Bio-energy and Land Use -

Background drivers, marginal effects and analytical options

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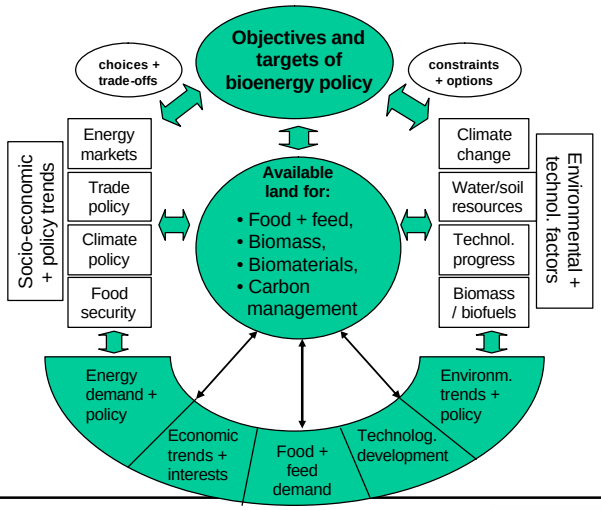
Trade-offs and/or synergies ?

- Agriculture is a major source of environmental pressure worldwide
- Climate change is a very important environmental *and* economic threat
- Great need to develop renewable sources of energy
- Global land use trends + deforestation
- Food supply and development needs

Interactions between the environmental, food and energy domains



Background drivers – a selection

- Global trends by 2030 (OECD, 2008):
  - 46-48% increase in global food demand
  - 10% in world farmland
- Structure of the energy sector: centralised or distributed energy systems?
- Need for substituting fossil fuels by renewable sources in many areas
- Increasing global interconnections
- Social and development aspirations
- Global governance + policy implementation

Identifying 'marginal effects'

- Which land use or biomass use is the marginal factor? Are there alternatives?
- How to estimate the marginal effects of additional increments in food consumption or biofuel demand?
- Modeling marginal effects requires us to hold everything else constant
- But how constant is 'everything else' in reality?!

  -> remember increases in global food demand
- Single or combined marginal effects?

Global bio-fuel targets (April 2008)

Country (group)	Blending target or mandate	Quantity or share	Target year
Brazil	M	**25% ethanol** **5% biodiesel**	**2007** **2013**
Canada	M	**5% ethanol** **2% biodiesel**	**2010** **2012**
China	T	**15% of fuel for transportation**	**2020**
EU-27	T	**10% of transport fuel**	**2020**
India	M	**10% ethanol** **5% biodiesel**	**2008** **2012**
Japan	T	**6 billion litres**	**2020**
USA	M	**134 billion litres**	**2022**

Agri-environmental baselines

- Agricultural land use change and land use intensity as a key environmental issue
- Marginal effects also exist in land use intensity: e.g., the higher the input use the bigger the risk of nutrient leaching or N2O emissions
- A critical balance: environmental impact or opportunities for improving environmental management
- Preserving critical natural capital requires application of a precautionary approach

Biodiesel from oilseed rape in Europe

Firewood collection in developing countries

Source: www.radford.edu

What tools do we have?

Analytical tools:

- Life cycle analysis
- Agro-economic modeling
- Satellite and field observations
- Scenario analysis

Weaknesses:

- *Indirect land use effects*
- *Environmental impacts*
- *Analysis of economic drivers*
- *Assumptions and system boundaries*

Some critical science issues

- Development of integrated assessment frameworks
- Increase awareness of the impact of system boundaries (spatial + time scales, alternative land uses, policy areas affected)
- Linking agro-econ./land use models with energy and general equilibrium models
- Analysis of policy options for steering bioenergy production:

  sustainability criteria, carbon trading/taxes,
  support to research/technologies,
  rural/regional/ international development tools
- Global to local governance + knowledge transfer

What public investments to make?

Developing a better basis for (policy) decisions:

- ❖ Development of suitable global data sets on land use and farming systems
- ❖ Consider the interactive impact of national policies on global resources
- ❖ Create global mechanisms for review + management of resources
- ❖ Create/maintain sufficient capacity for integrated analysis (in terms of inter-disciplinary knowledge and manpower!)
- ❖ Knowledge transfer + extension to producers

Thank you for your attention.

