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G.I.S.

Organization, Use, and Distribution of Spatial Data for Estimating the Current and Potential Bioenergy Feedstock Supply

Northeast Sun Grant Regional Feedstock Summit
November 11-13, 2007

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OAK RIDGE
National Laboratory

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- **Goals and objectives of GIS task**
- **Technical targets**
- **Current status (what has been completed?)**
- **Discussion of methods and data**
- **Future work (what needs to be completed?)**

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- Collect point data on feedstock yields, composition, and environmental factors (includes past experiments, future experiments, and literature).

- Analyze data to develop relationships between yields, composition, and environmental factors.

- Collect spatial data that will aid in mapping feedstocks based on above relationships.

- Map feedstocks according to probable feedstock location.

- Provide data and analysis capabilities to your region.

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- Identify species/crops within regions for field trials. ✓
- Begin field trials in Spring 2008. ✓
- Identify person(s) and methods for data collection. ✓
- Begin collection of data from published literature and unpublished literature from experiment stations.
- Begin GIS layer for point collection of point data; begin collection of relevant spatial data sets for respective regions.
- Establish protocols for data processing and metadata.

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]

4. INTERACTIVE WEB-BASED GIS FOR FEEDSTOCKS, REFINERIES, AND RELATED ENVIRONMENTAL INFORMATION
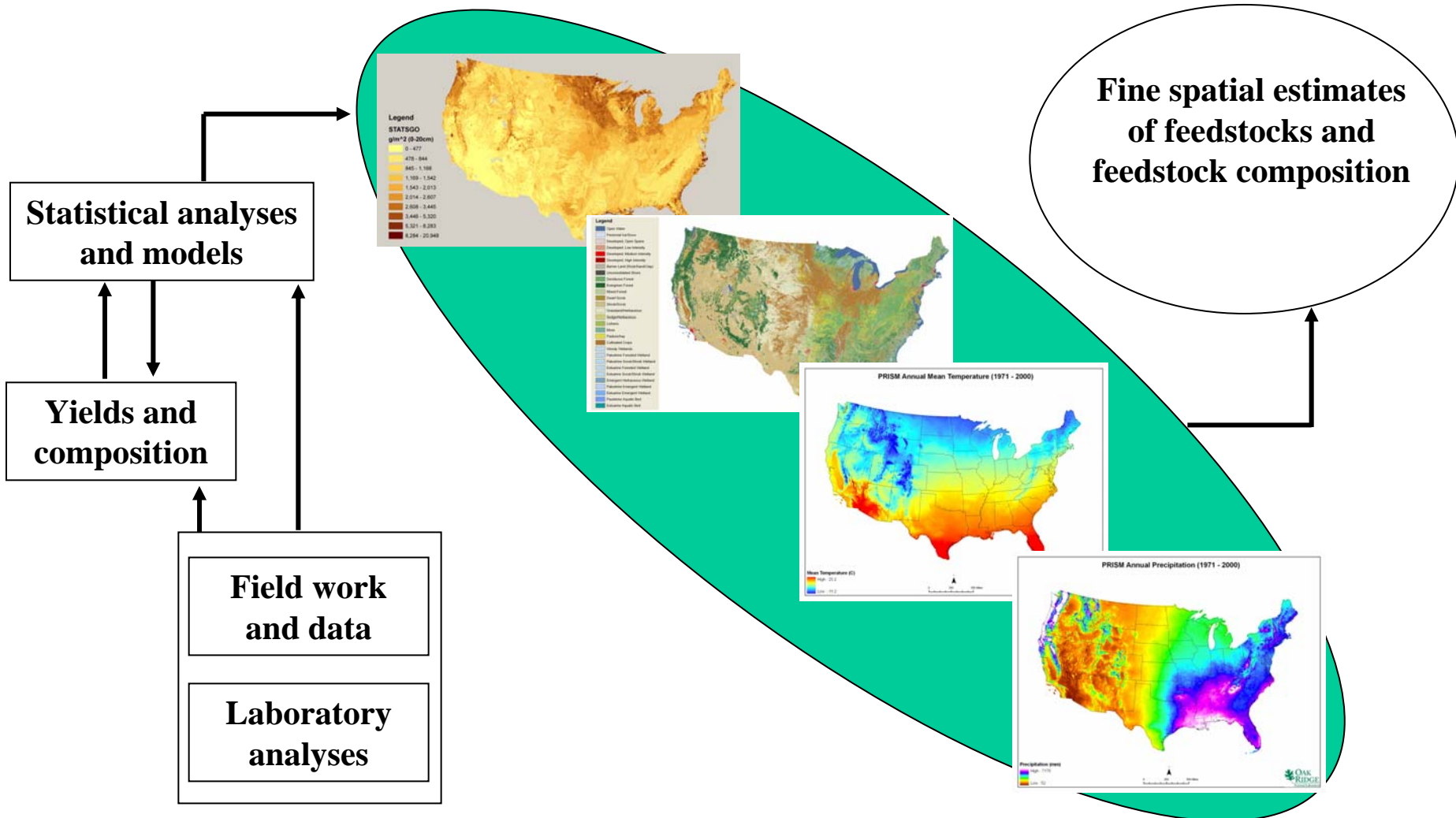- Feedstock yields
- Total feedstock biophysical potential
- Total feedstock economic potential
- Feedstock variability
- Biorefineries
- Transportation routes
- Elevation and topography
- Climate
- Soils
- Other data needed or used by the partnerships

