

# **Sustainability and Bioenergy**

**Marcia Patton-Mallory, PhD  
Biomass and Bioenergy Coordinator,  
US Forest Service**

**Federal Sustainability Network- West**

**June 19, 2008**



## **Biofuels 'crime against humanity'**

Published: 2007/10/27

**A United Nations expert has condemned the growing use of crops to produce biofuels as a replacement for petrol as a crime against humanity.**

The UN special rapporteur on the right to food, Jean Ziegler, said he feared biofuels would bring more hunger.

The growth in the production of biofuels has helped to push the price of some crops to record levels.

Mr Ziegler's remarks, made at the UN headquarters in New York, are clearly designed to grab attention.

washingtonpost.com

# All Biofuels Are Not The Same

By Vinod Khosla Monday, June 16, 2008; A19

Last month the Wall Street Journal accused me of advocating subsidies for food-based ethanol. I ought to "take a vow of embarrassed silence," it said, for claiming that ethanol's contribution to the food crisis is "overblown." The Journal's claims would be laughable if the stakes were not so high.

Cellulosic biofuels offer a chance to have an environmentally meaningful impact on petroleum use while benefiting farmers, entrepreneurs and consumers. I have many investments in biofuels companies. Some say I believe in biofuels because I have invested in them. The truth is that I invest in biofuels ...

**Secretary of Energy Samuel W. Bodman and Secretary of Agriculture Edward T. Schafer sent a letter on June 11, 2008 to Senator Jeff Bingaman addressing a number of questions related to biofuels, food, and gasoline and diesel prices. The letter is available at <http://www.energy.gov/>**

- Without Biofuels, Gas Prices Would Increase \$.20 to \$.35 per Gallon.**
- Biofuels are Reducing America's Dependence on Oil.**
- Biofuels are Reducing Greenhouse Gas Emissions.**
- Today's Biofuels Account for Only a Small Percentage of the Increase in Global Food Prices.**
- Future Biofuels Will Alleviate Much of the Concern about Competition Between Food and Fuel.**

# Dimensions of Sustainability

- Economic
  - New linkages in markets
  - Direct effects (supply, demand, price)
  - International trade
- Environmental
  - Direct effects
  - Indirect effects
  - Ecosystem services- coproduction
- Social
  - Regional, National, and International
  - New Energy Economy- renewables and advanced technology
  - Food, Fuel, Feed and Fiber

# Sustainability Frameworks

- International Dialog
  - Global Bioenergy Partnership
  - Roundtable on Sustainable Biofuels
- Certification- Forestry
- National Dialog
  - Interagency working group on sustainability
  - EISA 2007 biofuels mandate
  - Federal environmental regulations and standards
- States
  - Best Management Practices

# Example Sustainability Criteria

## Glenister SGS

- Net Reduction of greenhouse gases
- No competition with food, local energy supply, medicines and construction materials
- No loss of biodiversity
- Maintain or improve environment (soil, water, air)
- Contribution to local/ national economy
- Contribution to local well-being

# Example Sustainability Criteria

## Environmental

- Conserve Carbon
- Conserve Biodiversity
- Sustainable water
- Soil Conservation
- Air Quality

## Social

- Worker's rights
- Land rights
- Food security and availability
- Share benefit locally

“the right crops and trees in the right place with the right techniques”

# Not all biofuels are the same!

- Grain-based (food, feed)
- Sugar-based (food)
- Oil plant (food, oilseeds)
- Cellulosic (herbacious energy crops)
- Cellulosic (woody energy crops)
- Waste recycling (tallow, grease)
- Residues (crop, forest, urban wood diversion from landfills)

# Not all Biofuels Production is the Same!



Photo: Jake Eaton, Podlatch Corporation



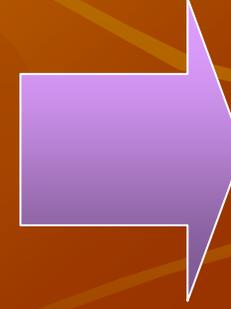
## Feedstock

- Forest Residues
- Hazardous Fuel Treatments
- Short Rotation Woody Crops
- Wood Waste
- Conventional Forestry
- Mill Wastes & Residues



## Conversion

- Manufacturing
- Co-firing
- Combustion
- Gasification
- Hydrolysis
- Digestion
- Pyrolysis
- Extraction
- Separation



