The Data Management and Research Path Forward

Mark Downing
Oak Ridge National Laboratory
Northeast Regional Feedstock Partnership
Kick-off Meeting
Cornell at Ithaca, New York
Nov 11-13, 2007

Existing data

Planting and collecting data

GIS Atlas

Supply curves

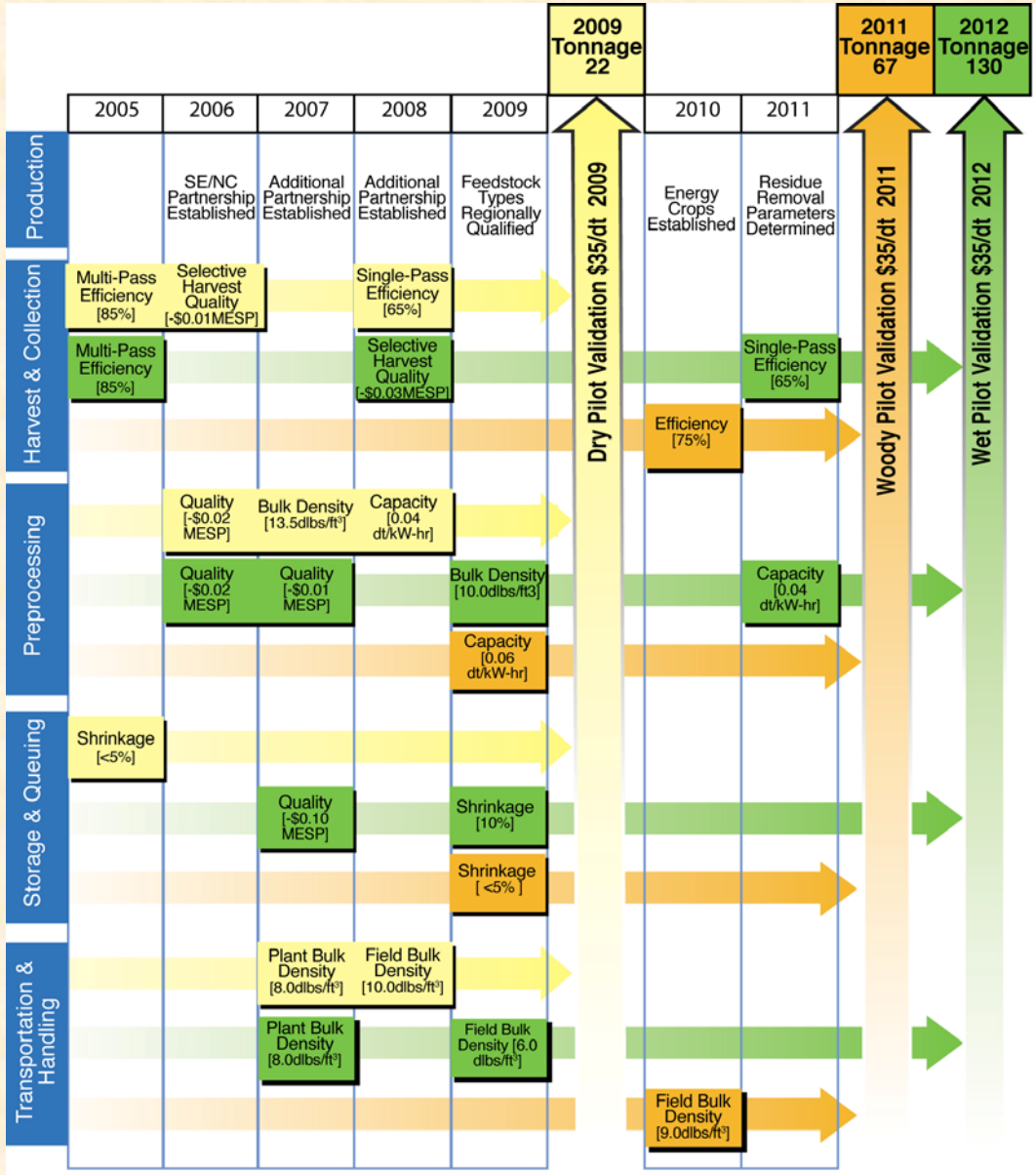
Visualize:

- **what's there now**
- **what we could project**
- **validate our projections**

R&D Plan Designed to Answer:

- ***What are the Feedstocks?***
  - Feedstock and characteristics
  - Location
- ***What are the Feedstock Tonnages and Costs?***
  - Supply potential
  - Availability and demand
- ***What are the feedstock locations' opportunities / constraints?***
  - Production practices
  - Infrastructure constraints
- ***What are the feedstock supply options and costs?***
  - Regional engineering designs
  - Dry, wet, and woody

