Food, energy, forestry, conservation: The complex equation of land use

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Working together to promote bioenergy for sustainable development

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Quick introduction to GBEP: G8 commitments and mandates

2005 Gleneagles Plan of Action:

*"We (the G8) will promote the continued development and commercialisation of renewable energy by: […] d) launching a **Global Bioenergy Partnership** to support wider, cost effective, biomass and biofuels deployment, particularly in developing countries where biomass use is prevalent, following the Rome International Workshop on Bioenergy".*

2007 Heiligendamm Summit Declaration:

*"We invite the **Global Bioenergy Partnership (GBEP)** to continue its work on biofuel best practices and take forward the successful and sustainable development of bioenergy"*

2008 Hokkaido Toyako Summit:

*"We support the work of the **Global Bioenergy partnerhsip (GBEP)** and invite it to work with other relevant stakeholders to develop science-based benchmarks and indicators for biofuels production and use"*

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GBEP and land-use change

- Land-use change discussion taking place in GBEP within both the Task Force on GHG Methodologies and the Task Force on Sustainability
- This discussion is at an early stage, but likely to get onto concrete issues such as indicators of both direct and indirect land-use change and comparison of ILUC methodologies used in GHG LCA in next few months

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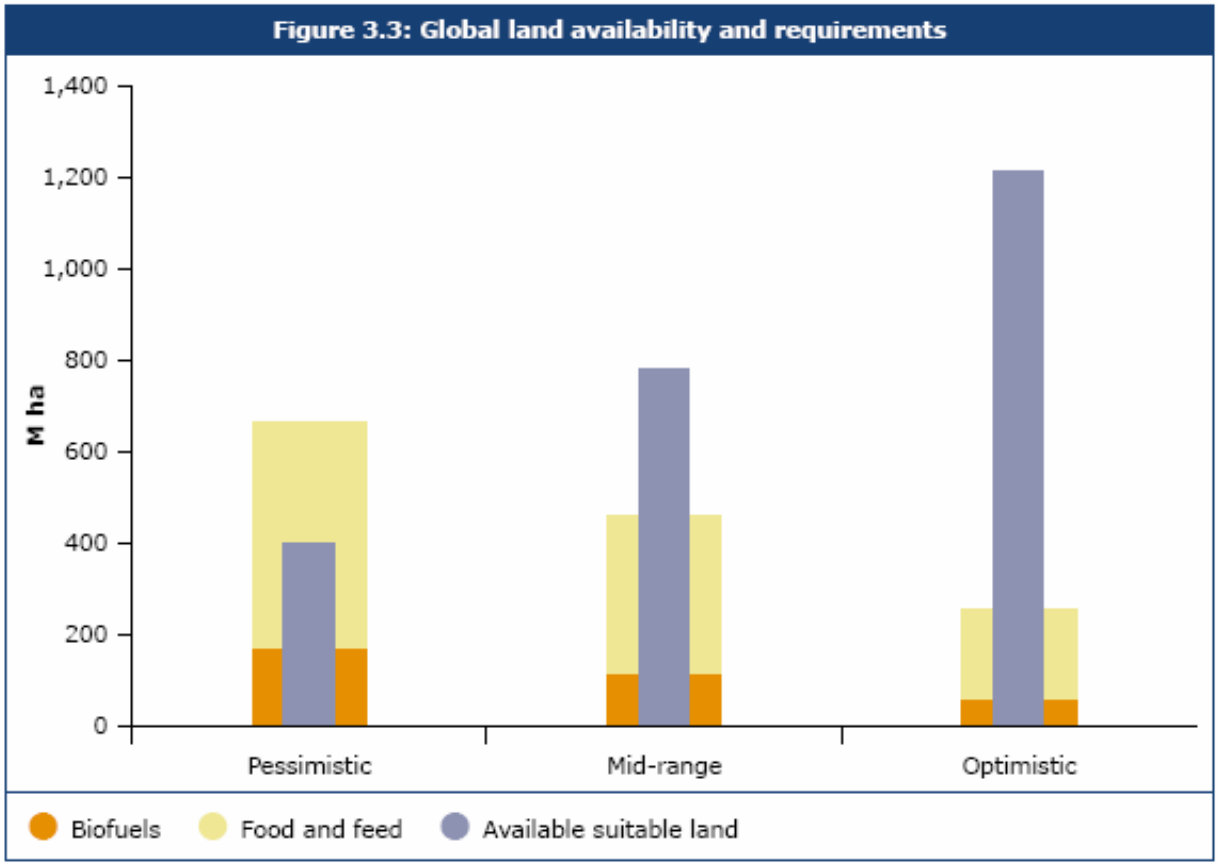
Adding up land use for food, feed and fuel

