

# Modeling Competition for Land : Some Discussion Points

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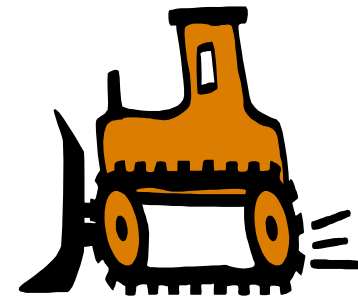
**Let's Avoid  
Climate Change**



**Mitigation**



**Climate Change  
is Happening**



**Effects/Adaptation**

**Presented at  
5th Forestry and Agriculture GHG Modeling Forum  
April 2009**

# What have we seen?

**Vince Camobreco & Aaron Levy**

**Ron Sands**

**Tom Hertel**

**Suk-won Choi**

**Ted Huffman & Stephen Smith**

Ted Huffman and Melodie Green

Stephen Smith

Denys Yemshanov

**Scott Malcolm**

**Ralph Alig**

**Bruce Babcock**

**Ruben Lubowski**

**11 papers**

**4 I have not seen**

**= an impossible discussion**

## What were we supposed to have seen?

*Session Objective:* The purpose of this session is to **review the capabilities of current models to assess the competition for land between agricultural and forest uses both nationally and internationally.**

Presenters will describe **how land moves** between **agricultural and forestry uses** within their respective models and **highlight how their models can be applied to analyze policies that result in land use change and GHG emissions/mitigation.**

Modelers are also encouraged to raise issues with respect to their modeling framework that could benefit from dialogue with the audience.

## What will I do

*A seemingly related set of ramblings on the charge and beyond, Why?*

**Too many papers**

**Too many missing**

**Few really stuck to the charge**

**Little on forestry**

**Charge was not inclusive so land use change**

*So I will cover*

**What is the issue**

**What kinds of lands can change**

**What types of changes can land go into**

**What are the characteristics underlying changing land**

**Is land use change where we need to stop**

## **What is the issue**

**Land and ecosystems thereon holds carbon and may emit CH<sub>4</sub> and N<sub>2</sub>O**

**When we change land we change carbon, CH<sub>4</sub> and N<sub>2</sub>O  
Net balance is important**

**Are economics big enough to cause the change?**

**Land use change causes land use change through markets  
- leakage**

**Multiple interacting conflicting policies**

**Land is heterogeneous as are land uses**

**Program design**

## Land use Associated items

### Agricultural/Forestry/Biofuel Mitigation Possibilities

Strategy	Basic Nature	CO2	CH4	N2O
<b>Crop Mix Alteration</b>	<b>Emis, Seq</b>	<b>X</b>		<b>X</b>
<b>Crop Fertilization Alteration</b>	<b>Emis, Seq</b>	<b>X</b>		<b>X</b>
<b>Crop Input Alteration</b>	<b>Emission</b>	<b>X</b>		<b>X</b>
<b>Crop Tillage Alteration</b>	<b>Emission</b>	<b>X</b>		<b>X</b>
<b>Grassland Conversion</b>	<b>Sequestration</b>	<b>X</b>		
<b>Irrigated /Dry land Mix</b>	<b>Emission</b>	<b>X</b>		<b>X</b>
<b>Biofuel Production</b>	<b>Offset</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>Stocker/Feedlot mix</b>	<b>Emission</b>	<b>X</b>		
<b>Enteric fermentation</b>	<b>Emission</b>	<b>X</b>		
<b>Livestock Herd Size</b>	<b>Emission</b>	<b>X</b>	<b>X</b>	
<b>Livestock System Change</b>	<b>Emission</b>	<b>X</b>	<b>X</b>	
<b>Manure Management</b>	<b>Emission</b>	<b>X</b>	<b>X</b>	
<b>Rice Acreage</b>	<b>Emission</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>Afforestation (not today)</b>	<b>Sequestration</b>	<b>X</b>		
<b>Existing timberland Mgt</b>	<b>Sequestration</b>	<b>X</b>		
<b>Deforestation</b>	<b>Emission</b>	<b>X</b>		

**direct land use**

**a broader land use item**

**associated with land use**

Murray, B.C., A.J. Sommer, B. Depro, B.L. Sohngen, B.A. McCarl, D. Gillig, B. de Angelo, and K. Andrasko, Greenhouse Gas Mitigation Potential in US Forestry and Agriculture, EPA Report 430-R-05-006, November, 2005. <http://www.epa.gov/sequestration/pdf/greenhousegas2005.pdf>  
 McCarl, B.A., and U.A. Schneider, "The Cost of Greenhouse Gas Mitigation in US Agriculture and Forestry," Science, Volume 294 (21 Dec), 2481-2482, 2001.