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.

See for example of interactive WEbGIS: http://webmap.ornl.gov/Website/daac_N M_beta1/viewer.htm?INSTANCE=MCI

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Statistical analyses and models

Yields and composition

Field work and data

Laboratory analyses

Fine spatial estimates of feedstocks and feedstock composition

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- Five regional points of contact for data analysis
- Centers standardize data units and conduct quality control as needed
- Centers house data in a regional database and in national ORNL database
- Regional partnerships analyze and publish results
- Centers coordinate with OBP, ORNL, and work independently

U.S. Department of Energy
Energy Efficiency and Renewable Energy

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- Tris West – ORNL and staff
- Dave Muth - INL
- Alison Goss Eng – DOE OBP
- **Cornell**: Larry Walker, Corey Rutzke, Peter Woodbury
- **South Dakota State**: Kevin Kephart, Jim Doolittle, Matt Hansen
- **Oklahoma State**: Ray Huhnke, Mike Dicks, Mark Gregory
- **Oregon State**: Jan Auyong, Thayne Dutson, Chris Daly, Mike Halbleib
- **Univ. of Tenn**: Tim Rials, Burt English, Daniel de la Torre-Ugarte, Sam Jackson

Collection of Primary or Point Data

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- Three data streams:
  - Data from published literature
  - Data from past or current field experiments within regions
  - Data from new feedstock field experiments (beginning in Spring 2008)
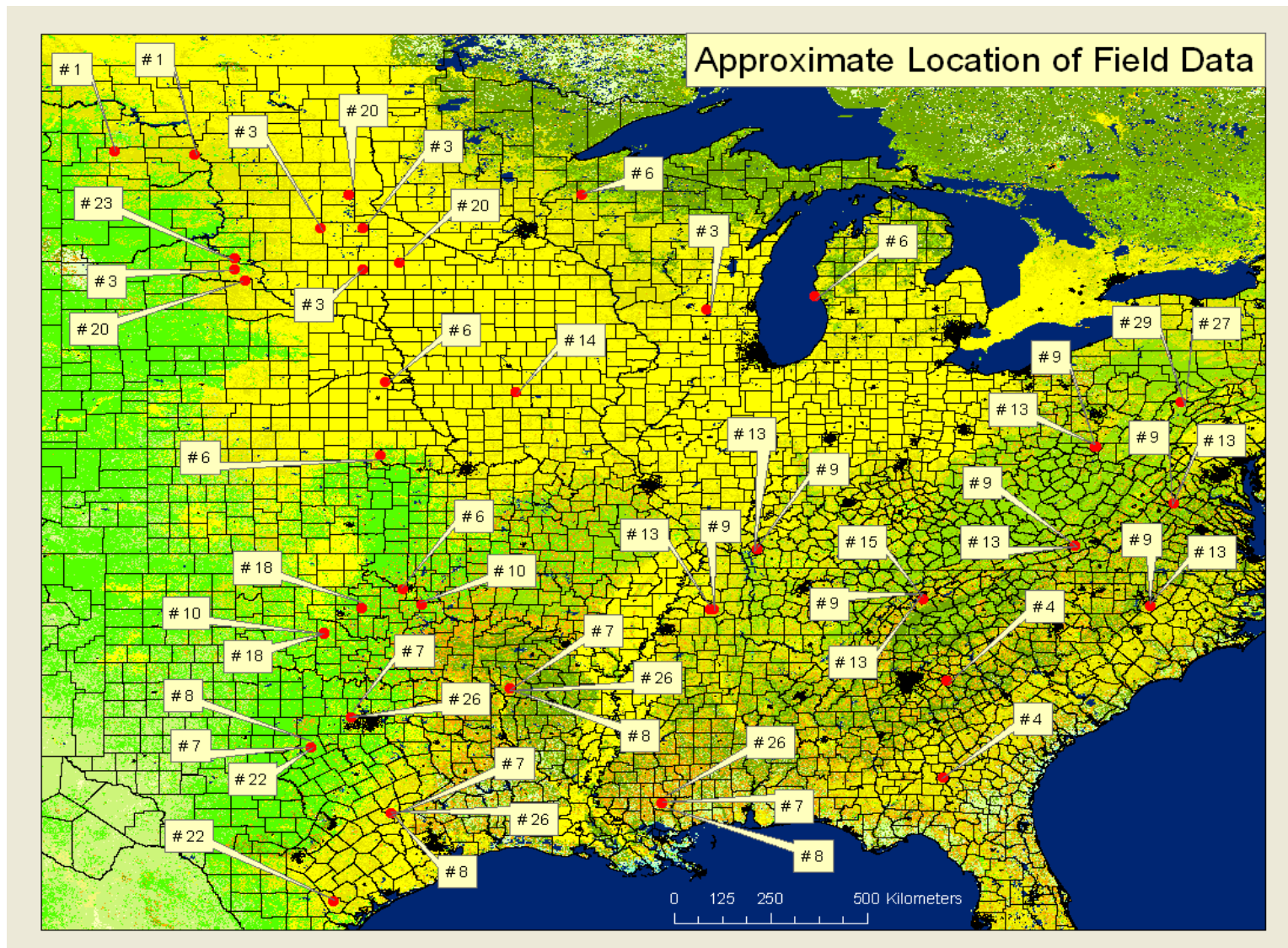
- Point data includes:
  - Location
  - Crop
  - Feedstock
  - Feedstock yields
  - Production inputs
  - Weather information
  - Soil attributes
  - Feedstock composition
  - Additional site information
  - Additional production inputs
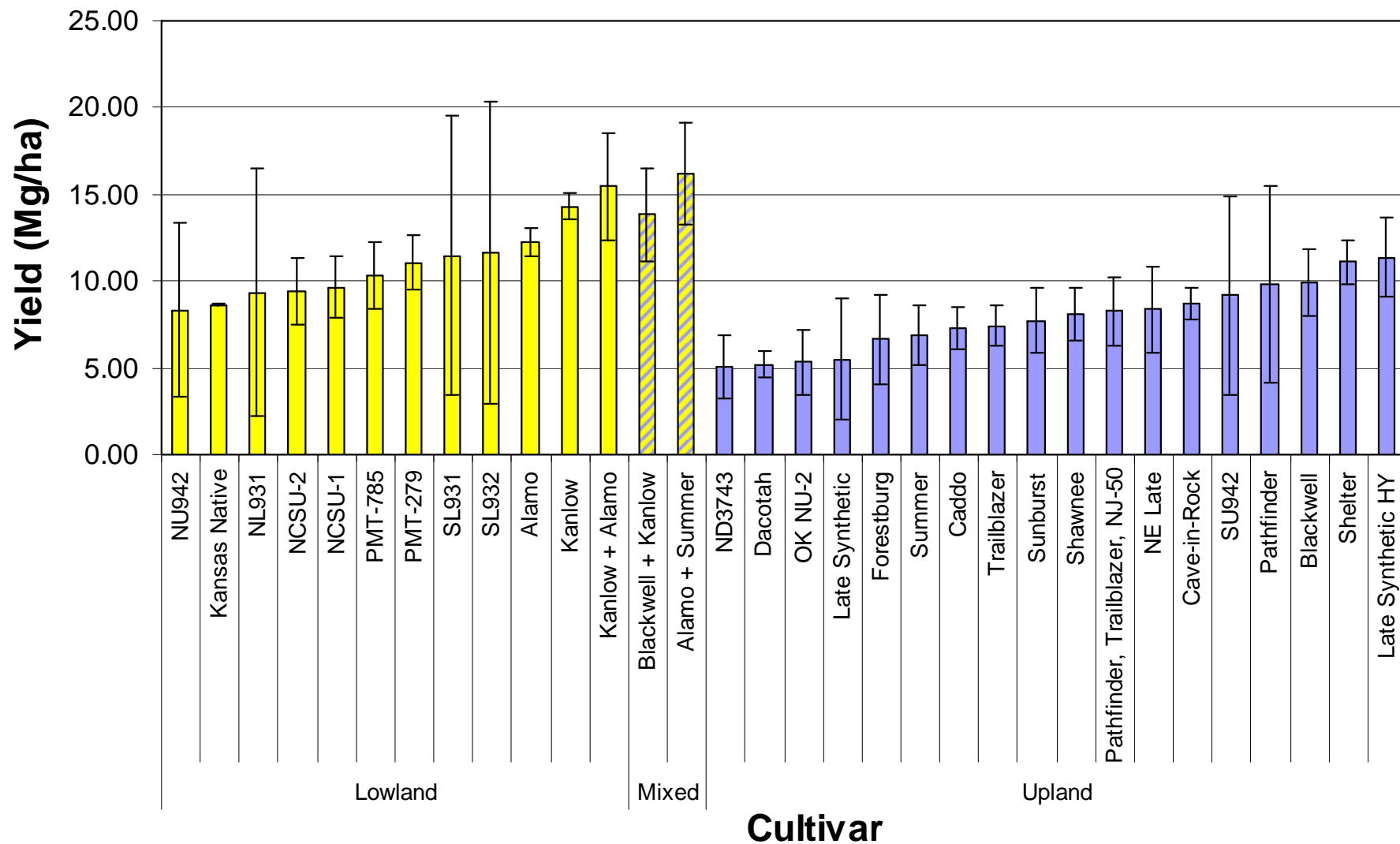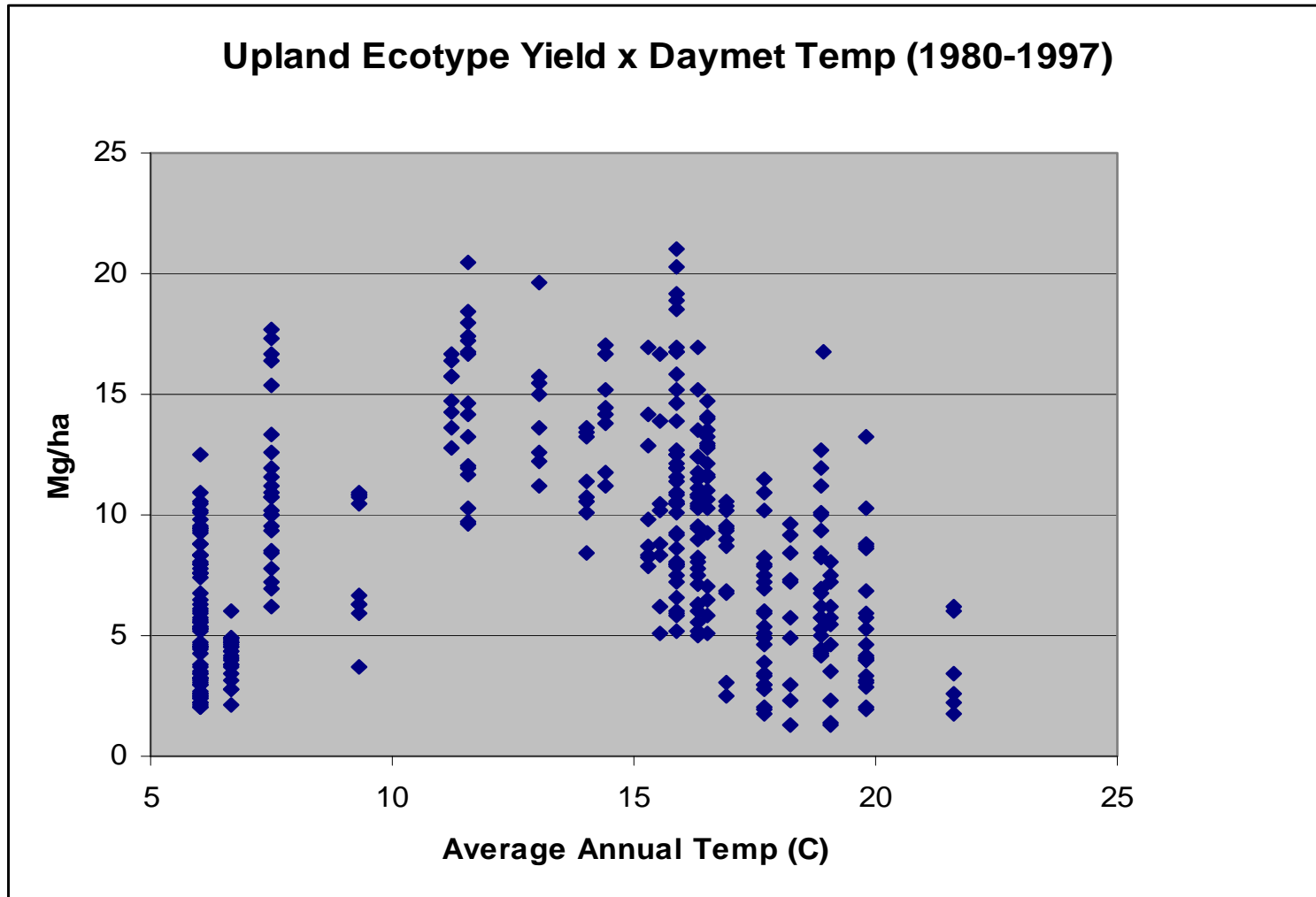
Listed in priority from top to bottom