## Uses

### Fuels:

- Ethanol
- Other Liquid Fuels
- Hydrogen

### Electricity and Heat

### Biobased Products

- Composites
- Specialty Products
- New Products
- Chemicals
- Traditional Products

# Energy from Biomass

- Liquid transportation fuels (renewable solar, wind or geothermal only provide heat and power)
- Heat
- Power (including co-firing with coal)
- Replace petroleum products (carbon fibers, plastics)
- Biorefinery- positive energy balance generating biofuels and coproducts, process heat, and electricity for the grid

# Economic Dimensions

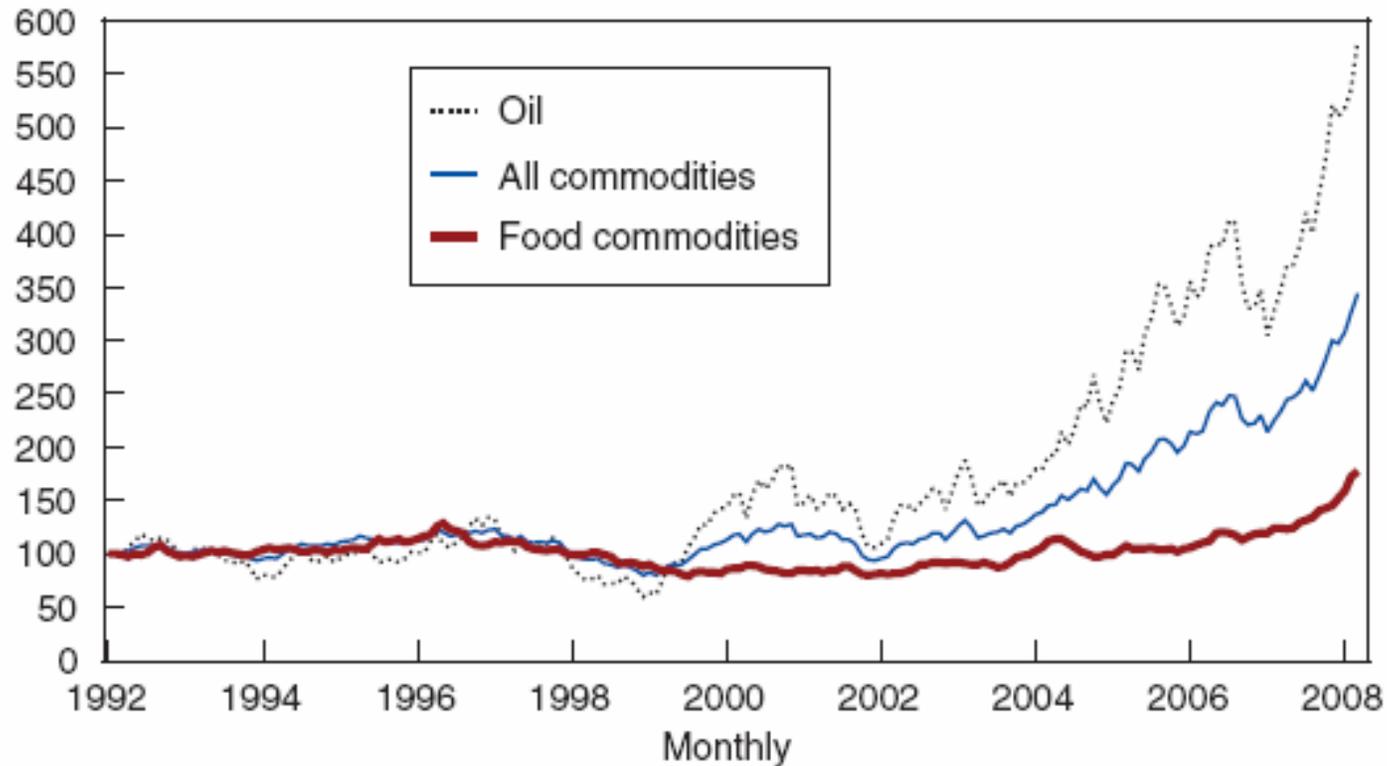


# Economics – market linkages

Figure 3

## Prices of many commodities rose

Index: January 1992 = 100



Source: International Monetary Fund: International Financial Statistics.

