ICTSD

International Centre for Trade and Sustainable Development

Trade and Biofuels
Opportunities and Challenges

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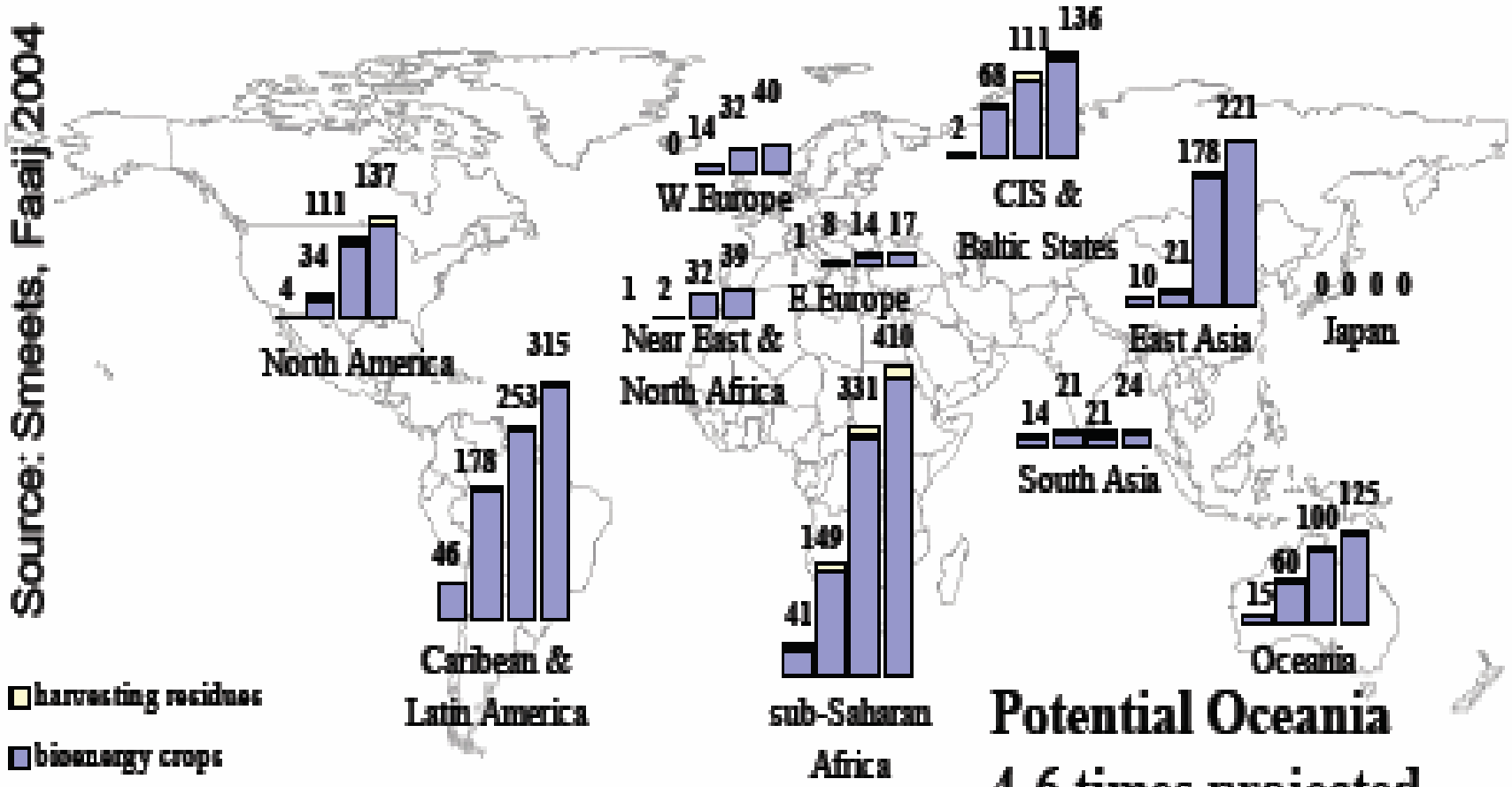
Biofuels: Import Substitution and Expert Potential

- 38 out of 47 of the world's poorest countries are net oil importers, and 25 of these import all of their oil.
- Many of these countries are well-positioned to grow highly productive energy crops.