Approximate Location of Field Data

Preliminary results for switchgrass yields in the U.S.

Ethan Davis, ORNL

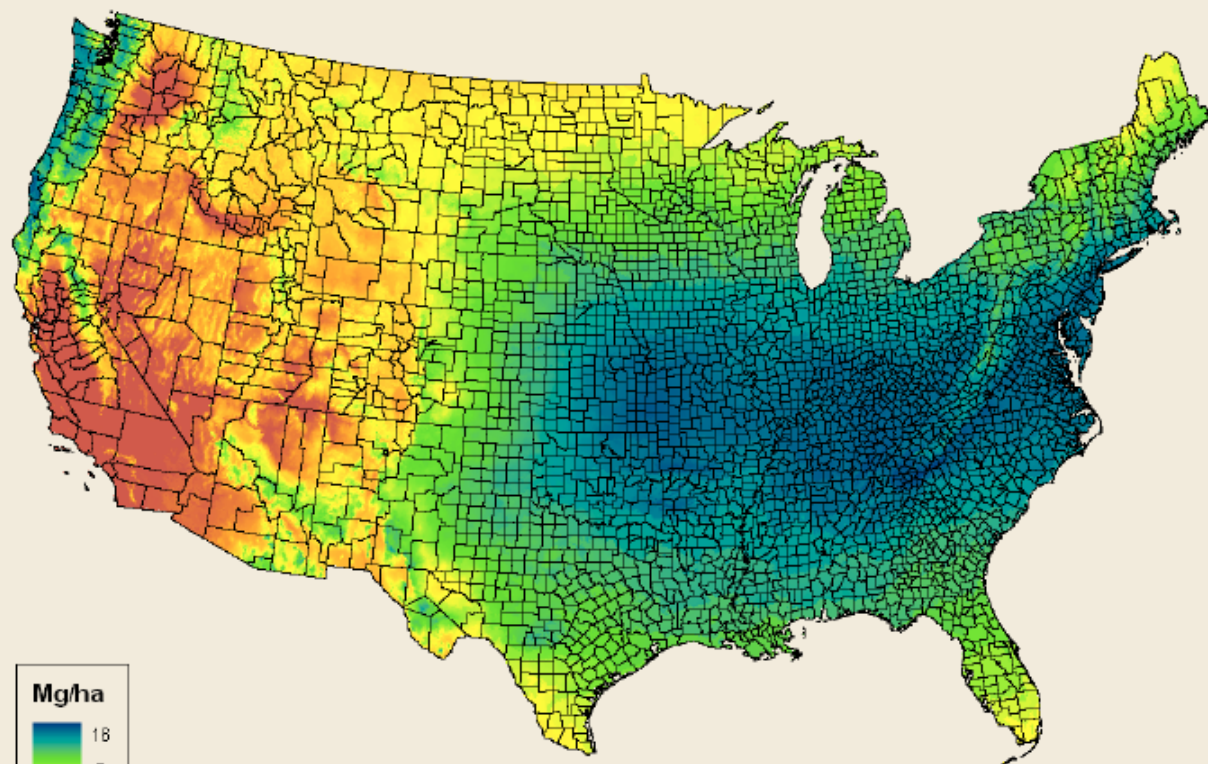# Preliminary results for switchgrass yields in the U.S.

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Upland Ecotype Yield x Daymet Temp (1980-1997)

Ethan Davis, ORNL

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Upland Yield

Natural Distribution

SWITCHGRASS (Panicum Virgatum)

Improving spatial accuracy: Collection of spatial data (land cover and use)

