Soils and Emissions• Agricultural and Industrial Byproducts• Pasture, Forage and Range Land Systems• Agricultural System Competitiveness and Sustainability• Bioenergy



USDA Agricultural Research Service

2000 Scientists, 90+ locations, \$1.1 billion budget



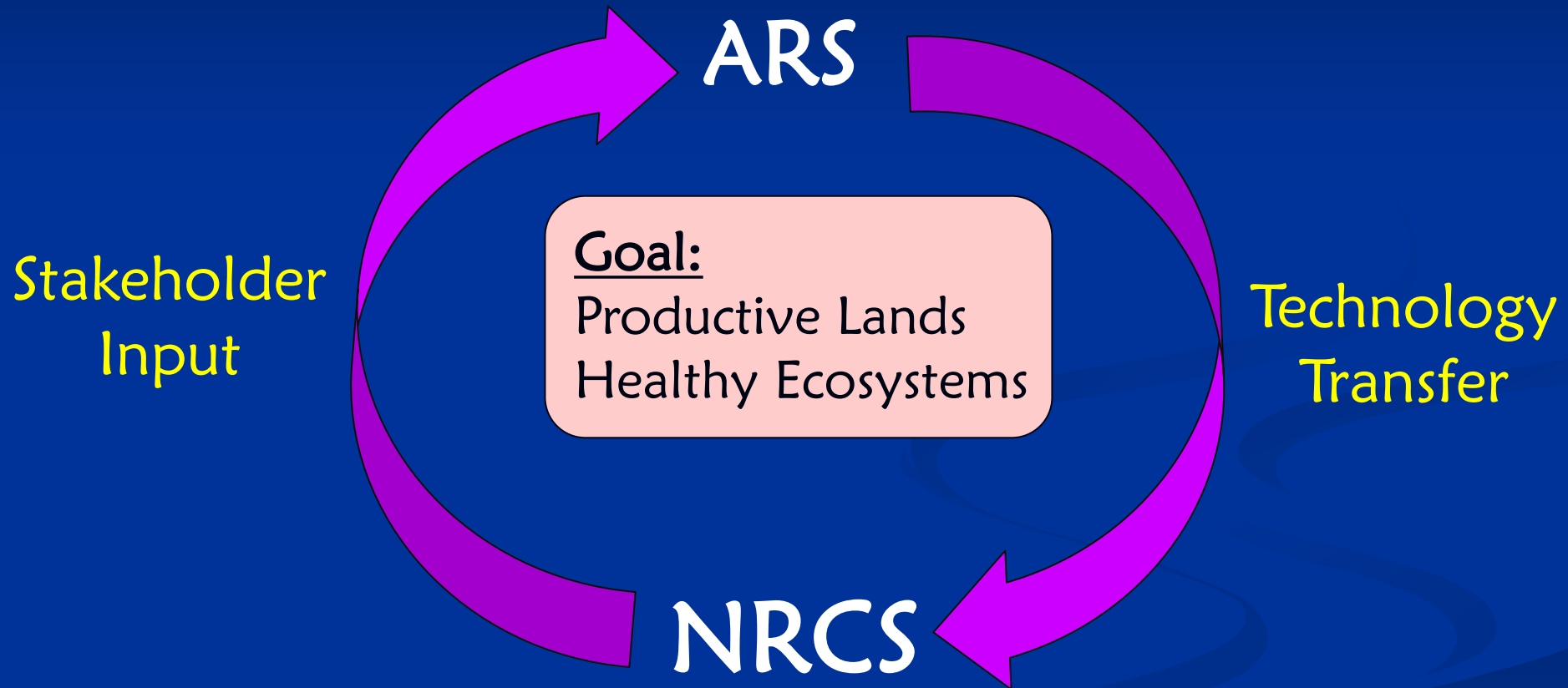
USDA NRCS

Originally established as the Soil Conservation Service now expanded to wider conservation services

NRCS works with landowners through conservation planning and assistance designed to benefit the soil, water, air, plants, and animals that result in productive lands and healthy ecosystems



Linking ARS and NRCS



ARS Technology Transfer

ARS's Office of Technology Transfer helps move ARS research discoveries to the marketplace.

Technology Transfer is also transferring research to our stakeholders including:

Producers

Public

Government Agencies (NRCS, EPA, etc.)



Technology Transfer can be accomplished via:

Publications

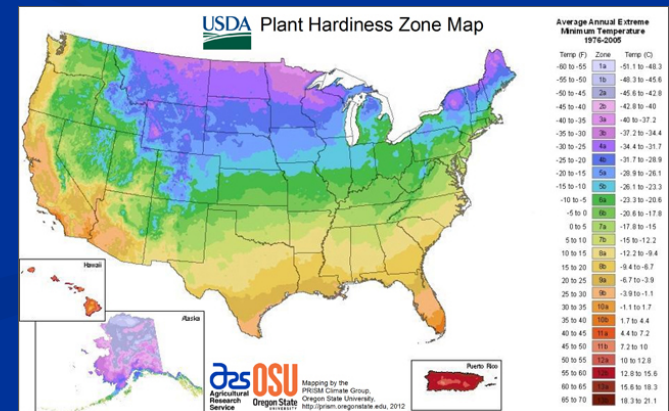
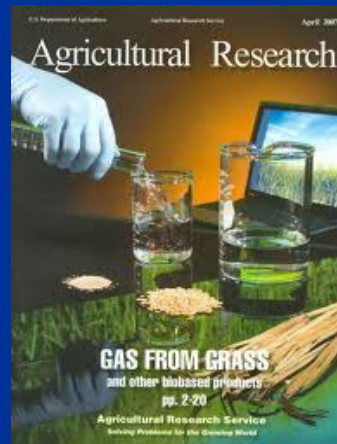
Presentations

