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Global outlook on development of sustainable biomass resource potentials.

1st Conference of the European Biomass Co-firing Network 2nd – 4th July 2007, Budapest – Hungary.

André Faaij

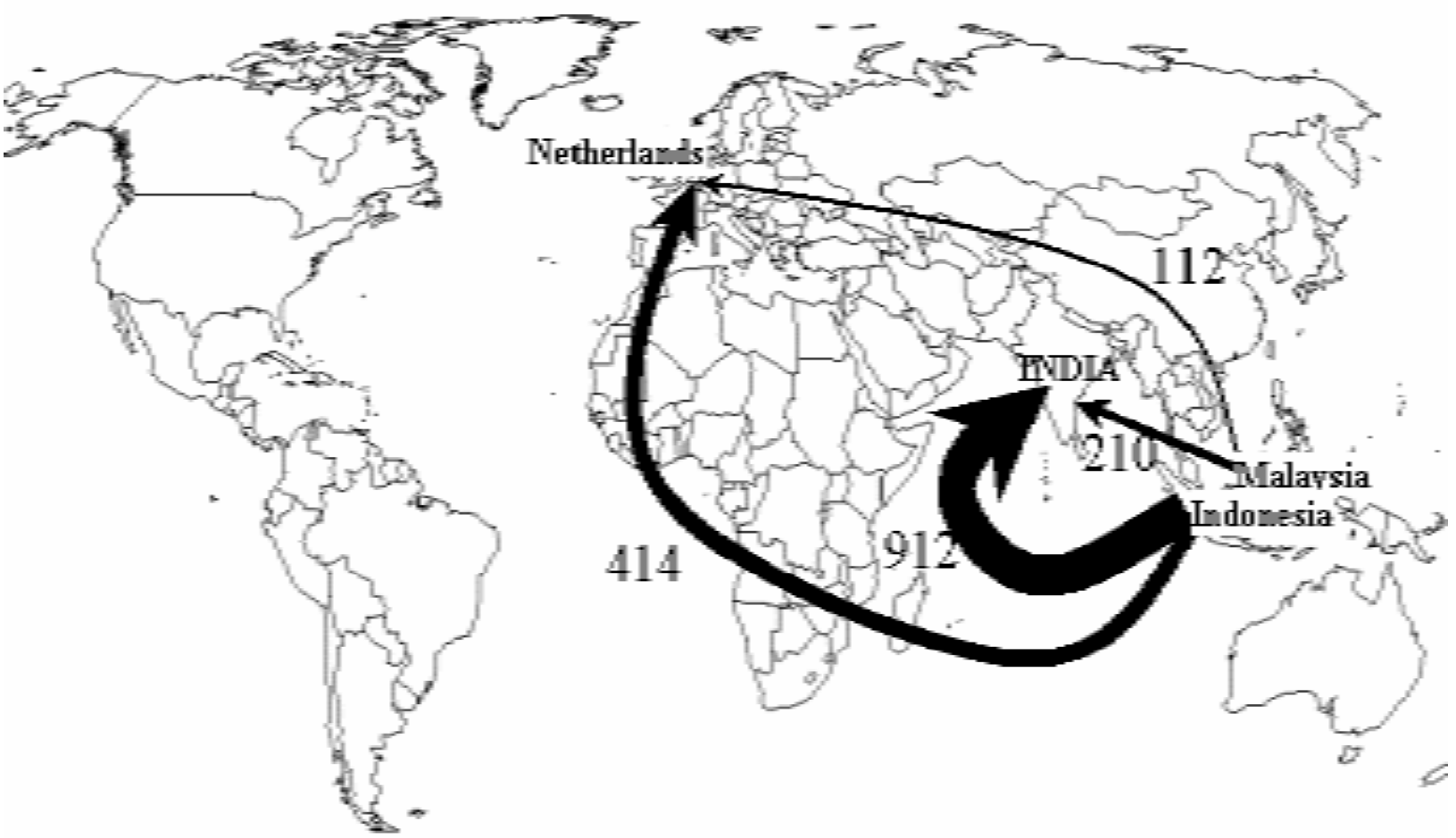
Copernicus Institute - Utrecht University

Copernicus Institute
Sustainable Development and Innovation Management

International bio-energy markets developing fast…

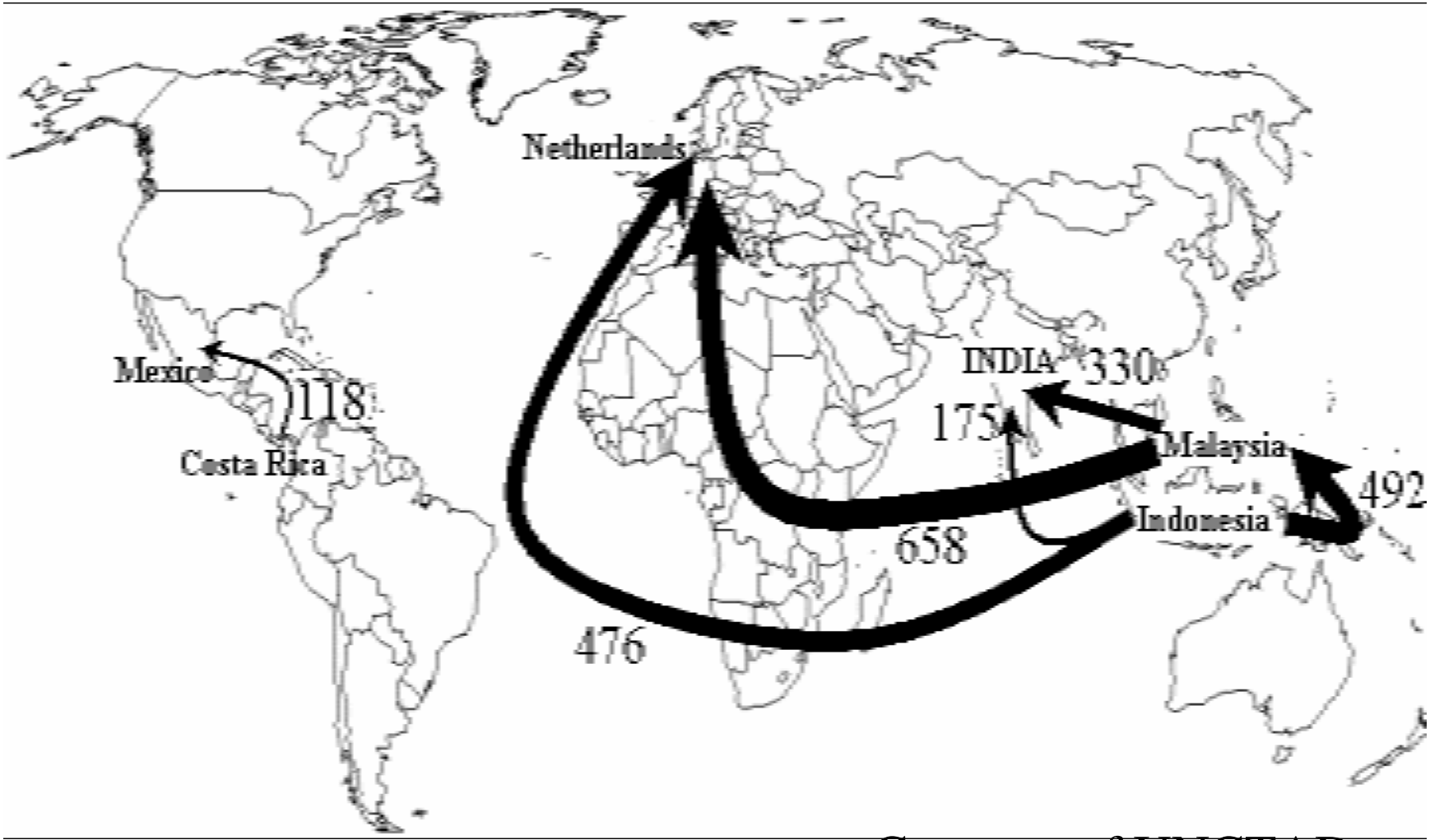
- Excitement:
  - Solid biofuels trading develops in bilateral setting; bio-ethanol entered first phases of commodity market trading; *''wild west phase''*
  - Growing bio-energy demand and international supply chains create unique opportunities for both producers regions as importers.
  - Entrepreneurs and policy makers are now dealing with development of regional or national biomass markets in a rapidly developing international context.
- Concerns:
  - Fierce international debate on sustainability
  - Different interests & perspectives on governance & policy
  - Many barriers remain