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- Primary (point) data collection is priority at this time.
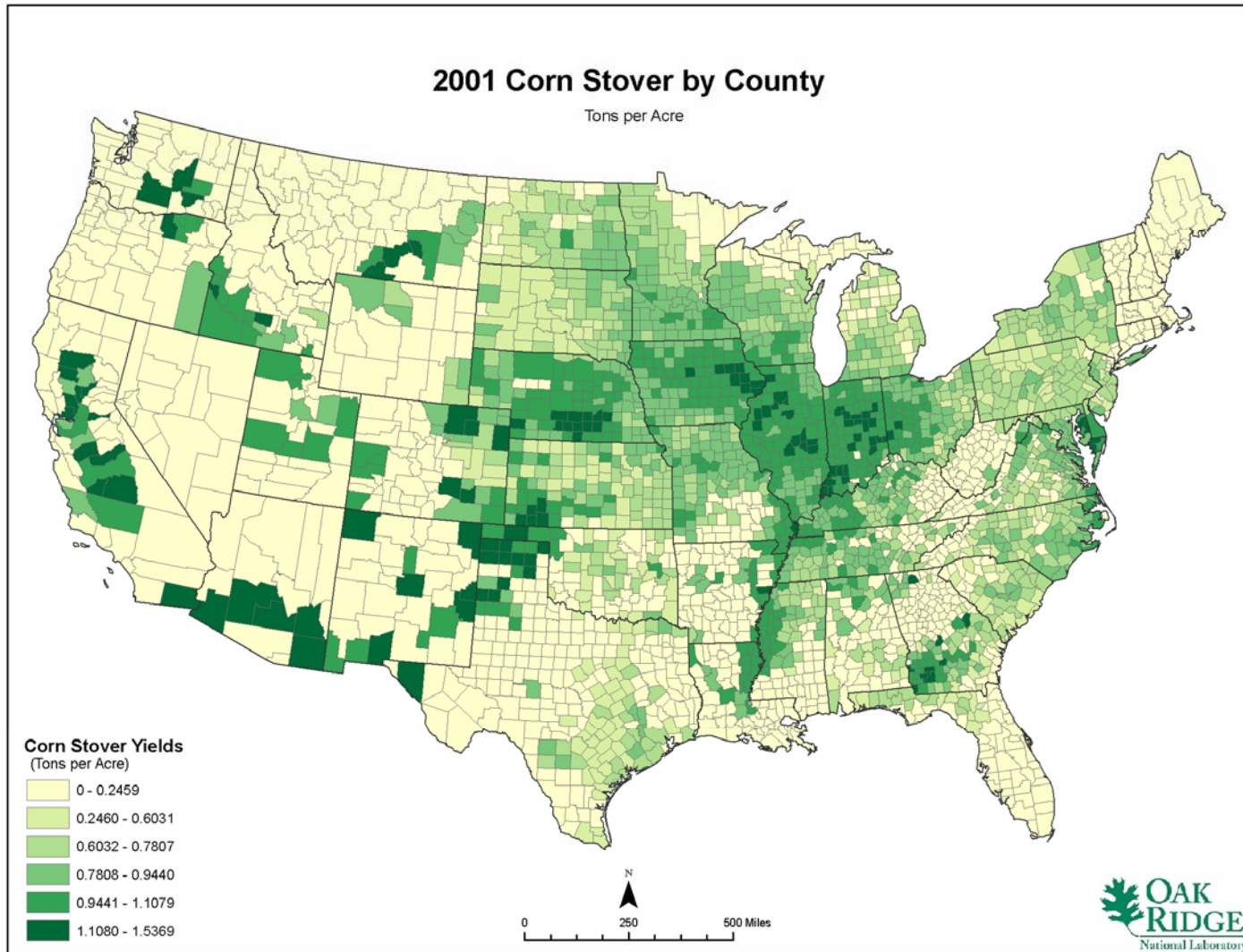- Continuing communication among regions to develop standard data sets for use.