Feedstock Platform 2012 R&D Milestones



ORNL, INL, and NREL Research

- ORNL – Feedstock resource analysis and logistics engineering modeling and support
- INL – Feedstock logistics and supply chain
- NREL – Conversion platform research
- Sun Grant – Utilizing strengths of the Land Grant Institutions and others: education, communication, policy analysis and crop development and extension outreach

	Regional Feedstock Planning Tasks and Activity Completion Year						
R&D Area	2006	2007	2008	2009	2010	2011	2012
Regional Partnership Organization / Planning	Establish SE and NC Regional Partnership		Establish the SE, NC, W, SC and NE Regional Partnerships.		Regional Partnership Project Review Meeting		Regional Partnership Project Review Meeting
Biomass Resource Assessment		Biomass Resource Tonnages and Cost quantified for 1, 5 and 60 B gal. ethanol, initiate Atlas	Fuel versus food and water impact analysis of a biomass biorefining industry (60 B gal fuel)	Identification, qualification and validation of feedstock for 1 and 5 B gal ethanol targets			Regional GIS-based biomass atlas for 1, 5, and 60 B gal ethanol
Education and Outreach		Establish a web-based biomass R&D repository for Regional Partnership activities	Develop a biomass technical monograph series for industry, policy makers, and producers		Establish biomass cropping system field trials and management demonstrations		Begin conducting grower oriented crop and residue production schools and field days
Biomass Resource Development		Corn Crop biomass resource potential analysis (Corn Growers recommenda	Initiate long-term cropping system sustainability studies for residue removal (i.e.		Energy Crops Established and Integration into current cropping systems demonstrated	Site-specific Residue Removal Parameters and Constraints Determined	

OBP/SGI Working Plan

PRIMARY DATA COLLECTION AND ANALYSIS → ***SPATIAL DISTRIBUTION OVER TIME*** → ***BIOMASS FEEDSTOCK WebGIS***

1. FIELD DATA

- Feedstock yields and sugar composition
- Management inputs
- Identification of optimum management strategies
- (fert., tillage, pesticides)

2. LITERATURE REVIEWS

- Conduct literature reviews and statistical analyses to obtain feedstock yields and statistical relationships between yields and environmental variables. These relationships will be used to determine the spatial extent (map out) yields, while we are waiting on additional field data (above).

3. ANALYSES AND MAPPING

- Current distribution of available feedstocks
- Expected distribution of future feedstocks and changes over time (Requires estimates of adoption rates and land use/cover that will be displaced.) [POLYSYS]
- Estimated location of refineries and optimal transportation routes to refineries [ORIBAS]
- Annual feedstock capacity provided to refineries and energy use and GHG associated with transport and processing [IBSAL]
- Environmental impacts and estimated sustainability of feedstock production [SWAT/GRASS]

Note: Models in [brackets] above will be used by OBP, but any means of estimating these items can be used by the SGI regional partnerships.

4. INTERACTIVE WEB-BASED GIS FOR FEEDSTOCKS, REFINERIES, AND RELATED ENVIRONMENTAL INFORMATION

- Feedstock yields
- Total feedstock biophysical potential
- Total feedstock economic potential
- Feedstock variability
- Biorefineries
- Transportation routes
- Elevation and topography
- Climate
- Soils
- Other data needed or used by the partnerships

See for example of interactive WEbGIS: http://webmap.ornl.gov/Website/daac_NM_beta1/viewer.htm?INSTANCE=MCI

Primary data (spatially-explicit) collection and use

Telecon summary (Sept 19)

- Primary data through lit search
- Gray literature vs peer-reviewed lit
- Regional point of contact (5)
- Regional partnerships publish results
- Centers house data in a regional database
- Centers coordinate with OBP, ORNL, and work independently
- Crop identification

Overview of who does what

- **Sun Grant regions need to begin collecting information on feedstock yields in their respective regions. ORNL would like to work with whomever collects the information. This is a priority. They will have no GIS work if we have no data.**

- **Sun Grant regions should develop a database with information from this review and also digitize the experiment locations in a GIS.**

- **Any thoughts on land cover are appreciated. We will likely have a meeting to coordinate these coverages and discuss which is best for national coverage.**
  - **USDA Cropland Data Layer.**
  - **USDA Farm Service Agency**
  - **Cornell has something of interest.**

Who and what (con't)

- **ORNL, INL, and Sun Grant Institution capabilities are in data analysis, meta-analysis, mapping, remote sensing, and knowledge of feedstock processing. We need to learn from others**

