Moving Forward: Policies to Improve Land Use & Address Social Concerns
(when effects "always depend")

CBES

Center for BioEnergy Sustainability

http://www.ornl.gov/sci/besd/cbes

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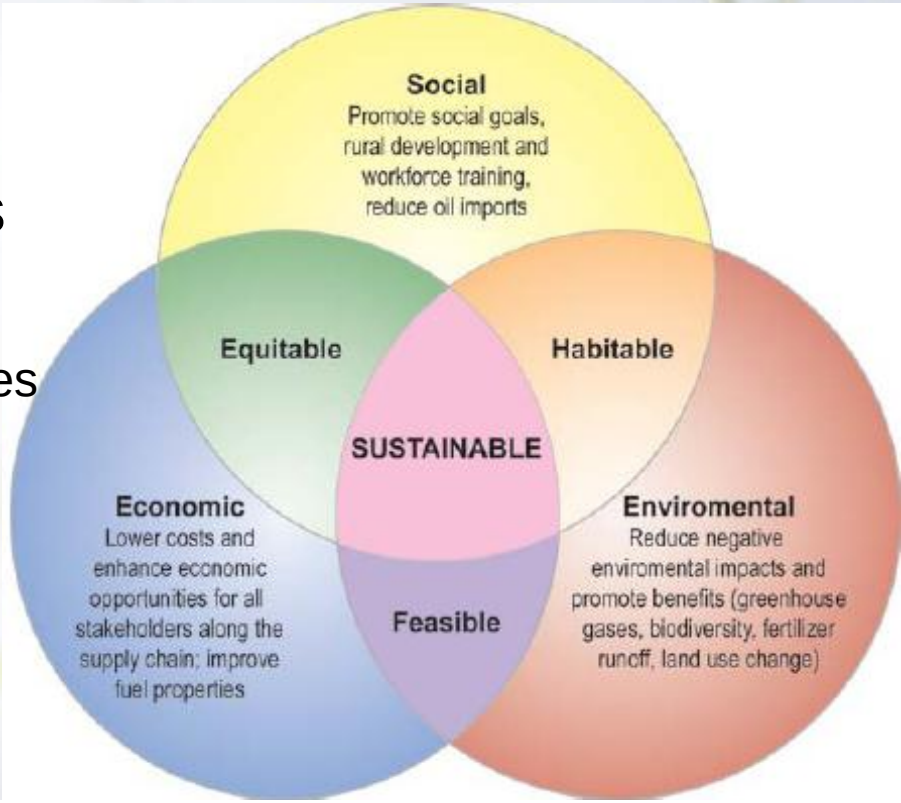
Goal: Increase sustainability of bioenergy production systems

- Society's perception of biofuels
- Legal, policy & regulatory issues
  - Carbon neutrality, stocks and flows
  - Competition with food and other services
  - GHG emissions and monitoring
  - Standards and certification

Depend on



Source: US DOE Multi-Year Plan, Sustainability Goals

Land Use & Land-Use Change

(and scale – spatial and temporal)

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Estimated Effects on Land Use Can Determine Biofuel Eligibility

- Based on models that rely on
  - Limited data
    - Land supply, conditions, changes, use
  - Assumptions require scientific review and revision
    - Elasticity values and yields
    - Causal analysis – local drivers
    - Incorporating effects of historic trends in scenario development
    - Interaction of policy with biophysical, political, demographic and market forces

