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Global Outlook on Biomass Supplies: Potentials, Markets and Securing Sustainability.

Emerging Industrial Technology
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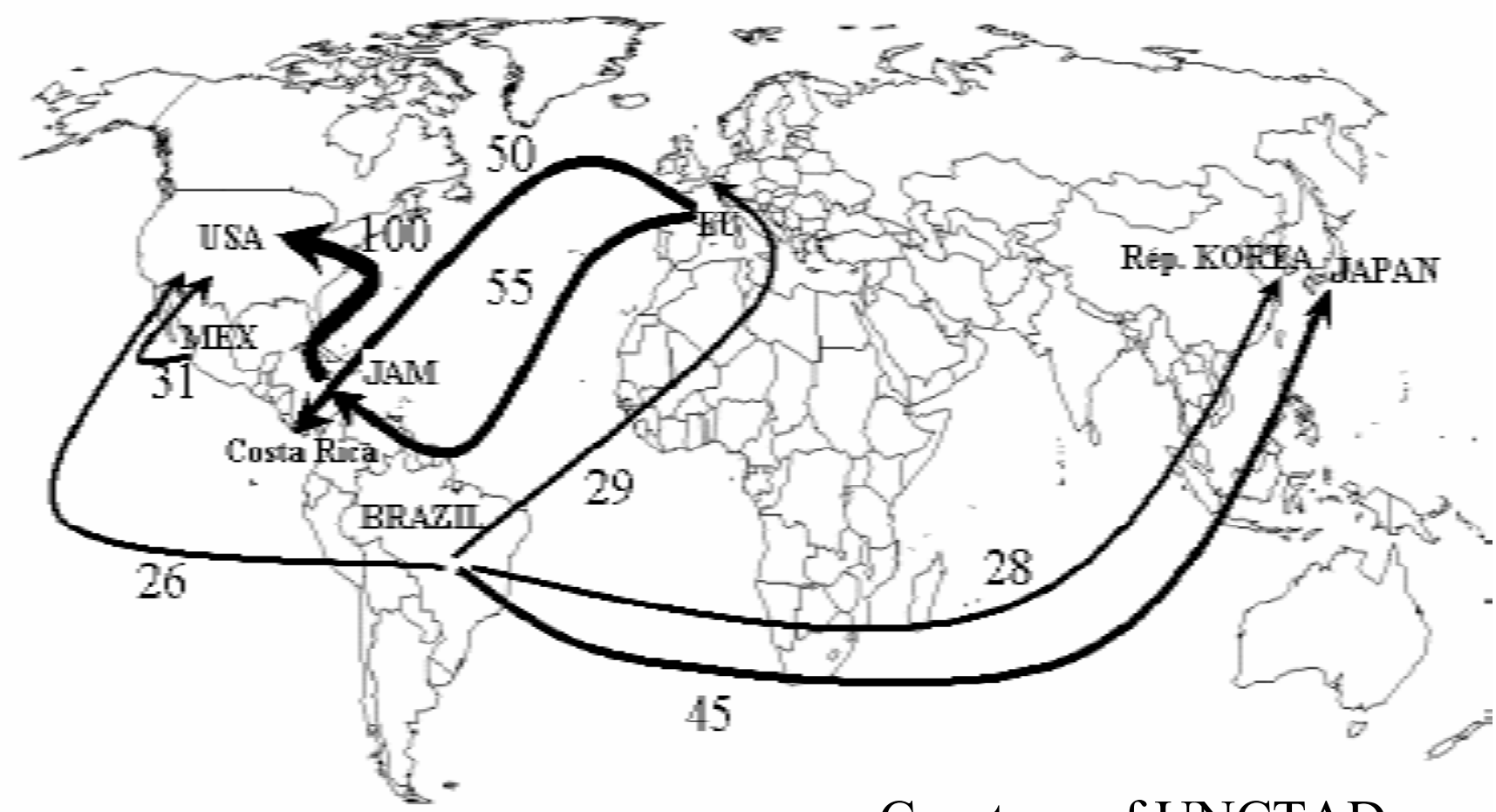
International bio-energy markets developing fast…

- 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

Bio-ethanol flows 2000 (kton)



Courtesy of UNCTAD

Traded: 3 billion litres
Global production: 32 billion litres

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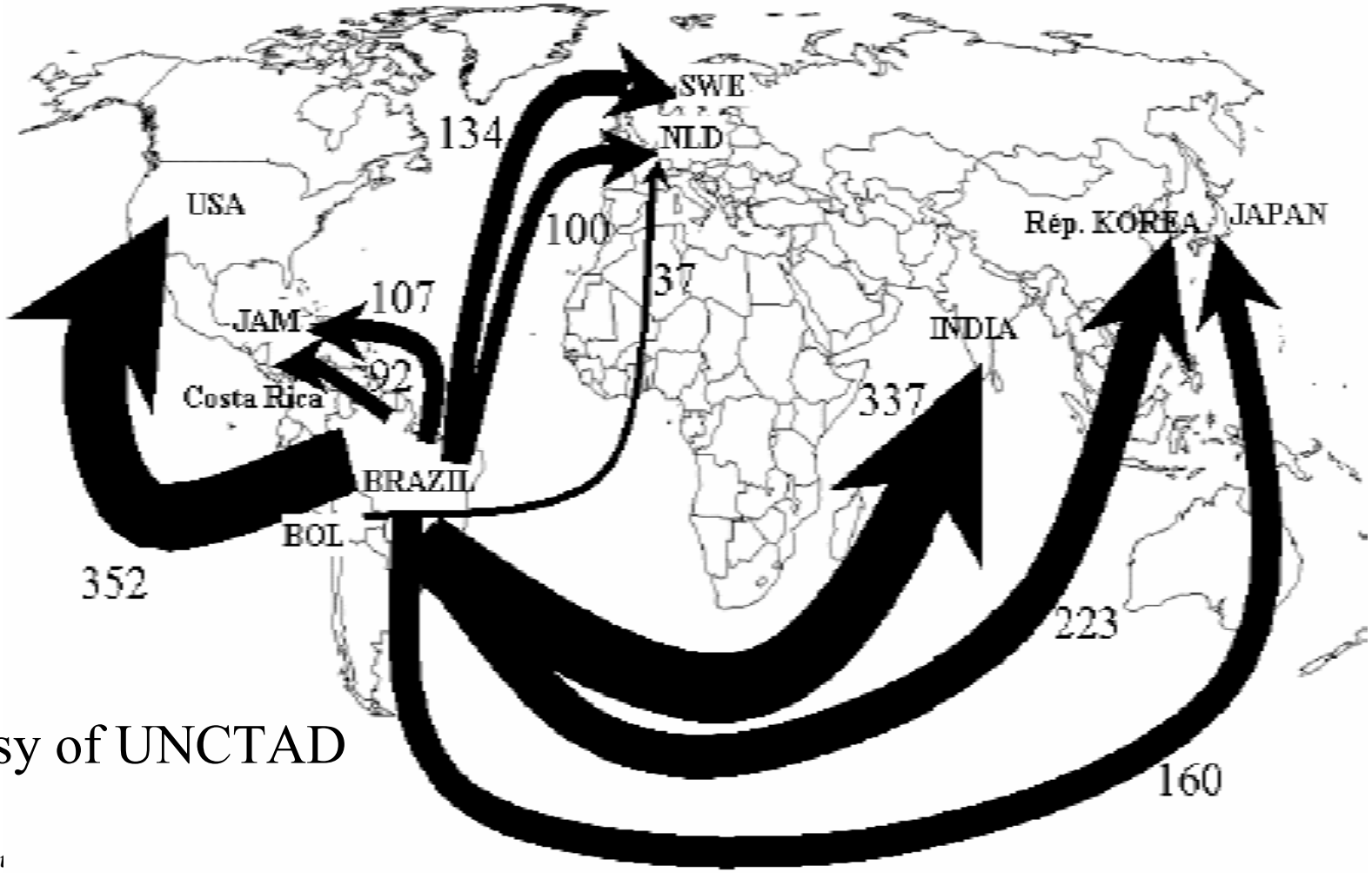
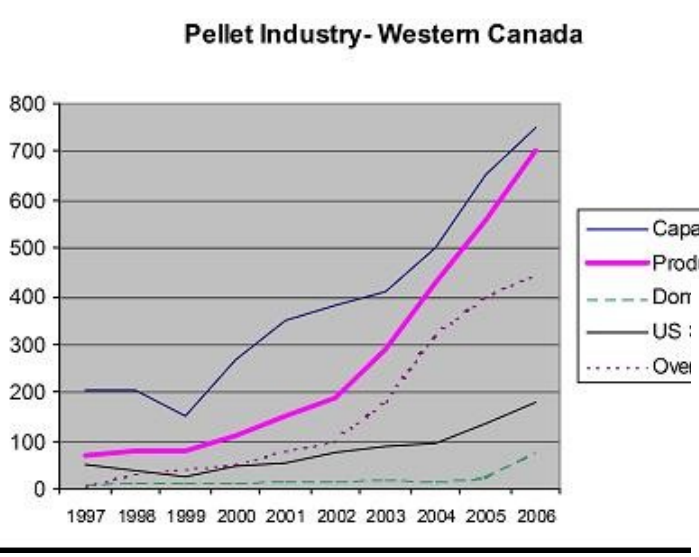
Bio-ethanol flows 2004 (kton)