- **We will probably start serving up basic soils and climate data for use in analyses following a couple of GIS meetings with Sun Grant representatives.**

The participants:

- Tris West – ORNL and staff
- Dave Muth - INL
- Alison Goss Eng – DOE OBP
- Cornell – Larry Walker, Corey Rutzke, Peter Woodbury,
- SDSU – Kevin Kephart, Jim Doolittle, Matt Hansen
- OK State – Ray Huhnke, Mike Dicks, Mark Gregory,
- OSU – Jan Auyong, Thayne Dutson, Chris Daly, David Hannaway,
- TN – Tim Rials, Burt English, Daniel de la Torre-Ugarte, Sam Jackson

Specific yield data needed

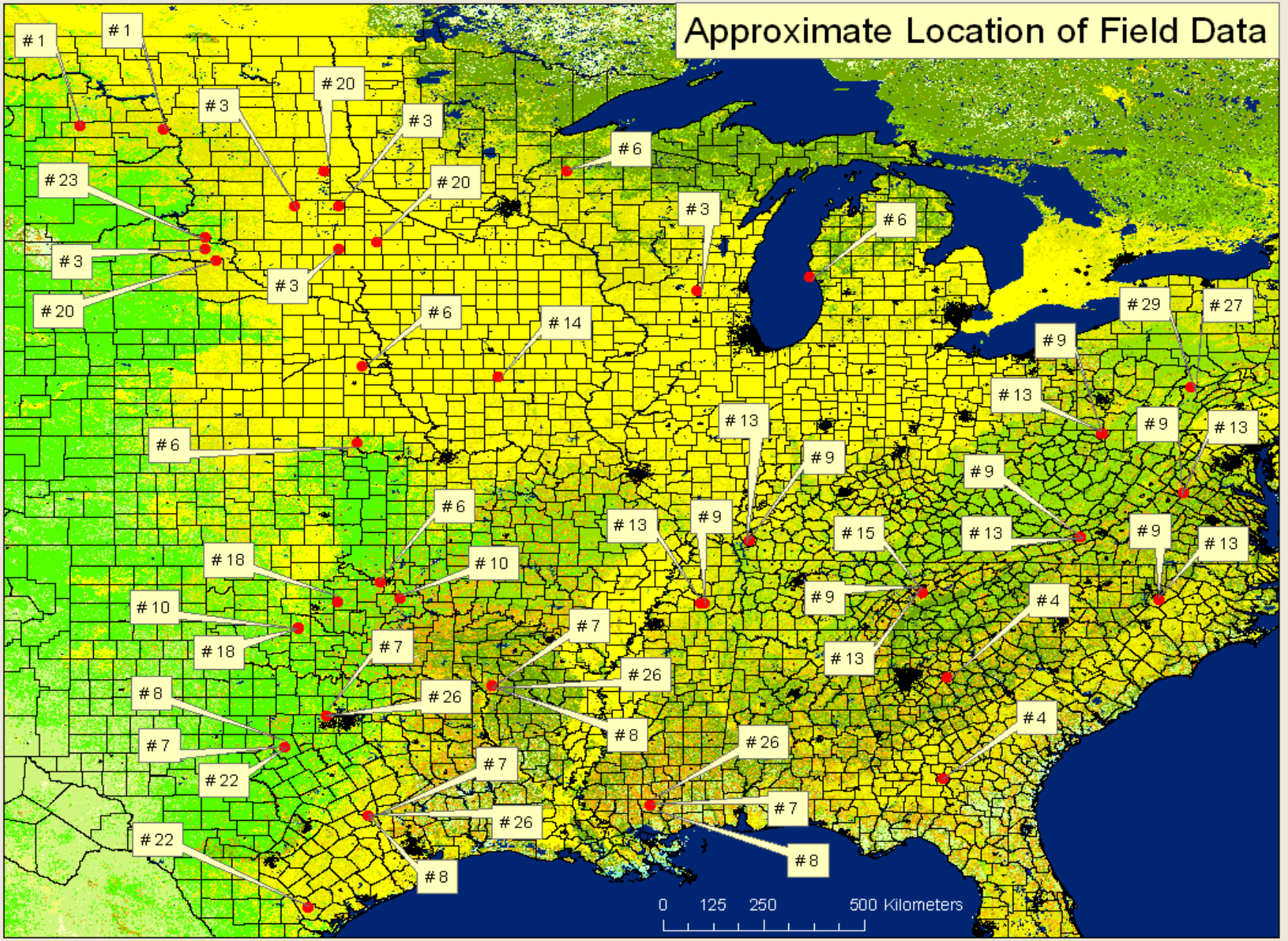
- Feedstock, cultivars, varieties, clones
- Lat and long
- Temporal data – planting, harvesting
- Yield
- % moisture at harvest
- Qualitative data at any level
- Any above- and below-ground biomass data