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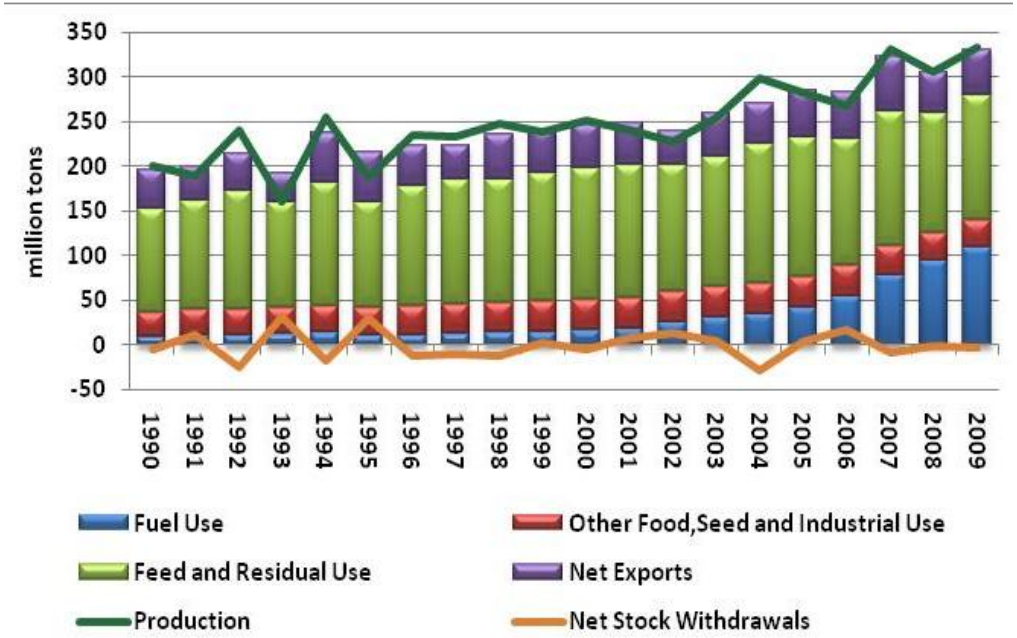
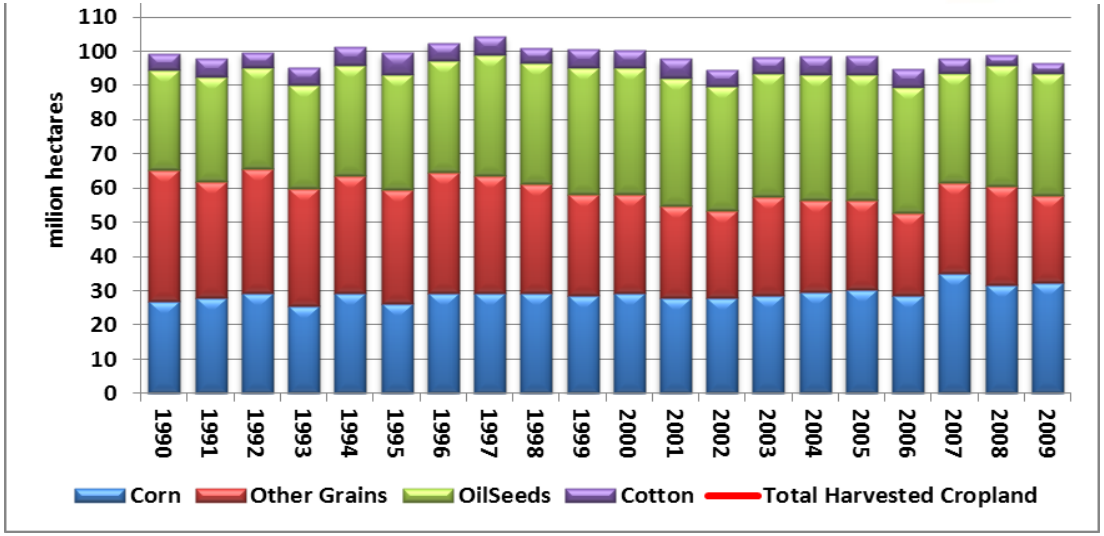
Empirical Analysis of Corn Use Data Did Not Support usual ILUC Assumptions

- Empirical decomposition analysis showed that recent corn use for ethanol production was largely derived from:
  - Reallocation of domestic use
  - Increased production, yields





Implication: No evidence of other crop or export displacement; domestic markets adjusted efficiently to meet ethanol demand

Science and Models

Science follows a *systematic methodology based on evidence**

Models are simplified views of the world, not true representations of complexity

Models explore specific relationships

- E.g. “shock” prescribed system to estimate biofuel effects on land
- Results reflect assumptions, baseline, input data, conceptual view
- **Science (data + resources + time) needed to assess and verify assumptions**

There is no scientific consensus on methods or estimates of indirect land use change from bioenergy**

Don’t forget to look outside!

