Bioenergy sustainability criteria and oil palm

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http://www.ornl.gov/sci/ees/cbes/
Opportunities to apply sustainability criteria to oil palm in Tabasco, Mexico

- Sustainability criteria
- Steps in supply chain
- Examples
- Discussion
U.S. Department of Energy (DOE) Approach to Assessing Bioenergy Sustainability

Select Indicators

Develop and test best practices

Establish baselines and targets

Identify trends and tradeoffs

Evaluate indicator values

A Watershed diagram showing rain, precipitation, snow, tributaries, watershed divide, percolation, groundwater (aquifer), and other components.
Sustainability criteria developed for bioenergy

- Greenhouse gas emissions
- Soil quality
- Water quality and quantity
- Air quality
- Productivity
- Biological diversity

- Social well being
- Social acceptability
- Resource conservation
- Profitability
- External trade
- Energy security
- Profitability
- Resource conservation
- Social acceptability
- Social well being

McBride et al. (2011) *Ecological Indicators* 11:1277-1289


Recognize that measures and interpretations are context specific

Looking at the biofuel supply chain in terms of sustainability indicators

Efroymson et al. (2013)
Dale et al. (2013)
Ecological Indicators 26:87-102.
### Examples of criteria and indicators applied to palm production

<table>
<thead>
<tr>
<th>Category</th>
<th>Indicator</th>
<th>Units</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social well-being</strong></td>
<td>Employment</td>
<td>Number of full time equivalent (FTE) jobs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Household income</td>
<td>Dollars per day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Work days lost due to injury</td>
<td>Average number of work days lost per worker per year</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Food security</td>
<td>Percent change in food price volatility</td>
<td></td>
</tr>
<tr>
<td><strong>Energy security</strong></td>
<td>Energy security premium</td>
<td>Dollars /gallon biofuel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fuel price volatility</td>
<td>Standard deviation of monthly percentage</td>
<td></td>
</tr>
</tbody>
</table>
### Examples of criteria and indicators applied to palm production

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<th>Category</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Social acceptability</td>
<td>Public opinion</td>
<td>Percent favorable opinion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transparency</td>
<td>Percent of indicators for which timely and relevant performance data are reported</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Effective stakeholder participation</td>
<td>Number of documented responses to stakeholder requests</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Risk of catastrophe</td>
<td>Annual probability of catastrophic event</td>
<td>?</td>
</tr>
</tbody>
</table>
Jobs are important for social and political sustainability – Fossil fuels = boom/bust cycles, while...

- **Bioenergy** (Biomass, Biofuels, Biogas)
- **Geothermal**
- **Hydropower** (Small-scale)
- **Solar Energy** (Solar PV, CSP, Solar Heating/Cooling)
- **Wind Power**

= 40,000 jobs

**World Total**

6.5 Million Jobs

i - Employment information for large-scale hydropower is incomplete and not included.

Source: www.ren21.net
Biofuels need to be sustainably managed

Thank you!

http://www.ornl.gov/sci/ees/cbes/
Thank you
Center for Bioenergy Sustainability
http://www.ornl.gov/sci/ees/cbes/

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The views in this presentation are those of the author/presenter who is responsible for any errors or omissions.
Bibliography and references

- Economic Research Service, Amber Waves, 10(2 (June)), 2012.
Further reading on bioenergy and sustainability:

- USDoe State of Technology updates: http://www1.eere.energy.gov/bioenergy/key_publications.html
- IPCC 2012 Special Report on Renewables and Climate Change Mitigation.