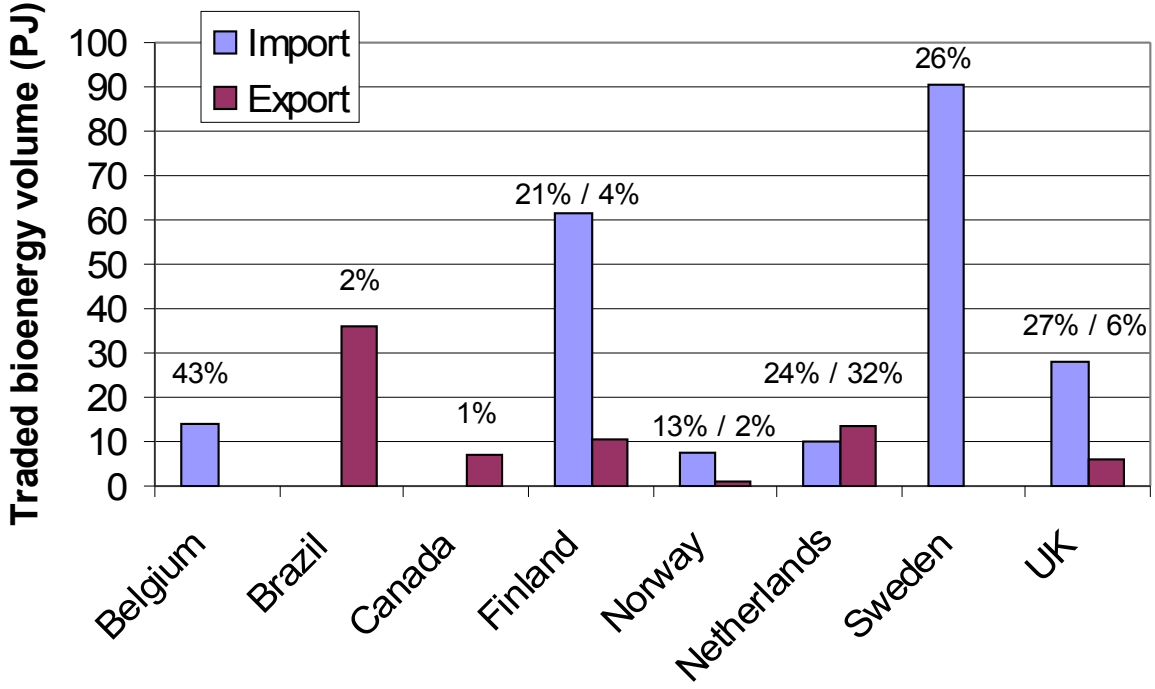


Courtesy of UNCTAD

More trade developments



Bradley, 2006



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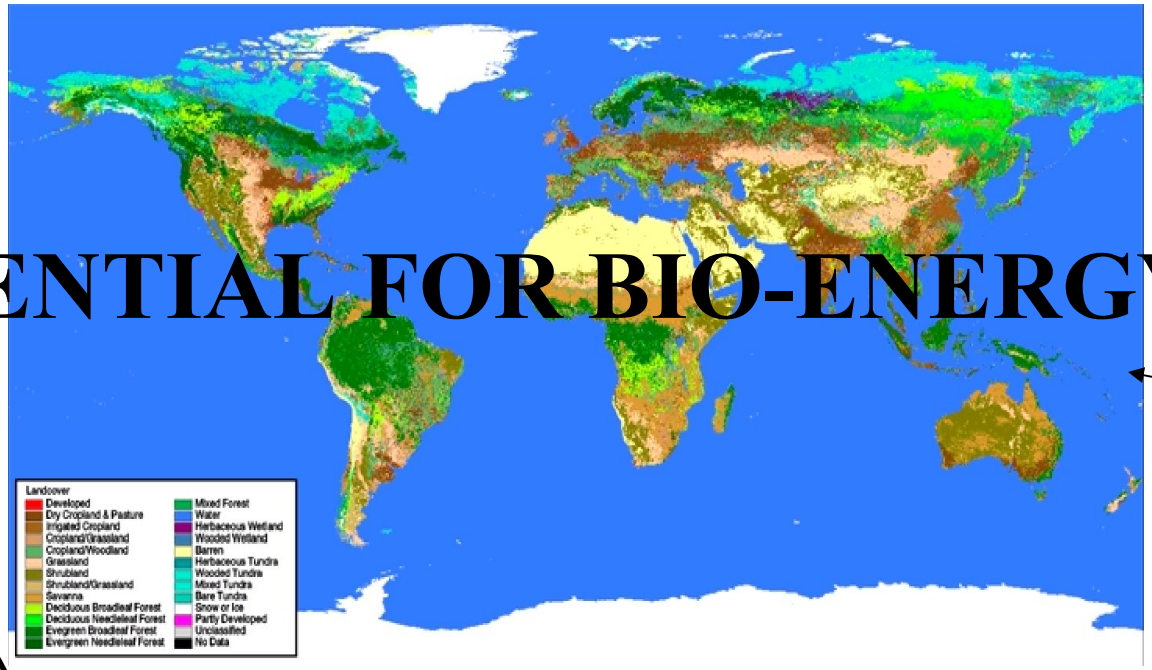
population

energy consumption

trade

future land use patterns

biotechnology



POTENTIAL FOR BIO-ENERGY?