Webinars

Factsheets

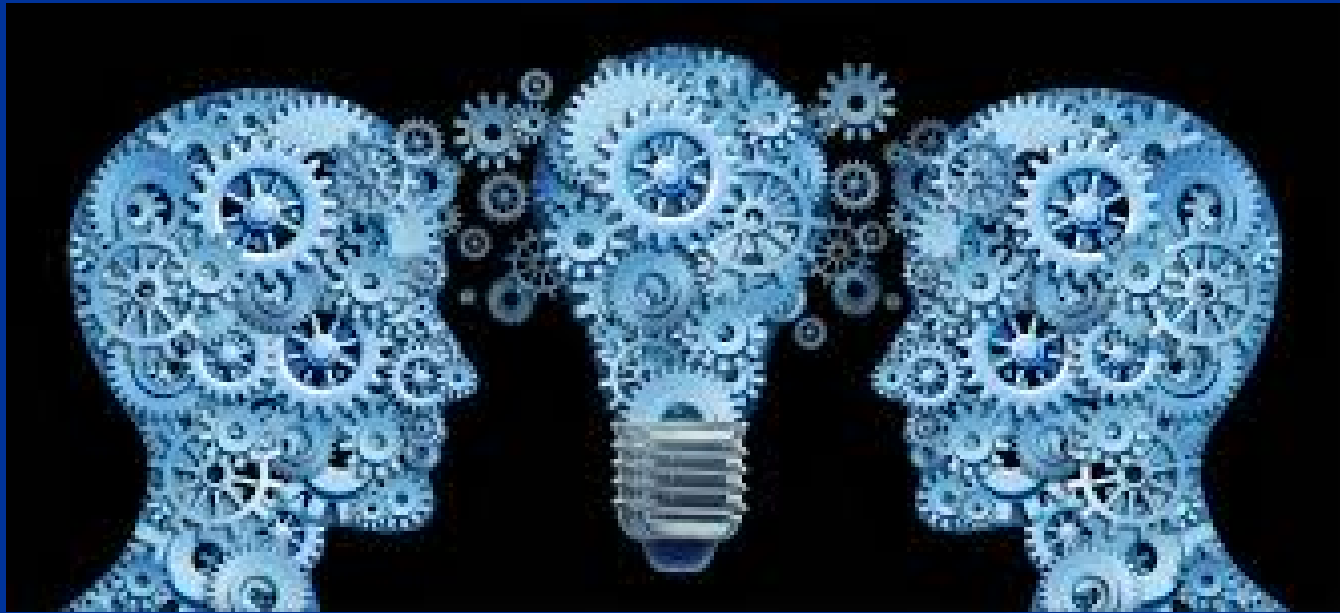
Websites

etc.



Livestock GRACEnet

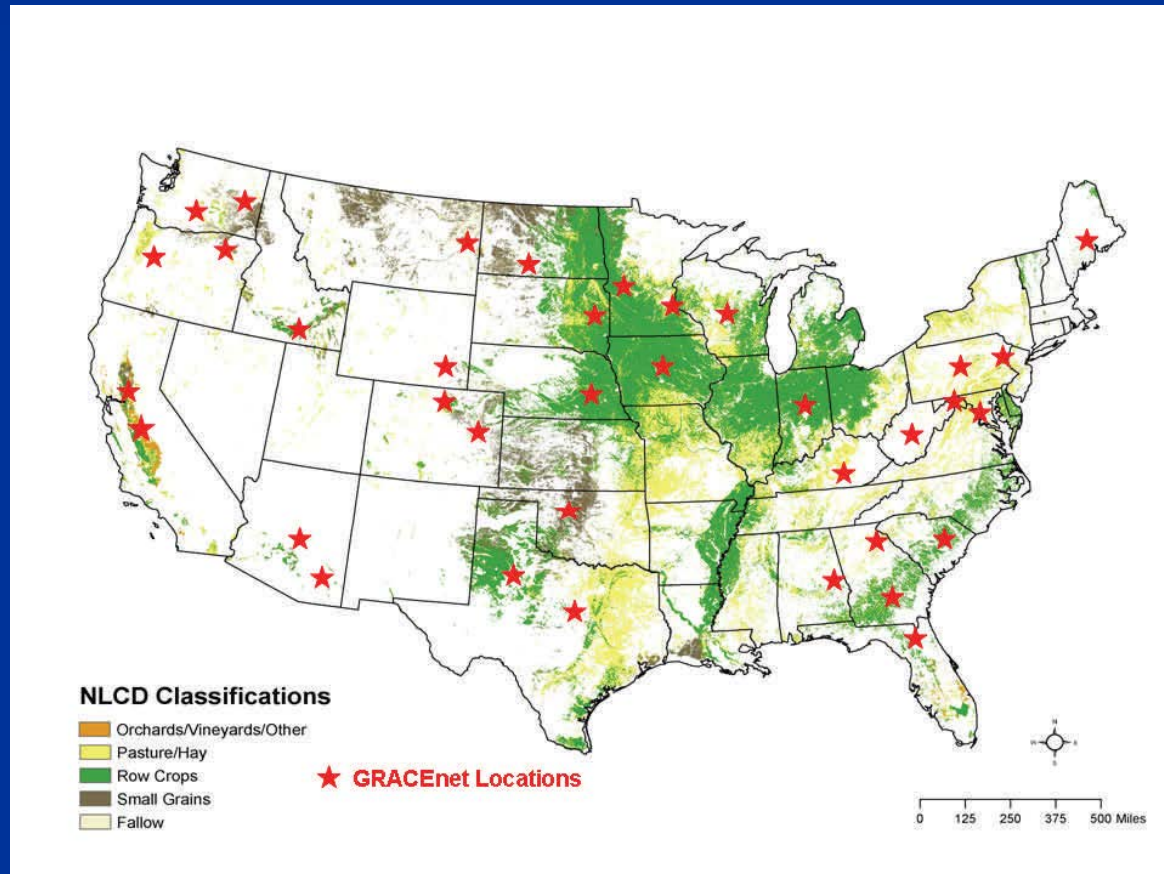
Another vehicle for Technology Transfer?



