BILLION-TON REPORT UPDATE

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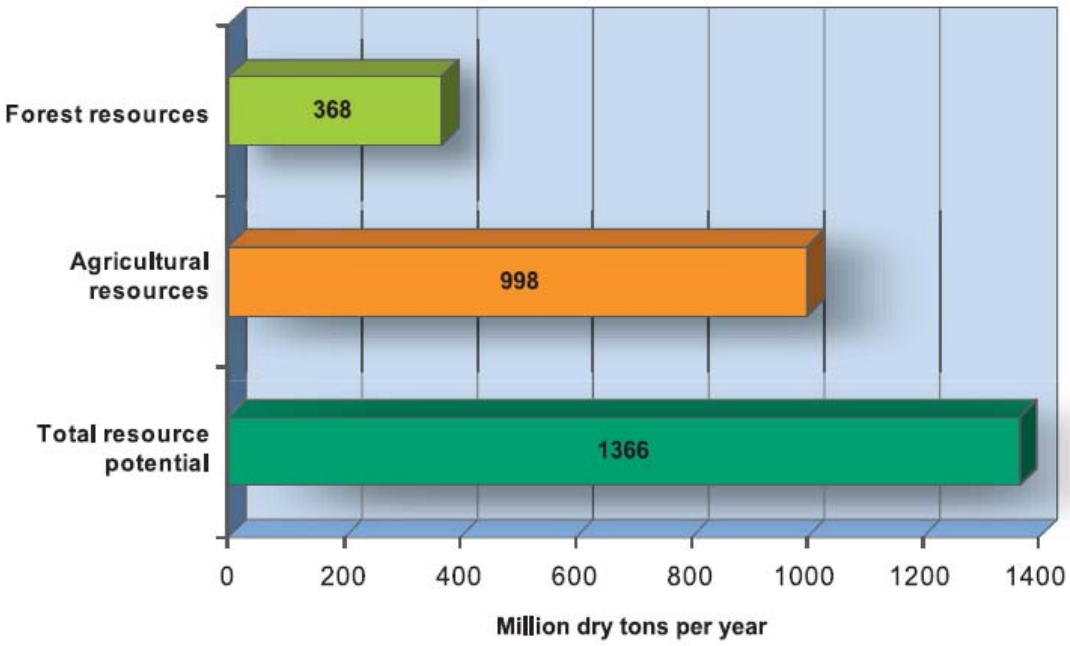
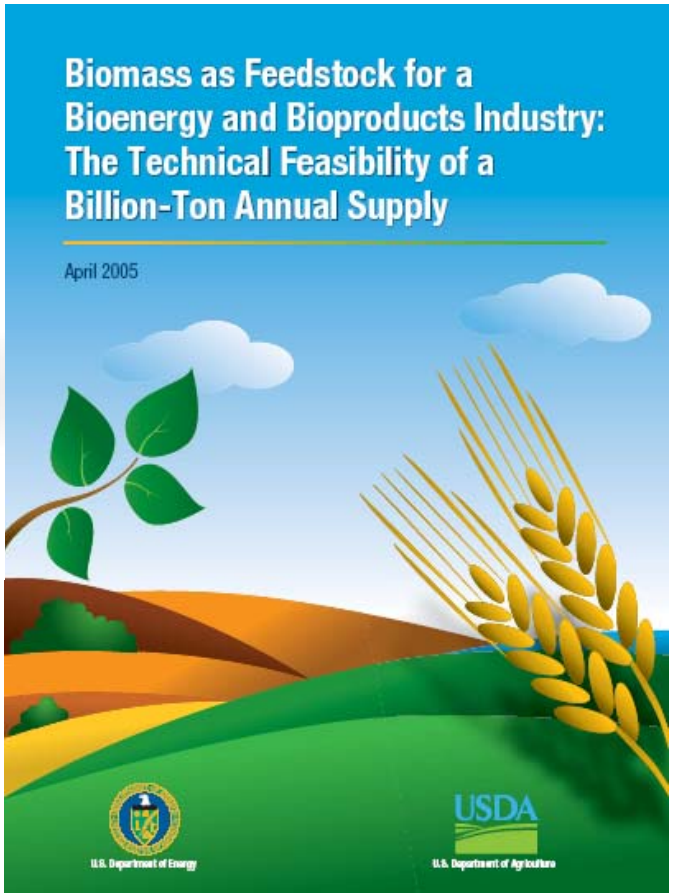
BILLION-TON RESOURCE ASSESSMENT