Specific environmental data needed

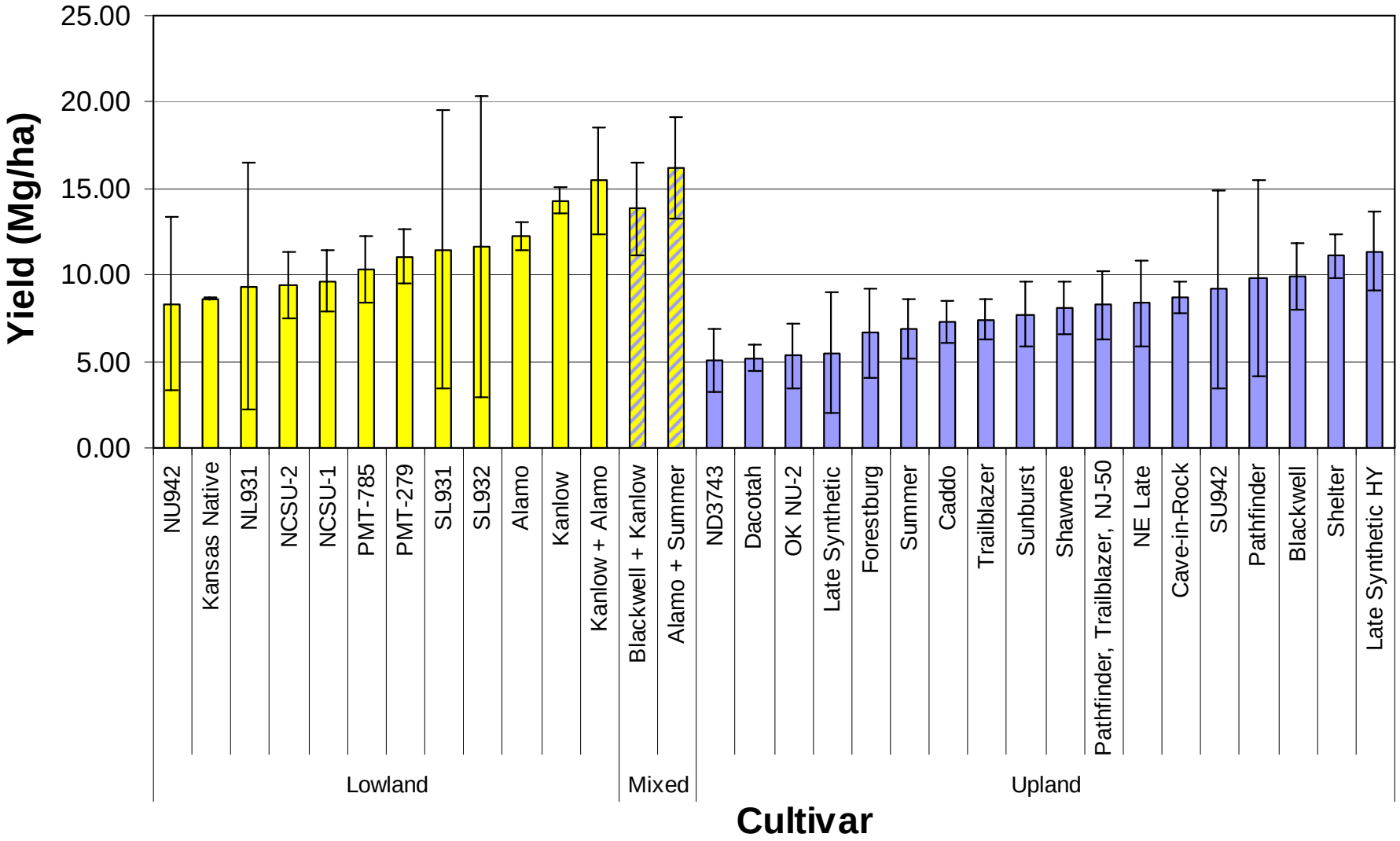
- Temp and precip
- Soils information
- Any SOC information
- N and other nutrient data
- Bulk density
- Erosion information

Specific management data needed

- Production information like:
  - Tillage
  - Specific inputs
  - Application methods
  - Harvesting technology
  - Drying and handling
  - Storage