*Source: Science Council of Britain http://www.sciencecouncil.org/

** CARB 2011, final reports from Expert Work Group on LUC. CBES 2010. EC 2010.

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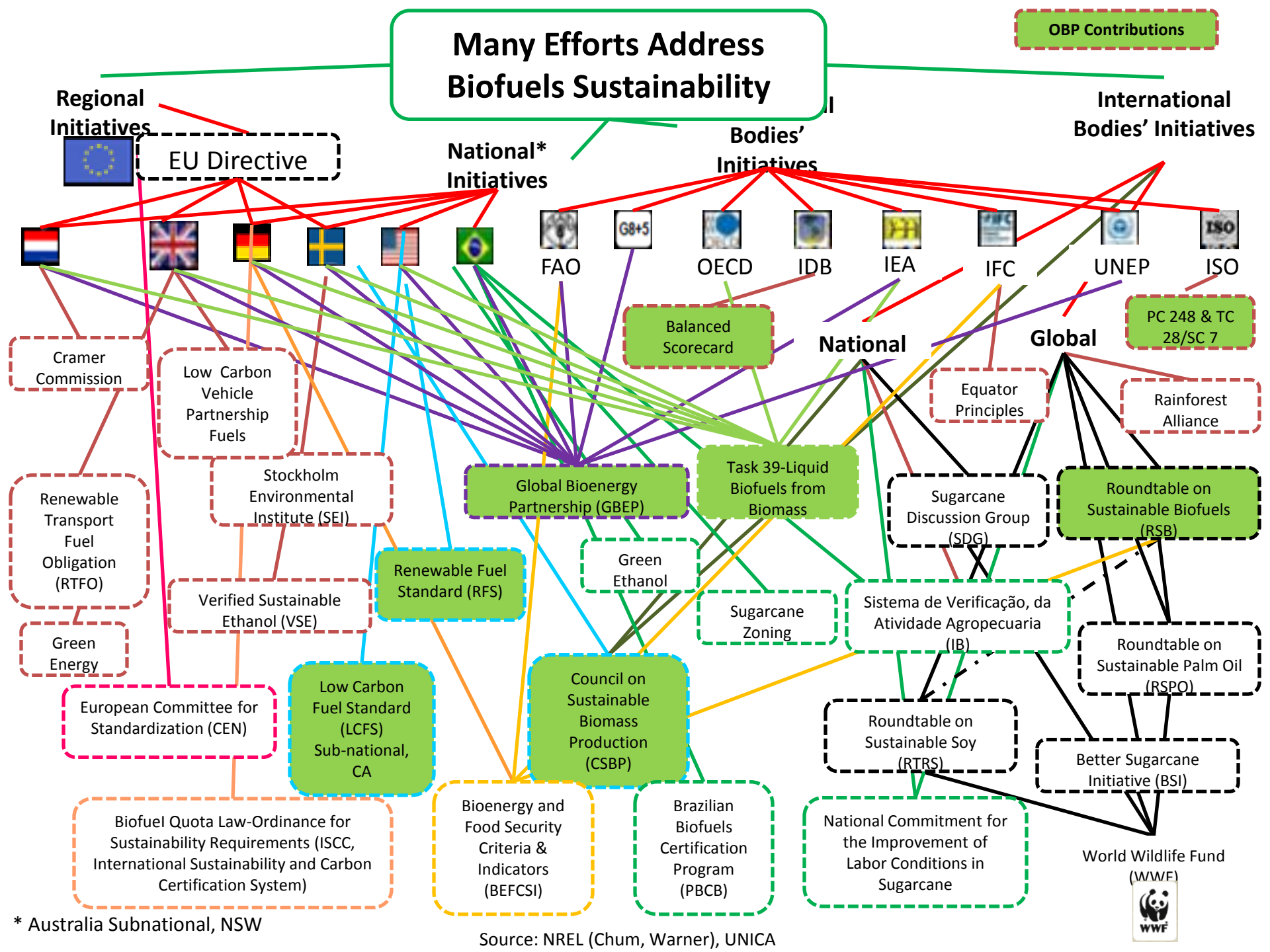
International Cooperation, Collaborative Research and Standards