GRACEnet Project

Greenhouse gas Reduction through Agricultural Carbon Enhancement network

A nationwide research program administered by USDA-ARS to assess soil carbon sequestration and greenhouse gas mitigation by agricultural management



GRACEnet Objectives

1. Evaluate status and direction of change in soil carbon for typical and alternative agricultural systems



2. Determine net greenhouse gas emissions (carbon dioxide, nitrous oxide, methane) of current agricultural systems for typical and alternative agricultural systems



3. Determine the environmental effects (water, air and soil quality) of agricultural systems developed to reduce greenhouse gas emission and increase soil carbon storage



GRACEnet Approach

1. Business as usual in production agriculture for various areas of the country.
What is the carbon accumulation/loss rate under typical agricultural management?
2. Maximizing carbon sequestration rate.
What can be done to reach the highest carbon sequestration rate?
3. Minimizing net greenhouse gas emission.
Agriculture is the main source of nitrous oxide and methane to the atmosphere. Practices will be developed to decrease the emission of these gases.
4. Maximizing environmental benefits by improving water, air, and soil quality.
This scenario investigates management systems to optimize both agricultural and environmental benefits by sequestering soil carbon and decreasing greenhouse gas emissions.

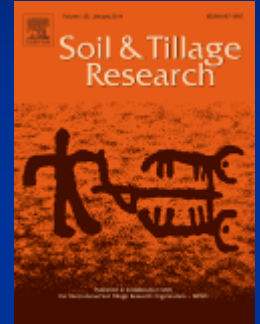
GRACEnet Products

1. Sampling protocols

Available for download on the website

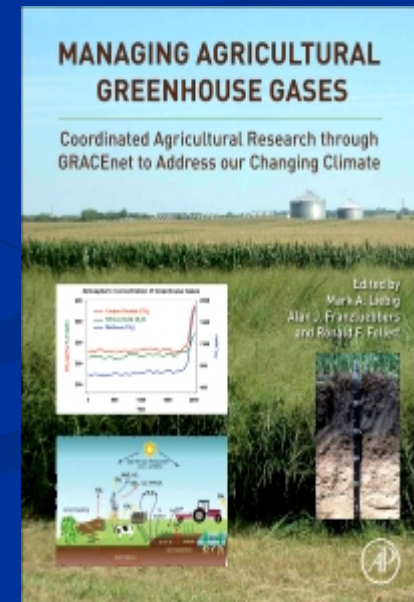
2. Publications

Multiple peer reviewed publications, Special Collections papers (Soil & Tillage Research) “Greenhouse Gas Contributions and Mitigation Potential in Agricultural Regions of North America” and book “Managing Agricultural Greenhouse Gases”



3. Database

Data from GRACEnet projects which can be used for model validation, testing, etc.



Livestock GRACEnet

...a USDA ARS working group
focused on atmospheric emissions
from livestock production.



Livestock GRACEnet Mission

...to lead the development of livestock management practices to reduce greenhouse gas, ammonia, and other emissions and provide a sound scientific basis for accurate measurement and modeling of emissions from livestock agriculture.

We will accomplish this by:

- Collaborating in the identification and further development of appropriate management practices
- Supporting policy-makers' and regulators' need for consistent, reliable data and information
- Fostering scientific transparency and rigor
- Transferring new knowledge efficiently to stakeholders and the scientific community

Livestock GRACEnet Objectives

1. Develop emission factors for NH_3 , CH_4 , N_2O , and VOCs from animal production facilities based on animal type, production scenario and climatic conditions



2. Identify and develop livestock management and manure handling systems to reduce emissions.

Livestock GRACEnet Approach

1. Business as usual.

What is the emission rate under typical management practices? These business as usual systems should be economically viable and used by the majority of producers in that region.

2. Optimize nutrient utilization (e.g. Dietary protein) and capture and reduce losses.

What has been done to achieve the highest reduction in emissions from that production system?