Bioenergy Production Potential in 2050 for Different Levels of Change in Agricultural Management



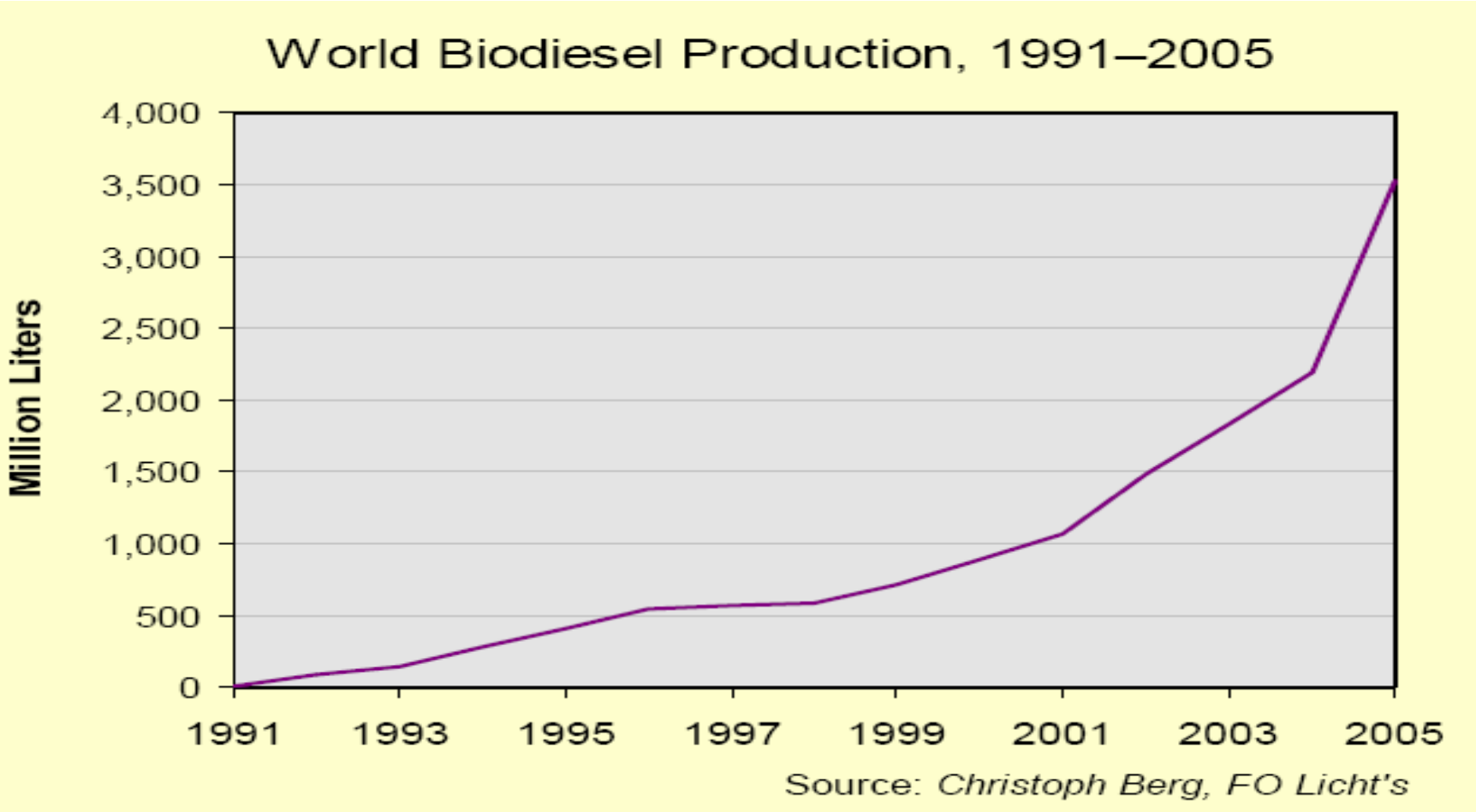
Potential Oceania

