Workshop on Scientific Issues on Biofuels

Session 2. The Science of Bioenergy and the Environment

- Environmental Certification of Biofuels
  - for INMETRO – Carlos Alberto Aragao de Carvalho
- Sustainable Bioenergy – Issues in Europe
  - Patricia Osseweijer, Delft Univ Technology
- The Science of Bioenergy - Environmental Impacts
  - Jeremy Woods – Imperial College of London
- Brazilian bio-ethanol and other biofuels: Their impact on the mitigation of greenhouse gas emissions
  - Robert Boddey – EMBRAPA Seropedica

Reported by Helena Chum
National Renewable Energy Laboratory, Colorado

Uncertainties in Attributional LCA

- **Very good data from companies collected by CTC**
  - **Unique mutual benchmark situation**
  - **Opportunity to improve individual companies and the industry**
  - **LCA tool important for each company to improve – could lead to certification**
  - **Analysis so far of anhydrous ethanol (blendstock) to assess the GHG emissions of Gasoline C (up to 25% ethanol)**
  - **Comparable quality emissions from the Brazilian gasoline mix needed**
  - **What is the Brazilian baseline emissions? Gasoline C? No neat gasoline used**
  - **Productivity of sugarcane most important parameter – RD&D and GMO can be solutions**

- **Field emissions – principally N_2O – Literature debate**
  - IPCC default values are broad averages
  - Crutzen et al. values may be overstated methodologically (N further used in the system)
  - Brazilian sugarcane case has the possibility of biological nitrogen fixation decreasing fertilizer need and opening an approach – understanding the science of biological fixation
  - Is it possible that such biological approaches could be applicable in other regions of the world?

- **Soil carbon and other data**
  - Expanding production onto pasture land is an opportunity to measure the baseline of the system (also on nitrogen emissions and use)
  - Integrated biomass systems should be the emphasis – biorefineries with multiple products. Advance methodology and reporting of LCA results

Uncertainties in Consequential LCA

Varies with Space and Time

- Coupling LCAs with econometric/biophysical models provides dynamic modeling opportunities to understand systems linkages
  - Models are improving but they are tools for understanding of possible systems responses
  - Multiple scenarios should be exercised with multiple models
  - The land use system includes agriculture, bioenergy, forestry, and ecosystem services…and the economic system – engage in global RD&D
  - Direct causal relationships linkages

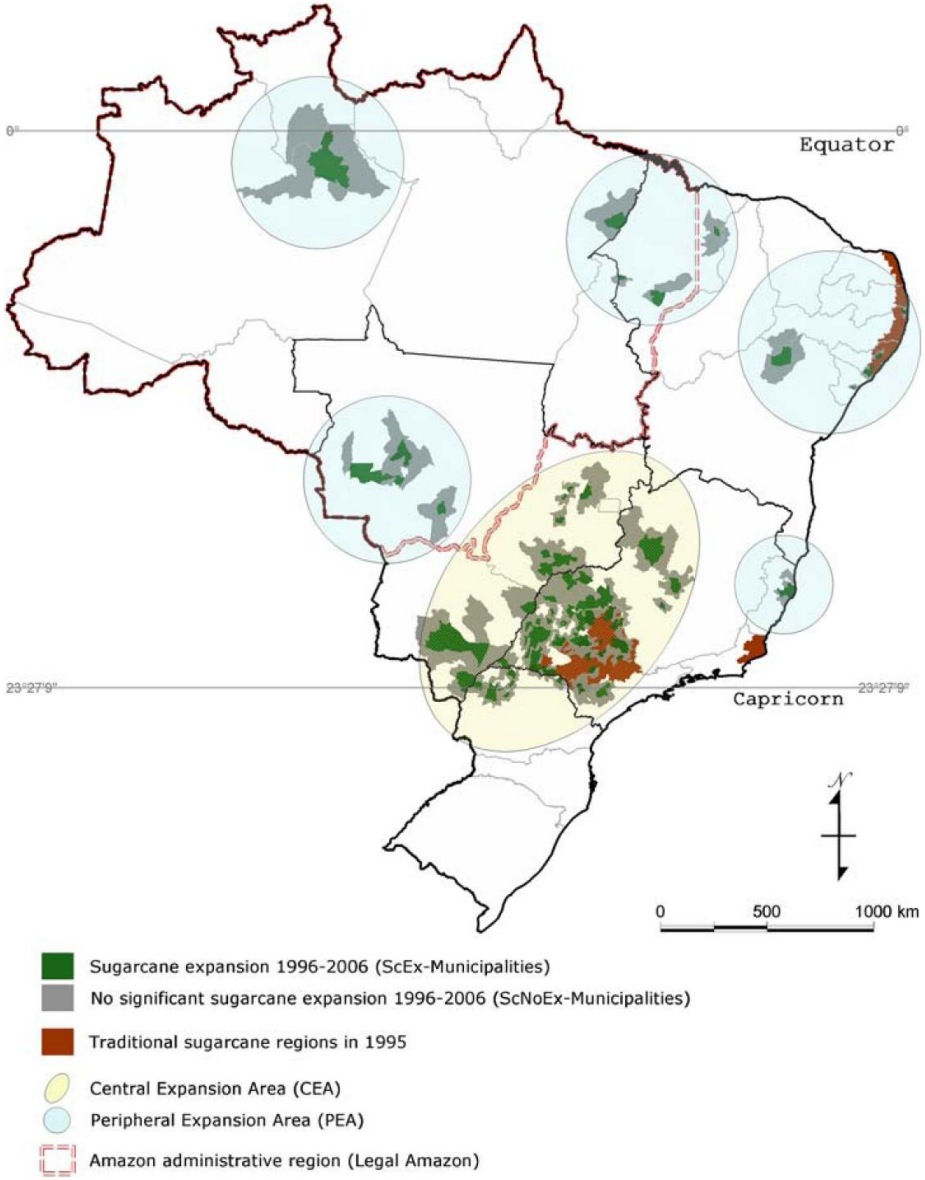
Accuracy, precision and uncertainty

"*It is much more important to be able to survey the set of possible systems approximately than to examine the wrong system exactly. It is better to be approximately right than precisely wrong.*"

Tribus and El Sayed (1982). Quoted by Jesper Kløverpris in RSB GHG working group response, 17th May 2010.

Public Perception

- Understand attributional and consequential LCA principles and why literature data diverge to explain sources and that convergence is occurring
- Biomass, bioenergy and biofuels can be done right (or wrong)
- Geography matters – Brazil has a plus situation – land, water, sunshine, … each country may require different solutions that creatively handle land use change to achieve multiple objectives
  - climate change mitigation
  - rural and industrial development
  - energy security/diversification
  - social equality



Spyrovek et al measurements (2009)

EMBRAPA AgroEcological Zoning