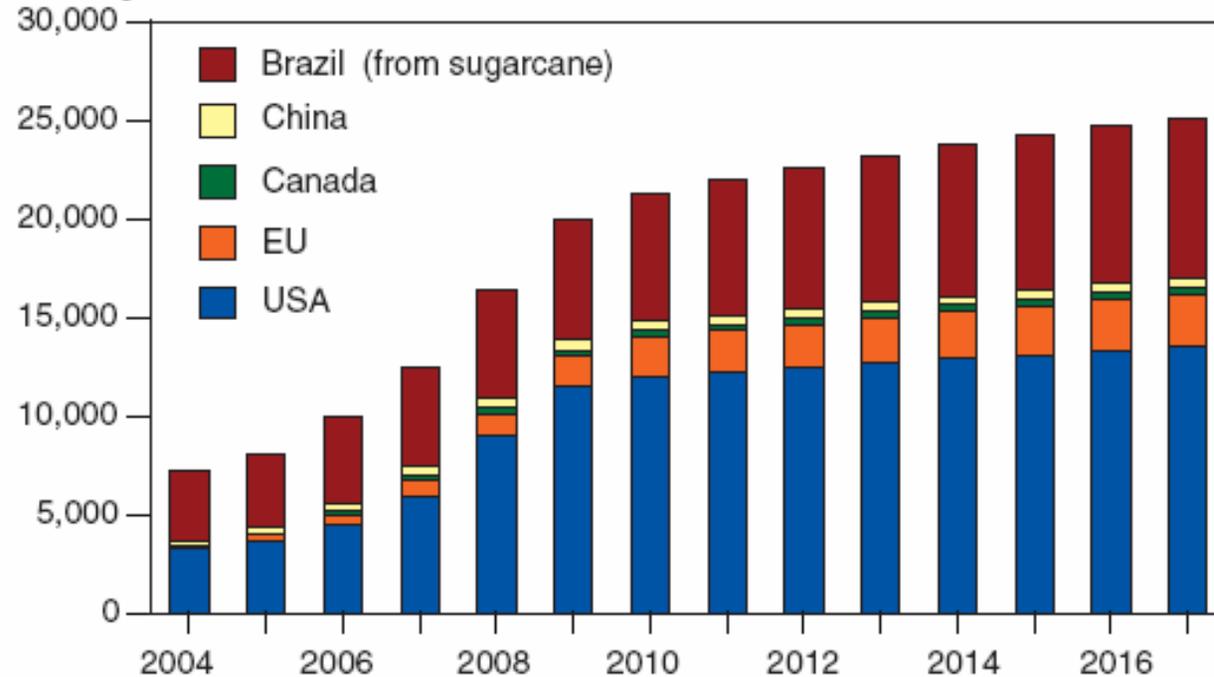
# International- Ethanol

Figure 17

## Ethanol production

*Mostly from grain feedstocks except for Brazil*

Million gallons

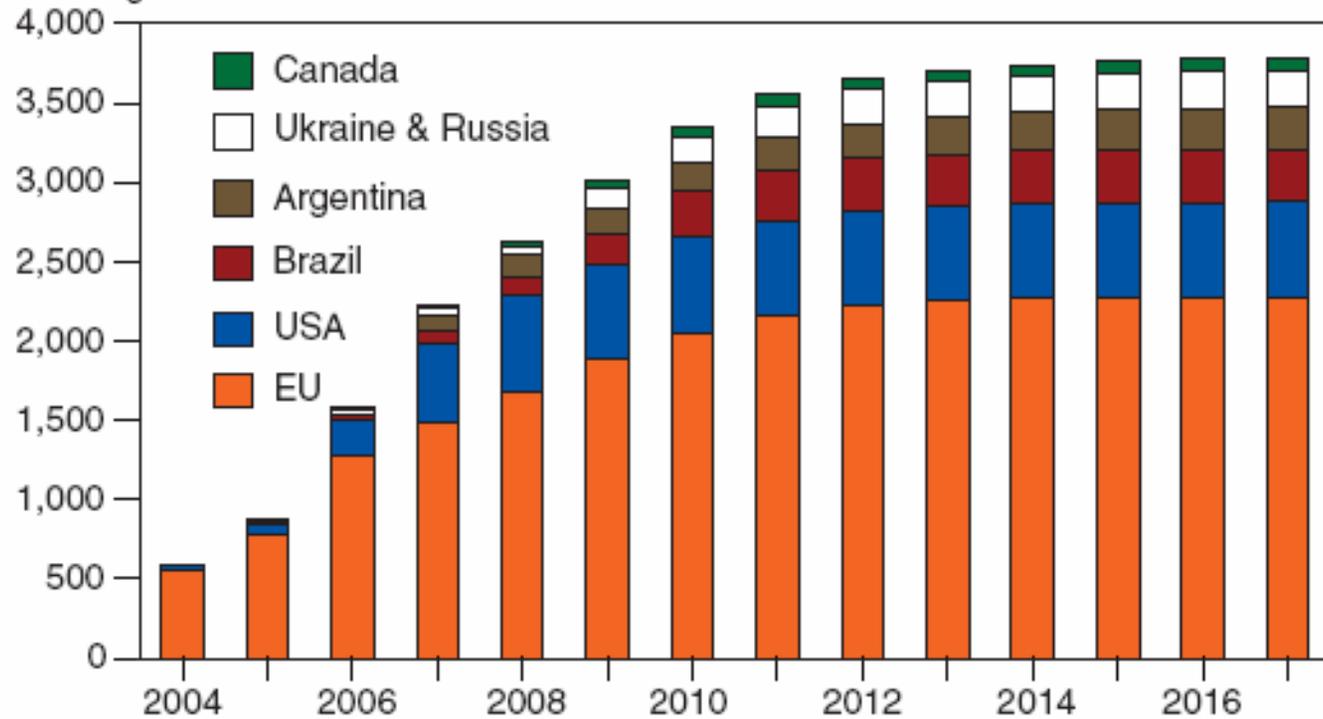


Source: USDA Agricultural Projections to 2017.

# International- Biodiesel

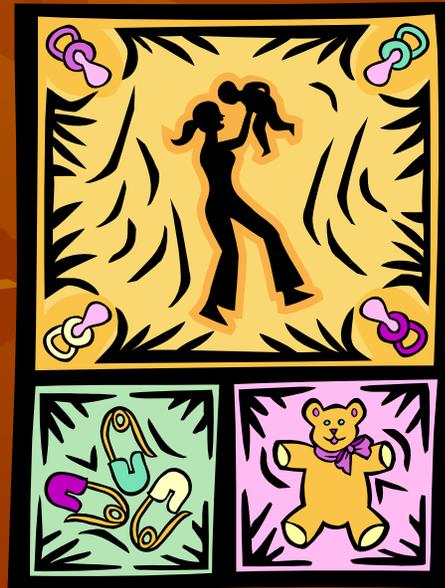
Figure 18  
**Biodiesel production**

Million gallons



Source: USDA Agricultural Projections to 2017.