4-6 times projected primary energy use

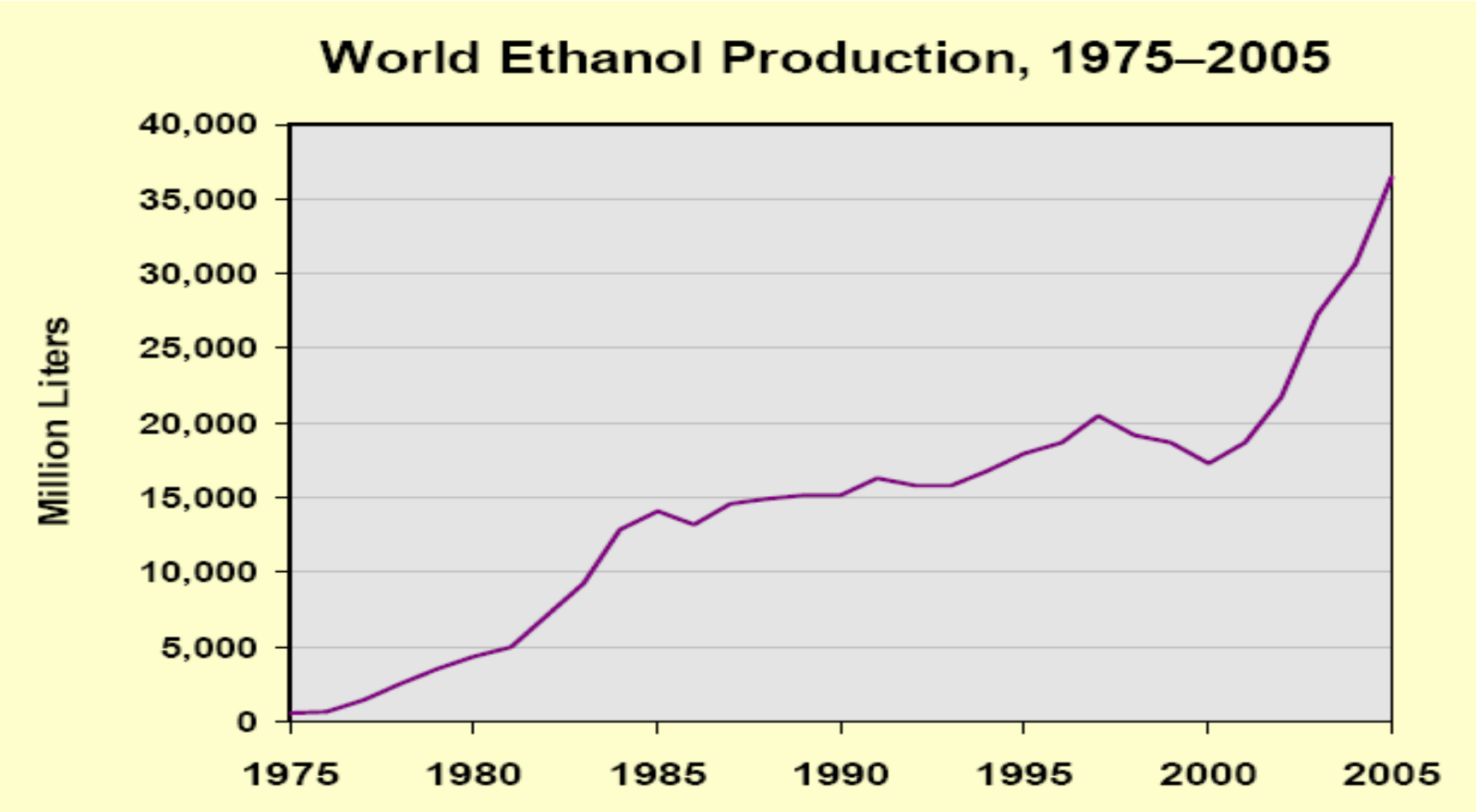
Copernicus Institute
Sustainable Development and Innovation Management