- Accelerate process
  - Sharing new findings and viewpoints
  - Identifying novel solutions
  - Deploying of new technologies
- Standards are important for developing markets for clean energy products and technologies
- Sector (Roundtables), National (RTO, CSBP), State (CARB)…



* Australia Subnational, NSW

Source: NREL (Chum, Warner), UNICA

Examples - Sustainability through Standards, Certification and Regulation

- International Organization for Standards (ISO)
- Council on Sustainable Biomass Production (CSBP)
- California Air Resources Board (CARB) Low-Carbon Fuel Standard

ISO 13065: Sustainability Criteria for Bioenergy

Support Project Committee 248 mandate:
"Standardization of sustainability criteria for production, supply chain & application of bioenergy"

Results

- **Draft sub-report on food security**
- **Draft report on indirect effects**
- **Draft chapter on GHG emission calculation methods**
  - Separate accounting for treatment of fossil & biogenic carbon (emissions, removals & carbon stock changes)
  - Consideration of other climate forcing factors
  - Methods for detection of soil carbon change
- **Scientific approach defined: *systematic methodology based on evidence…***

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Council on Sustainable Biomass Production

- **A multi-stakeholder organization**
  - Growers
  - Environmental & social interests
  - All sectors of biofuel industry
- **Goal: To develop comprehensive, *voluntary* sustainability standards for the production of biomass & its conversion to bioenergy**
- **Transaction costs versus value added; roles and opportunities to streamline**

www.csbp.org

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CARB: Low Carbon Fuel Standard

- **Process and Transparency**
- **Analysis**
  - Uncertainty
  - Questions of time
  - Land supply, quality, emissions
  - Effects of other fuels
  - Social, food-fuel concerns…
- **Recommendations**
  - Assess actual effects of *policy*
  - Apply measurable, performance-based incentives to improve direct land management