Palm oil flows 2000 (kton)



Courtesy of UNCTAD

Palm oil flows 2004 (kton)



Courtesy of UNCTAD

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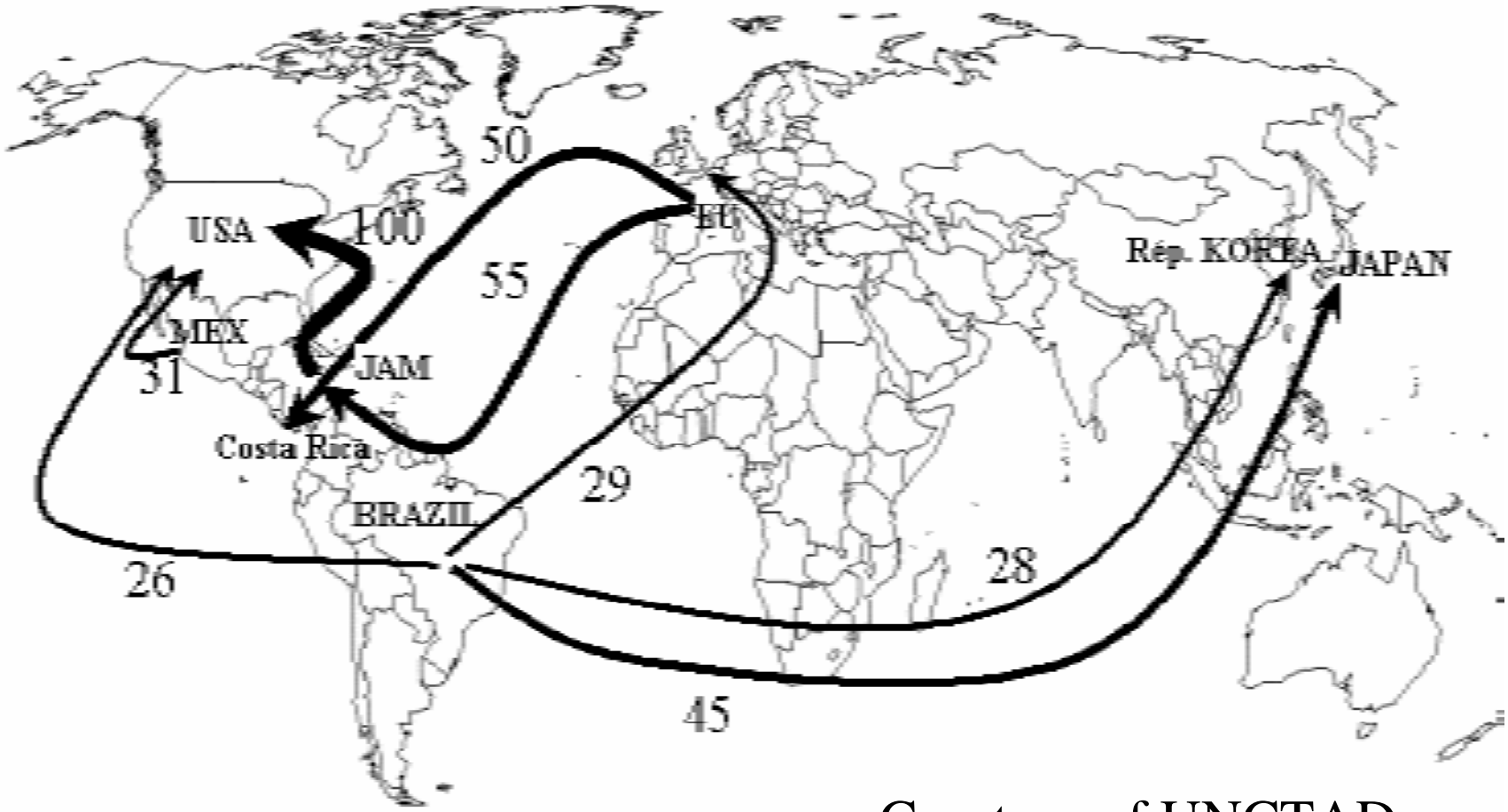
Bio-ethanol flows 2000 (kton)