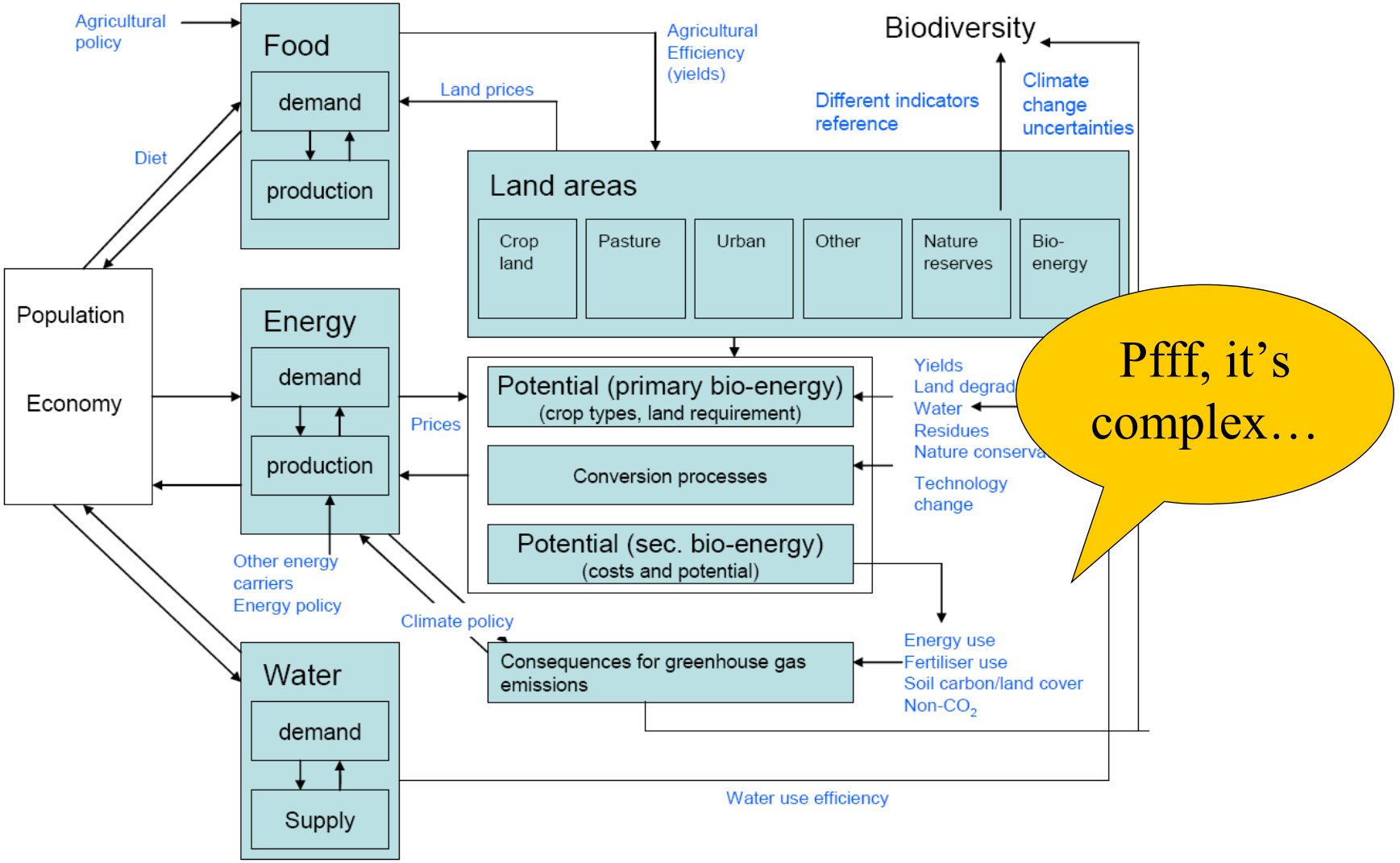
GDP

agricultural system irrigation, breeding, mechanization, chemicals

land productivity

agricultural policy

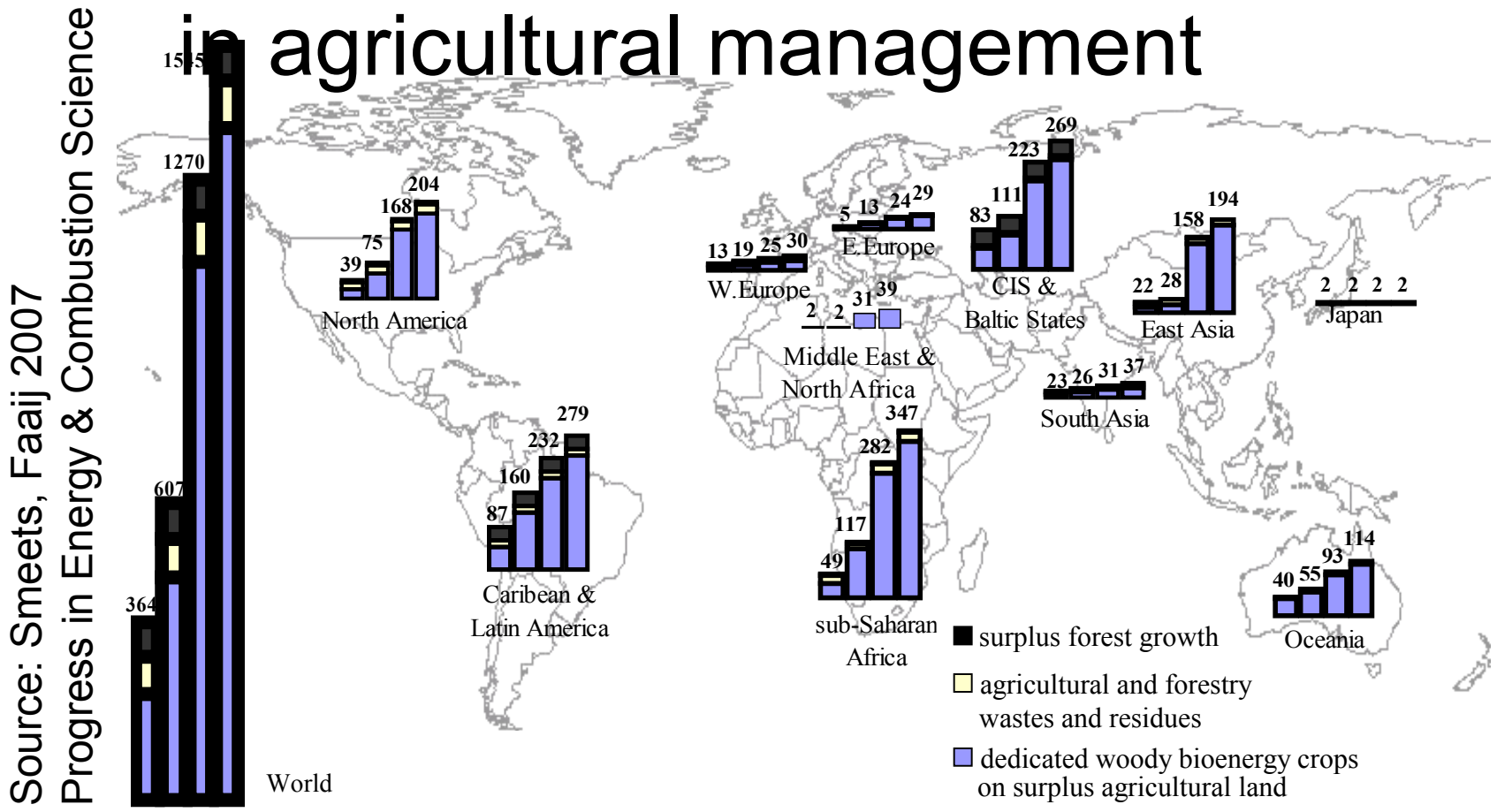
Integration…



Global land surface and main land use categories

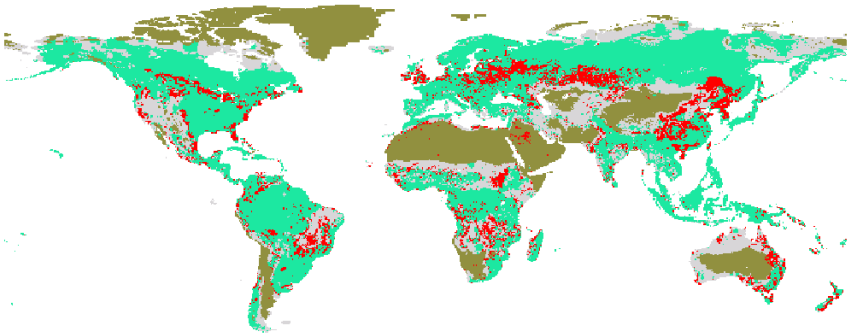
Land use category	(Gha)	Remarks
Agriculture	1,5	Includes grassland for intensive cattle farming
Pastures/grassland	3,5	More extensively managed
Forest	4,0	Includes natural – production forest
Inproductive	4,2	Includes (semi-)deserts, mountainous terrain and built-on areas.
Total	**13,2**	**Global land-surface (excludes large ice sheets).**