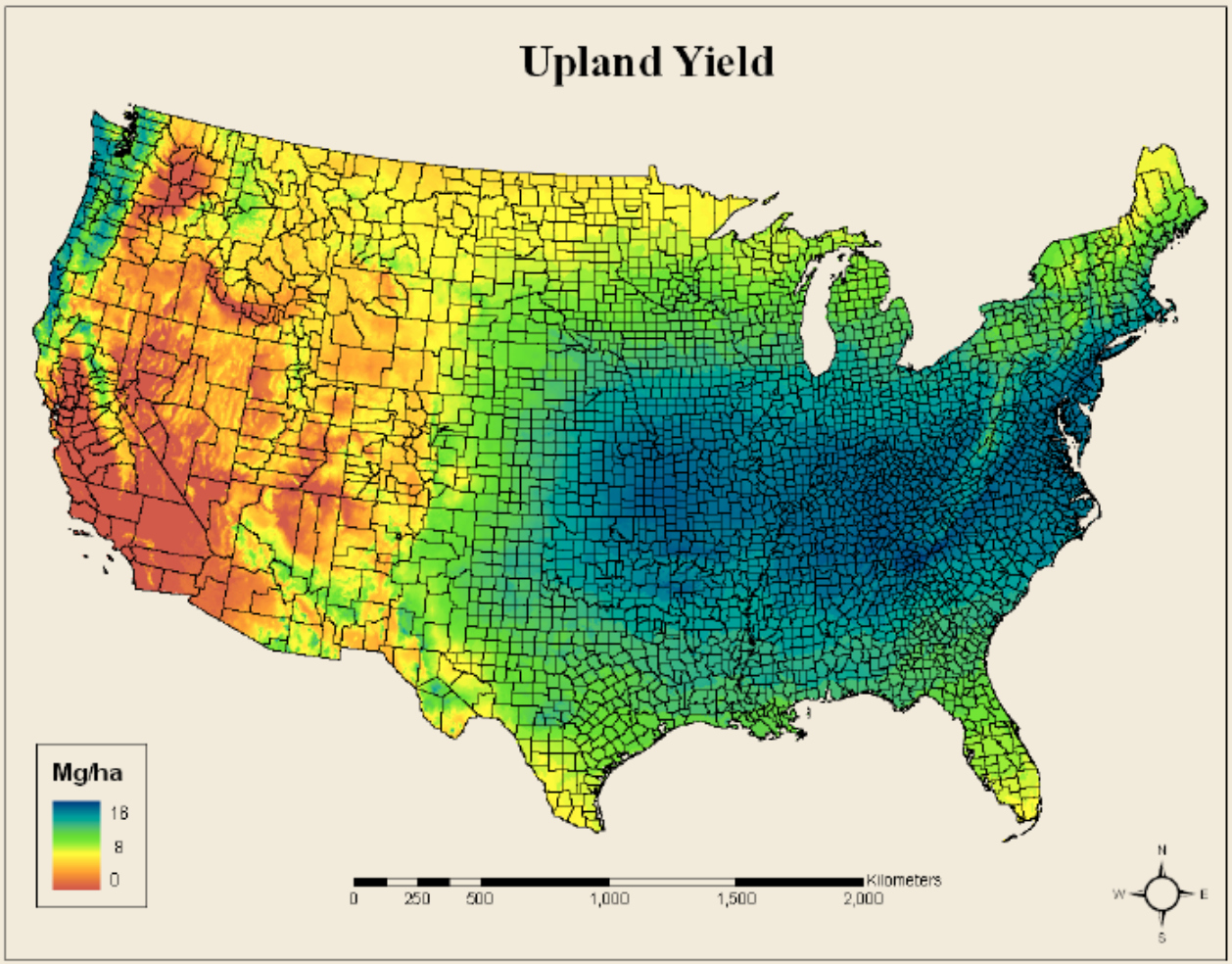

Approximate Location of Field Data
#1
#1
#20
#3
#3
#6
#23
#20
#3
#3
#3
#6
#20
#6
#14
#29
#27
#9
#13
#9
#13
#6
#13
#9
#9
#6
#13
#9
#15
#13
#9
#13
#18
#10
#9
#4
#10
#7
#18
#13
#7
#26
#8
#26
#8
#26
#4
#7
#22
#7
#26
#7
#22
#8
#8
0
125
250
500 Kilometers

Preliminary results for switchgrass yields in the U.S.