1. The Trade Potential

Growth in Biodiesel Production



Growth in Ethanol Production



Biofuel Demand from Major Export Markets

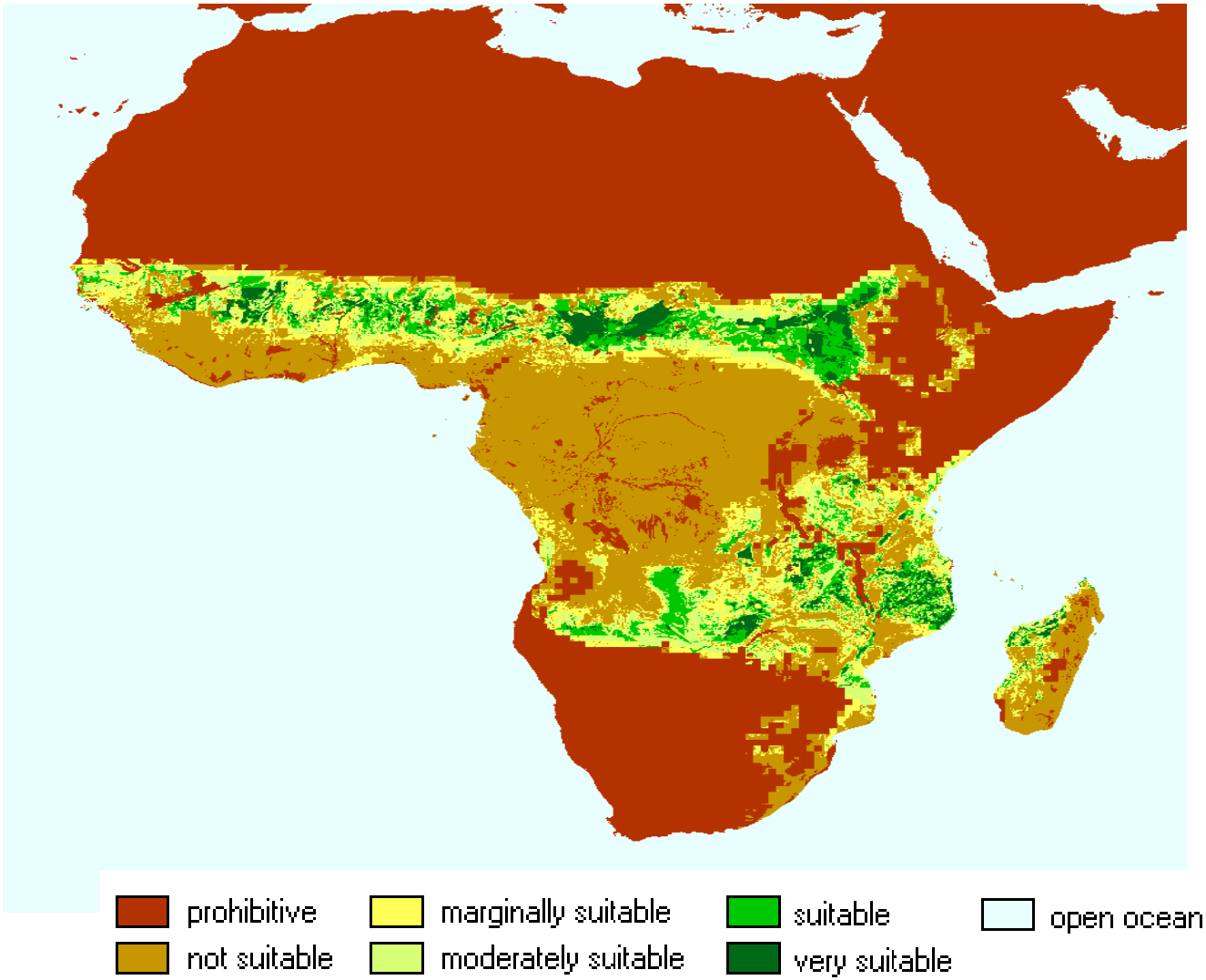
EU import requirements:

- Bioethanol: EU production not cost-competitive with sugar cane based ethanol (2010 cost of € 900 / Toe vs € 680 /Toe cheapest import source). Without import duties, 100% EU ethanol market supplied by imports.

- Biodiesel: without barriers of standards, about 50% of EU biodiesel market could be supplied by imports (mainly for feedstocks to EU industry).