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

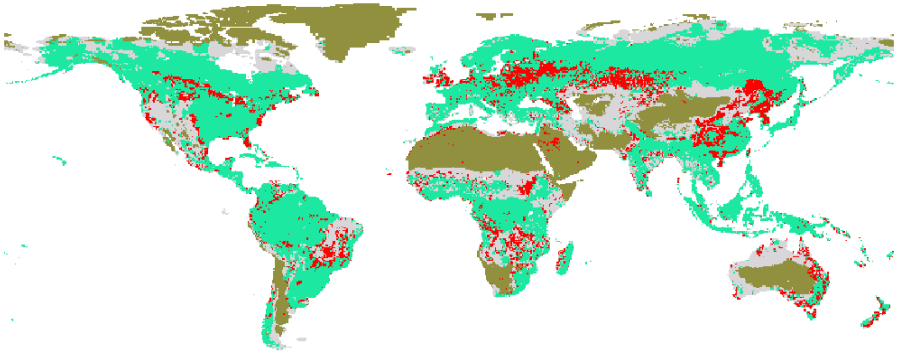


Total bioenergy production potential in 2050 based on system 1 to 4 (EJy^{-1}; the left bar is system 1, the right bar is system 4

B1 2050



A1 2050

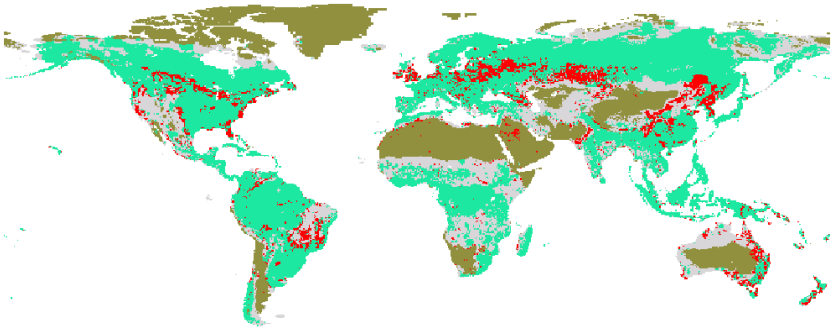


rest land
Abandoned cropland
low-productive Land
Other

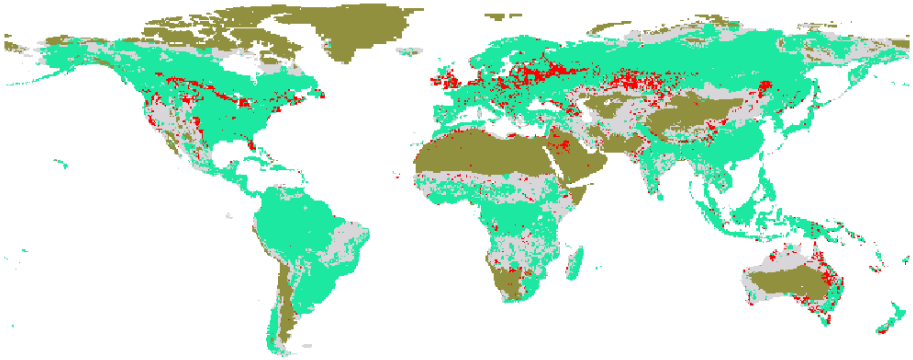
Integrated assessment modelling results (IMAGE)

rest land
Abandoned cropland
low-productive Land
Other

B2 2050



A2 2050



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Source: Hoogwijk, Faaij 2005