Objective was to determine if we had enough biomass available to produce 60 billion gallons equivalent of biofuels per year.

http://www1.eere.energy.gov/biomass/pdfs/final_billionton_vision_report2.pdf

What is the goal of the update?

- To address availability, sustainability, and costs collectively and spatially specifically.
- To improve the data, the methodology, and the assessment.
- To address concerns and issues from the original.
- To make the data and analysis transparent and available to others.
- To improve projections into the future.

BIOMASS FEEDSTOCK RESOURCE BASE

- About one-half of the land in the contiguous U.S.
  - Forestland resources: 504 million acres of timberland, 91 million acres of other forestland
  - Agricultural resources: 342 million acres cropland, 39 million acres idle cropland, 68 million acres cropland pasture

- Forest resources
  - Logging residues
  - Forest thinnings (fuel treatments)
  - Conventional wood
  - Fuelwood
  - Primary mill residues
  - Secondary mill residues
  - Pulping liquors
  - Urban wood residues

- Agricultural resources
  - Crop residues
  - Grains to biofuels
  - Perennial grasses
  - Perennial woody crops
  - Animal manures
  - Food/feed processing residues
  - MSW and landfill gases

KEY DIFFERENCES BETWEEN THE 2005 STUDY AND THE BILLION-TON UPDATE

2005 Original

- National estimates – no spatial information
- No cost analyses
- Environmental sustainability addressed from national perspective
- No explicit land use change modeling
- 2005 USDA agricultural baseline and 2000 forestry RPA/TPO
- Long-term time horizon (2005 – 2050)

2010 Update

- County-level with aggregation to state, regional and national levels
- Supply curves by feedstock by county
- Environmental sustainability modeled for residue removal
- 2009 USDA agricultural baseline and 2007 forestry RPA/TPO
- 2009 - 2030 (and 2050) timeline
- Land use change modeled

