Impact of Biofuels Production on Marginal Lands

Presented by

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Structure of Land-Supply in GTAP

- Conceptual land-owner’s problem (Keeney and Hertel, 2008)
  - Maximizes total returns to land (CET revenue function) subject to constraint on transforming land from one use to another.
  - In the first stage, the land owner allocates land across crops within the harvest cropland with the transformation parameter -0.5 (Keeney and Hertel, 2008).
  - In the second stage, the allocation happens across cover types (crop-cover, pasture-cover, forest-cover) with the transformation parameter -0.20 (Lubowski et al. 2008).
Land in value-added nest

Land-AEZi

ETRAE1 = -0.04 to -0.36
(mean = -0.20)

Cropland

ETRAE2 = -0.5

Sugar-crops

Oilseeds

Oth grains

Oth agri

Cr grains

Pasture

Forestry
Land Supply Curve - LEI approach.

-Determining land conversion and land rental rate

Most productive land is used first.

Source: van Meijl et al. (2006)
Potential Impact on Marginal Lands

With the growing demand for food and biofuel feedstocks, there is potential pressure on *marginal/idle* lands to grow these crops.

The marginal lands that can be brought under cultivation of food/feedstock crops particularly in the U.S. are (i) *cropland pasture* and (ii) *Idle cropland* – CRP, WRP, etc.

- **Cropland pasture**: includes land used for growing pasture crops (long-term rotation).
- **Idle cropland**: includes cropland enrolled in Federal Conservative Reserve Program (CRP) and Wetland Reserve Program (WRP).
Marginal Lands in the context of Biofuels

CRP originally designed to reduce soil erosion and commodity surpluses, has evidently resulted in other environmental benefits.

- CRP rewards farmers with annual rental payments and cost-share assistance.
- USDA will distribute $1.8 billion over 430,000 farms at an average of $50.93/acre, in the FY 2009.
- Loss of CRP lands could have many implications on – beekeeping industry, specialty crop industry, etc.
Current Status of CRP Lands


Enrollment authority set at 39.2 million acres through 2009 and reduced to 32.0 million acres for fiscal years 2010, 2011, and 2012.

Commodity prices and cost of production would determine the early release of land in CRP.
Major Uses of U.S. Cropland

Source: Lubowski et al. (2006)
CRP Enrollment:

FY 2002 cumulative – 34 million acres

Adding Marginal Land Information

ETRAE1 = -0.04 to -0.36 (mean = -0.20)

ETRAE2 = -0.5

Cropland

Sugar-crops
Oilseeds
Oth grains
Oth agri
Pasture-crop
CRPx land

Land-AEZi

Forestry
Pasture
Cr grains
## Data on Land-use and Land-cover - USA

<table>
<thead>
<tr>
<th>Description</th>
<th>SAGE</th>
<th>NASS, ERS/USDA</th>
<th>Modified</th>
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<tbody>
<tr>
<td><strong>Crop-cover</strong></td>
<td>454</td>
<td>442</td>
<td>454</td>
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<tr>
<td><strong>Forest-cover</strong></td>
<td>835</td>
<td>651</td>
<td>835</td>
</tr>
<tr>
<td><strong>Pasture-cover</strong></td>
<td>573</td>
<td>587</td>
<td>573</td>
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<tr>
<td><strong>Unmanaged land</strong></td>
<td>276</td>
<td>228</td>
<td>276</td>
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<tr>
<td><strong>Total</strong></td>
<td>2,137</td>
<td>1,908</td>
<td>2,137</td>
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<tr>
<td><strong>Harvested Area</strong></td>
<td>326</td>
<td>340</td>
<td>326</td>
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<tr>
<td><strong>Pasture-crop (U of T)</strong></td>
<td>56</td>
<td>62</td>
<td>62</td>
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<tr>
<td><strong>CRP–Idle Land (U of T)</strong></td>
<td>28</td>
<td>40</td>
<td>40</td>
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<tr>
<td><strong>Total</strong></td>
<td>410</td>
<td>442</td>
<td>428</td>
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Data on Land-use and Land-cover - Brazil

<table>
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<tr>
<th>Category</th>
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<tbody>
<tr>
<td>1 Crop-cover</td>
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<td>2 Forest-cover</td>
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<td>389</td>
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<tr>
<td>3 Pasture-cover</td>
<td>447</td>
<td>378</td>
<td>378</td>
</tr>
<tr>
<td>4 Unmanaged land</td>
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<tr>
<td>Total</td>
<td>1365</td>
<td>1293</td>
<td></td>
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<tr>
<td>5 Harvested Area</td>
<td>120</td>
<td></td>
<td>120</td>
</tr>
<tr>
<td>6 Pasture-crop (ORNL)</td>
<td></td>
<td>58</td>
<td>58</td>
</tr>
<tr>
<td>Total</td>
<td>1365</td>
<td></td>
<td>1352</td>
</tr>
</tbody>
</table>
Computing Land Rents for Marginal Lands across AEZs

- **Pasture-crop**

\[
LR_{ijr}^{pasturecrop'} = \begin{cases} 
0 & \text{if } LR_{i'livestock'}^{r} < 0 \\
\theta_{ijr} \cdot LR_{i'livestock'}^{r} + (1 - \theta_{ijr}) \cdot \sum_{k=food crops}^{n} LR_{ikr} & \text{else,}
\end{cases}
\]

\[\theta_{ijr} = 0.6 \text{in the U.S., 0.8 in Brazil}\]

- **CRP-Lands**

\[
LR_{i'CRP_xland'}^{r} = \theta_{ijr} \cdot \sum_{k=food crops}^{n} LR_{ikr} \cdot \frac{n}{n}
\]

\[\theta_{ijr} = 0.7 \text{in the U.S.}\]
Qualifications

Though we expect that the new modification in the land-supply would reduce pressure on forest and pasture cover, it is subjected to sensitivity of various factors:

- Our assumptions in computing land-rents (as indicators of productivity) for pasture-crop and CRP lands.
- Structure of land supply function.
- Elasticity of transformation of marginal lands.
- Any associated conversion costs that we ignore here.
Thank You

Questions / Comments?
Land Supply Curve - Canada

Land productivity

Land area (million km²)

1/yield

Land supply

Land use (million km²)

Source: Eickhout et al. (2008)