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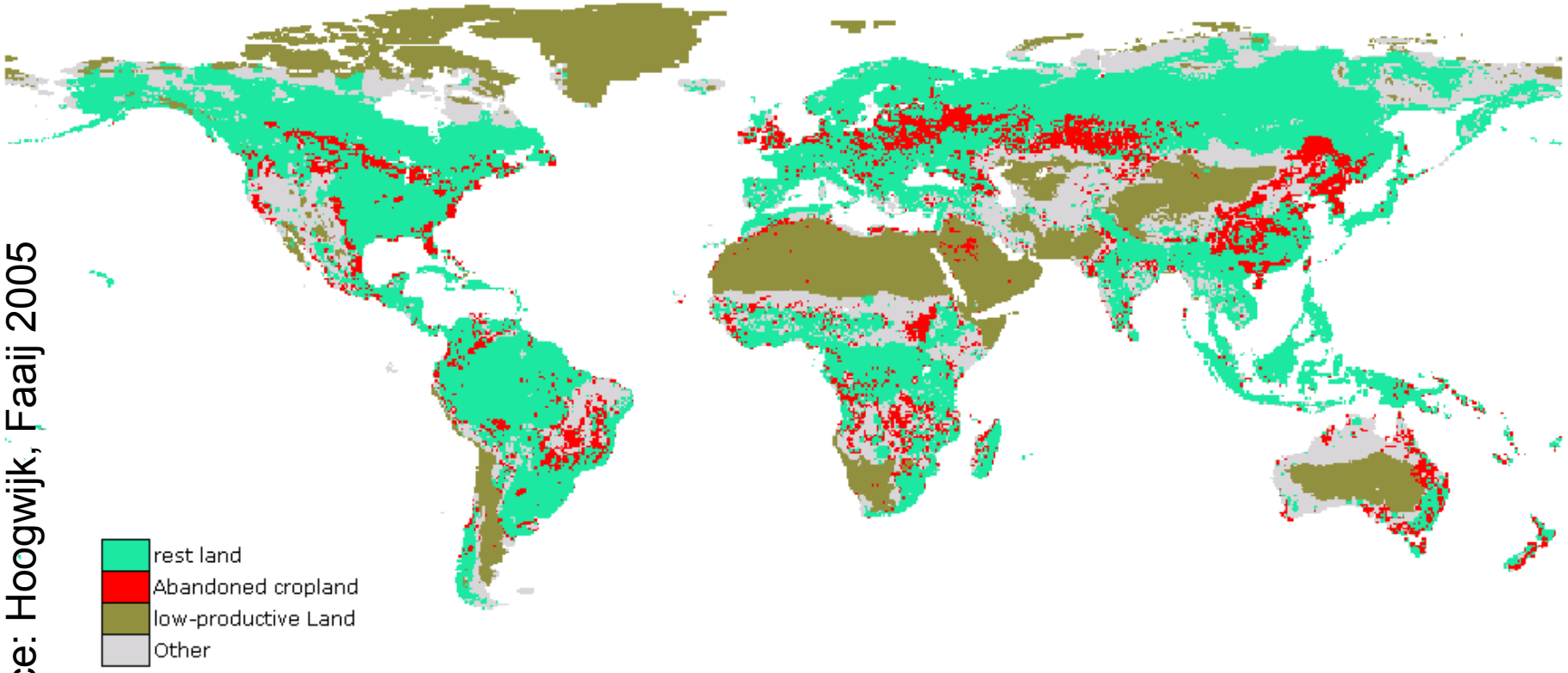
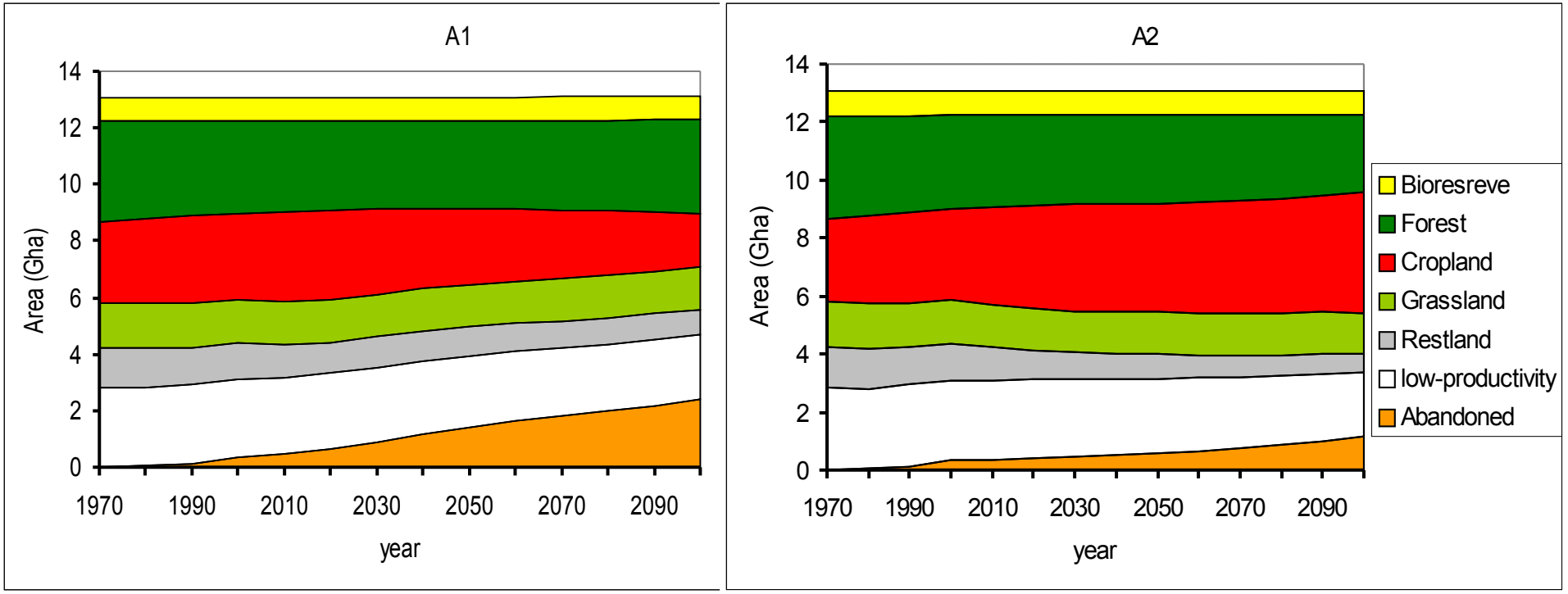