GENERAL APPROACH

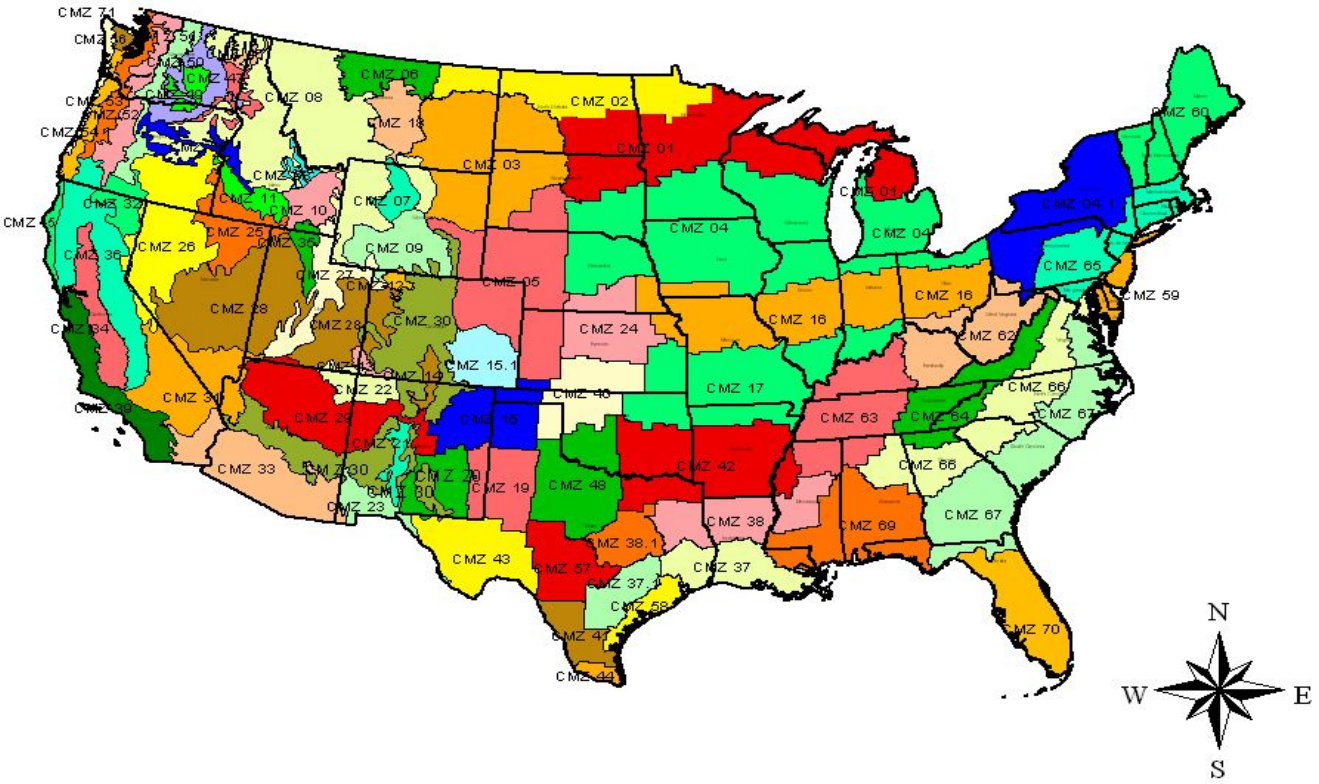
- **Estimate county-level feedstock supply curves for all major primary cropland and forestland resources**
  - USDA baseline forecast and projections (yields, acres, crop prices, production, exports, etc.) to 2030 (extrapolation to 2050)
  - Crop yields, acres, tillage, rotations
  - Sustainability constraints (erosion, soil carbon)
  - Grower payments and collection/harvest costs to road-side
- **Resource cost analysis database (costs-quantities)**
- **Agricultural policy model - POLYSYS (3,110 counties)**
  - County-level supply curve estimation and land use change
  - Allocates land based on relative profitability
  - Carbon and energy flows (in future)
  - Forest resources exogenous to the model
  - Model requires meeting projected demands for food, feed, fuel, and exports
- **Consider how the resource potential is affected by environmental sustainability, harvest/collection, crop management, productivity, …**
- **Relied on outside experts for key technical and factor input cost data, enhancement of models (e.g., POLYSYS), and analyses**
- **Resource cost-quantity analysis for secondary and tertiary resources**
- **Coordination with the KDF to disseminate results and Regional Partnerships to update data**

ENVIRONMENTAL SUSTAINABILITY: Retention Coefficients for Agricultural Residues

- Assumed no-till practices only
- Obtained realistic commodity crop rotations by multi-state crop management zones from NRCS
- Established “baseline” erosion and carbon levels for each rotation (and subject to tillage, soils, topography, climate, etc.) using RUSLE2 and WEPS
- Used INL residue removal/harvesting systems model to estimated removals
- Used RUSLE2 and WEPS to model erosion and soil carbon impacts for set levels of residue removals
- Calculated county averaged retention coefficients for wind, rain, and soil carbon for each rotation and tillage combination by crop management zone

Note: Much of this work was completed by Richard Nelson, Kansas State University, and Dave Muth, INL.