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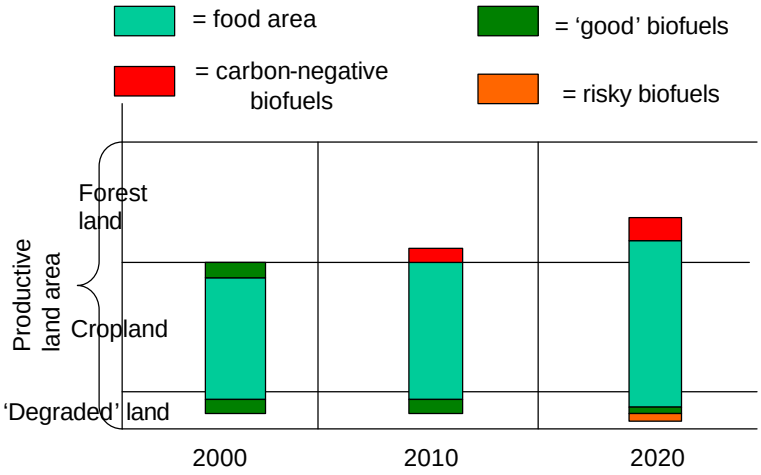
Carbon effects of different land use starting points + developments..



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Critical factors in assessing bioenergy production

Relevant factors and tools	Progress so far
Choice of environmental factors	Range is ok, but too much focus on GHG balance (+ what about iluc?!)
Methodological tools	Various approaches available, but need further integration + field data
Technological standards / yield increase + cropping practices	More work required, in particular on yields + cropping practices
Available land / biomass	Much work remains to be done, in particular at global level
Interactions between food + energy markets	Some modeling results, but require better links to (bio)energy markets; but future food demand seems ignored
Type and strength of external trends	Very difficult to assess, e.g. impact of climate change, carbon payments
Implementation + governance	Increasing insight into standards, but generally a black box…

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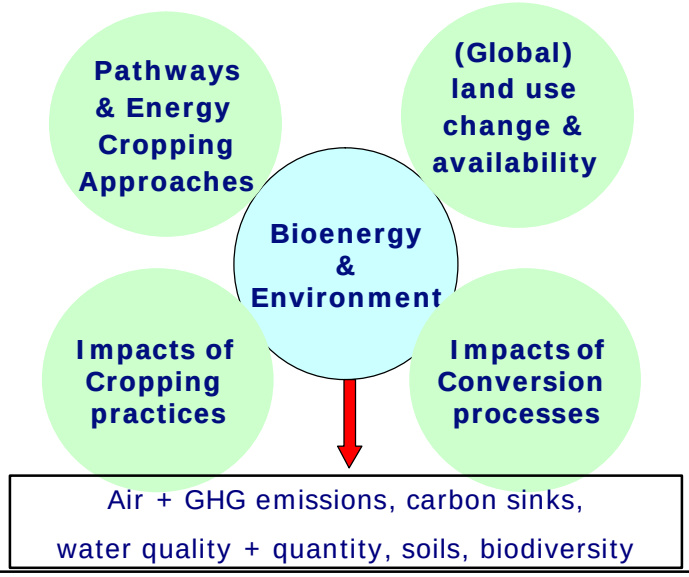
Environmental issues of energy cropping



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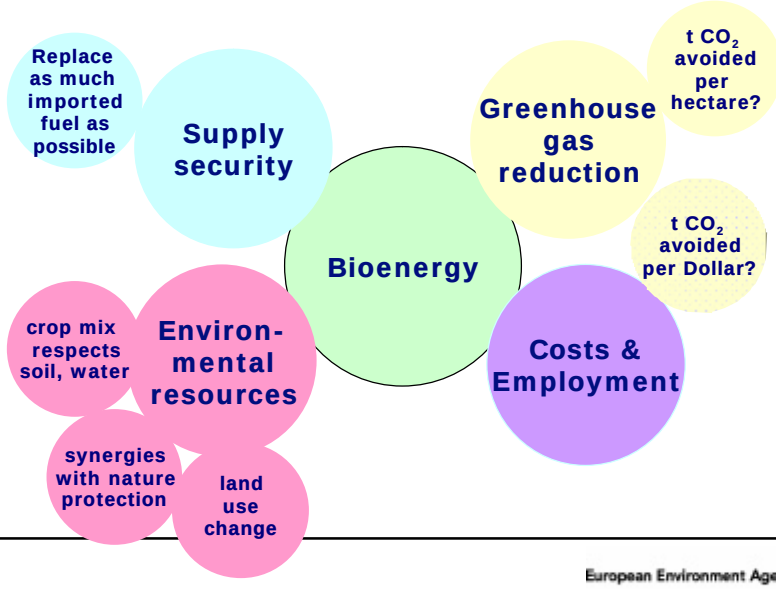
How best to use biomass potential?



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