## What kinds of lands can change

**Charge limits to forest and ag -- I wont**

**Crops**      **Crop Conventional, Energy crops, Uses cover  
crop**

**Tillage form**

**Grazed**      **Pasture - Cropland suitable, Forest suitable,  
neither**

**Range**

**Partly forested**

**By product grazed**

**Forest**      **Crop or pasture suitable**

**Ownership**

**Waiting for development**

**Retired**      **CRP**

**Unused??**      **Rainforest, Shrubland, Grassland**

**Public**      **Forest or parks**

## What can land go to

<b>Crops</b>	<b>Crop Conventional, Energy crops</b> <b>Uses cover crop, Tillage form</b>
<b>Grazed</b>	<b>Pasture - Cropland suitable, Forest suitable, neither</b> <b>Range</b> <b>Partly forested</b> <b>By product grazed</b>
<b>Forest</b>	<b>Crop or pasture suitable</b> <b>Ownership</b> <b>Waiting for development</b>
<b>Retired</b>	<b>CRP</b>
<b>Unused??</b>	<b>Rainforest, Shrubland, Grassland</b>
<b>Public</b>	<b>Forest or parks possibly <b>with added management</b></b>
<b>Developed</b>	<b>Low density housing, high density, shopping centers</b>



# **What are the characteristics underlying change**

**Land quality as it varies in and across uses**

**Access to water**

**Access to infrastructure**

**Amenity demand (generally non market)**

**Carbon stock and demand (generally non market)**

**Value in existing and alternative use**

**Conversion cost and productivity**

**Longevity of new use**

**Income opportunities of locals**

**Wishes of developed world**

**Livestock demand**