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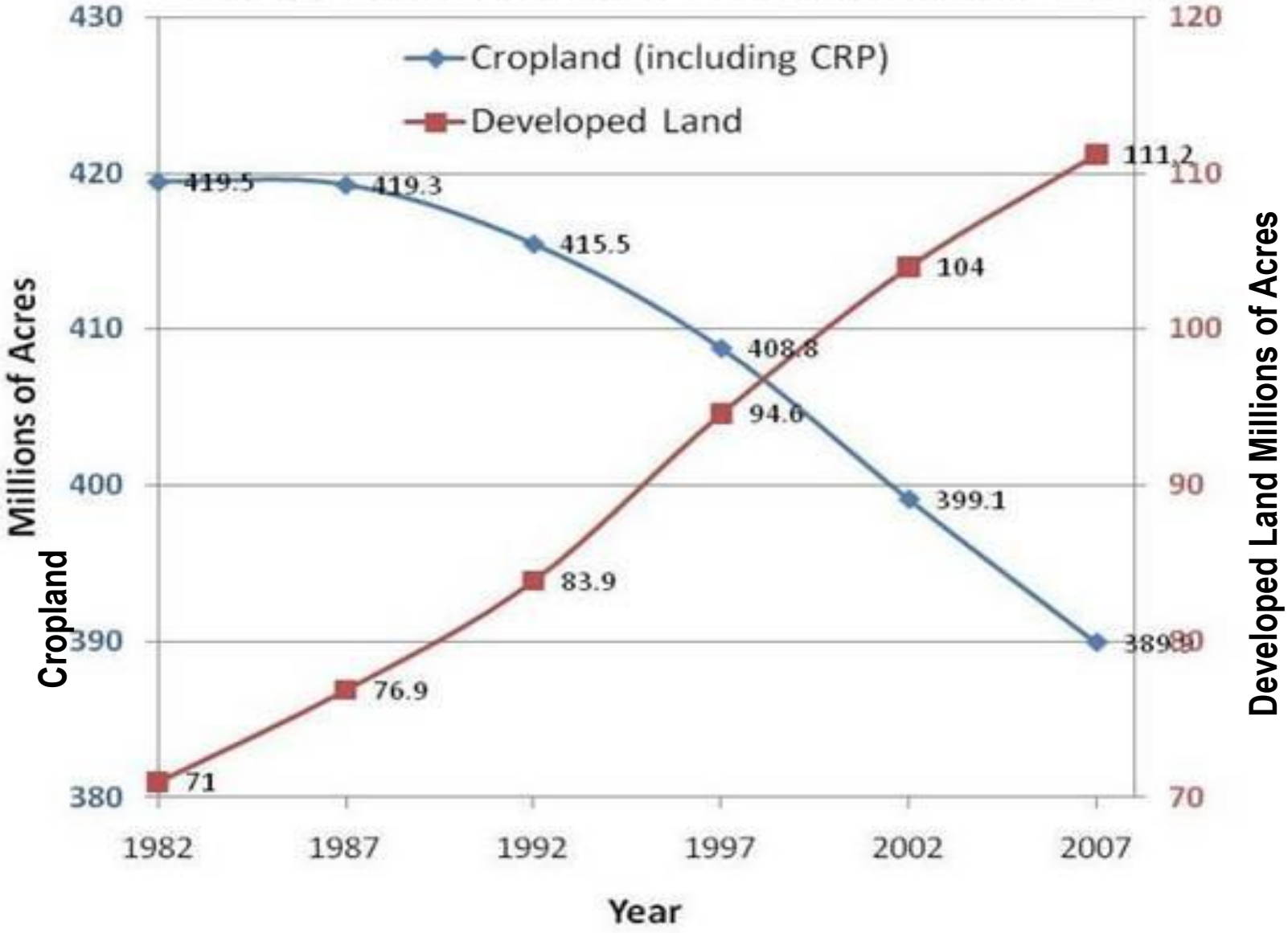
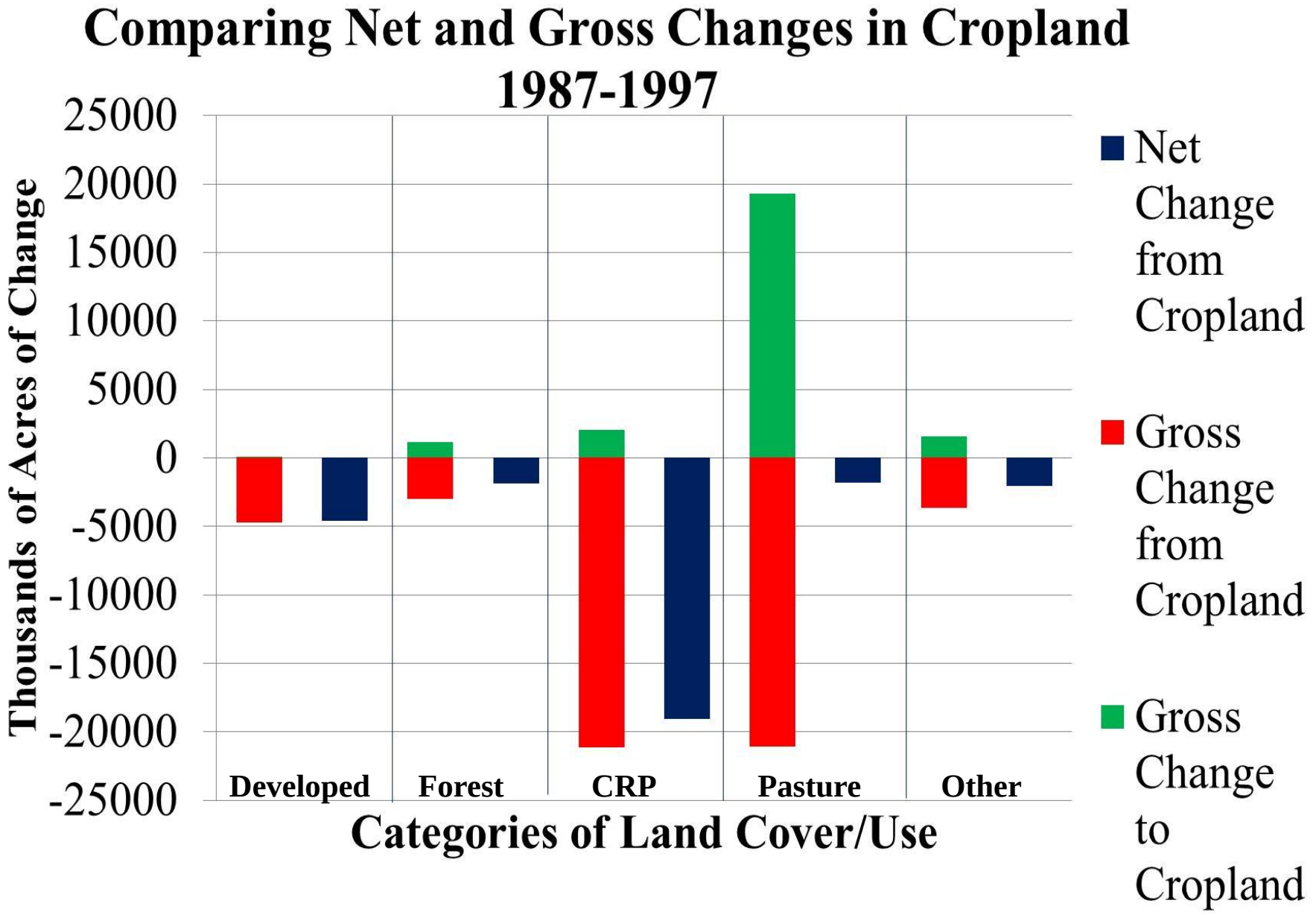
What are Implications of *Real* (not modeled) Change in U.S. Land Use (Source: USDA 2009, NRI)