Source: Hoogwijk, Faaij 2005

Potential land-use pattern changes



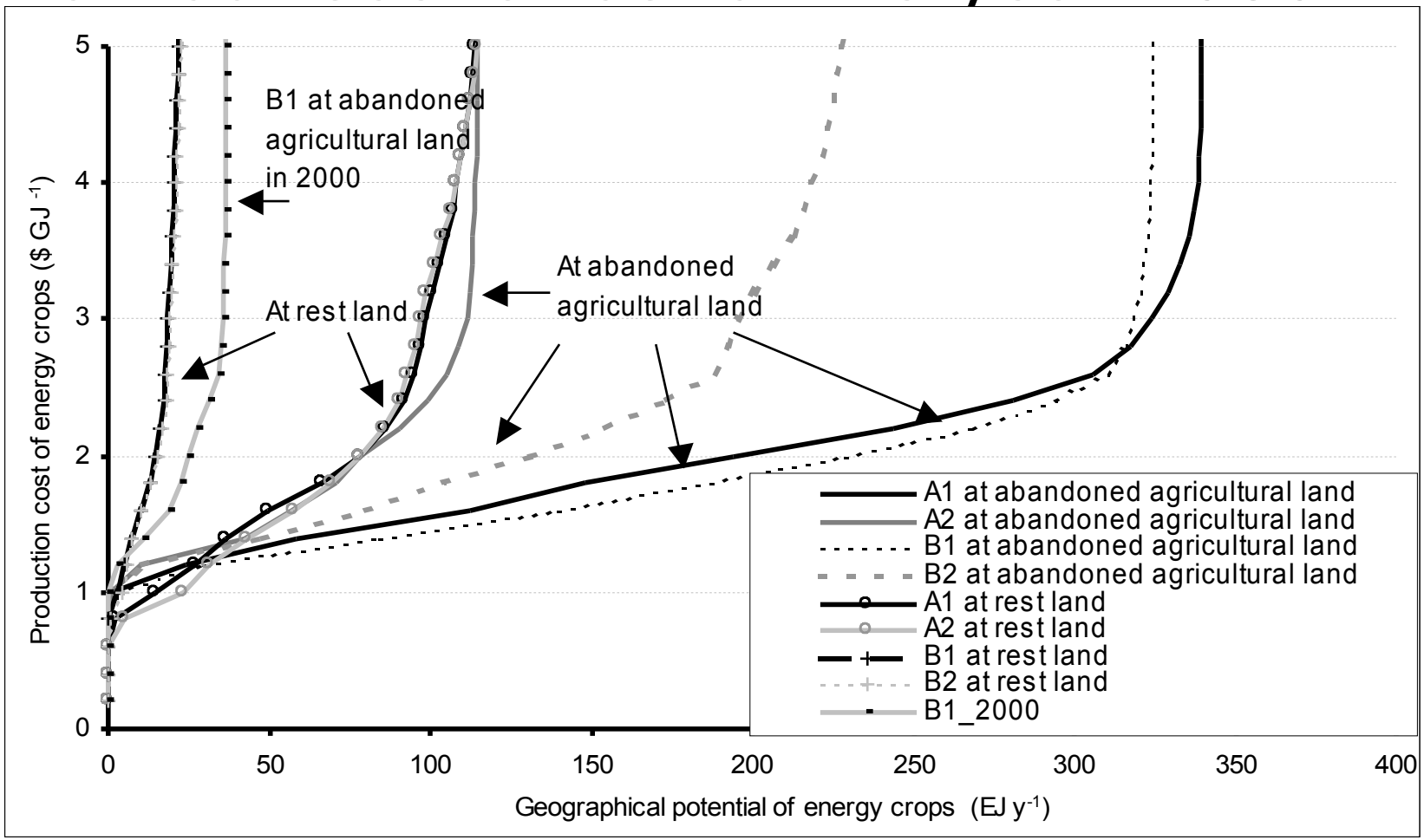
[Hoogwijk, Faaij et al., Biomass & Bioenergy, 2005]

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

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

Source: Hoogwijk, Faaij, B&B Forthcoming



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).

Initiatives on certification of biomass for energy

- Governments: UK, NL, D, B, and more EU nations...; EC.
- NGO's:
- International bodies: UNEP, UNCTAD, FAO,...
- Market initiatives/multistakeholder: roundtables on palm, soy and biofuels, GGL, Electricity,...

IEA Task 40 Van Dam et al., 2007; Biomass & Bioenergy, Forthcoming:

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

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

Potential barriers and boundary conditions

- Sense of urgency – international trade is growing fast
- But, with too many initiatives on varies levels, a danger of fragmentation and incompatible certification systems exists – prevent proliferation of standards
- Stakeholder involvement in producing countries often neglected, especially smallholders

Potential barriers and boundary conditions

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- Compliance with WTO rules and international treaties
- some sustainability criteria may actually conflict with each other
- additional costs of meeting the sustainability criteria (and cost of certification) will have to be evaluated
- Inclusion of not enough/soft criteria will result in "greenwashing" (fear of NGO's)
- Inclusion of too many criteria will may in fact create new market barriers (fear of industry)
- Monitoring of compliance crucial, otherwise the "cheaters" may win (fear of