3. Maximizing environmental benefits.

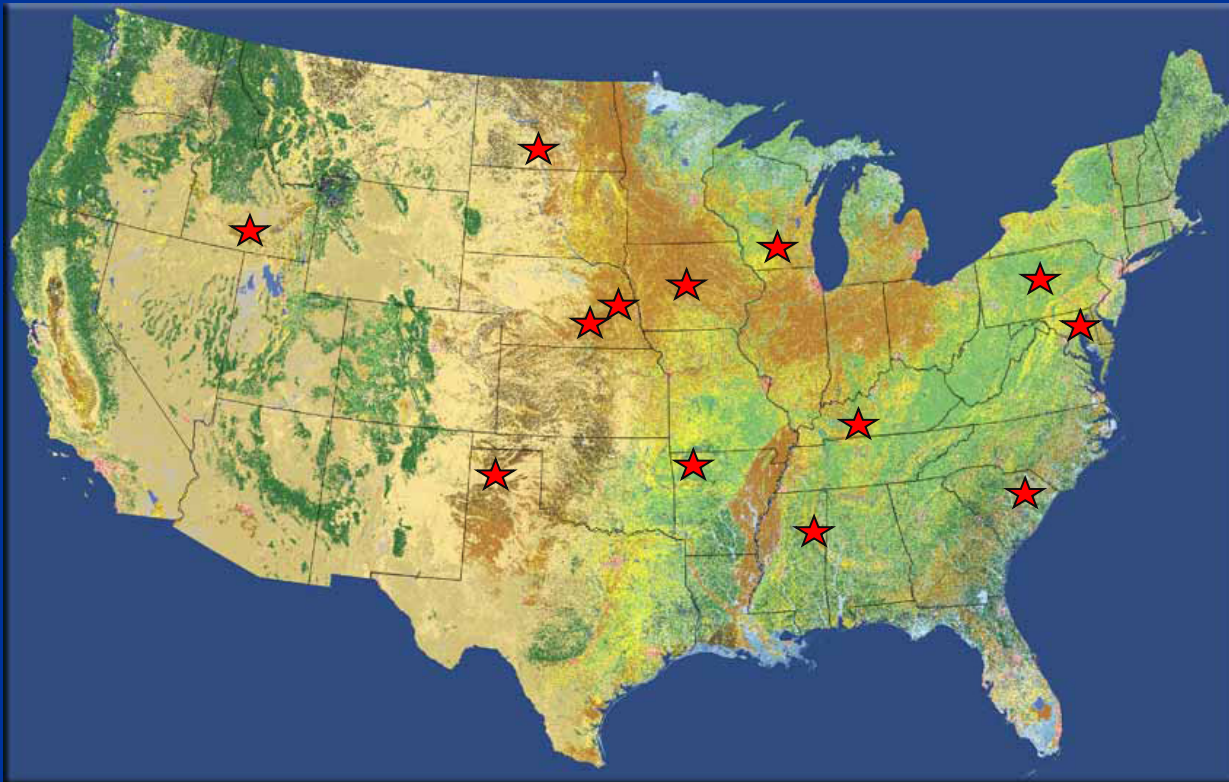
Reducing emissions may become part of a larger conservation benefit package. Producers and policy makers will be interested in tradeoffs among management options. With careful management how can emission be balanced with water quality, air quality and animal production/health goals?

Livestock GRACEnet Products

1. A national database of emissions from a range of species, production scenarios, and climatic conditions.
2. Regional and national guidelines related to estimating emission factors from animal production facilities.
3. Regional and national guidelines of management practices to reduce emissions from production facilities.
4. Development and evaluation of process based models to estimate emissions from production facilities and whole farm systems
5. Summary papers for action agencies and policy makers based on the current state of knowledge.

Livestock GRACEnet Members

ARS workgroup focusing on the effects of livestock production on emissions and air quality (beef, dairy, poultry, swine).