Courtesy of UNCTAD

Traded: 3 billion litres
Global production: 32 billion litres

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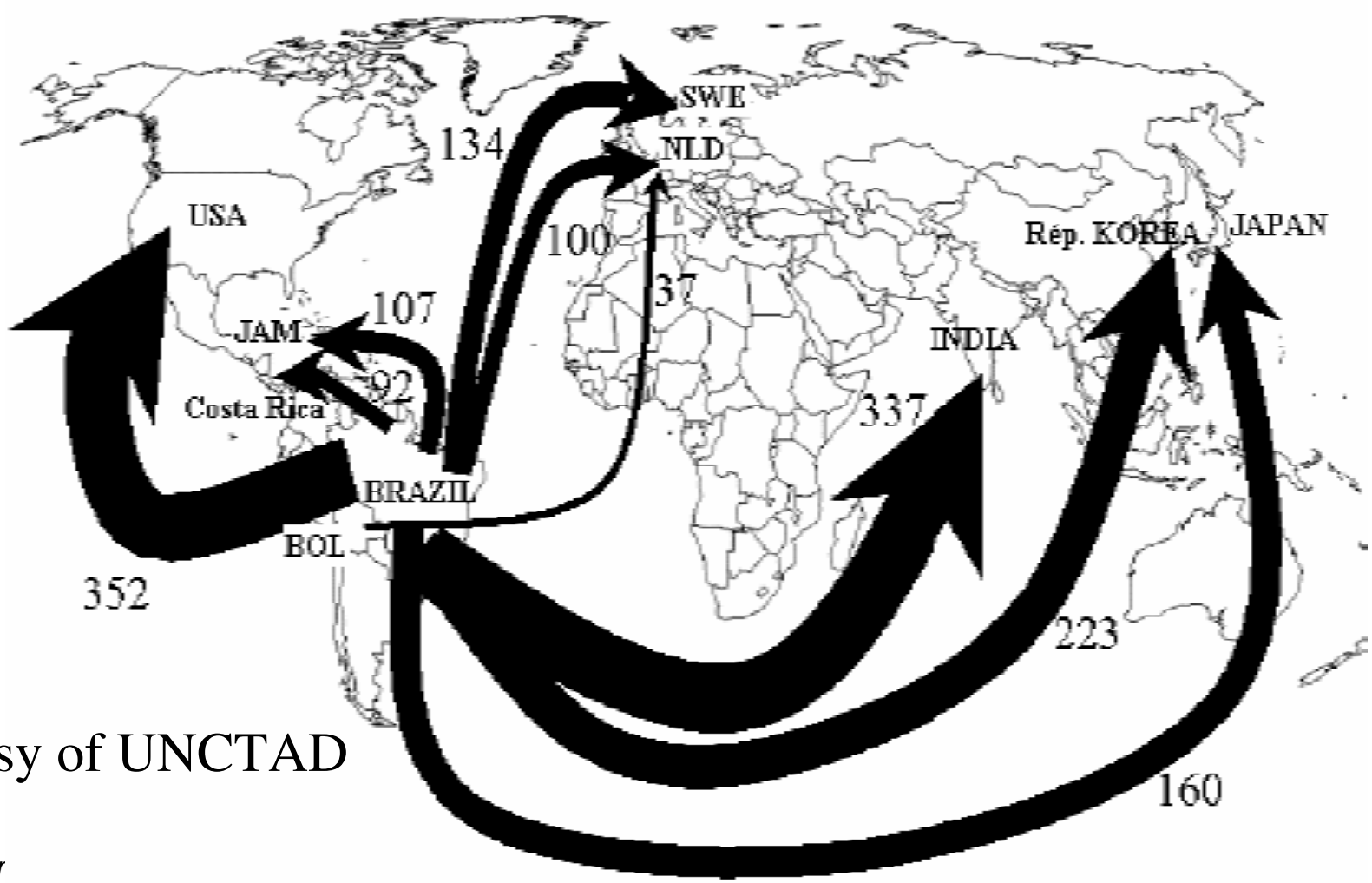
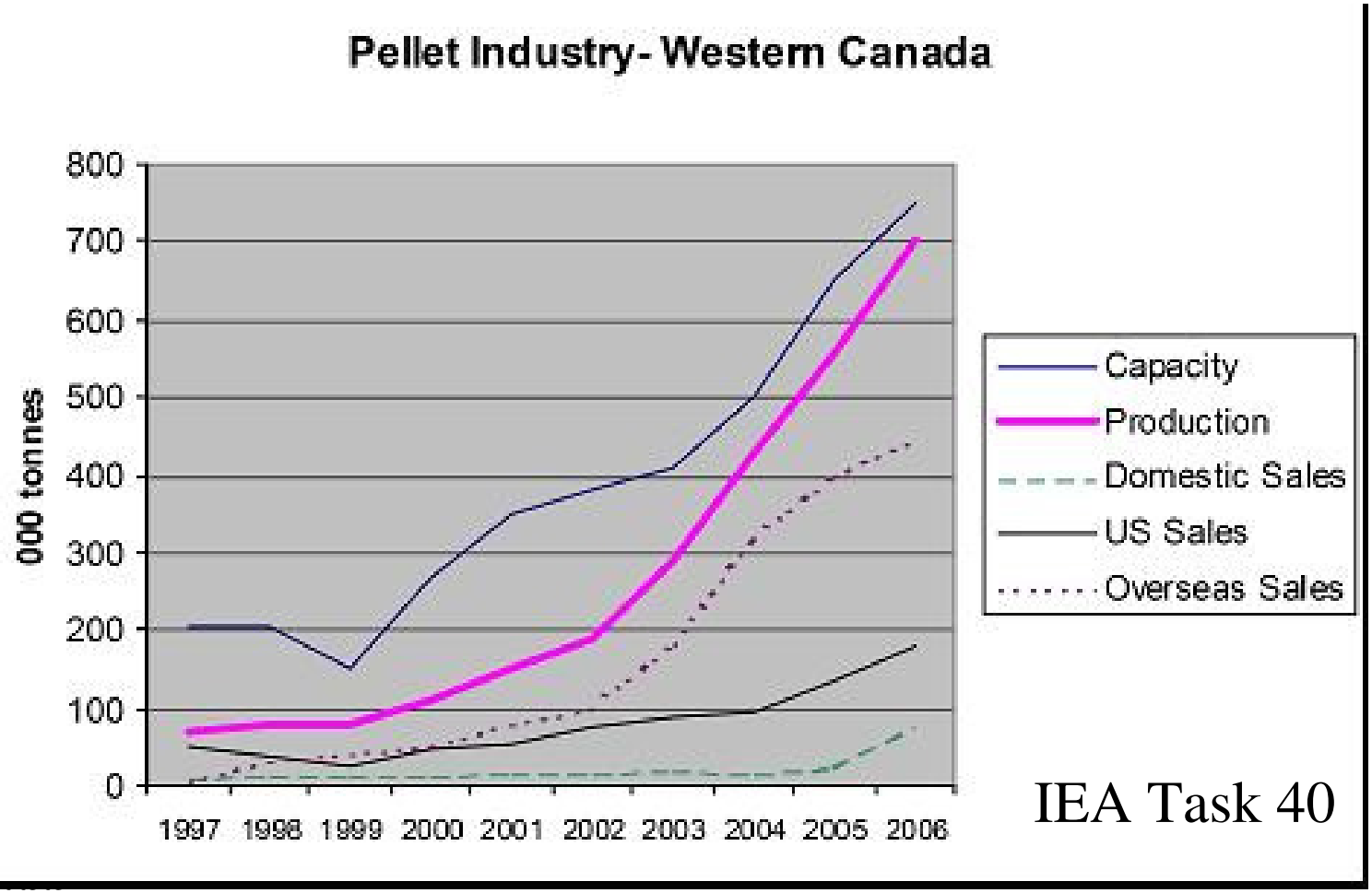
Bio-ethanol flows 2004 (kton)



Courtesy of UNCTAD

Overview (western) Canadian wood pellet production,use and export (Bradley, 2006)



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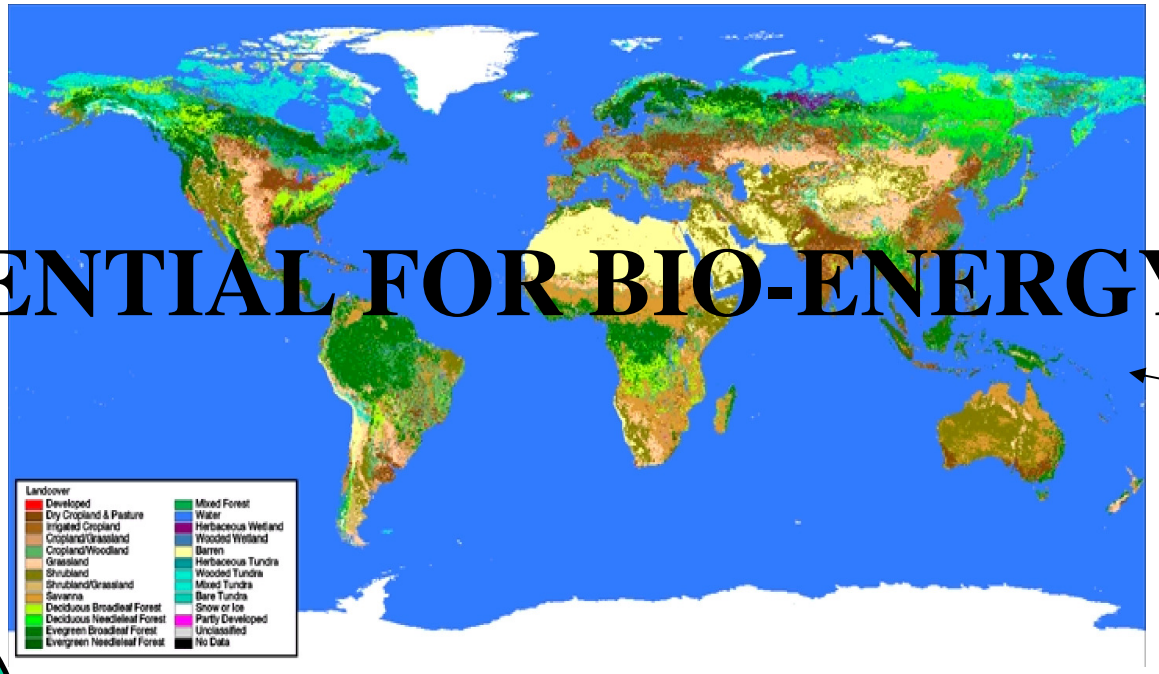
population

energy consumption

trade

future land use patterns

biotechnology



POTENTIAL FOR BIO-ENERGY?