Chart from the Gallagher Review showing various projections for land availability and requirements for food, feed and biofuels in 2020



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Drivers of land-use change

Drivers of land-use change include:

- economics and profitability (demand for products, financial incentives and disincentives, land prices and cost of conversion);
- local culture (e.g. dietary and other lifestyle preferences, mobility);
- changes in environmental conditions (soil quality, terrain, availability of water, climate change);
- land-use policy (rural or urban development programmes, building of roads, ports and other infrastructure, zoning and other planning schemes, conservation sites)
- other policy and legislation affecting production of food, feed, fibre or fuel (e.g. banning GMOs in animal feeds, setting biofuel targets, altering import tariffs on agricultural products);
- technological advances and access to technology (e.g. crop yield and other productivity improvements, mechanisation of harvesting, genetic modification of crops); and
- effects of past human activity (e.g. land degradation from agriculture).

Much overlap and feedback between above drivers (which makes the equation more complex...)

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Land-use change: an interdisciplinary subject

Interdisciplinary analysis required to study drivers of LUC, forecast future LUC and formulate policies to mitigate potential adverse effects and promote potential positive effects. Such analysis should include:

- anthropology
- climatology
- ecology
- economics
- environmental science
- geography
- hydrology
- political science
- sociology
- soil science.

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Land-use planning

General features include strategic objectives, optimisation of resource use, SD framework, spatial and temporal elements, consultation, nest of local, regional, national plans.

- Cross-sectoral – e.g. UK marine planning
- Bioenergy – e.g. Mozambican biofuels strategy under development
- Agriculture – e.g. Brazilian economic and ecological zoning, linked to financial incentives and possibly certification for export

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Impacts of land-use and land-cover change

The areas in which the effects of land-use change and land-cover change are felt are wide-ranging and include:

- carbon cycle
- water cycle
- biodiversity
- land degradation
- food security
- migration
- human wellbeing.

For example, the Millennium Ecosystem Assessment lists land-use change as the leading cause of biodiversity loss.

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Land-use change and climate change

Since much work on LUC and biofuels is done in order to estimate the impact on climate change (but without indicating that other impacts are less important), perhaps worth noting key processes that link land-use and land-cover change to climate change:

- uptake and release of **greenhouse gases** by the land cover of the terrestrial biosphere to and from the atmosphere through photosynthesis, respiration, and evapotranspiration
- release of **aerosols and particulates** from surface land-cover change perturbations
- variations in absorbance and reflectance of radiation as land-cover changes affect surface **albedo**
- **surface roughness effects** on atmospheric momentum.

Plus feedback, e.g. through climate change adaptation and mitigation measures such as increased use of renewable energy.

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Biofuels and direct and indirect land-use change

- Direct v. indirect
- Both direct and indirect land-use change can negate GHG savings of biofuels in some cases
- System expansion – indirect effects harder to estimate (uncertainties greater) but uncertainty is not a reason to ignore or assume zero in all cases
- Need to ensure GHG equation includes the largest terms
- Co-products, price-induced yield improvements

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Attempts to model GHG emissions from ILUC due to biofuel production

- General equilibrium
- Partial equilibrium
- Deterministic
- Social discount rate

Difficult to link GHG emissions from ILUC to one batch of biofuels – easier to model macro effects of policies.

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Attempts to estimate causality or correlation between biofuel production and LUC

- Projected baseline/counterfactual
- Regression analysis – e.g. UNICAMP work showing correlation between return on various agricultural activities in certain areas and the deforestation rate in the same area and neighbouring areas
- Social science: ground-truthing of agro-economic models is essential
- If results of models are to be implemented in regulatory instruments, or used to distinguish between different biofuels, then the models must allow for positive actions (including policy and economic frameworks and actual practice) to be reflected
- Bringing together modellers and experts in local drivers of LUC today should help this process

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Returning to the question of what policy-makers need (out of today and follow-up)

- Macro analysis (e.g. effect of a 10% biofuel penetration mandate)
- Micro analysis (e.g. full life cycle GHG emissions due to a single batch of biofuels)
- Plus intermediate levels (e.g. biofuels from one feedstock in one country with one set of co-product uses)
- Confidence in something approaching an internationally accepted methodology for determining or estimating the order of magnitude of GHG emissions due to LUC from biofuels
- Evidence-based guidance for how to establish regulatory and economic frameworks that encourage sustainable land use (e.g. PES, including carbon-pricing, water-pricing, zoning linked to tax credit...)

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Thanks and have a good workshop!

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