**Technological progress and time**

**Carbon accumulation rate and timing**

# Is land use change where we need to stop

**Comprehensive GHG accounting**

**Leakage**

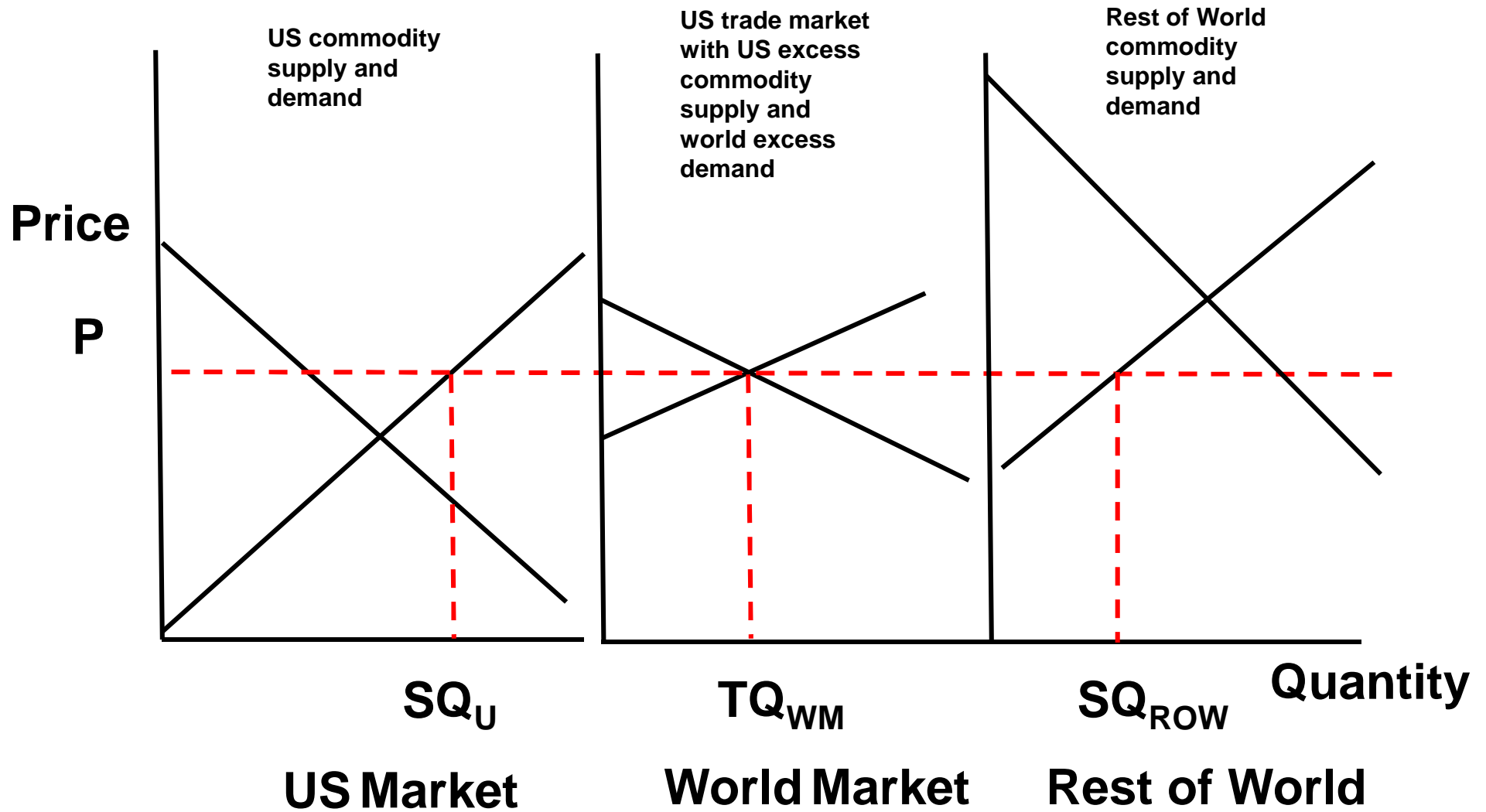
**Land use**

**Broader**

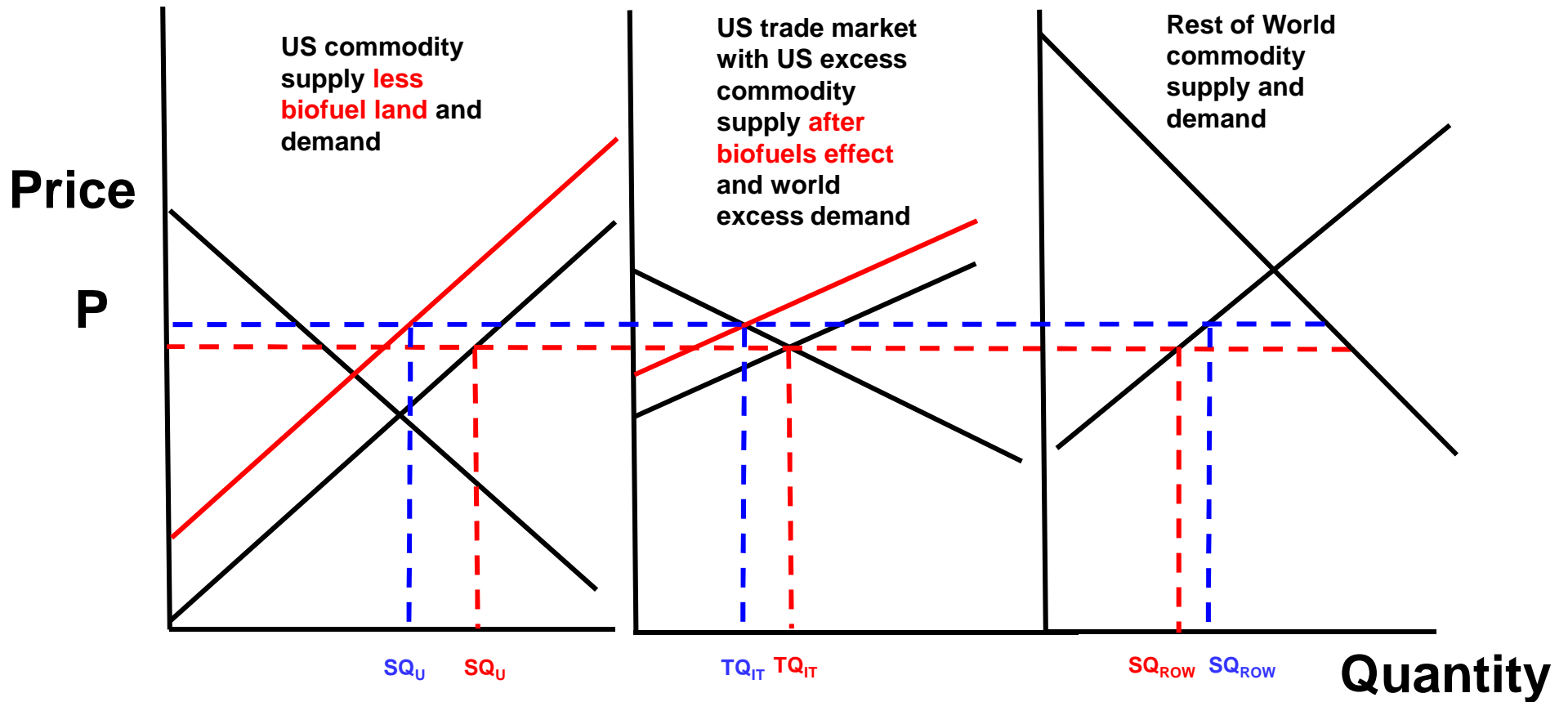
**Effects of other policies**

**Complementary policies**

# Is land use change where we need to stop Leakage



# Is land use change where we need to stop Leakage



**US Market w/o biofuel**

**World Market**

**Rest of World**

**LEAK = 1 -**

$$\frac{SQ_{ROW} - SQ_{ROW}}{SQ_U - SQ_U}$$

$$SQ_U - SQ_U$$

**Less US Supply to non biofuels market**

**Less US exports, More Supply from ROW**

**More ROW Supply**

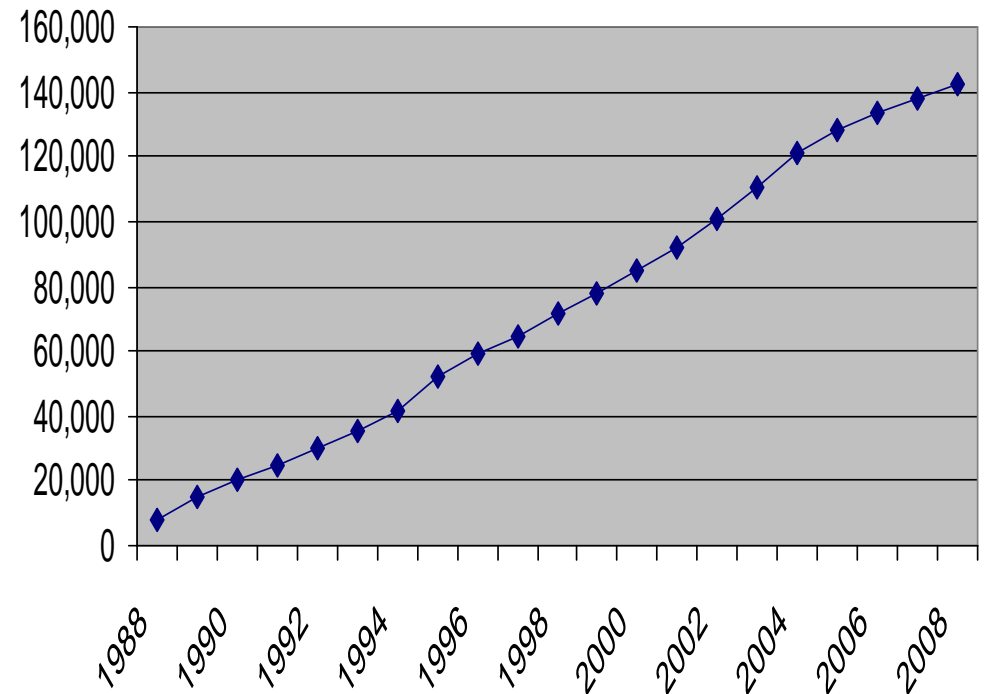
# Is land use change where we need to stop