GDP

agricultural system irrigation, breeding, mechanization, chemicals

land productivity

agricultural policy

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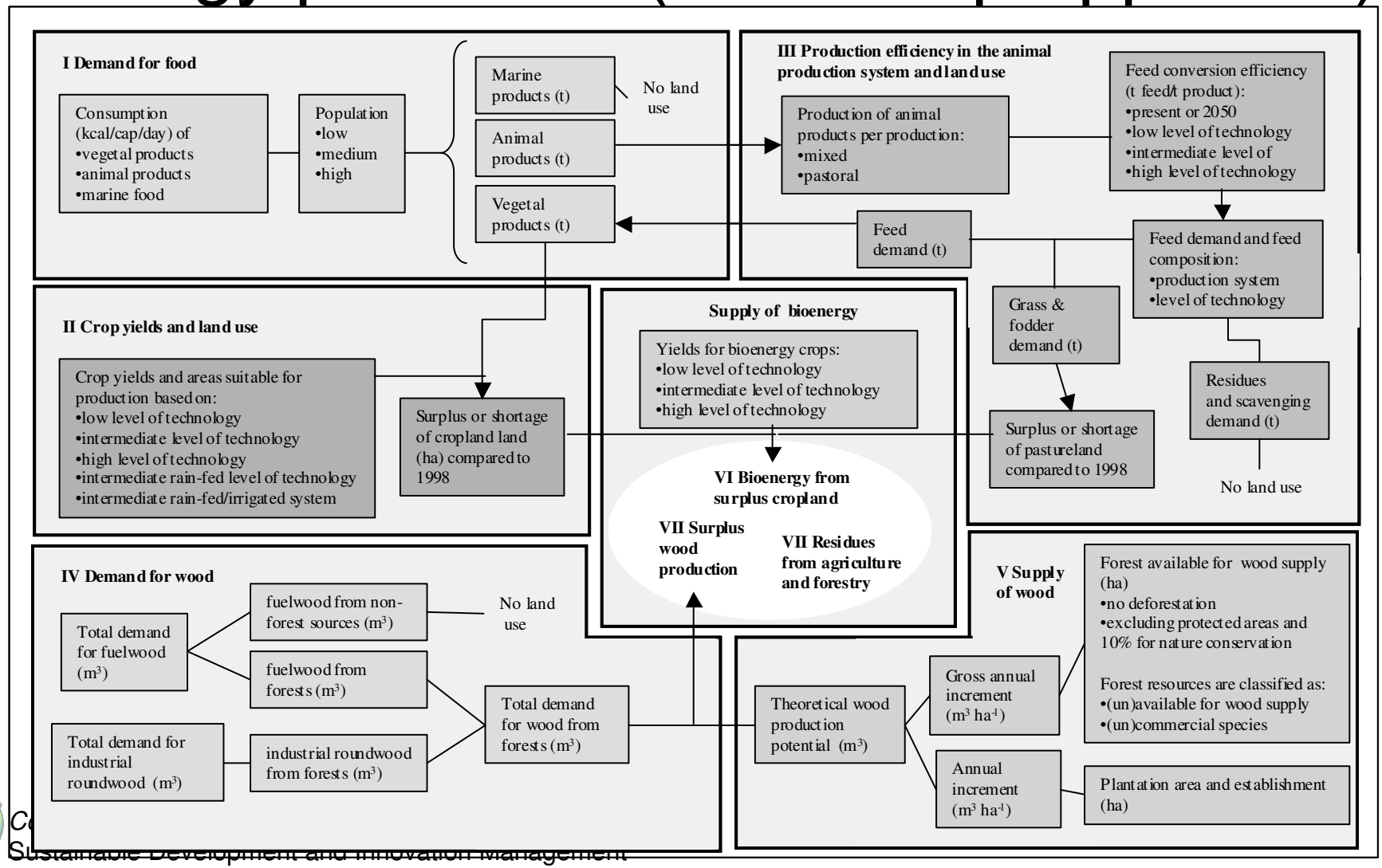
Key elements for assessing future bioenergy potentials (bottom-up approach)



Source: Smeets, Faaij 2004

Bioenergy production potential in 2050 for different levels of change in agricultural management

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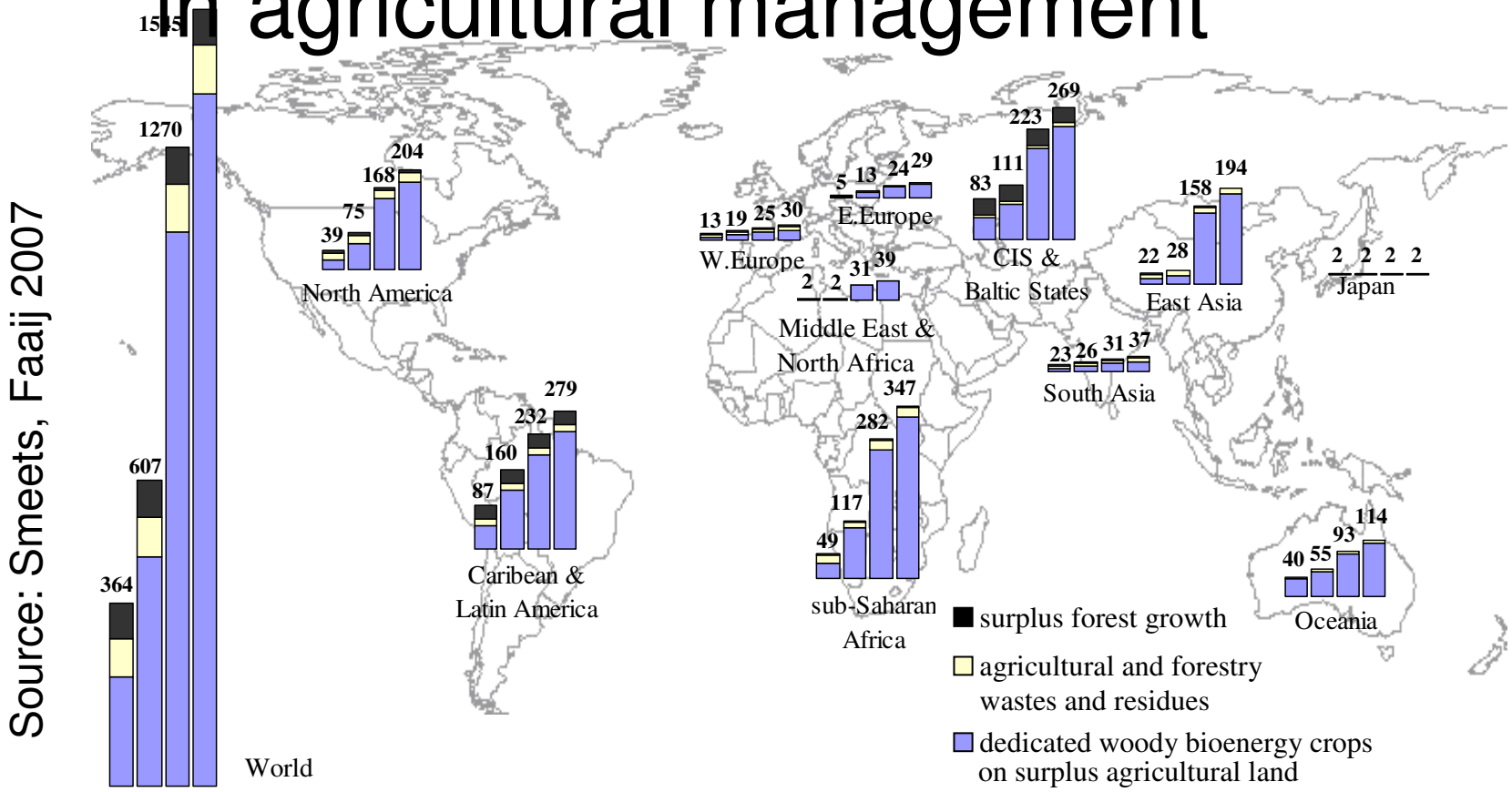
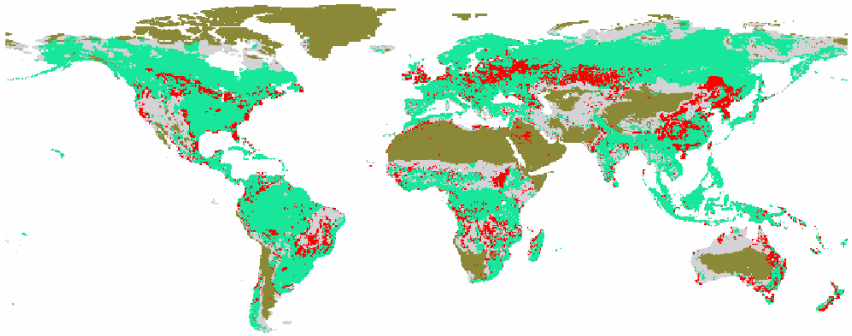
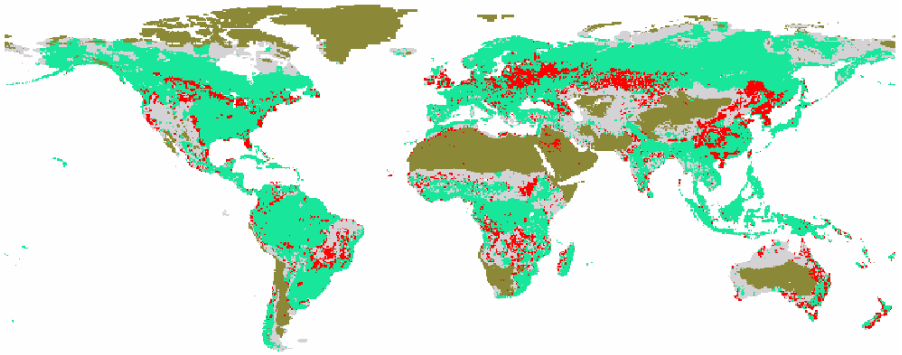