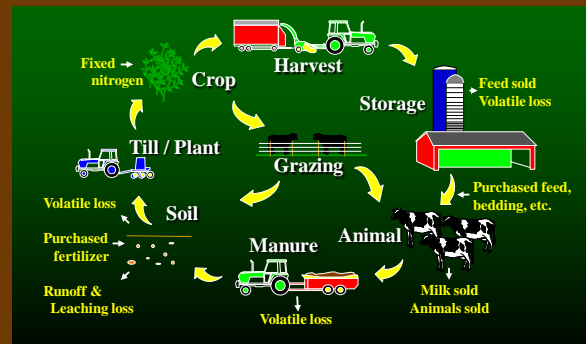
24 Scientists
13 Locations

Livestock GRACEnet Research

University Park, PA
Al Rotz

Whole farm systems modeling to
estimate emissions and nutrient losses

Integrated Farm System Model
Dairy Gas Emissions Model
Dairy GHG



Livestock GRACEnet Research

Florence, SC

Kyoung Ro, Ariel Szogi and Matias Vanotti

Emissions from swine production

Validating emissions techniques

Treatment technology for ammonia

Ammonia recovery



Livestock GRACEnet Research

Bowling Green, KY

Karamat Sistani, Kim Cook, John Loughrin,
Nanh Lovanh, Phil Silva

NH_3 and N_2O emissions from high rise
swine housing

NH_3 from manure windrows

NH_3 and N_2O from manure land
application

Odor from anaerobic swine lagoons



Livestock GRACEnet Research

Mississippi State, Mississippi
Dana Miles

NH_3 and GHG emissions from
broiler production



Livestock GRACEnet Research

Madison, WI
Mark Powell

NH₃ and GHG abatement
strategies in dairy production

Dietary affects on emissions



Livestock GRACEnet Research

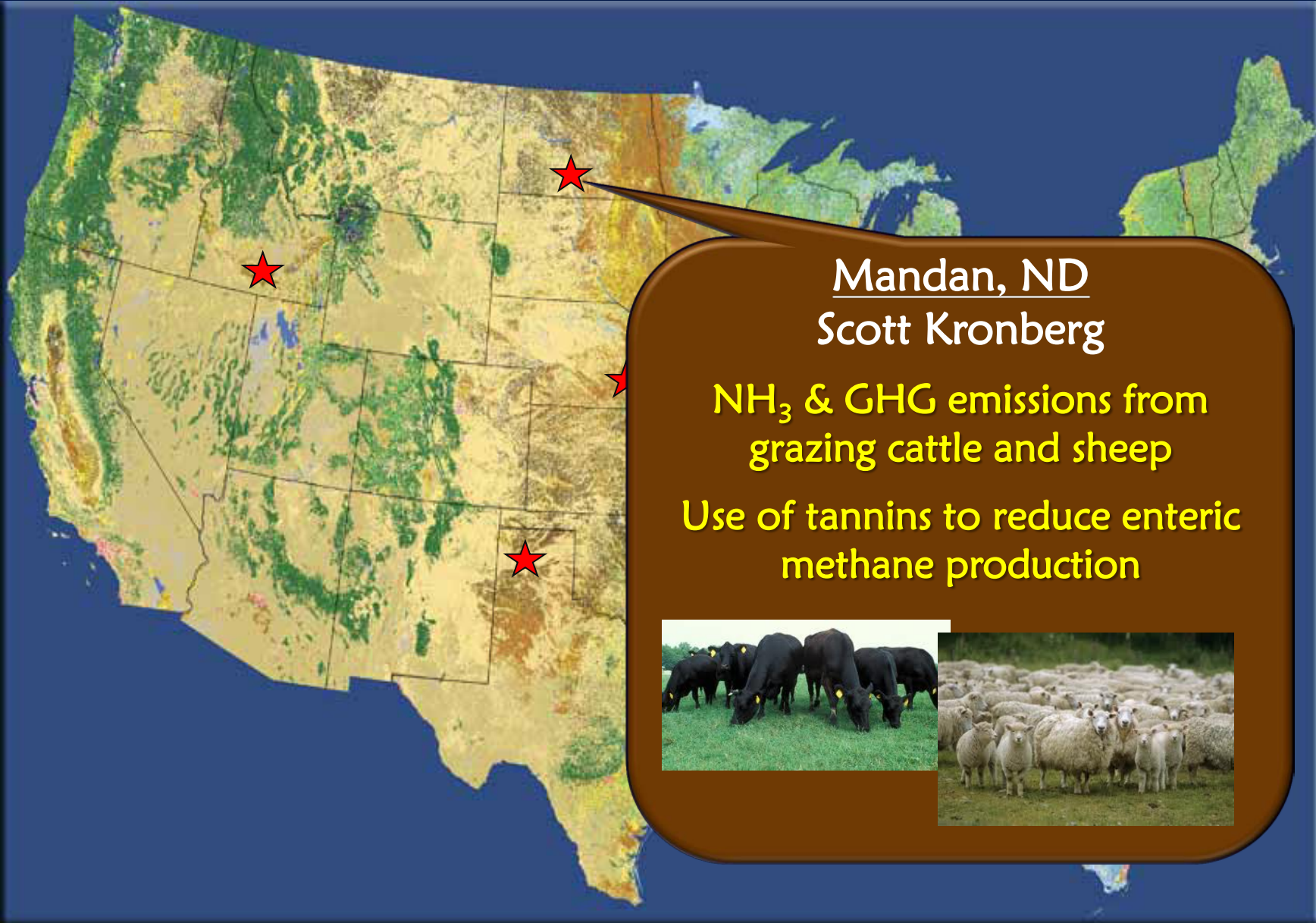
Ames, IA

Steve Trabue and Brian Kerr

Odor and NH_3 emissions from
swine production



Livestock GRACEnet Research



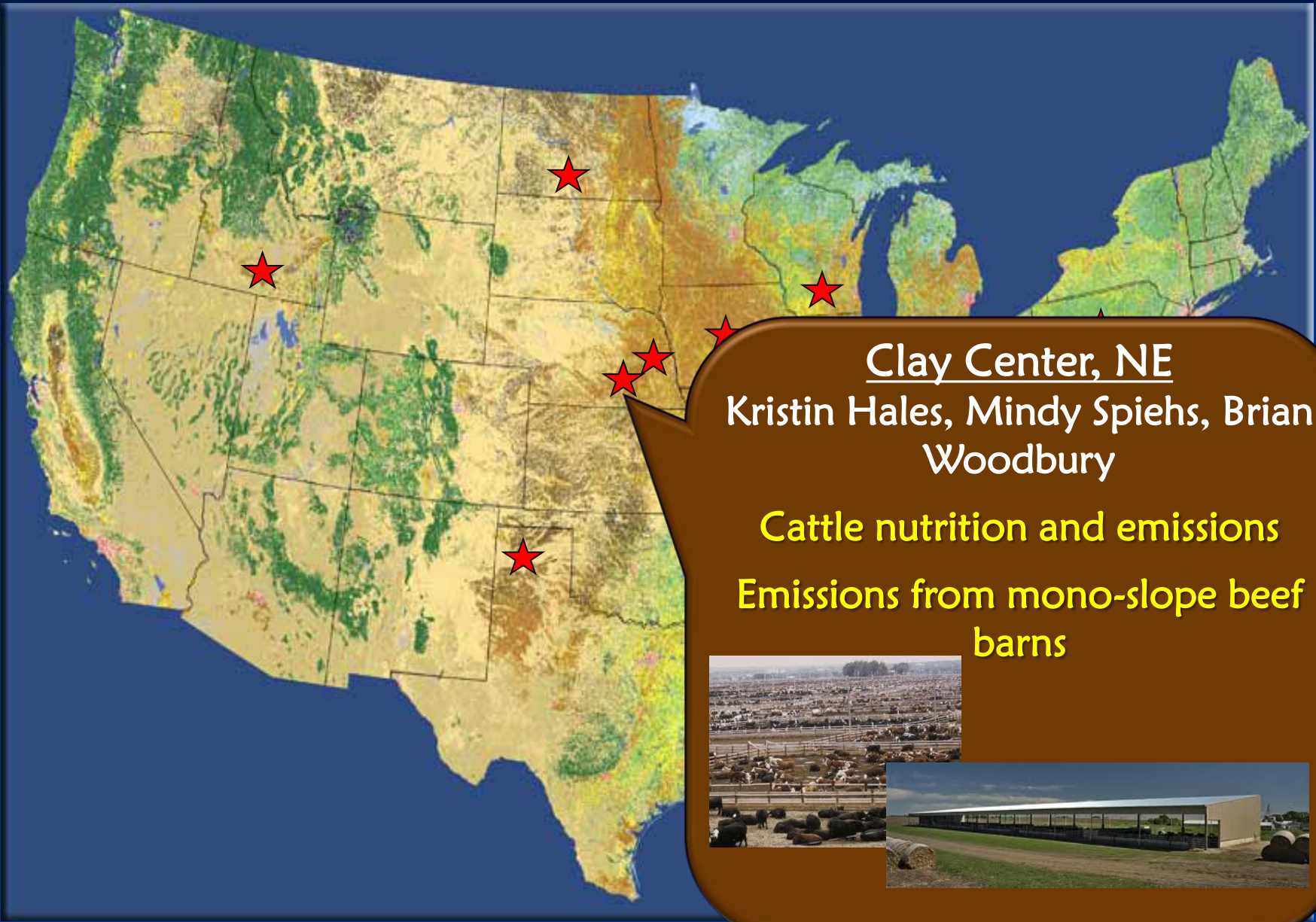
Mandan, ND
Scott Kronberg

NH₃ & GHG emissions from grazing cattle and sheep

Use of tannins to reduce enteric methane production



Livestock GRACEnet Research



Clay Center, NE
Kristin Hales, Mindy Spiehs, Brian Woodbury

Cattle nutrition and emissions
Emissions from mono-slope beef barns

Two photographs are included in the callout box. The top photograph shows a large herd of cattle in a field, with many animals visible in the background. The bottom photograph shows a long, modern mono-slope beef barn with a white roof and dark siding, situated in a rural setting with hay bales in the foreground.