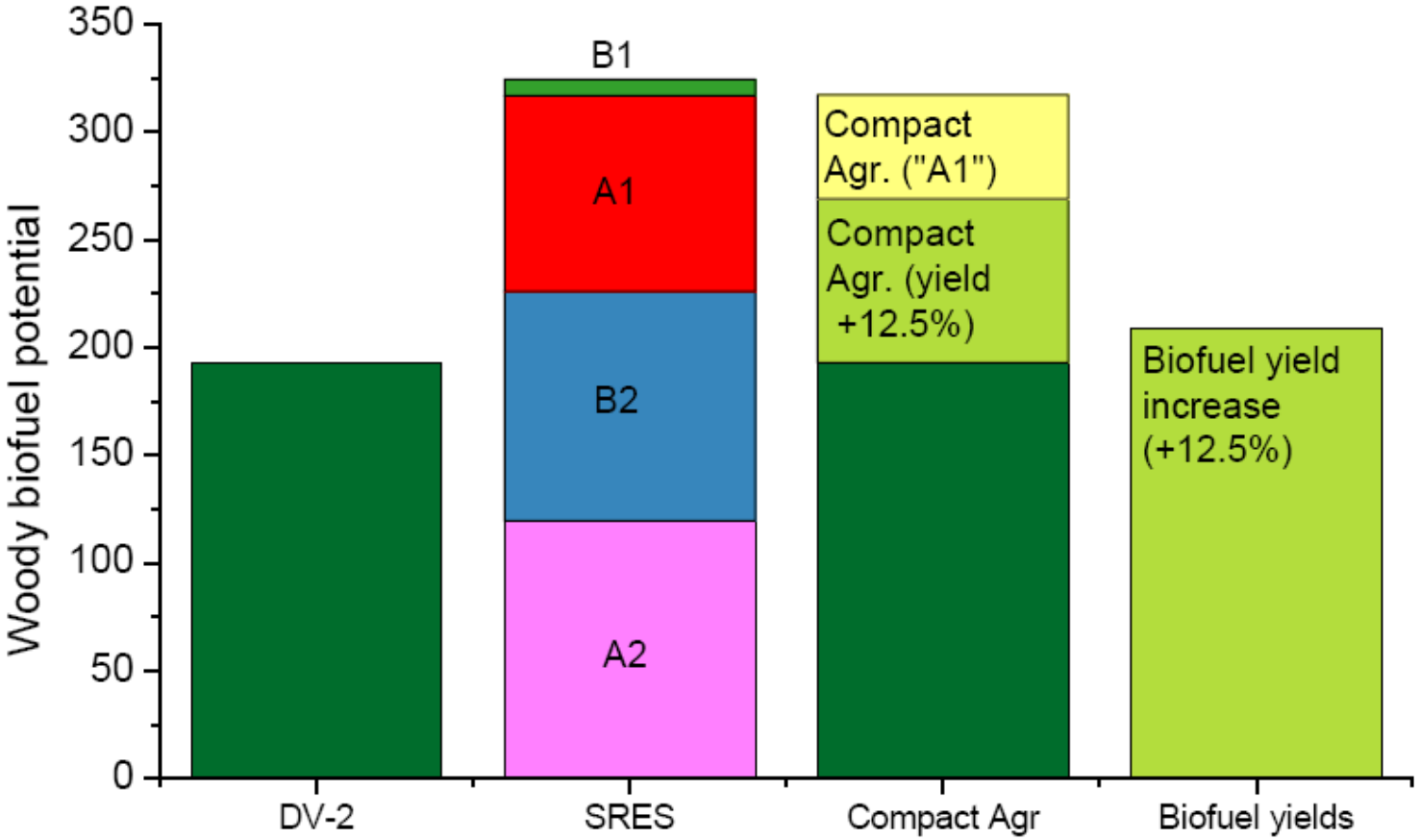
Water

- Many (potentially) stressed areas
- Assessment on watershed level needed

Biodiversity

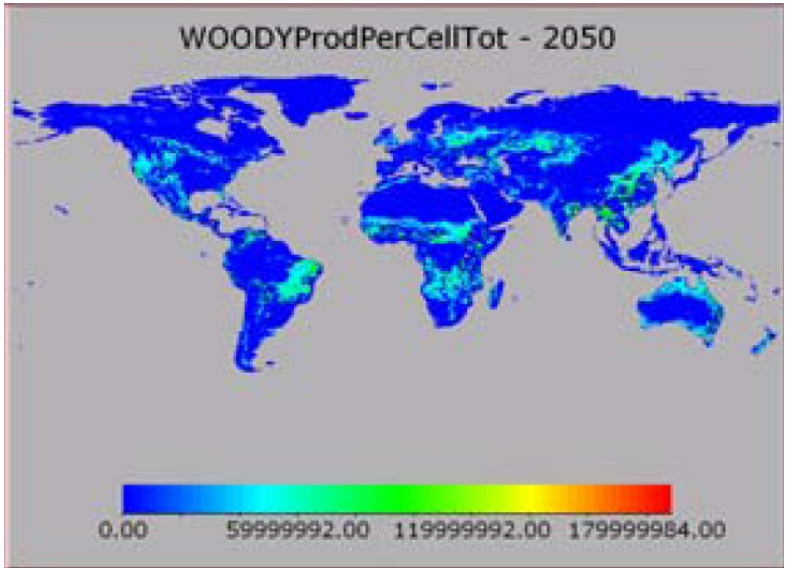
- Lack of clear indicators
- Impacts of bioenergy vary
- Differences in time horizons
- Difference 1st - 2nd generation biofuel crops