Total bioenergy production potential in 2050 based on system 1 to 4 (EJy^{-1}; the left bar is system 1, the right bar is system 4

B1 2050



A1 2050



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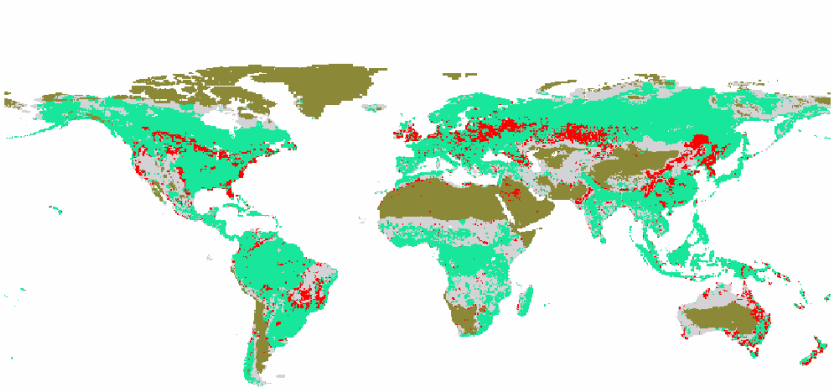
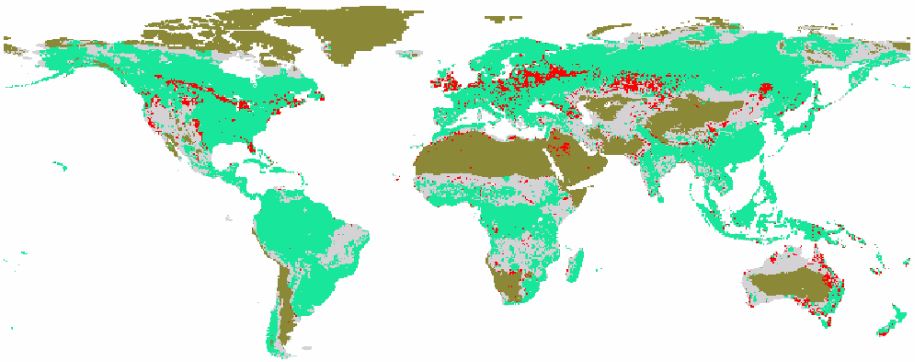
Integrated assessment modelling results (IMAGE)

rest land
Abandoned cropland
low-productive Land
Other

B2 2050



A2 2050



rest land
Abandoned cropland
low-productive Land
Other

Source: Hoogwijk, Faaij 2005

B1 2050

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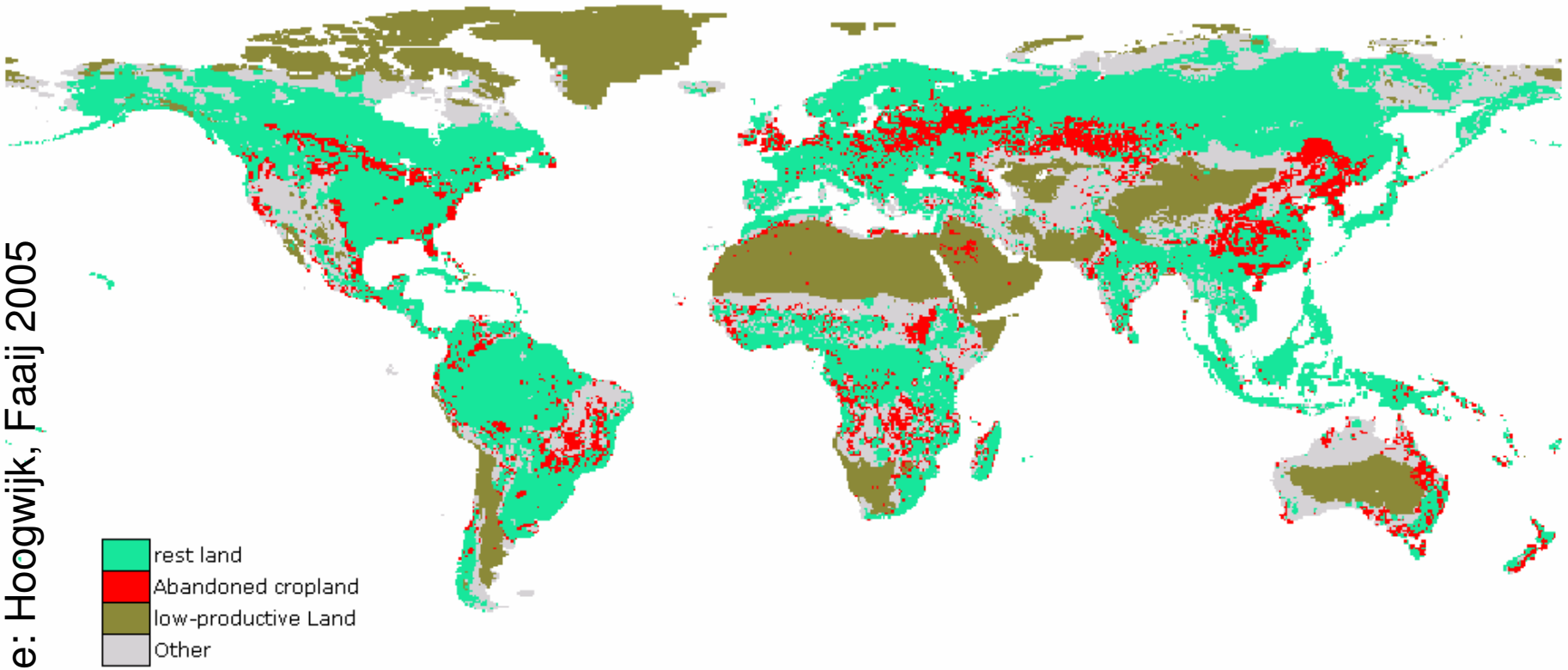
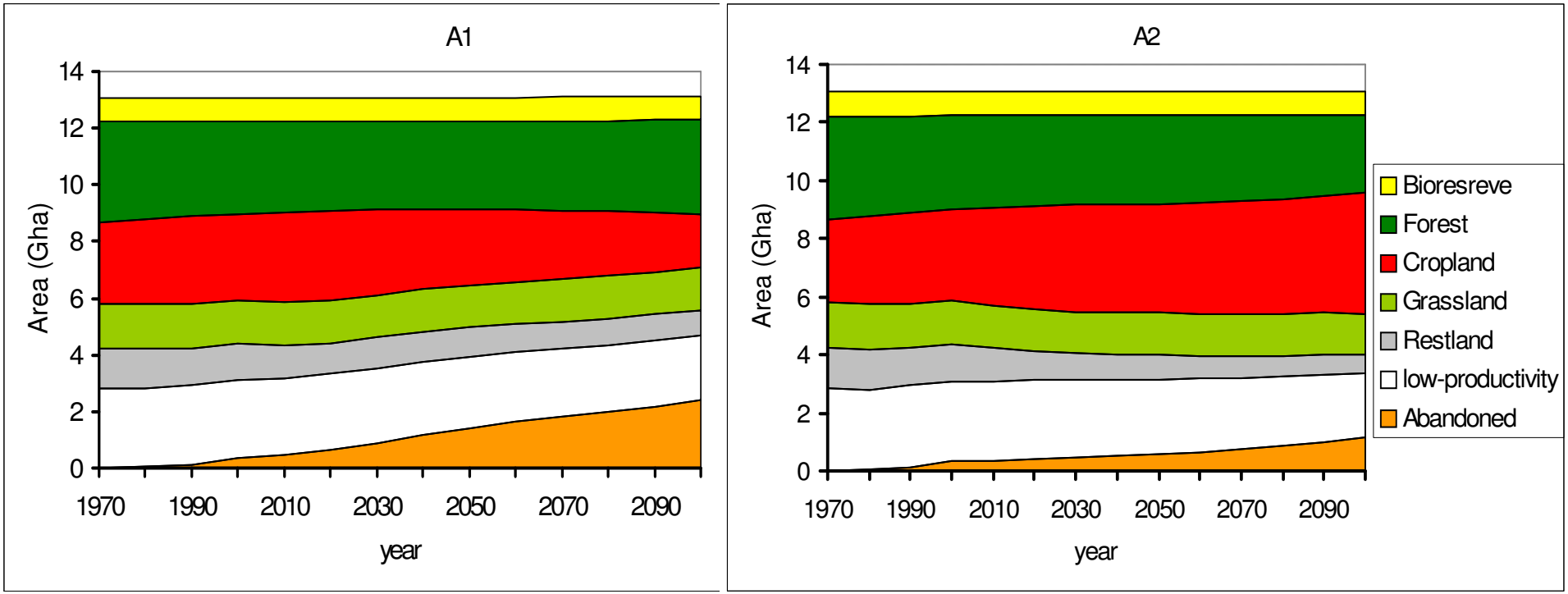