Livestock GRACEnet Research

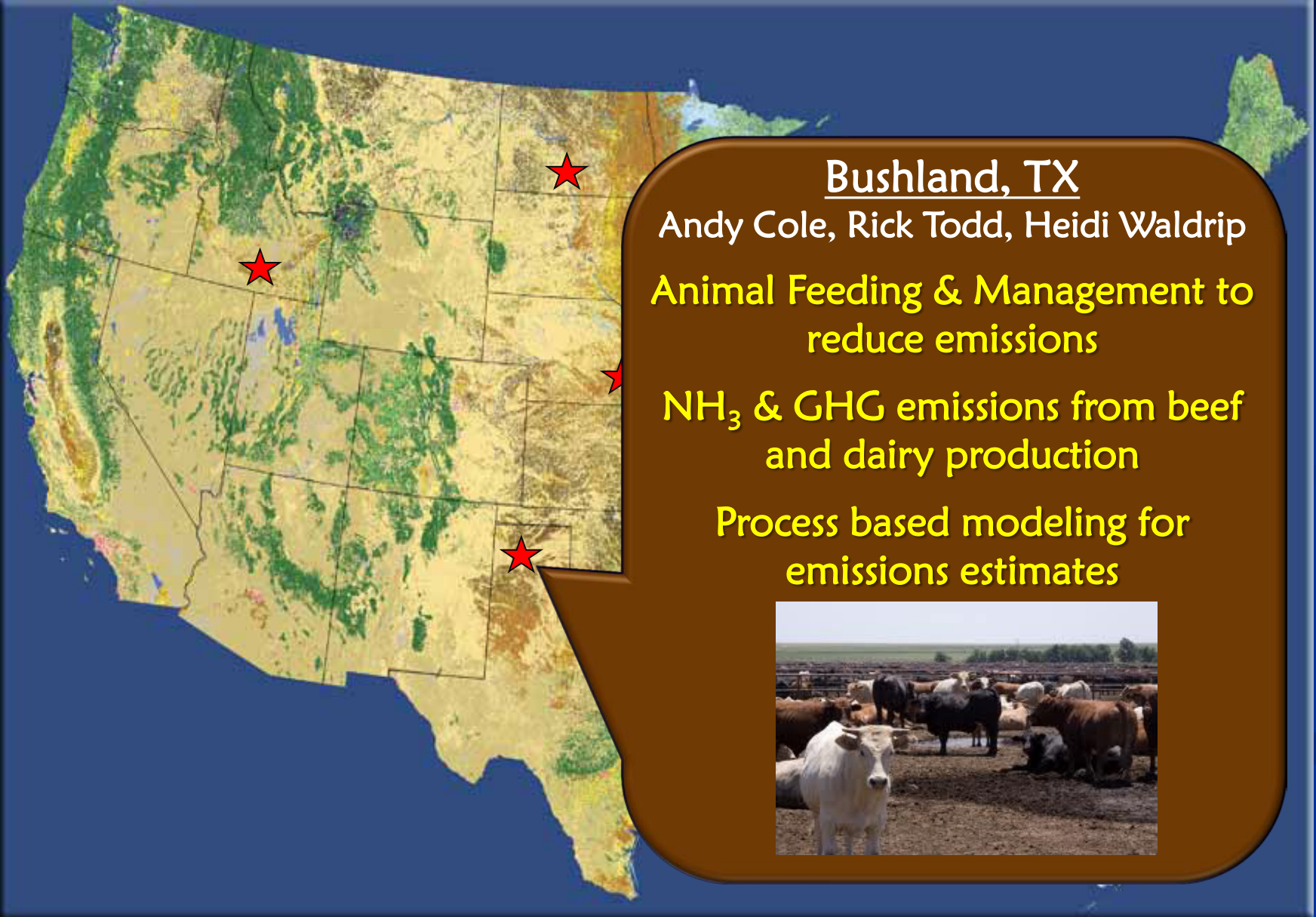


Lincoln, NE
Dan Miller

H₂S and odor emissions



Livestock GRACEnet Research



Bushland, TX

Andy Cole, Rick Todd, Heidi Waldrip

**Animal Feeding & Management to
reduce emissions**

**NH₃ & GHG emissions from beef
and dairy production**

**Process based modeling for
emissions estimates**



Livestock GRACEnet Research

Kimberly, ID

April Leytem and Robert Dungan

NH₃ & GHG emissions from dairy production

Bioaerosol emissions and pathogen drift



Livestock GRACEnet website

ARS Climate Change, Soils, and Emissions National Program (212) - Windows Internet Explorer

http://www.ars.usda.gov/research/programs/programs.htm#ng_usd

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Research

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National Program 212: Climate Change, Soils, and Emissions and NP214: Agricultural & Industrial Byproducts

Livestock GRACEnet

Welcome to Livestock GRACEnet!

