1st Workshop
ESSP Bioenergy

Bioenergy and Earth Sustainability

19-21 July 2008
22 July – field day
Piracicaba, Brazil

With the funding support of:
International Geosphere-Biosphere Program, Brazil
Global Carbon Project
Several Agencies in Brazil
Global Environmental Change and Food
The H John Heinz III Center for Science, Economics, and the Environment
Earth System Science Partnership

Background

Presently, the global demand for bioenergy is driven by demand for "traditional bioenergy" in rural communities of developing countries, which accounts for 10 percent of global primary energy. More recently, the demand for "new", highly standardized biomass for energy is rising rapidly posing a new set of opportunities and challenges to Earth system sustainability.

The are different perspectives through which bioenergy is viewed:

- Energy security: biofuels are seen as a means to reduce dependence on oil imports, and thus contribute to energy security at the national level. If biofuel production increases substantially, strategic and geopolitical aspects of biofuel production and trade may assume increasing importance.

- Livelihood security and rural development: the distributed production of biofuels (whether cane or maize ethanol, straight vegetable oil or biodiesel) is often seen as a means for enhancing farm incomes, supporting income diversification, support for an already heavily subsidize agriculture in developed countries, and essentially contributing to rural development.

- Environmental: biofuels are seen as one of the means for reducing carbon intensity of the energy system and thereby leading to the mitigation of GHG emissions. Apart from global environmental benefits, the "modernization" of biomass may also produce significant local environmental benefits in terms of reduced particulate emissions.

- Innovation and new business opportunities: while the production of fuel is the most visible transformation of biomass, there is also an increasing interest in bio-based products, or the use of biomass as a feedstock for downstream industries. An important question is with regard to the techno-economic viability of an integrated biorefinery (analogous to a petrochemical refinery). This "second generation" of biofuels is already attracting large investments in R&D.

Each of these opportunities comes with a range of challenges – environmental, economic, social, political and institutional, in addition to questions regarding the underlying carbon cycle implications and technology options. In a sense, they provide the criteria on the basis of which alternative biofuel pathways may be evaluated and assessed. Different combinations of *feedstocks*, *conversion routes*, *fuels* and *end applications* lead to a wide range of pathways for biofuels. Some of these pathways are already commercially viable at large-scale; while others are at varying stages of research, development and commercialization.

The major challenges are:

- Environmental risks associated with agriculture expansion such as overuse and pollution of water resources, and threats to conservation areas.
- Food security as land competition for food and energy increases, also leading to a coupling of the energy and food prices.
- Social and economic consequences of displacing less economically favourable or subsistence agricultural and forest production into marginal areas and primary forests.
- Climate protection benefits of replacing fossil fuels by biofuels when all radiative forcing components are considered.
- Distribution/market of biofuels; and the role played by the petroleum industry in this matter.
- Long term policy-related actions towards biofuels (distinguishing agricultural or energy-related political and institutional structures).
- Technology challenges associated with cost-effective and feasible technologies for fuel production and end-use.

Goals of the workshop

To identify the major opportunities and constraints for bioenergy in the context of Earth system sustainability.

Sub-goals:

- To identify and characterize the key trade-offs and synergies associated with different bioenergy pathways.
- To develop frameworks, measures and associated metrics that would allow for a quantitative assessment of these tradeoffs and synergies. Eventually they could contribute to the development of sustainability safeguards.
- To identify an ESSP research portfolio to assist moving towards sustainable bioenergy pathways.
- To design a set of analyses to feed into major research syntheses leading to major publication/s.

Initial ideas for focused developments:

- To quantify the "climate-protective" domain of bioenergy production. Some bioenergy pathways will not achieve negative forcing of climate when all radiative forcing components are considered (GHGs, albedo, energy partition and hydrological cycle).
- To quantify the effects of biomass energy production on food availability and prices, water availability, water pollution, and biodiversity.
- To develop global as well as local-scale assessments of the impacts and potential of bioenergy developments, accounting for the full range of effects. This could lead to the development of complex Earth system model, or to the development of a simple model (or non numerical framework) deployable at the local scale on a laptop to assist policy decisions.

Products

- A high profile paper focused on the need to put biomass energy in the context of its effects on the full range of ecosystem goods and services including approaches to deal with trade offs. It could include a preliminary analysis defining areas (and yield potential) that appear to be attractive for expanded biomass energy production.
- A report outlining the major research needs in support to the development of sustainable bioenergy pathways.
- Agreement on a major set of analyses to be performed in the months to follow and as part of a synthesis paper/s. For example, we could develop a set of ESSP bioenergy scenarios, where these tradeoffs / synergies are made explicit.
- Initiate the development of quantitative frameworks to deal with trade-offs.

Scientific/Organizing Committee

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Host Organization

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