Source: Hoogwijk, Faaij 2005

Potential land-use pattern changes



[Hoogwijk, Faaij et al., 2005]

Perennial crops (vs. annual crops)

- Lower costs (< 2 €/GJ)
- Planted for 15-25 years
- Low(er) intensity
  - Can restore soil carbon and structure
  - Suited for marginal/degraded lands
  - Requires less inputs (well below key threshold values)
- Earlier development stage
  - Large scale and diverse experience needed
  - Learning curve to be exploited
- Wide portfolio of species
  - Possibilities for enhancing (bio-) diversity
  - Adaptable to local circumstances (water, indigenous species)
  - Improvement potential

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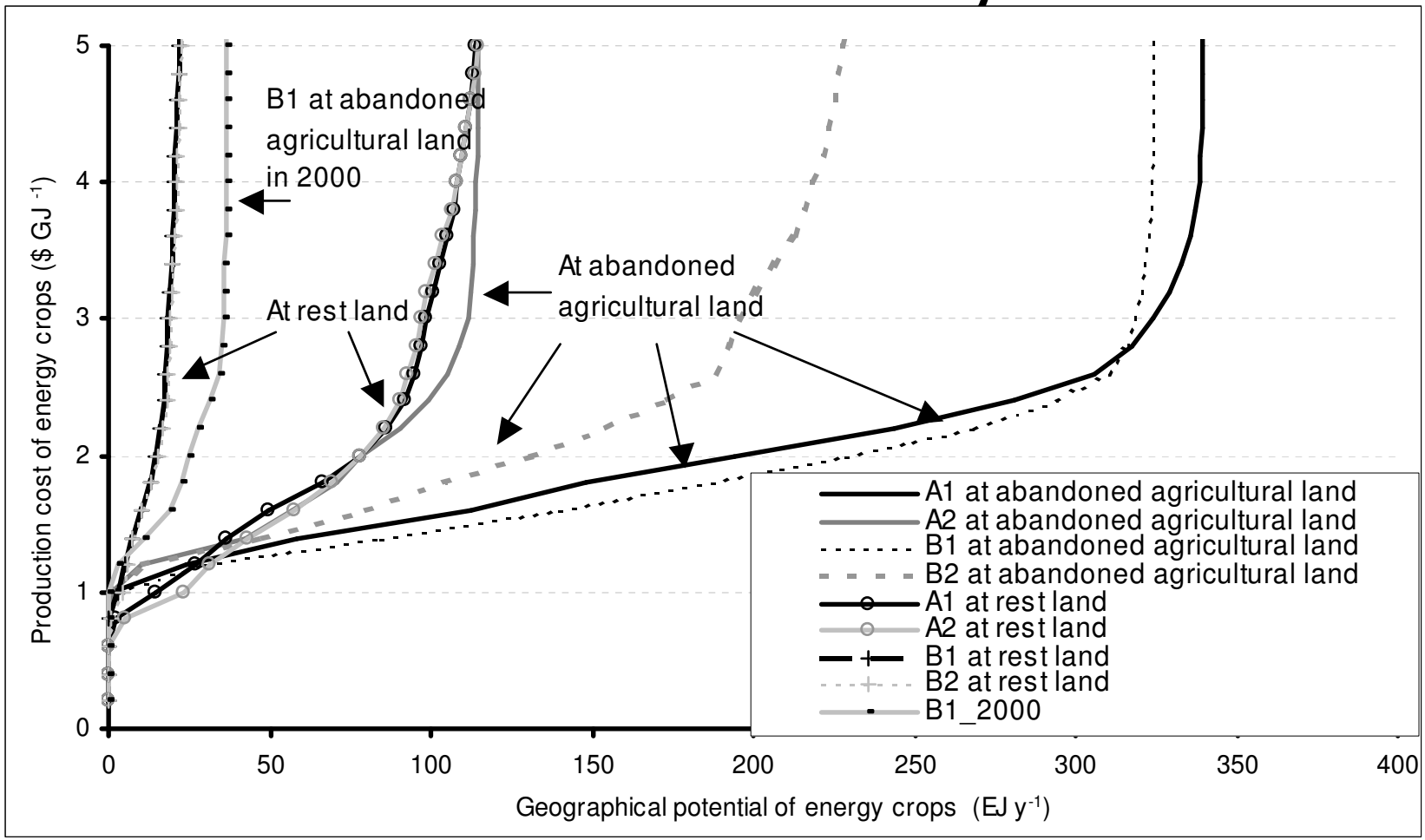
Global cost-supply curve for energy crops for four scenarios for the year 2050



Source: Hoogwijk, Faaij, 2004

Overall picture 2050

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Biomass category	**Main assumptions and remarks**	**Potential bio-energy supply up to 2050.**
Agricultural land	Potential land surplus: 0-4 Gha (more average: 1-2 Gha).	0 – 700 EJ (average: 100 – 300 EJ)
Marginal lands.	On a global scale a maximum land surface of 1.7 Gha could be involved.	(0) 60 – 150 EJ
Residues agriculture	Estimates from various studies	15 – 70 EJ
Forest residues	Low value: figure for sustainable forest management. High value: technical potential. Figures include processing residues.	(0) 30 - 150 EJ
Dung	Use of dried dung. Low estimate based on global current use. High estimate: technical potential.	(0) 5 – 55 EJ
Organic wastes	Figures include the organic fraction of MSW and waste wood. Higher values possible by more intensive use of bio-materials.	5 – 50 (+) EJ
Total	Most pessimistic scenario: no land available for energy farming; only utilisation of residues. Most optimistic scenario: intensive agriculture concentrated on the better quality soils.	**40 – 1100 EJ** **(250 - 500 EJ)**

Uncertainties and key issues

- Water resources
- Management of biodiversity
- Interaction with conventional markets (food, forestry).
- Proper GHG accounting and land-use management.
- Balanced economic development (macro & micro scale).