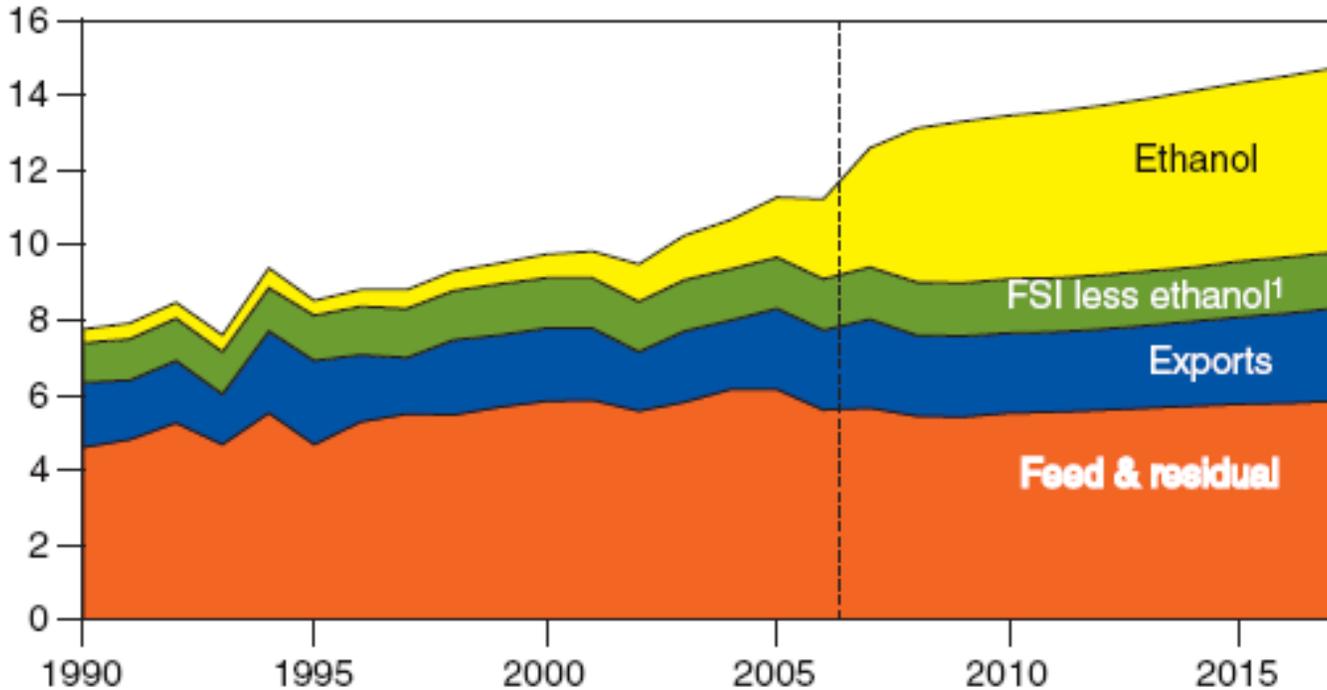
# Social Dimensions



# US Trends in Biofuels from Corn

Figure 19  
U.S. corn use

Billion bushels



<sup>1</sup>Food, seed, and industrial less ethanol.

Source: USDA Agricultural Projections to 2017.

# Food, Feed, Fuel and Fiber

## Feed-to-meat conversion rates

Class of animal	Pounds of feed needed to produce 1 pound of meat
Chicken	2.6
Pork	6.5
Beef	7.0

Source: Ephraim Leibtag, "Corn Prices Near Record High, But What About Food Costs?" In *Amber Waves*, February 2008.

<http://www.ers.usda.gov/AmberWaves/February08/Features/CornPrices.htm>

# Environmental Dimensions



# Land Use Change

- Switching to growing annual biofuels crops in place of food and feed crops on productive land
- Global demand for food and feed crops potentially shifts to new acres (domestically or internationally)
- “Carbon debt” concept for sequestered carbon in perennial plants and soils now put into biofuels crop production

# Biofuels Production Systems

- Cost of inputs (energy, water, fertilizer)
- Biotechnology (improved yield and customized to assist conversion)
- Harvest and Transport (cost and efficiency)
- Locally matched feedstock and production systems (economy of scale vs transportation)
- Climate change (water availability, temperature, precipitation, growing season, yield, new crops, different conditions?)

# Biofuels that make sense...

- Use material that would otherwise have negative environmental consequences
  - Reduces wildfire, improves forest health, protects watersheds, and provides habitat
- Produced on marginal lands with minimal inputs
  - Water, fertilizer, and low impact harvesting
- Scaled to match feedstock availability and provide value to help maintain working landscapes
- Have favorable net energy and net GHG profiles

# Certification and Labeling

- Forestry- examples include Forest Sustainability Council and Sustainable Forestry Initiative
- Additional labeling about net energy and greenhouse gas emission profile is evolving and not yet available



# Net Energy and Net GHG Emissions

Units of biofuel produced from 1 unit of fossil fuel	Reduction in GHG emissions to make ethanol compared to gasoline made from fossil fuel
1.3 Corn to ethanol	22%
8 Sugar Cane to ethanol	56%
2.5 Soybean to biodiesel	69%
Up to 36 Wood/Grass to ethanol	91%

Data Sources (adapted from C.Mater, Mater Engineering)

- Corn to ethanol data: US DOE; EPS; Renewable Fuel's Association; Energy Future Coalition; Worldwatch Institute
- Cane to ethanol data: USDOE; Worldwatch Institute; Iowa State University
- Soy to biodiesel data: USDOE; EPA; Worldwatch Institute;
- Woody/grass biomass to ethanol: USDOE; EPA; WorldWatch Institute

# Managing our lands for energy, food and fiber

