GBEP Sustainability Indicators: the U.S. Experience

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Overview

• U.S. Government Sustainable Bioenergy Programs and Activities
  – Multi-agency collaboration
  – National reporting
  – Outcomes and impacts

• Reporting on the Indicators
  – Indicator evaluation empowers continuous improvement
  – Questions and challenges

• Summary
Multi-agency Collaboration

Biomass R&D Board

- Co-chaired by USDA & DOE, eight agency membership
- Coordinates R&D activities relating to biofuels and biobased products
Impact & Outcomes

Technical Assistance & Best Practices

Research & Development

National Surveys

Planning and Assessment Tools

Scientific Publications

Public Data

**Multimetric spatial optimization of switchgrass plantings across a watershed**

**Abstract**

The increasing demand for bioenergy is prompting efforts to design, renovate, and expand bioenergy feedstock production systems. Efforts to optimize the placement of switchgrass plantings have the potential to improve water quality and soil health. This can be achieved by converting agricultural land to sustainable switchgrass plantings in the Lower Lake Plateau. The model used in this study is based on a life-cycle model for predicting water quality and soil health impacts. The model uses a GIS-based approach to simulate water flow and nutrient cycling in the watershed. The results showed that the life-cycle model accurately predicted changes in water quality and soil health, providing valuable insights for future bioenergy feedstock production systems.

**Keywords**

bioenergy, landscape design, sustainability, switchgrass, water quality.
National Reporting

• National Report on Sustainable Forests

• Biofuels and the Environment: First Triennial Report to Congress

• U.S. Billion Ton Update

• Inventory of U.S. Greenhouse Gas Emissions and Sinks
Indicator 3: Harvest Levels of Wood Resources

Annual harvest of wood resources by volume and as a percentage of net growth or sustained yield, and the percentage of the annual harvest used for bioenergy

Preparation of the 2015 report is underway.
Indicator 7: Land Use and Land Use Change Related to Bioenergy Feedstock Production

- Total area of land for bioenergy feedstock production, and as compared to total national surface and agricultural and managed forest land area.

Attribution to bioenergy is a challenging problem.
Impact of Policy on U.S. Production: Iowa planted more Corn

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Land-Use Time-Series Data at Farm-Scale Resolution

- **CORN**
- **SOYBEAN**

Yearly land-use maps from 2005 to 2012.
U.S. land use data is public and freely available

Welcome to GDG

The Geospatial Data Gateway (GDG) is the One Stop Source for environmental and natural resources data, at anytime, from anywhere, to anyone. The Gateway allows you to choose your area of interest, browse and select data from our catalog, customize the format, and have it downloaded or shipped on CD or DVD.

This service is made available through a close partnership between the three Service Center Agencies (SCA); Natural Resources Conservation Service (NRCS), Farm Service Agency (FSA), and Rural Development (RD).

System Status

Please Note:
5/16/2013 7:40:28 PM MST:
All products and services are running normally.
Sustainable Feedstock Production Systems

Goal: Enable new optimal practices and systems that maximize the sustainable yield of high-quality bioenergy feedstocks

- optimize sustainable feedstock production systems
- develop biophysical-economic models
- utilize biorefinery co-products such as distillers grains and biochar on-farm
Indicator 1: Lifecycle GHG emissions
Indicator 18: Net Energy Balance

The energy balance and GHG emissions of conventional ethanol are improving in the U.S.

Dry Mill Ethanol Production Volume

Life Cycle GHG
Emissions in 10 g CO$_2$ eq per 1000 L ethanol

Fossil Fuel use in MJ per per 1000 L ethanol

Chum, Zhang et al., submitted Biofpr
Indicator 1: Lifecycle GHG emissions

Improvements come from better farming and industrial practices

Data collection is essential for promoting improved methods of bioenergy production

Wang et al. (2011) Biomass and Bioenergy

Corn Farming Inputs

Fertilizer Use Per Bushel of Corn (relative to 1970)

- Nitrogen
- Potassium (K₂O)
- Phosphorus (P₂O⁵)

Wang et al. (2011) Biomass and Bioenergy
Indicator 5: Water use and efficiency

Water Analysis Tool - [water.es.anl.gov](http://water.es.anl.gov)

- Select feedstock type
- Select county, state, region
- Calculate green, blue, and grey water
- 10-year average or single year
- Water use by unit of land, feedstock, or fuel
- Map, chart, and table display
Indicator 5: Water use and efficiency

*Production:* Amount of precipitation used for irrigation

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**Corn**

**Soybean**

Percent of Annual Precipitation used for Irrigation (2008)

Attribution to bioenergy is a challenging problem
Challenges to Evaluating the Water Use and Efficiency Indicator

• Attribution
  - U.S. water monitoring does not distinguish between bioenergy crops and other crops
  - Farmers often grow a mix of crops using the same irrigation system
  - A single crop type often flows into commodity market with mixed end uses
  - Feedstock production and processing may occur in different watersheds

• Difficult to disaggregate renewable from non-renewable water resources

Photo: Jim Bauer
Challenges in Evaluating Indicators

• Attribution
  • bioenergy vs. agricultural
  • natural processes
  • other activities

• Spatial variability

• Focus on past, present, future potential? Trends?

• Reliable, consistent data

• Modeled vs. primary data
Next Steps for U.S. Indicator Evaluation

• Survey U.S. domestic commitment to policies, research, and tools for sustainable resource management
• Work to translate extensive reporting and data streams into indicator evaluations
• US-funded projects filling key gaps
  – National LCA projects
  – USDA NIFA sustainability grants
  – DOE Bioenergy Sustainability projects