Cramer Cie.: minimum safeguard-> stabilisation-> improvement…

1. **GHG balance** -> Chain performance (30-80%+..)
2. **Land-use/competition with food**: reporting; to be developed.
3. **Biodiversity** -> reporting/FSC/RSPO; to be developed.
4. **Wellfare** -> Reporting EPI; to be developed further.
5. **Well being** -> ILO, Social accountability standards, etc.
6. **Environment**
   - Waste; law, GPG's
   - Agrochemicals; law, GPG's (further development).
   - Soil quality; reporting/monitoring (further development).
   - Water quality & quantity; law, reporting/monitoring (further development).

Operationalisation of sustainability criteria

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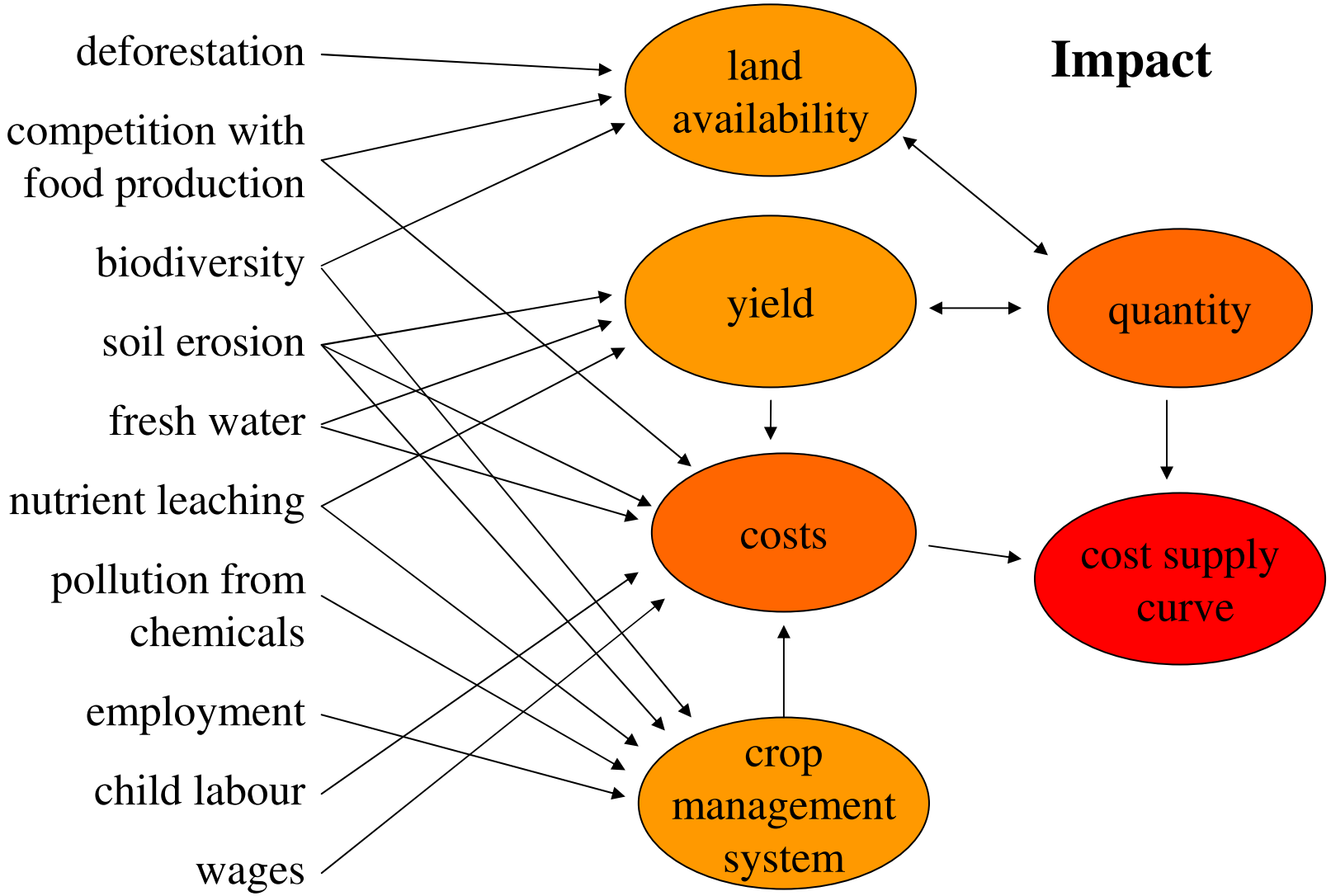
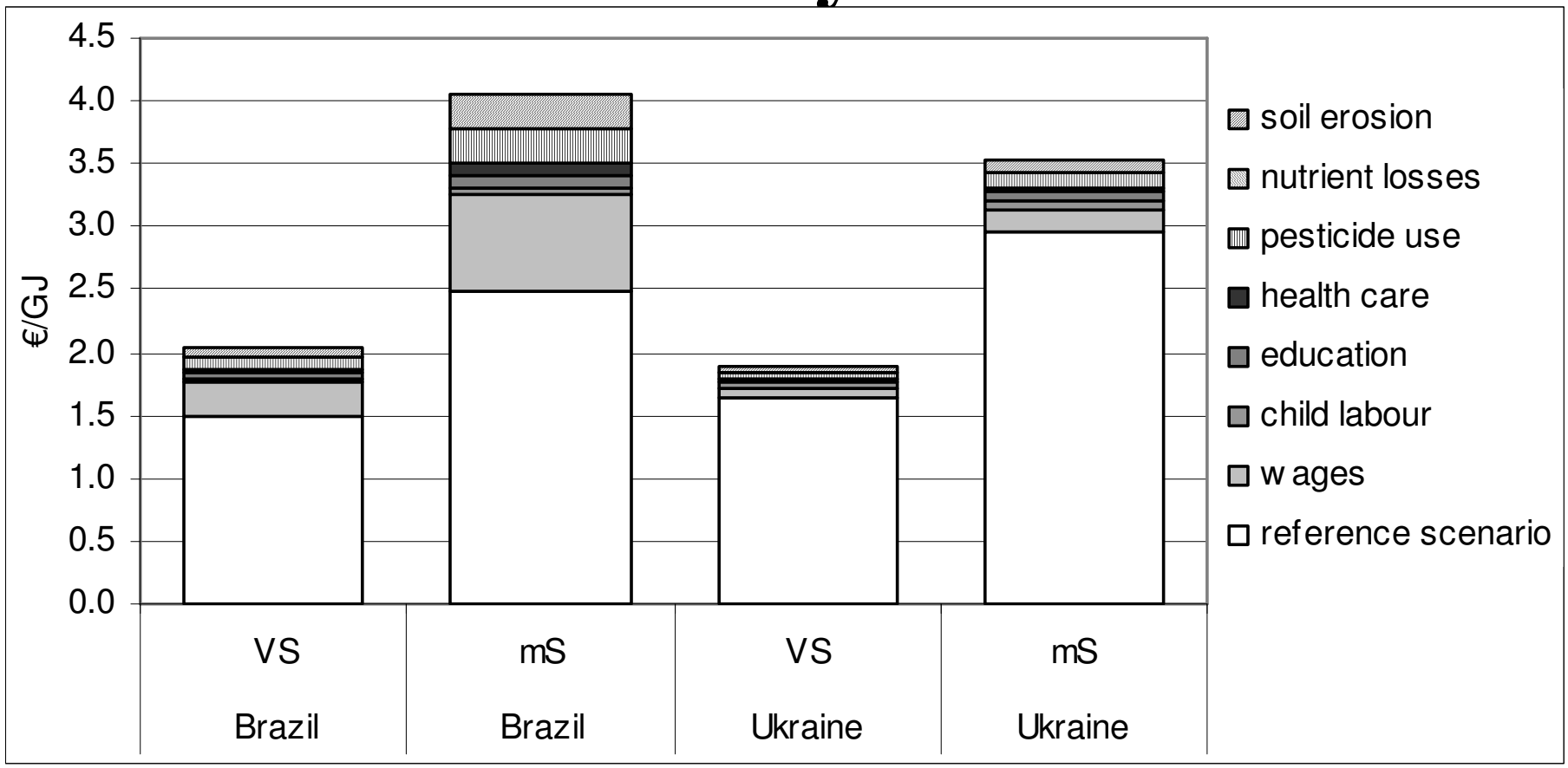