The mission of Livestock GRACEnet is to lead the development of livestock management practices to reduce greenhouse gas, ammonia, and other emissions and provide a sound scientific basis for accurate measurement and modeling of emissions. We will:

- Collaborate with fellow scientists and stakeholders to identify and develop appropriate management practices
- Support the need of policy makers and regulators for consistent, accurate data and information
- Foster scientific transparency and rigor
- Transfer new knowledge efficiently to stakeholders and the scientific community

Success in our mission will help to ensure the economic viability of the livestock industry, vitality and quality of life in rural areas, and environmental services benefits.

The Livestock GRACEnet group is composed of 24 scientists from 13 locations working on the effects of livestock production on emissions and air quality. For a list of scientists and information about their research programs click [here](#).

The Livestock GRACEnet group has produced several fact sheets related to management practices aimed at reducing on farm emissions. To read or download factheets click [here](#).

To see a list of upcoming meetings and events related to emissions from livestock production click [here](#).

Livestock GRACEnet is an integral part of NP 212 Climate Change, Soils, and Emissions and NP 214 Agriculture and Industrial Byproducts

If you would like more information about Livestock GRACEnet contact April Leytem at april.leytem@ars.usda.gov, Charlie Wathall (NP 212) at charlie.wathall@ars.usda.gov, or Matt Smith (NP214) at matt.smith@ars.usda.gov.

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http://www.ars.usda.gov/research/Docs.htm?docid=22942

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Research

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Livestock GRACEnet Researchers

The Livestock GRACEnet team is made up of 24 scientists from 13 locations working on the effects of livestock production on emissions and air quality. The team covers poultry, swine, beef and dairy cattle. Read about our scientists and their research below. Feel free to contact any of us for more information about our projects!

Dr. John Brooks, Mississippi State, MS

Dr. Andy Cole, is a Research Animal Scientist (Nutrition) and Research Leader with USDA-Agricultural Research Service, Conservation and Production Research Laboratory in Bushland, Texas. His independent and team research programs are designed around the following five objectives: (1) quantify emissions of ammonia and greenhouse gases from beef cattle and beef cattle feedyards; (2) develop an improved understanding of the chemical and physical mechanisms regulating ammonia and greenhouse gas emissions from animal feeding operations; (3) develop dietary and management strategies to increase efficiency of nutrient utilization and decrease emissions of ammonia and greenhouse gases from feedyards; (4) improve the utilization of by-product feeds such as distillers grains by beef cattle, and (5) develop models to efficiently estimate emissions from feedlots.

Dr. Kimberly Cook, Animal Waste Management Research Unit, Bowling Green, KY

Dr. Kristin Hayes, U.S. Meat Animal Research Center, Clay Center, NE

Dr. Catherine Hansen, Environmental Management and Byproduct Utilization Laboratory, Beltsville, MD

Dr. Scott Kronberg, is a Animal Scientist with ARS at the Northern Great Plains Research Laboratory in Mandan, North Dakota. One aspect of his research has focused on reducing ammonia and greenhouse gas emissions from grazing cattle and sheep. For this, he has studied the possibility of putting small amounts of condensed tannin into cattle and sheep via their drinking water to reduce the amount of urea excreted in their urine, which can be converted into ammonia and nitrous oxide.

Dr. April Leytem is a Soil Scientist at the Northwest Irrigation and Soils Research Laboratory at Kimberly, Idaho. Her research examines nutrient cycling and losses in dairy production systems. Current focus is on determining emissions of ammonia, methane and nitrous oxide from dairy housing, manure management systems, and land application of manures.

Dr. John Loughris, Animal Waste Management Research Unit, Bowling Green, KY

Dr. Nash Lovanh, Animal Waste Management Research Unit, Bowling Green, KY

Dr. Laura McConnell is a Research Chemist at the Environmental Management and Byproduct Utilization Laboratory, Beltsville, MD. She specializes in the investigation of the processes controlling the environmental fate and transport of pesticides, volatile organic compounds and other pollutants from agricultural operations. The ultimate goal of her research is to support the development of more sustainable farming systems that will minimize negative impacts on surrounding ecosystems.

Dr. Dana McGee Miles, is a Chemical Engineer with USDA-Agricultural Research Service, Crop

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http://www.ars.usda.gov/research/Docs.htm?docid=22946

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Livestock GRACEnet Factsheets

The Livestock GRACEnet group has prepared a series of publications related to reducing emissions from livestock production as well as a few related to modelling on-farm emissions. Please click on the links below to download the factsheets. Author contact information is listed on each sheet for further information.

- [Treating Poultry Litter with Aluminum Sulfate](#)
- [Poultry Litter Moisture Management to Reduce Ammonia](#)
- [Subsurface Injection of Manure to Reduce Ammonia Losses and Odor](#)
- [Manure Scraper for Reducing Odor Emissions from Swine Barns](#)
- [Dietary Management to Decrease Methane Emissions from Beef Feedlots](#)
- [Phase Feeding Crude Protein to Decrease Ammonia Emissions from Finishing Beef Cattle](#)
- [DairyGen: Software for Evaluating Gaseous Emissions from Dairy Farms](#)
- [The Integrated Farm System Model: Software for Evaluating the Performance, Environmental Impact and Economics of Farming Systems](#)

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Series of factsheets that

- Treating Poultry Litter with Aluminum Sulfate
- Poultry Litter Moisture Management to Reduce Ammonia
- Subsurface Injection of Manure to Reduce Ammonia Losses and Odor
- Manure Scraper for Reducing Odor Emissions from Swine Barns
- Dietary Management to decrease Methane Emissions from Beef Feedlots
- Phase Feeding Crude Protein to Decrease Ammonia Emissions from Finishing Beef Cattle
- DairyGEM: Software for Evaluating Gaseous Emissions from Dairy Farms
- The Integrated Farm System Model: Software for Evaluating the Performance, Environmental Impact and Economics of Farming Systems



Emissions Management Practices

Protecting Air Quality

Authors e-mail:
andy.cole@ars.usda.gov

Developed by:
Livestock GRACEnet
Leading the development of mitigation practices to reduce emissions from livestock production

For more information visit us at
www.ars.usda.gov/livestockGRACEnet

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simulated on a daily time step over thirty years of weather. Nutrient flows through the farm are tracked to predict potential nutrient accumulation in the soil and loss to the environment. Environmental impacts include erosion of sediment, soluble and sediment-bound phosphorus runoff, nitrate leaching, ammonia and hydrogen sulfide volatile loss,

variables involved and the judgments that must be made in choosing inputs, interpreting outputs, and general use of this software, the USDA's Agricultural Research Service is not responsible for any problems, damages, or losses caused either directly or indirectly by use of the model.