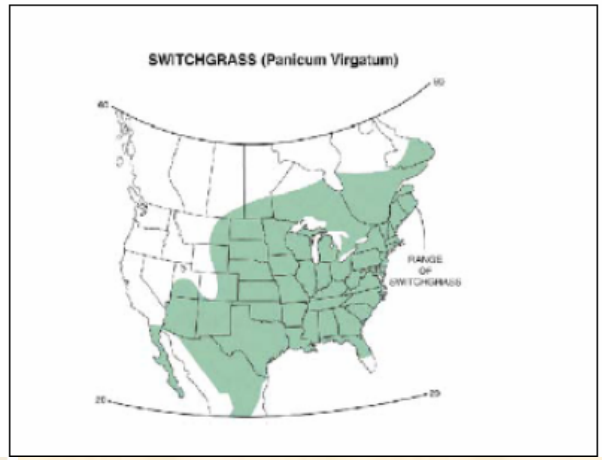


Ethan Davis, ORNL

Predicted yields in U.S.



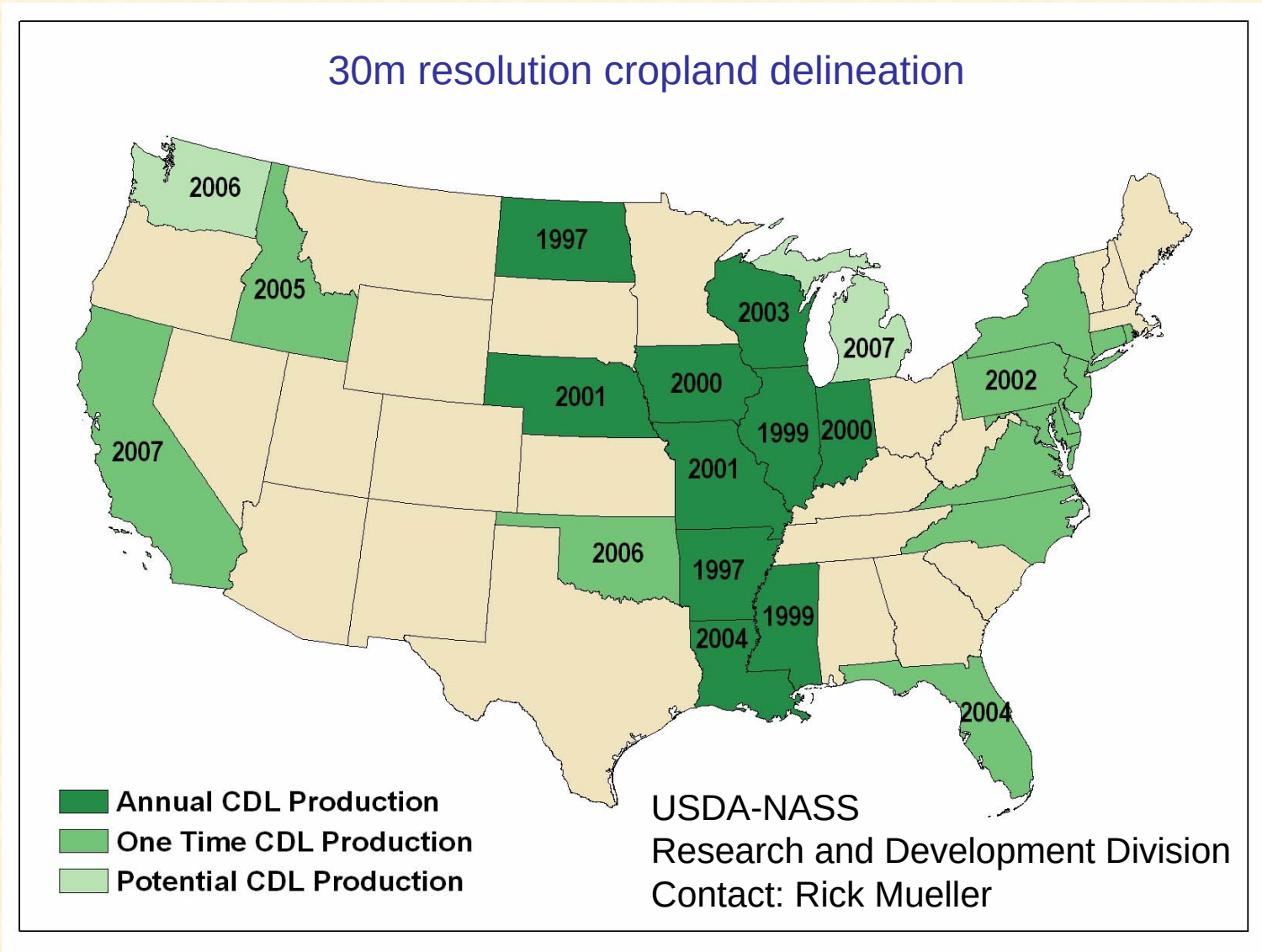
Natural Distribution



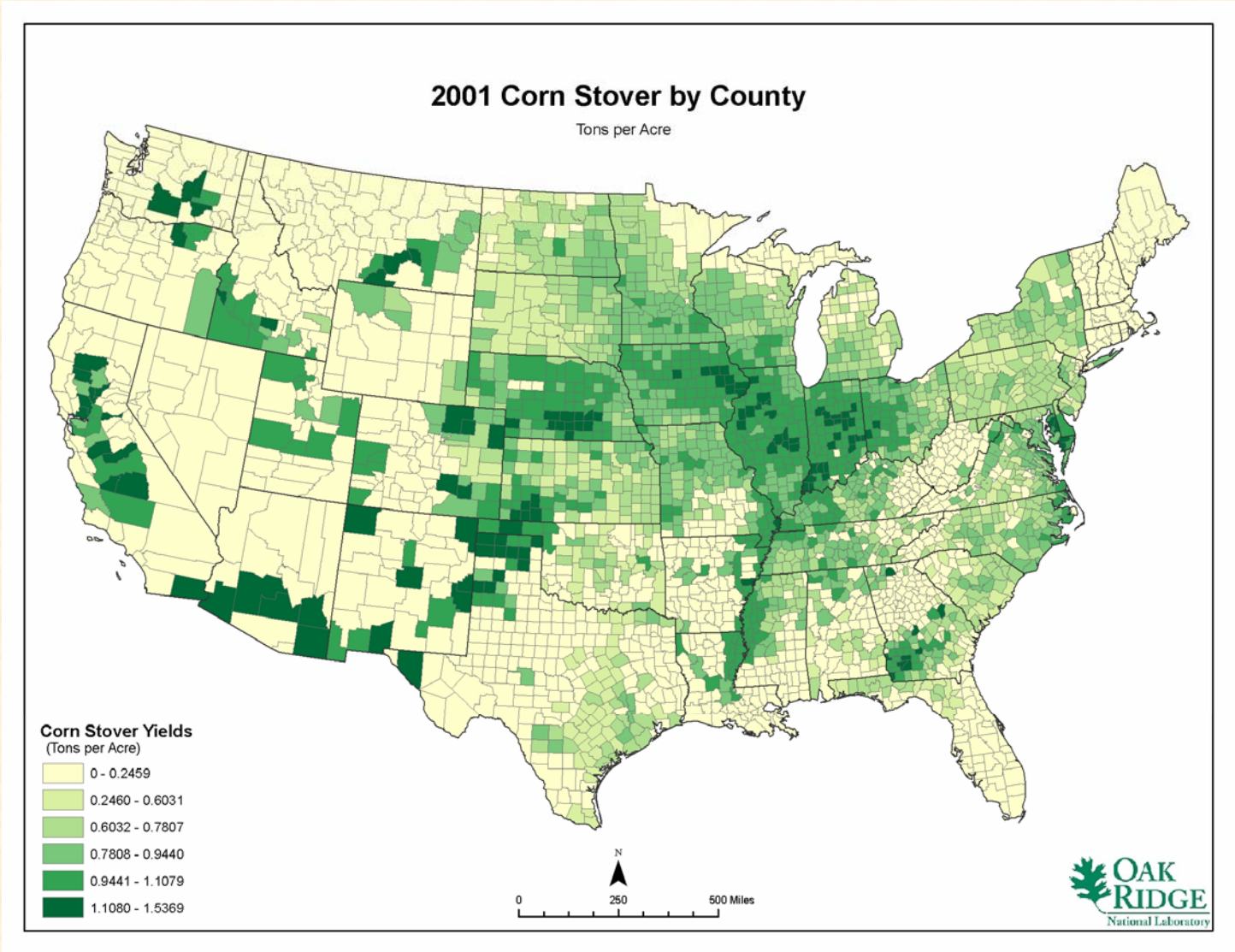
Improving spatial accuracy

Cropland Data Layer

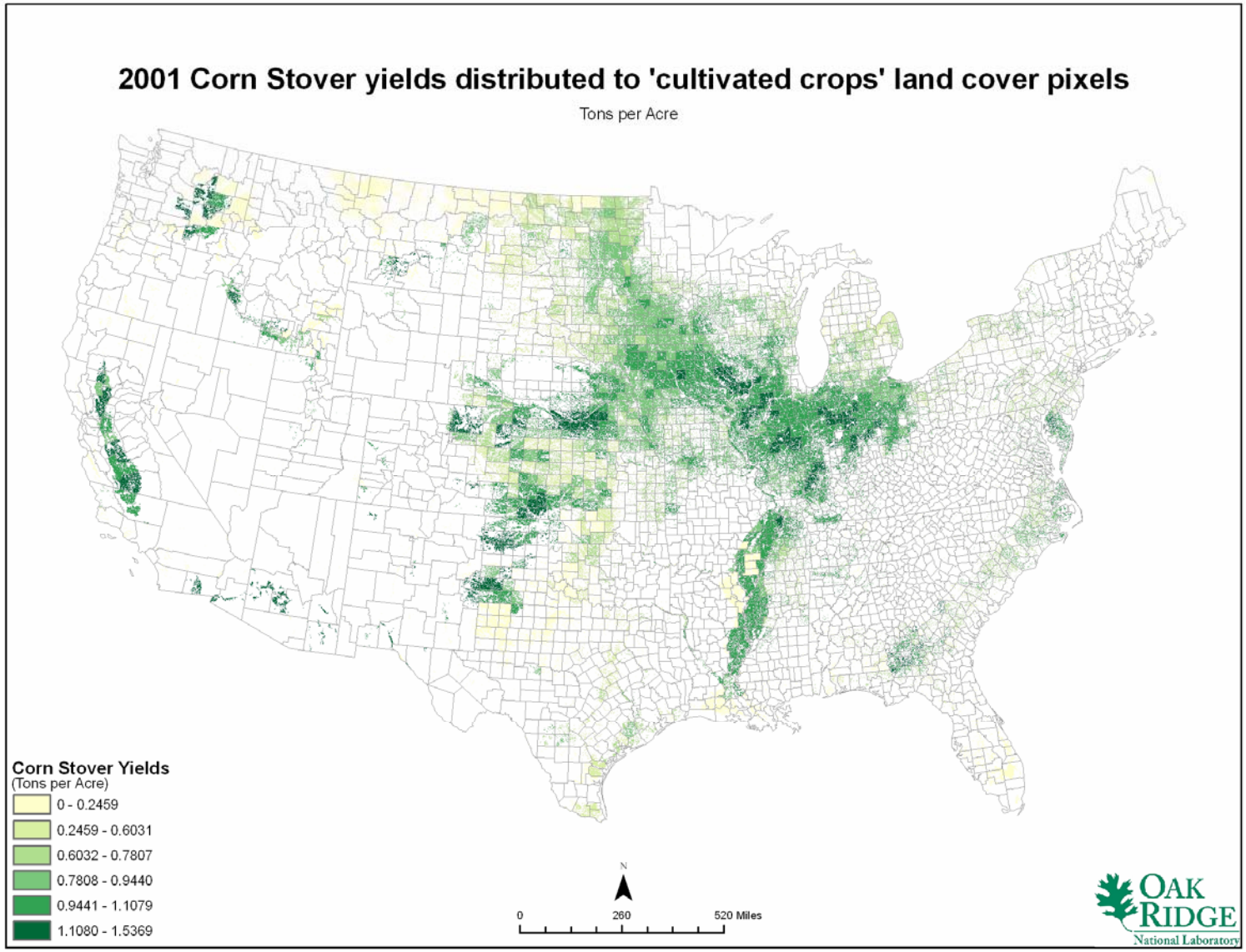
USDA Partnership



County-level statistics on feedstock



Spatial location of feedstock and refined estimates of yields and composition



Project Management Plan
Resource Assessment

GIS Atlas and Supply Curves (ORNL)

9-30-07 GIS Team Members Confirmed

10-30-07 Current project data submitted to ORNL; environmental data at higher resolution submitted

11-07 Field study inventory

12-07 Regional supply curves (ORNL, INL)

3-08 Input data available for plantings (write protocol)

9-08 Beta-version of the GIS Atlas

Project Management Plan
Resource Development

- **Replicated Field Trials (residues)**
  - **12-07 planting dates set; experimental design with crops selected**
  - **3-08 identify existing plots for grain and residue trials**
  - **6-08 residue analysis tool developed with trials conducted**
  - **9-08 Preliminary results of trials**

Project Management Plan
Resource Development

- **Replicated Field Trials (energy crops)**
  - **10-07 existing plots identified**
  - **12-07 experimental design completed and planting dates set**
  - **3-08 develop descriptions of field trials to be used to test genetic variation**
  - **6-08 evaluation of planting success; field trials conducted**
  - **9-08 Preliminary results of first year replicated trials**

Historical Perspective on How and Why Switchgrass was Selected as a "Model" High-Potential Energy Crop

ORNL TM – Lynn Wright

Kicking The Oil Habit—Evaluating Potential U.S. Cellulosic Feedstocks & Ethanol Production As A Substitute For Petroleum & Gasoline

ORNL – Ethan Davis