Crop Management Zones

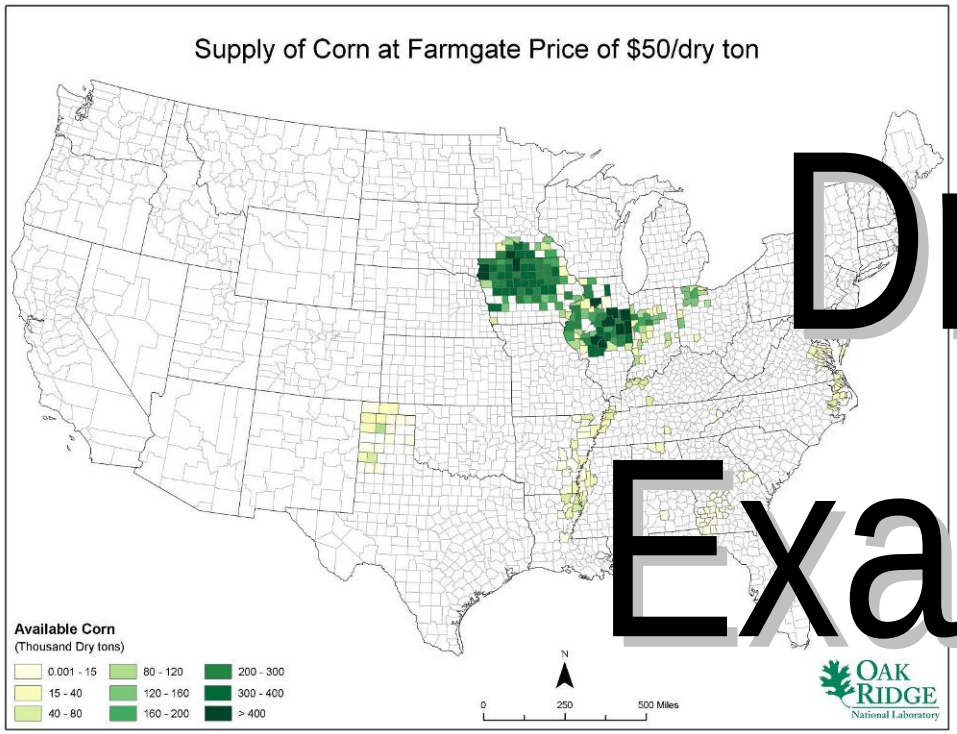


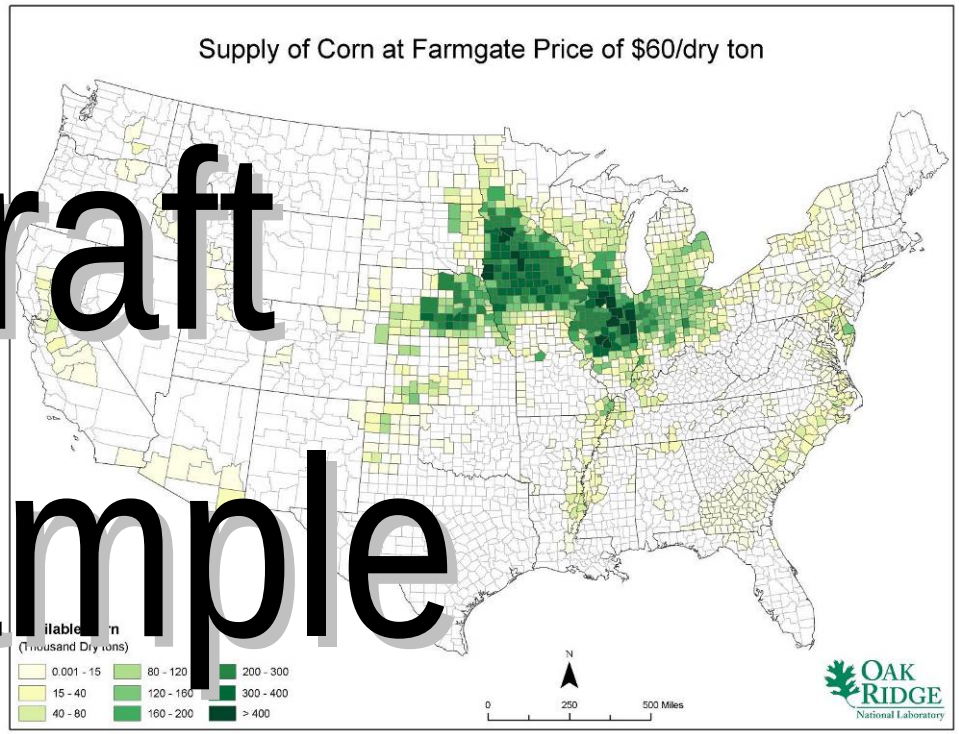
CMZ4 -
Continuous corn grain; NT no stover harvest
Corn grain;NT, corn grain;NT, Soybean, wide row, NT
Corn, grain; NT, SB NT, WW NT
Corn grain;NT, Soybean, narrow row, NT single disk

