Synthesis of findings

of the workshop:

Quantifying and managing land use effects of bioenergy

Neil Bird (T38),

André Faaij (T40), Göran Berndes (T43)

Conclusions from Session 2a

Conceptual approaches: methodology, modeling approaches, estimation techniques

Themes and Issues

- Estimate of direct impacts
- Evidence-based assessment of LUC due to biofuels
- Applicability of economic models for estimating iLUC
- Including iLUC in LCA
- An example

Estimates of Impacts of Direct LUC

- **Other climate change indicators?**
  - Using radiative forcing instead of GWP
  - Cyclic nature of bioenergy means that benefits are dependent on the cycle time and the time frame of analysis
  - Benefits of bioenergy
    - Decrease with shorter cycle biomass
    - Decrease with longer time frames
  - Suggest that bioenergy CO2 should have less value that fossil energy CO2

- **Optimization of carbon storage and bioenergy?**
  - Biochar from pyrolysis is a technology that should be investigated for its combined benefits of
    - Soil carbon sequestration
    - Bioenergy production
  - Optimization depends on biomass source and energy requirements

1. Francesco Cherubini
2. Annette Cowie

Evidence-based Assessment of LUC due to Biofuels

- **LUC occurs for many reasons of which biofuels is just one driver**
  - Require to identify which lands change and from which crops to which crops
  - Problems with classification of grasslands
  - Elasticities vary with region
  - Based on identified land use changes
  - Combine with an economic based LUC model that includes
    - A deforestation cost
    - A crop switching cost

1. Cheney Schreve and Jessica Chalmers
2. Marcel Moreira
   * listed as André Nassar in program

Applicability of Economic Models for Estimating iLUC

- Development phase of our understanding of the impacts of bioenergy
- Economic models though our best method for estimation.
- However many model assumptions are not realistic or poor
  - Shocks
  - “rational” decision making (profit maximization)
  - Not realistic on the frontier of deforestation
  - Land supply and management specifications in the model are poor
  - Stable land conditions in the baseline
  - Yield changes
  - Land classification into distinct groups (B&W) not grey-scale
  - Fires and other disturbances
  - Causation and correlation
- How should we use and/or incorporate the results?

Keith Kline

Including iLUC in LCA

- **Should it be done?**
  - iLUC does not fit in attributional LCA (aLCA)
  - iLUC is an average estimate and consequential LCA (cLCA) is a marginal estimate
- **How should it be done?**
  - Allocation of LUC to bioenergy
- **What should be an appropriate functional unit?**
  - Energy produced / Energy from NPP

1. Serina Ahlgren
2. Rodrigo Augusto Freitas de Alvarenga

Example

- Use of an economic model to investigate the LUC due to increase fossil prices
  - Changing petroleum prices with change the mix between transportation biofuels and bioelectricity
  - Higher fossil fuel prices => higher production costs => decreased likely of intensive agricultural management
  - Higher energy prices result in
    - Decrease in corn based ethanol
    - Increase in ethanol from other grains
    - Shift to cellulosic ethanol
    - Decrease in use of biomass for electricity since liquid biofuels are more profitable
    - Reduction in GHG emissions due to increasing efficiency of production practices
    - Higher prices of biofuels and agricultural crops by 1 – 10% of the increase in fossil fuel price.

Conclusions from Session 3b

Conceptual responses and practical applications

LUC and governance

”Bioenergy means new opportunities for land use diversification to improve land/water use productivity, make land use more sustainable and mitigate environmental impacts of present land use”

•Displace unsustainable food production with sustainable biomass production for energy (e.g., the ”degraded land vision”)?

•Displace food production to meet water quality objectives

Addressing iLUC

•Target bioenergy as indirect LUC driver or directly influence the real agents behind LUC?

•Natural ecosystem conversion into sustainable and productive bioenergy systems vs. establishment of badly performing production systems on marginal soils that have small chances of becoming competitive in absence of economic support

The role of certification systems and standards

•Will project level certification contribute to attractive landscape level development?

•Certification based on global C&I harmonizes well with implementation of rural development plans

•Guarantee ”full sustainability” or guide decisions when there are trade-offs?

Confrontation of bottom-up vs. top down

Key steps iLUC modelling efforts:

- CGE; historic data basis
- Model shock, short term, BAU, current technology.
- Quantify LUC
- Quantify GHG implications (carbon stocks)

Bottom-up insights:

- Coverage of BBE options, advancements in agriculture, verification of changes (land, production)
- Gradual, sustainability driven, longer term, technological change (BBE, Agriculture
- LUC depends on zoning, productivity, socio-economic drivers
- Governing of forest, agriculture, identification of ‘’best’’ lands.

Important insights (a selection):

- Verification of model outcomes (statistics (Kline/Stevens, LUC data (Nassar), FAO, LCA's…)
- Other BBE options and improvements in management major impact on performance (Borjesson, Hamelin, Hess)
- Yield gap analysis and system change fundamental (Sparovek, Dunkelberg)
- Much more sophisticated knowledge on management of carbon stocks (e.g. forestry)
- Not ''just'' GHG's (biodiversity, socio-economic,…; many authors…)

Provocation?

Current iLUC exercises (and modeling frameworks deployed) do currently **not** give a proper picture of (i)LUC (or ways to avoid that) and can therefore not be used as a basis for policy.

But we need the aggregated modeling frameworks…

- World is far too complex…
- E.g. consequential LCA becomes unmanageable.
- Many interactions come from global level: trade determining factor (Timilsina), food & energy prices, competing (energy & mitigation) technologies, etc.
- Showing BAU IS important: markets and governments are imperfect (Laborde)

Ways forward…

- But top-down and bottom-up approaches are reaching out to each other
- More sophisticated approaches give more balanced outcomes (e.g. Nassar).
- Much to gain from combined efforts (e.g. Wicke, Witcover)

Key questions:

- Do we have enough modeling capabilities, methods, data and tools to provide *sufficient* answers to policy and the market (on iLUC)?
- Are the right questions being asked to science? (quantify iLUC vs. mitigation of iLUC)
- Honesty, limitations, uncertainties and the science – policy interface…
- What are we trying to govern here?; how to prioritize GHG, energy, land-use, agriculture, forestry, rural development…