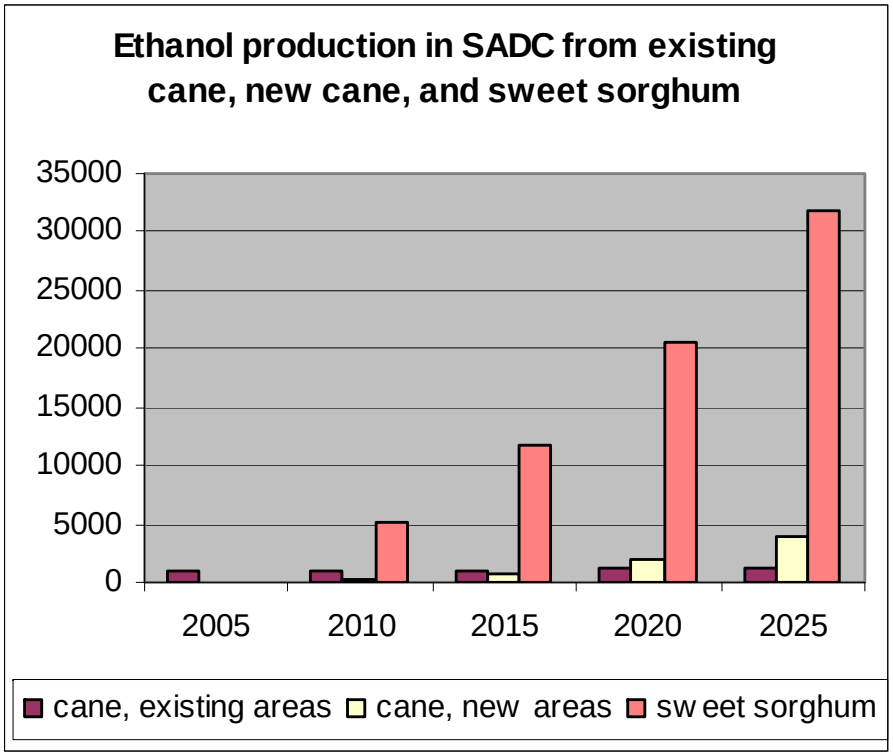
- In total: about 70% of EU biofuels market would be supplied by imports (Van Houtte, European Commission, DG Development, 2006)

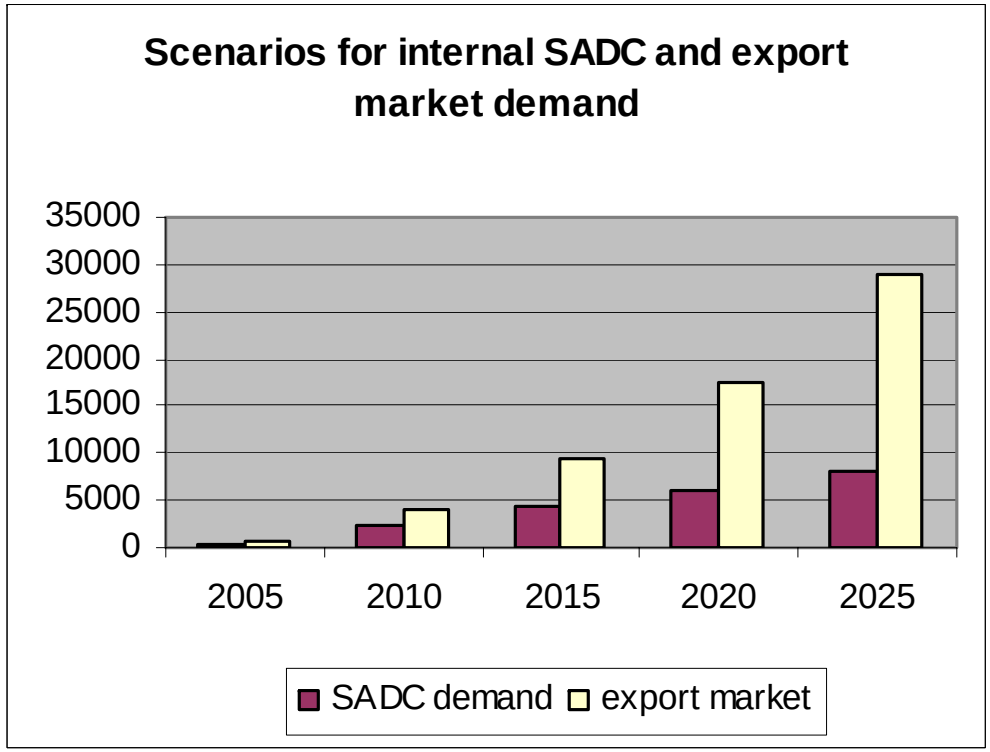
Land Suitability for High Input Levels: Sweet Sorghum Production in Africa