[Smeets et al., 2005]

Indicative cost impacts of applying sustainability criteria…



[Smeets et al., 2005]

Ethanol in Brazil; the costs of compliance with various sustainability criteria compared to the reference situation

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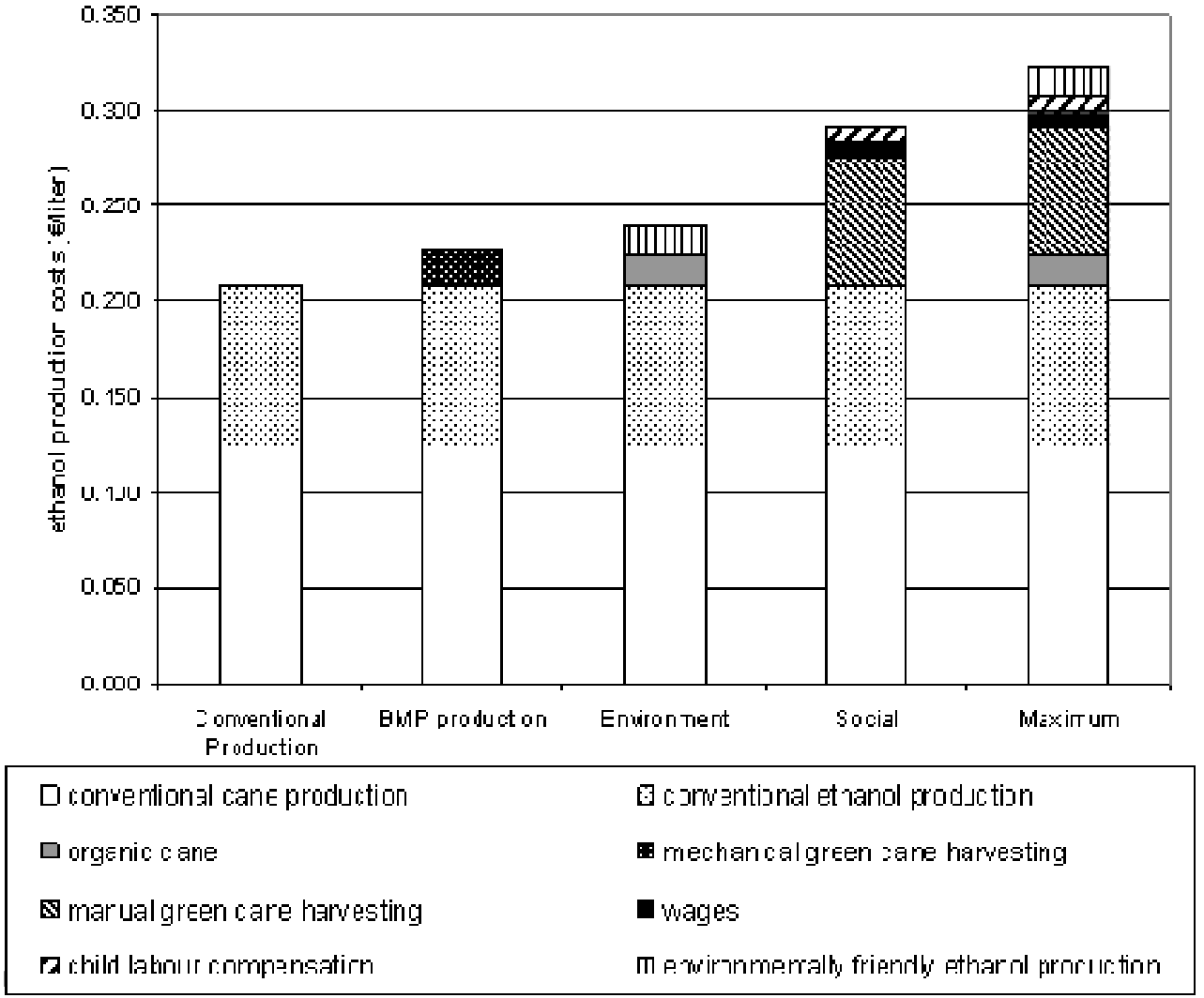
Smeets,
Junginger,
Faaij,
Walter,
Dolzan, 2006



Bioenergy halfway this century…

- 100 EJ from forest & Ag. residues & organic wastes
- 100 EJ from restoration schemes degraded lands
- 200 EJ from good quality land released due to higher efficiency in agriculture (DC's, Eastern Europe…)

Bioenergy halfway this century…

- ~ 400 EJ is an expected 1/3 of the world's future energy needs; the key alternative for mineral oil!
- Represents 1-3 TRILLION U$ market value worldwide; larger than agriculture…
- Involves some 10% of the worlds land surface / one fifth of agricultural/pasture lands.

The key linkages…

- Agriculture key for bio-energy…
- Bio-energy could be the key lever for rural development.
- Bio-energy is increasingly propelled by sound economics; market almost unlimited (and uncontrolled)
- Sustainability to be secured in a global setting.

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Closing remarks (I)

- Sustainable biomass production achieving multiple benefits is possible (but needs frameworks and good governance).
- Diversity in ecological and socio-economic conditions to be recognized (asking for regional approaches in a global setting; stakeholder approaches seem best model).
- Sense of urgency is needed; market forces are already steering development of international bio-energy markets.

Closing remarks (II)

- Flagship projects (to demonstrate multiple benefits and framework(s) under different conditions)
- Promising future; but policy needs to choose and coordinate (agriculture, trade, climate, energy and development are interlinked here).
- Strong need for international collaboration.

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What I did **NOT** say:

- Biomass potentials are a given (1000 EJ +)
- Biomass is always good.
- Developing biomass potentials is easy.
- Biomass monocultures are great.
- All questions are solved.

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What you **may** conclude:

- Biomass resource (and land) base much more diverse than agricultural crops (and land) alone.
- Biomass cultivation schemes (with perennials) *can* offer substantial ecological and socio-economic benefits.
- In large parts of the world, more efficient agriculture is desirable for sustainable development *as such*.
- Biomass production to be seen as a wide portfolio of possible cultivation & supply systems.
- This option/pathway is too important to be discarded; rare link between rural development issues, GHG control and energy security on a global scale.

IEA Task 40

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- **Members:** Netherlands (T.L.; Copernicus & Essent), Sweden, Norway, Brazil, Finland, Canada, UK, Belgium; Germany.

Expected: EC, other EU, Japan, Australia…

- **Affiliated international bodies**
  - FAO, World Bank; (collaboration with UNCTAD, UNEP, OECD, WEF, WWF)

www.bioenergytrade.org:

- Detailed activities
- Results (e.g. country reports, analyses)
- Events
- Partner for collaboration