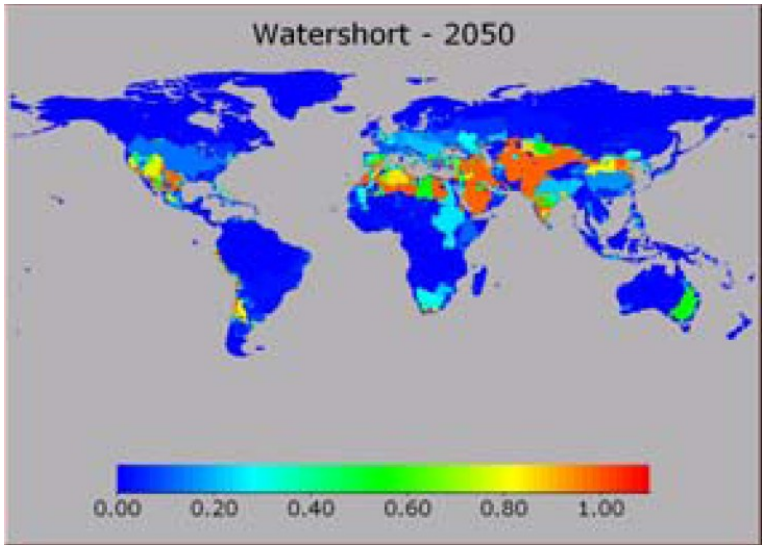
Limitations in potentials: agri yields

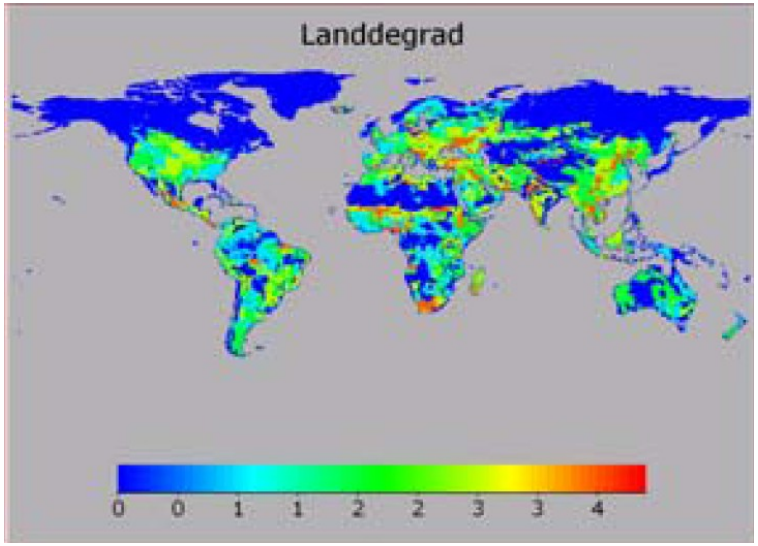


Compact food production >Biomass yield increase

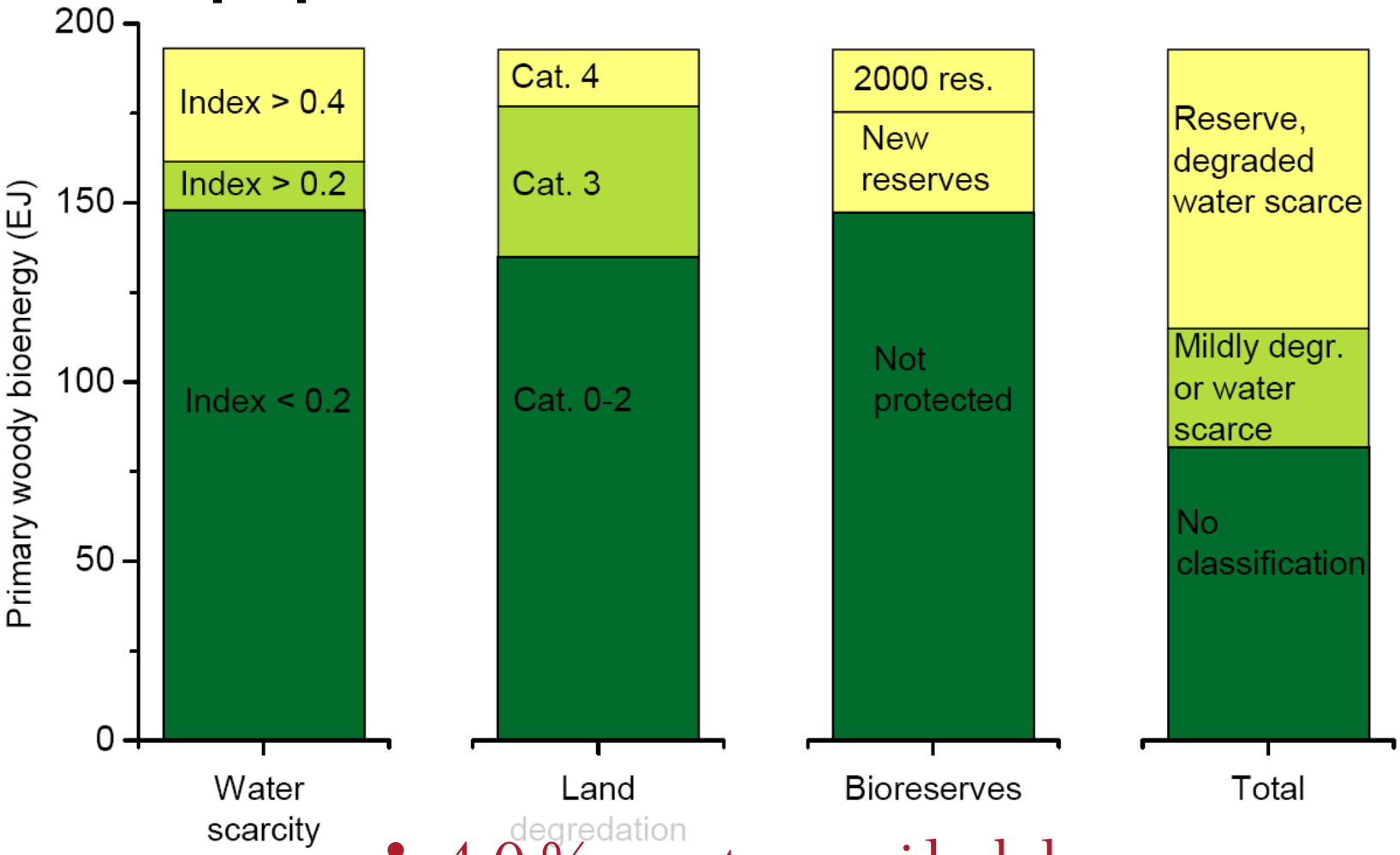
Limitations in soil and water







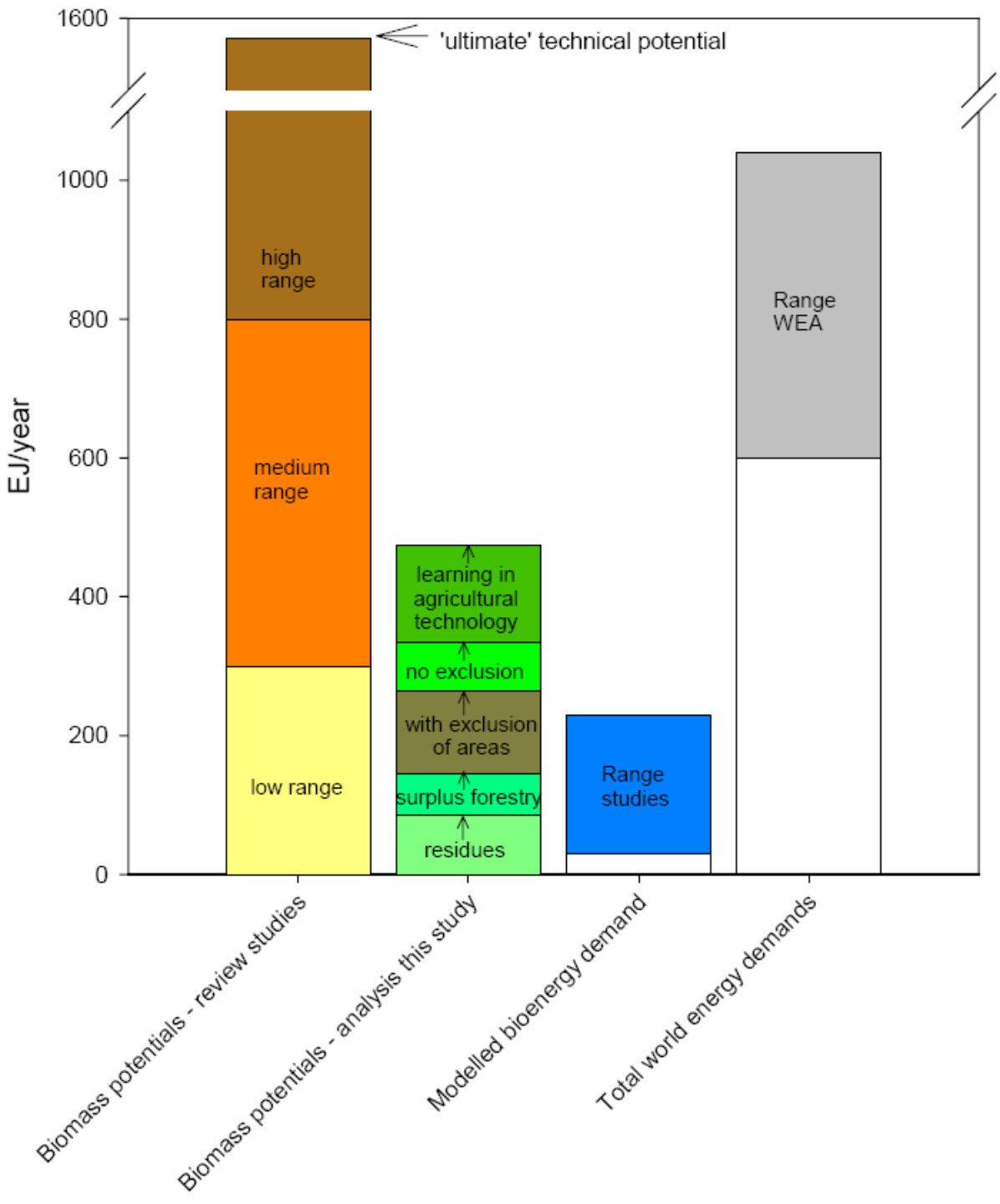
Impacts on (woody) crop potentials



- 40% not available
- 20%: less useful or more

Overall Picture

Yes, biomass can play a significant role in future energy supply



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.

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.

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

Closing remarks (III)

- Flagship projects (to demonstrate multiple benefits and framework(s) under different conditions; solid fuels… multiple markets with international focus…
- Promising future; but policy needs to choose and coordinate (agriculture, trade, climate, energy and development are interlinked here).
- Strong need for international collaboration and action: harmonization on certification, market development & trade, investment in DC's…