Source: FAO, in Johnson et al., 2006

Scenarios for SADC Ethanol Supply and Demand





Source: Johnson et al. 2006

Potential Supply for Export (million litres)

YEAR	2005	2010	2015	*2020*	*2025*	*Average Annual Increase*
Scenarios for ethanol production in SADC	939	6443	13787	23650	36996	20,16%
SADC petrol demand - projections (energy basis)	203	2475	4315	6155	8195	20,30%
assumed % ethanol:	***1%***	***10%***	***15%***	***20%***	***25%***	
Remaining allocation for export market	**736**	**3968**	**9472**	**17495**	**28801**	**20,12%**
relative to demand in other regions (volume basis)						
China	1%	4%	9%	15%	21%	
Japan	1%	7%	16%	29%	48%	
United States	0%	1%	2%	3%	4%	
EU15	0%	2%	6%	10%	16%	
Sources: demand projections from IEA 2005, U.S.DOE/EIA 2005						

Domestic regulatory frameworks: Biofuels Mandatory Blending

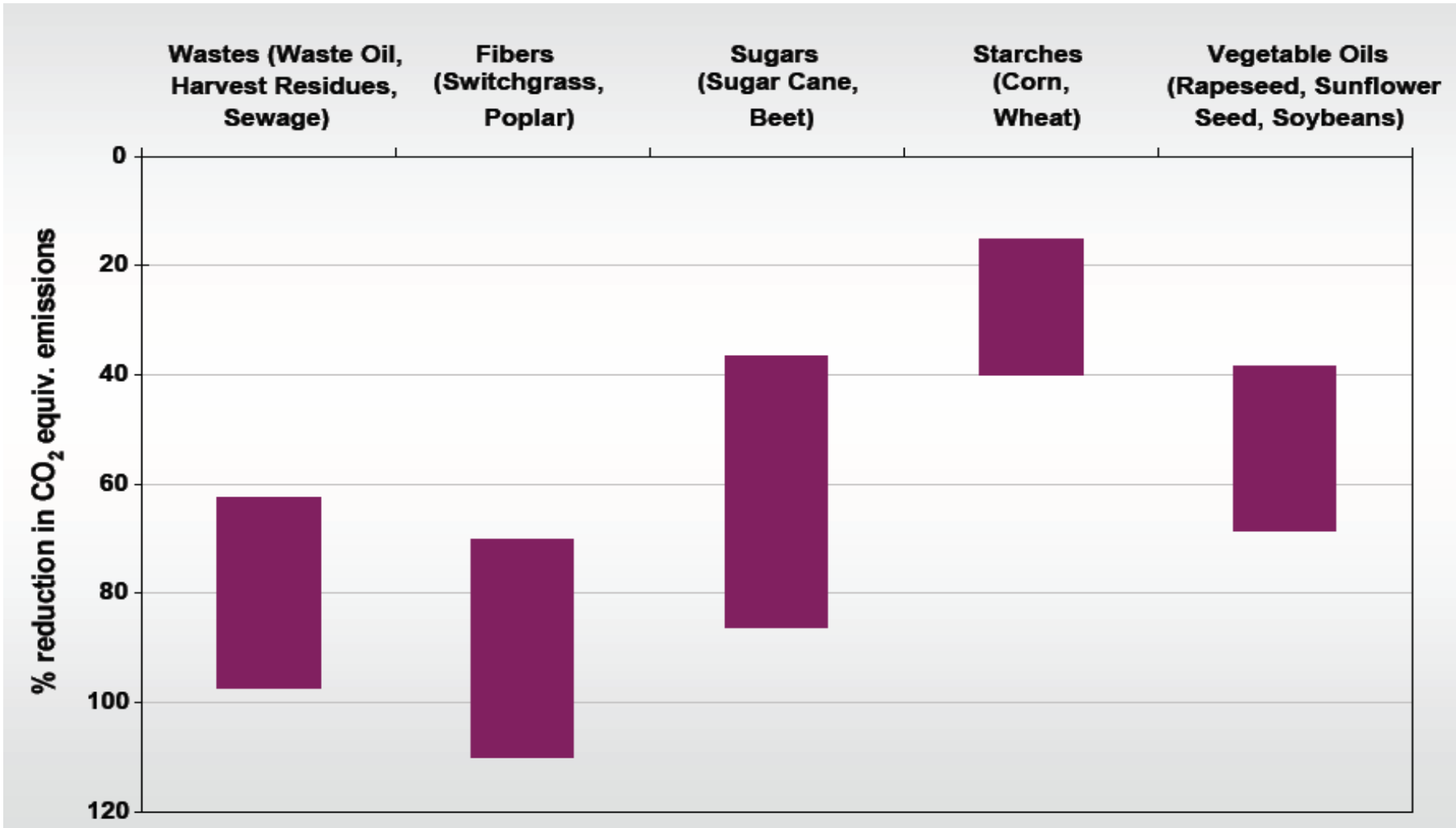
- **US:** 2005 Renewable Fuels Standard (RFS) requiring the use of 28.4 billion liters (7.5 billion gallons) of biofuels for transportation by 2012.
- **Brazil:** all diesel fuel must contain 2% biodiesel by 2008, increasing to 5%by 2013
- **Columbia** mandates the use of 10% ethanol in all gasoline sold in cities with populations exceeding 500,000
- **EU:** goal of obtaining 5.75% of transportation fuel needs from biofuels by 2010 in all member states. February 2006, the EU adopted an ambitious *Strategy for Biofuels* with a range of potential market-based, legislative, and research measures to increase the production and use of biofuels.
- **Japan:** long-term intention of replacing 20% oil demand with biofuels or gas-to-liquid (GTL) fuels by 2030.
- In **Canada**, the government aims for 45 percent of the country's gasoline consumption to contain 10 percent ethanol by 2010.
- **Thailand** has mandated an ambitious 10 percent ethanol mix in gasoline starting in 2007.
- **China** is making E10 blends mandatory in five provinces that account for 16% of national passenger cars.
- Several African countries including **Ethiopia**, **Ghana**, **Kenya**, **Malawi**, **Nigeria**, **Senegal**, **South Africa**, and **Zimbabwe plan** to expand biofuels production and use (Worldwatch 2006)