Livestock GRACEnet

2013 Waste to Worth Conference

Nine presentations that highlighted some of the work being done by our scientists

Presentations are available on-line at eXtension.org

Special JEQ Issue

There will be a special issue of JEQ that features work being done by the Livestock GRACEnet group which will be out late this year.

Methods Manual

We are developing a methods manual outlining the best methods for estimating emissions from livestock production facilities.

Future Livestock GRACEnet

There has been interest from the Global Research Alliance to open the group up to any interested parties....

Livestock Research Group

- Improve the greenhouse gas intensity of livestock production systems
- Increase the quantity of carbon stored in those soils
- Key emissions covered:
 - methane from enteric fermentation and waste management
 - nitrous oxide from animal wastes and fertilizers



Paddy rice



Livestock



Crops

<http://www.globalresearchalliance.org/>

Livestock GRACEnet - NRCS Technology Transfer Webinar Series

This webinar series was developed to provide more information to NRCS regarding technologies that can be utilized to mitigate air quality concerns from livestock production systems. Each of the webinars will focus on the following:

- What is the technology? Provide some background on what it is, how it was developed, where it is applicable, what impact it can have, economics, etc.
- What NRCS practice standard does/can the technology fit under?
- What are the specific design, installation, and operation/management criteria that need to be followed to ensure a successful application of the technology?

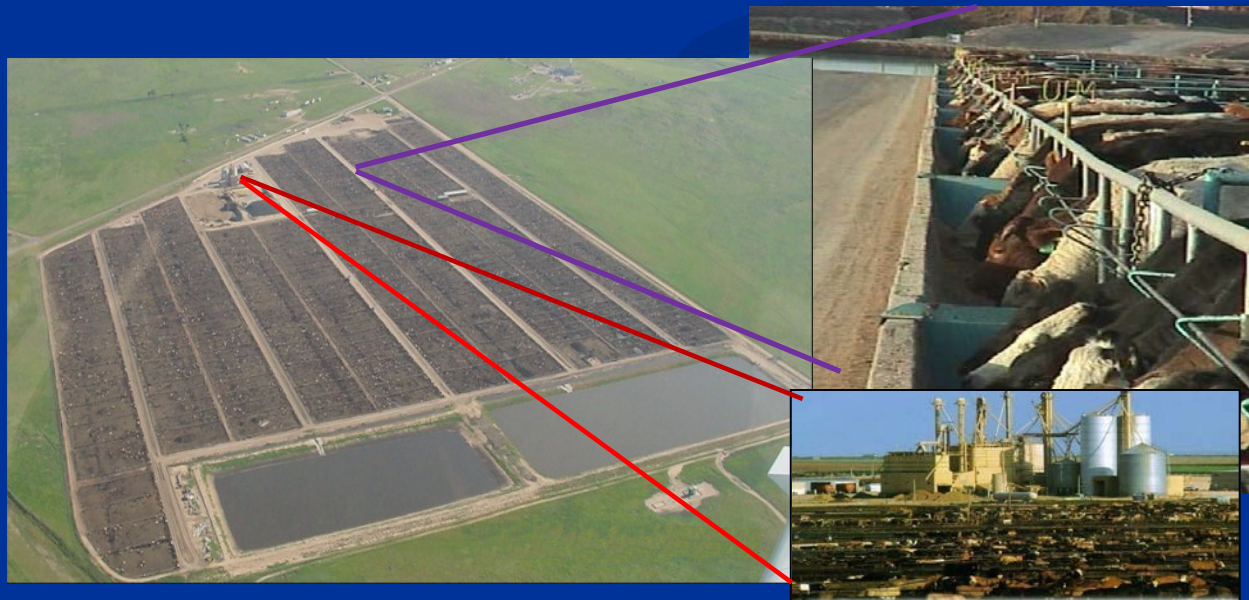
Livestock GRACEnet - NRCS Technology Transfer Webinar Series

“Feed Management for Beef Feedlots to Reduce Air Emissions”

Andy Cole, ARS Bushland TX

January, 2014

What effects do feedlots have on air quality?
What can we do (and not do) to decrease their effects?



Livestock GRACEnet - NRCS Technology Transfer Webinar Series

“Feed Management for Dairy Operations to Reduce Air Emissions”
Mark Powell, ARS Madison WI

February, 2014

Evaluating the effects of forages, concentrates and protein supplements on ammonia and methane emissions from dairy barns



Livestock GRACEnet - NRCS Technology Transfer Webinar Series

“Ammonia Recovery in Manure Management Systems”
Ariel Szogi and Matias Vanotti, ARS Florence, SC

March, 2014

Using anammox based de-ammonification

Ammonia Recovery from livestock waste with gas permeable membranes



Livestock GRACEnet - NRCS Technology Transfer Webinar Series

“Acid Scrubbers for Removal of Ammonia from Mechanically Ventilated Broiler Houses”

Philip Moore, ARS Fayetteville, AR

April, 2014

Ammonia Emissions from Broiler Production
Reduction in Ammonia Emissions with Ammonia Scrubbers





Questions?