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- Basic spatial data sets will likely include:
  - A version of STATSGO
  - A version of NASS data
  - Weather data
  - Topography
  - Multiple LULC data
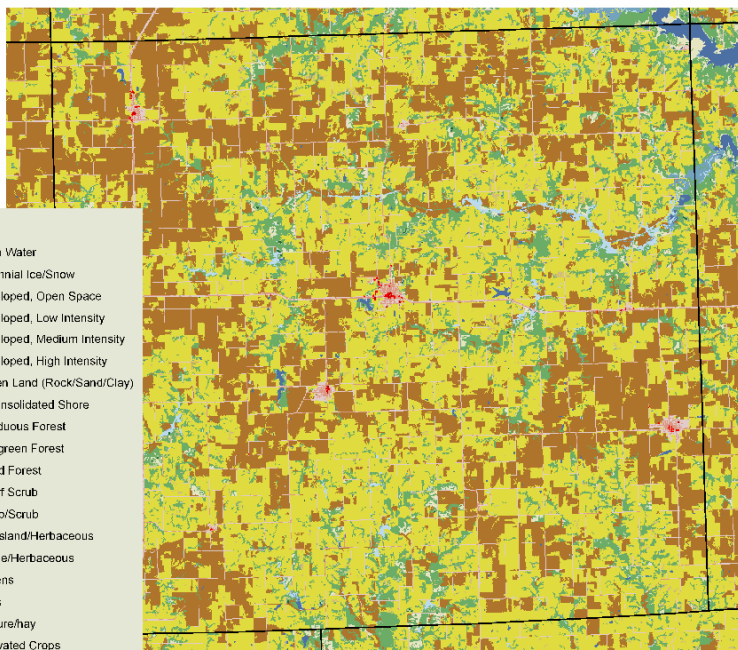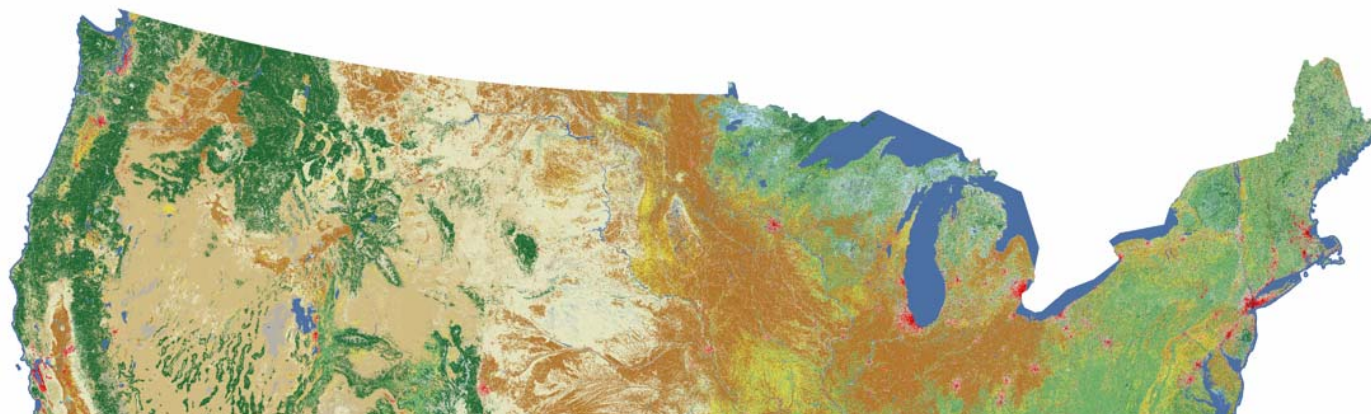 - Road networks
  - Others not yet identified

2001 Corn Stover by County
Tons per Acre

Corn Stover Yields
(Tons per Acre)
- 0 - 0.2459
- 0.2460 - 0.6031
- 0.6032 - 0.7807
- 0.7808 - 0.9440
- 0.9441 - 1.1079
- 1.1080 - 1.5369