Defined as regions with like cropping rotations and field management practices

Used extensively by NRCS for Conservation Planning

COUNTY-LEVEL CORN STOVER SUPPLY





Draft Example

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ENVIRONMENTAL SUSTAINABILITY:
Forest Residues and Thinnings

- Evaluated the "state-of-the-science" for biomass removal and implications for erosion, soil nutrients, biodiversity, soil-organic carbon, and long-term soil productivity
- Developed "conservative" woody retention levels by slope classes within the context of the science review
- Removed steep and wet sites
- Excluded sites requiring road building
- Made cost assumptions based on the use of integrated logging systems and the use of Best Management Practices

ENVIRONMENTAL SUSTAINABILITY: Energy Crops

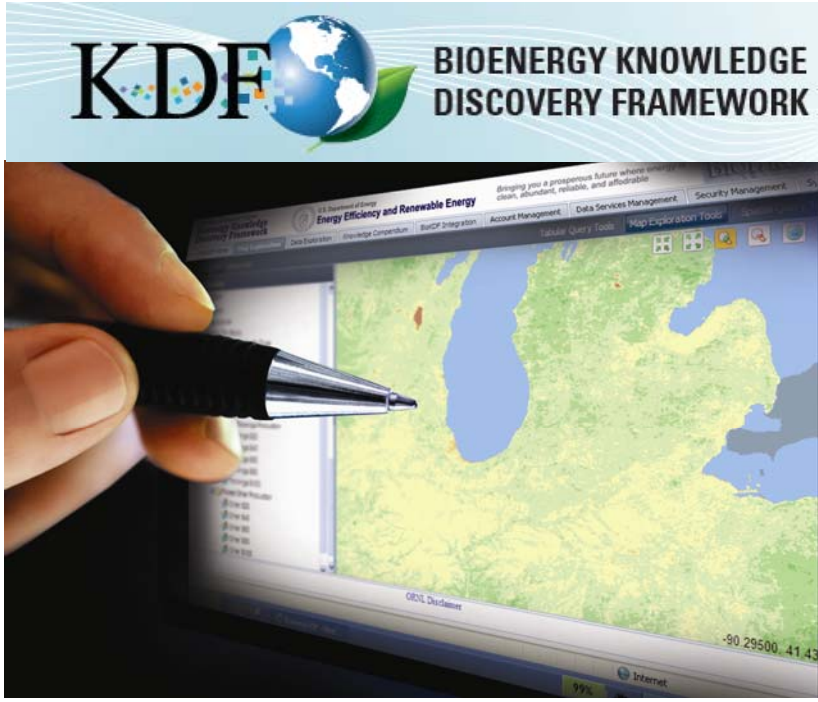
- Only on pasture land and cropland
- Some intensification of pasture land required to meet lost forage
- Cultural practices based on minimal tillage and recommended fertilizer and herbicide applications
- Retained low-levels of biomass for long-term site productivity with nutrient replacement
- Assumed landscape diversity of energy crops with other agricultural and forestry activities
- Used Best Management Practices for establishment, cultivation, and collection/harvesting

Bioenergy Knowledge Discovery Framework (KDF)

KDF is an DOE OBP platform for data sharing – future capability to synthesize, analyze, and visualize vast amounts of information.

Outputs from the Billion Ton update will be loaded onto the KDF

The public will have capability of developing tabular and graphical spatial summaries: county to national



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