ORNL graphic based on data from the USDA 2009-NRI



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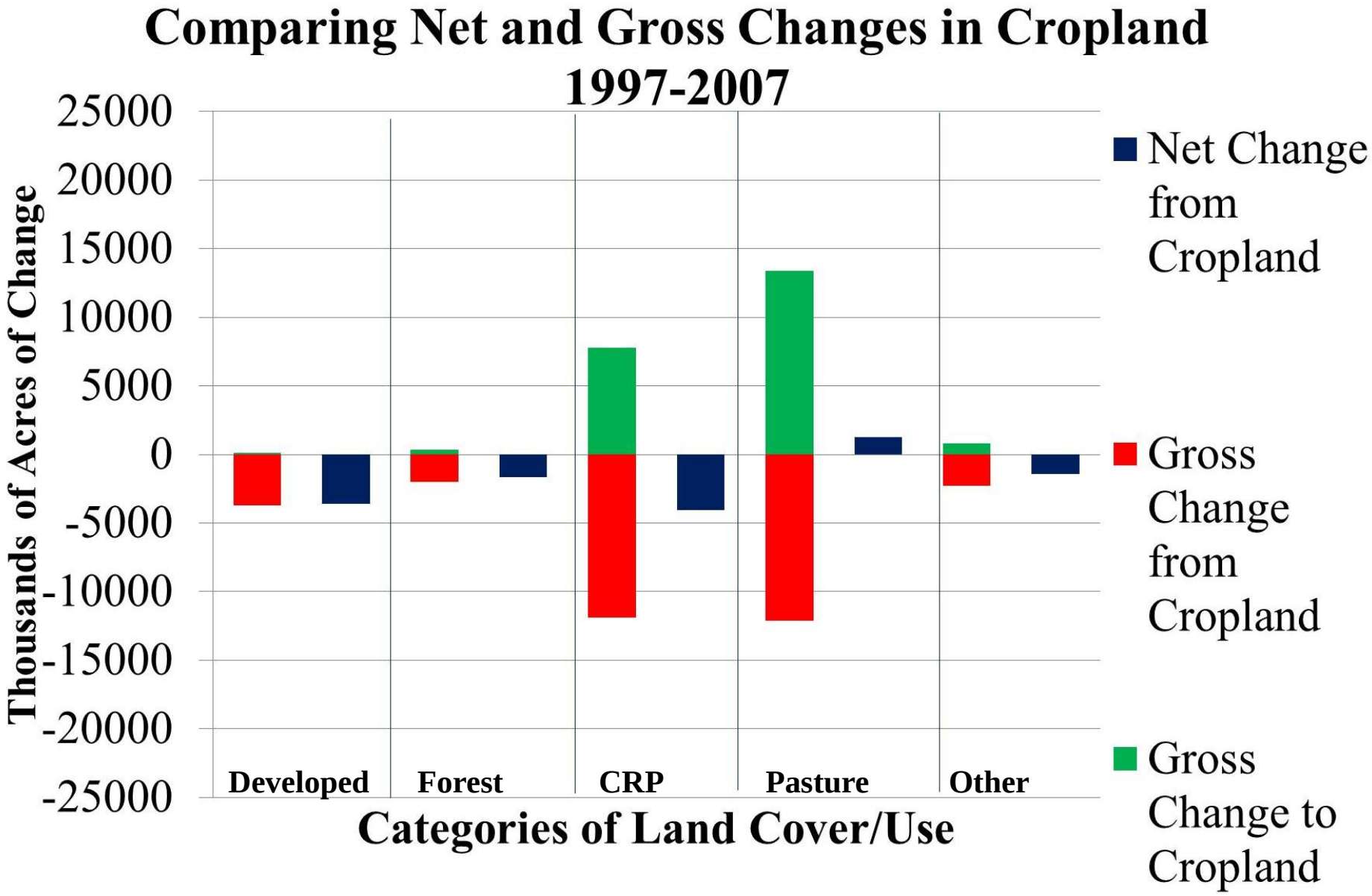
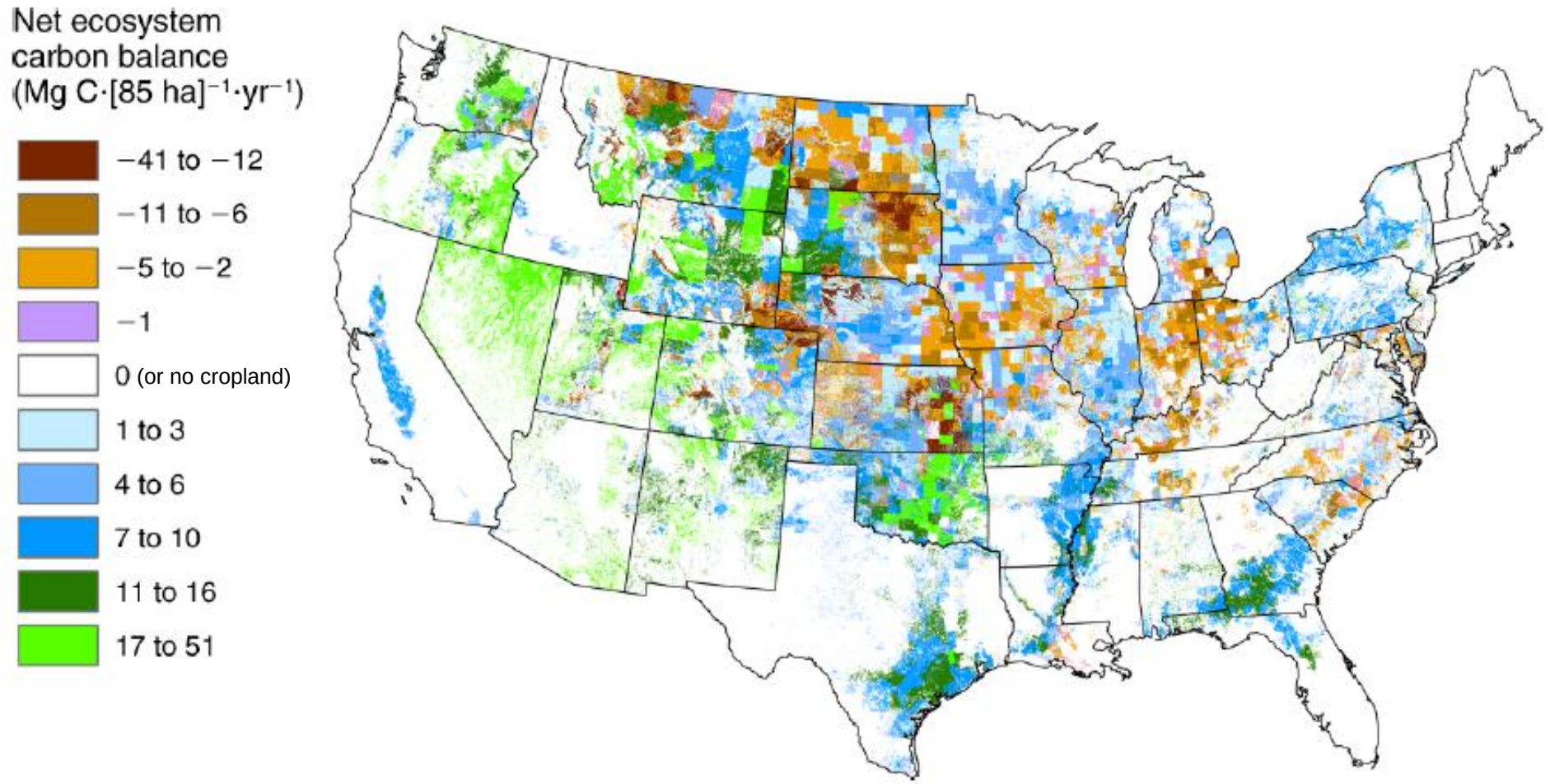