## Why Brazil and Leakage

Causes of Deforestation in the Amazon, 2000-2005



Deforested area in Brazil 1988-2008



**Note crops displace pasture which moves livestock which is big source of rainforest displacement**

TROPICAL RAINFORESTS: Deforestation in Brazil,  
<http://www.mongabay.com/brazil.html>

## Is land use change where we need to stop Why Brazil and Leakage

Cout/Cproj	Leak	GHG - Leak Discount
1	45%	55% (Only pay for 1/2)
2	91%	9% (Only pay for 10%)
0.5	23%	77% (Only pay for 3/4 )

Case 1 Emissions per acre of commodity prices  
= biofuel offset

Case 2 Emissions per acre of commodity prices  
= twice biofuel offset

Case 3 Emissions per acre of commodity prices  
= one half biofuel offset

With corn at 20% and rainforest??

## So indirect land use is important

### what can be done

**Need to rely on biofuel feedstocks that are less competitive with crops**

**Lets look at yields and ethanol**

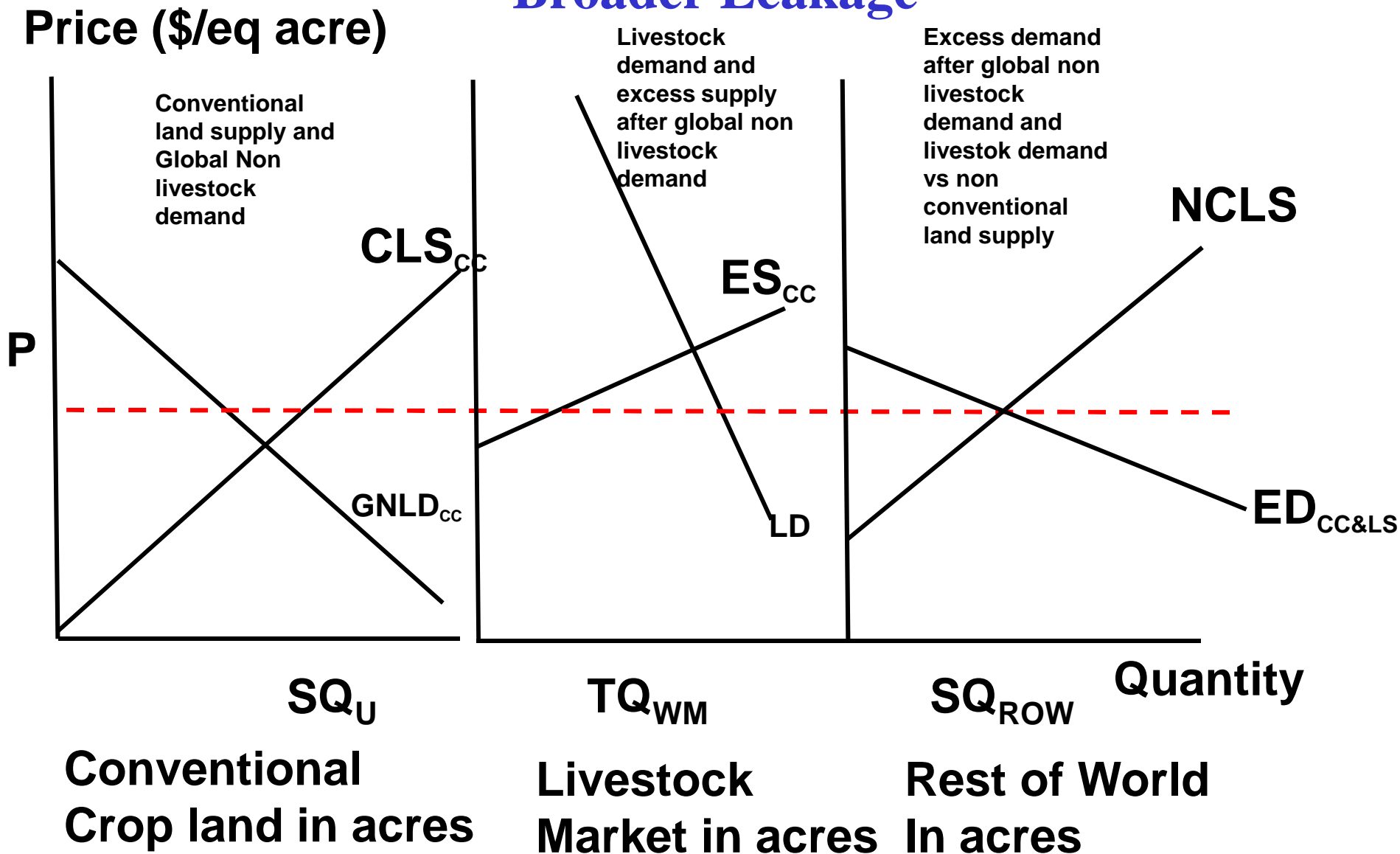
	<b>Yield</b>	<b>Ethanol</b>	<b>Ethanol</b>	
	<b>/acre</b>	<b>/unit</b>	<b>/acre</b>	
<b>Corn</b>	<b>150</b>	<b>3</b>	<b>450</b>	
<b>Corn residue</b>	<b>1.6</b>	<b>100</b>	<b>160</b>	<b>Complement</b>
<b>Switchgrass</b>	<b>5.5</b>	<b>100</b>	<b>550</b>	<b>Not much more</b>
<b>Energy Sorghum</b>	<b>18</b>	<b>100</b>	<b>1800</b>	<b>4X</b>
<b>Miscanthus</b>	<b>18</b>	<b>100</b>	<b>1800</b>	<b>4X</b>