2. Climate Change and Sustainable Development Benefits

Biofuels and GHG Emissions

- Transportation accounts for about one-quarter of energy-related GHG emissions.
- Potential to reduce GHG emissions by more than 100% depending on feedstock choice, land use changes, feedstock production system, and the type of processing energy used:
  - **Fibers (e.g. switchgrass): 70–110 %**
  - **Wastes (e.g. waste oil): 65–100 %**
  - **Sugars (e.g. sugar cane): 40–90 %**
  - **Vegetable oils (e.g. soybeans): 45–75 %**
  - **Starches (e.g. corn): 15–40 %**

GHG Reduction Potential of Biofuels



IEA 2005

Energy Balance Positive, But Potential Depends on Crops

- Both corn grain ethanol and soybean biodiesel produce more energy than is needed to grow the crops and convert them into biofuels.
  - Soybean biodiesel returns 93% more energy than is used to produce it.
  - Corn grain ethanol currently provides only 25% more energy (Hill, J. et al. 2006).

Biofuels and Employment Generation

- The World Bank reports that biofuel industries require about 100 times more workers per unit of energy produced than the fossil fuel industry.
- The ethanol industry is credited with providing half a million direct jobs in Brazil.
- Indonesia's biofuel sector already employs 1.5 million people (The Economist 2006).