ORNL graphic based on data from the USDA 2009-NRI

Policy Opportunities to Move Forward

Improve soil & water management	• Precision management • Tillage intensity • Crop mix, rotations, cover crops • Land restoration • Technology (plants, microbes, biochar)
Increase Efficiency	• Reduce inputs/increase ***yields*** • Open, transparent markets • Minimize transaction costs • Prioritize, incentivize, measure
Diversify	• Uses & markets • Substitution options • Bases of production
Adopt Systems Perspective	• Multi-scale • Long term & adaptive • Integrated land-use plans

Cropland can be net sink (or source) of carbon, with potential to increase C storage



Source: Energy Use and Carbon Dioxide Emissions from Cropland Production in the United States, 1990–2004 in J Environ Qual 38:418-425. R.G.Nelson, C.M.Hellwinckel, C.Brandt, T.West, et al. (2010)

Win–Win options

Good policy & governance are key

Improve livelihoods, resilience	Build capacity	Reduce volatility
Provide incentives (for things we can measure)	Start with what is most important	Cooperate (plenty we *can* agree on)

Increase system efficiency & capacity to provide multiple services over long term

Integrated Silvopastoral Approaches to Ecosystem Management (PES Pilot Project)

(José Luis Gómez; Fondo Acción, Colombia; US$ 7.5 million, 2003-2007)

- Capacity Building
- Systematic Monitoring (LUC, productivity, income…)
- Eco-services payments (habitat, carbon)
- Policy (intensification guidelines; ecosystem services & financing; replication)

Economic & cultural changes	Baseline	Result
Net income per hectare (US$)	$237.7	$888.5
Mean soil erosion (tons/ha)	80.9	44.1
Avg. milk production (daily liters/cow; dry season)	5.0	6.1
Avg. Stocking rate (animals per ha)	1.8	2.5
Fire (% farms that use fire)	38%	2.3%
Use of herbicides (liters)	13,913.6	7,899.9

Thank you!

http://www.ornl.gov/sci/besd/cbes

- **Reports**
- **Forums**
- **Other presentations**
- **Recent publications**

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Related Publications (ORNL)

- Kline KL, et al. 2011 (in press; on-line Sept. 10). Scientific analysis is essential to assess biofuel policy effects: In response to the paper by Kim and Dale on "Indirect land use change for biofuels: Testing predictions and improving analytical methodologies." *Biomass and Bioenergy*; doi:10.1016/j.biombioe.2011.08.011
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- Dale VH, Kline KL, Wiens J, Fargione J. January 2010. Biofuels: Implications for Land Use and Biodiversity. Ecological Society of America special report: http://www.esa.org/biofuelsreports
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Sustainability

- Contextual, relative (more/less) & process based (a trajectory not a “state”)
- Scales matter
- Systems approaches can optimize socio-economic & ecologic benefits of bioenergy
- Sustainability implications of biofuel choices are complex
- Definitions and assessment involves stakeholder participation and a suite of measures
- You can only manage what you can measure