**Last 4 cellulosic – when?**

**Hauling and seasonality an issue particularly with corn res.**

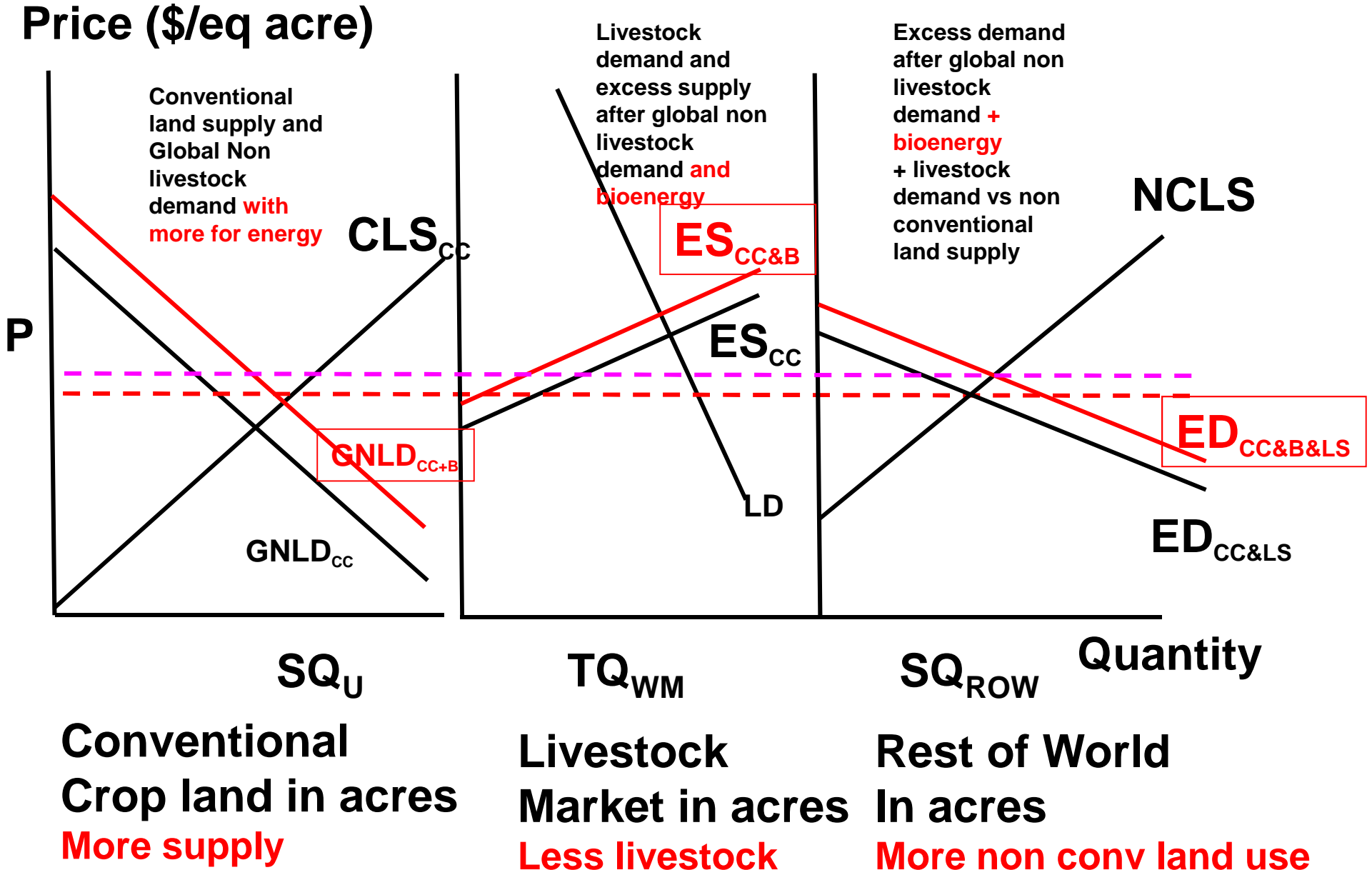
# Is land use change where we need to stop