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Legend

- Open Water
- Perennial Ice/Snow
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land (Rock/Sand/Clay)
- Unconsolidated Shore
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Dwarf Scrub
- Shrub/Scrub
- Grassland/Herbaceous
- Sedge/Herbaceous
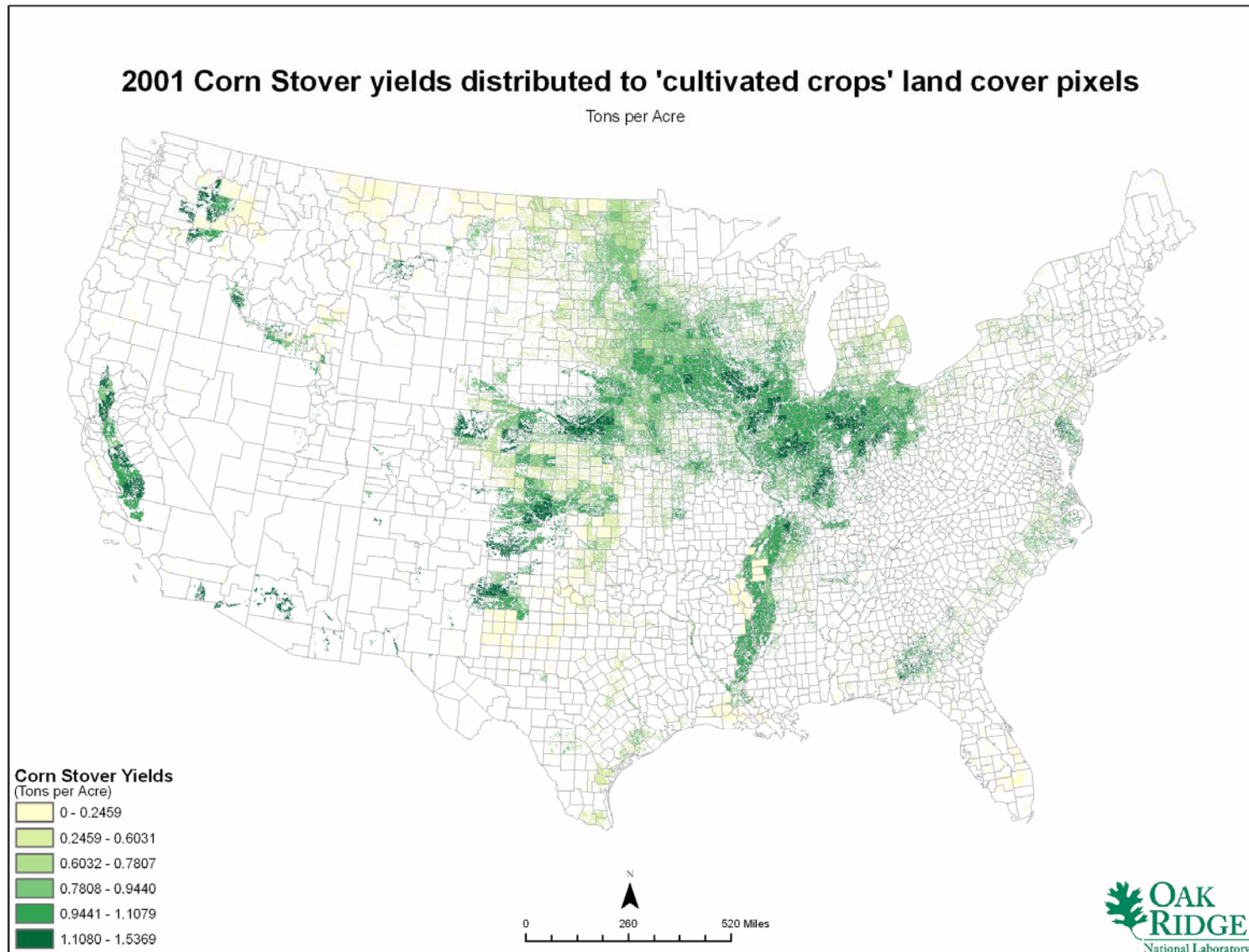- Lichens
- Moss
- Pasture/hay
- Cultivated Crops
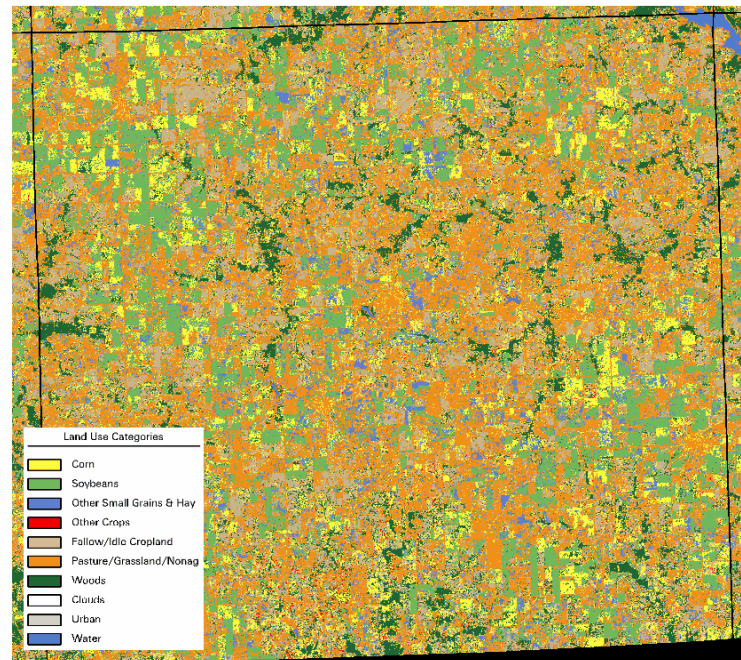
Land Use Categories

- Corn
- Soybeans
- Other Small Grains & Hay
- Other Crops
- Fallow/Idle Cropland
- Pasture/Grassland/Nonag
- Woods
- Clouds
- Urban
- Water

2001 Corn Stover yields distributed to 'cultivated crops' land cover pixels

Tons per Acre

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0   260   520 Miles

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9-30-07   Regional GIS / Spatial Data Analysis
           Team Members Confirmed

11-30-07   Point data are identified and
           confirmed

3-30-07   Spatial data needs are identified and
           confirmed

9-08   Beta-version of the GIS Atlas

11-08   Progress reports on data collection
           and analysis; meeting with
           presentations of results