## Broader Leakage





# Is land use change where we need to stop Broader Leakage



# Is land use change where we need to stop

## Effects of other policies and events

EISA

World supply demand

Slowing technology

Higher oil prices

The new domestic forestry and agriculture show **less mitigation potential than the curves used in previous analyses**. Abatement from the bioelectricity is increasing over time, but the overall contribution is also significantly less compared to the old curves.

The most consistent outcome of the updated domestic baseline and resulting MACs is that the **U.S. forestry and agriculture sector is still estimated to have an important role** in providing cost-effective options to mitigate climate change.

## Is land use change where we need to stop

### Complementary policies – Food prices

- Today food prices have increased quite a lot
  - Corn is up by 2.5
  - Rice has almost tripled but is not a biofuel crop
- Why?
  - Land competition – Biofuels
  - Exchange rate
  - Self sufficiency kick
  - Strong export demand
  - Bad yields and weather – climate change influence?
  - Income and population growth
  - Slowing technical progress
- Will induce technical progress and we will produce our way partially out of this but demand here to stay

## Is land use change where we need to stop Complementary policies – Food prices

- Are high food prices bad for poor?
- Short run **yes**
- Longer run
  - Give a person a fish they eat today, teach them to fish they eat forever.
  - Lots of poor in rural areas
  - Urban poor have a problem

## Is land use change where we need to stop Complementary policies – Food prices

- Are high food prices bad for poor?
- Traditional development strategy
  - Provide improved access to markets and you will raise rural incomes and have more employment
  - Give a poor rural area cheap food and they will eat today, give them improved access to markets and they will raise income, nutrition, productivity and employment
  - Asian situation and US rural urban migration a reflection of this

## Is land use change where we need to stop Complementary policies – Food prices

- Is food price induced rain forest deforestation bad?
- In wealthy western eyes **yes**
- What about in northeast Brazil or Rural Indonesia
  - Two of the most impoverished areas on the globe
  - Rain forest does not now provide a large source of income.
  - When agricultural prices / market access rise leads to cutting to exploit income possibilities and improve rural life
- Classic Conflict of western (rich) values vs local (poor) interests

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## Is land use change where we need to stop Complementary policies – Food prices

- Is rain forest deforestation bad?
- What about providing better income potential in northeast Brazil or Rural Indonesia
- Can policy address?
  - May need a compensation policy to reflect our valuation – allow payment for REDD
  - Allowing prices to transmit through to rural areas in countries with government trading
  - May need urban poor food relief
  - Will economics win?
  - As population /food demand rises can we protect?
  - Looks like US immigration policy

## **Scoring the Studies**

**Comprehensiveness of use depiction**

**Incentives modeling/discounts/permanence/uncertainty**

**Transformation rate modeling**

**Locality of data**

**Crops and livestock**

**Depicting infrastructure**

**Will future be like past**

**GHG accounting**

**Market comprehensiveness**

**Dynamics of accumulation and offset**

**Technology**

**Modeling markets and dominos**

**Market comprehensiveness**