3. Addressing Challenges

Many Environmental Concerns …

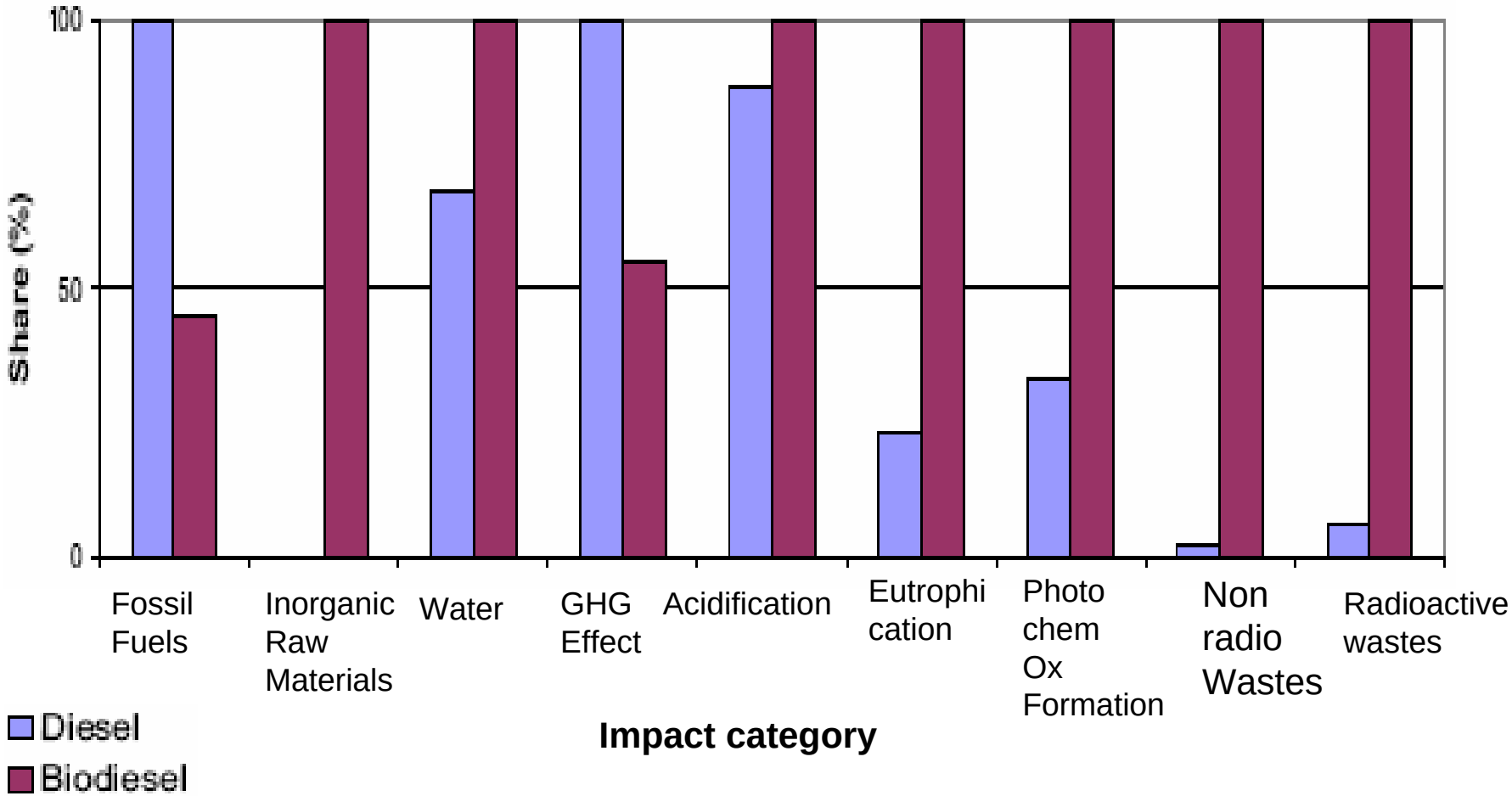
- Key environmental concerns in the production of biofuels:
  - Soil erosion
  - Water and air pollution
  - Chemical contaminants
  - Monoculture
  - Deforestation
- *U.S. corn production used in ethanol production causes more total soil erosion, uses more herbicides and insecticides and more nitrogen fertilizer, causing more water pollution than any other crop* (Pimentel, 2002).

… When Less Efficient Crops are Promoted

- Soybean biodiesel produces 41% less GHG emissions than diesel fuel whereas corn grain ethanol produces 12 % less GHG emissions than gasoline.

- Biodiesel (from soybeans) uses, per unit of energy gained, only 1% of the nitrogen, 8.3% of the phosphorus and 13% of the pesticide (by weight) of corn production (Hill, J. et al. 2006).

LCA Comparative Environmental Profiles of Diesel and Biodiesel

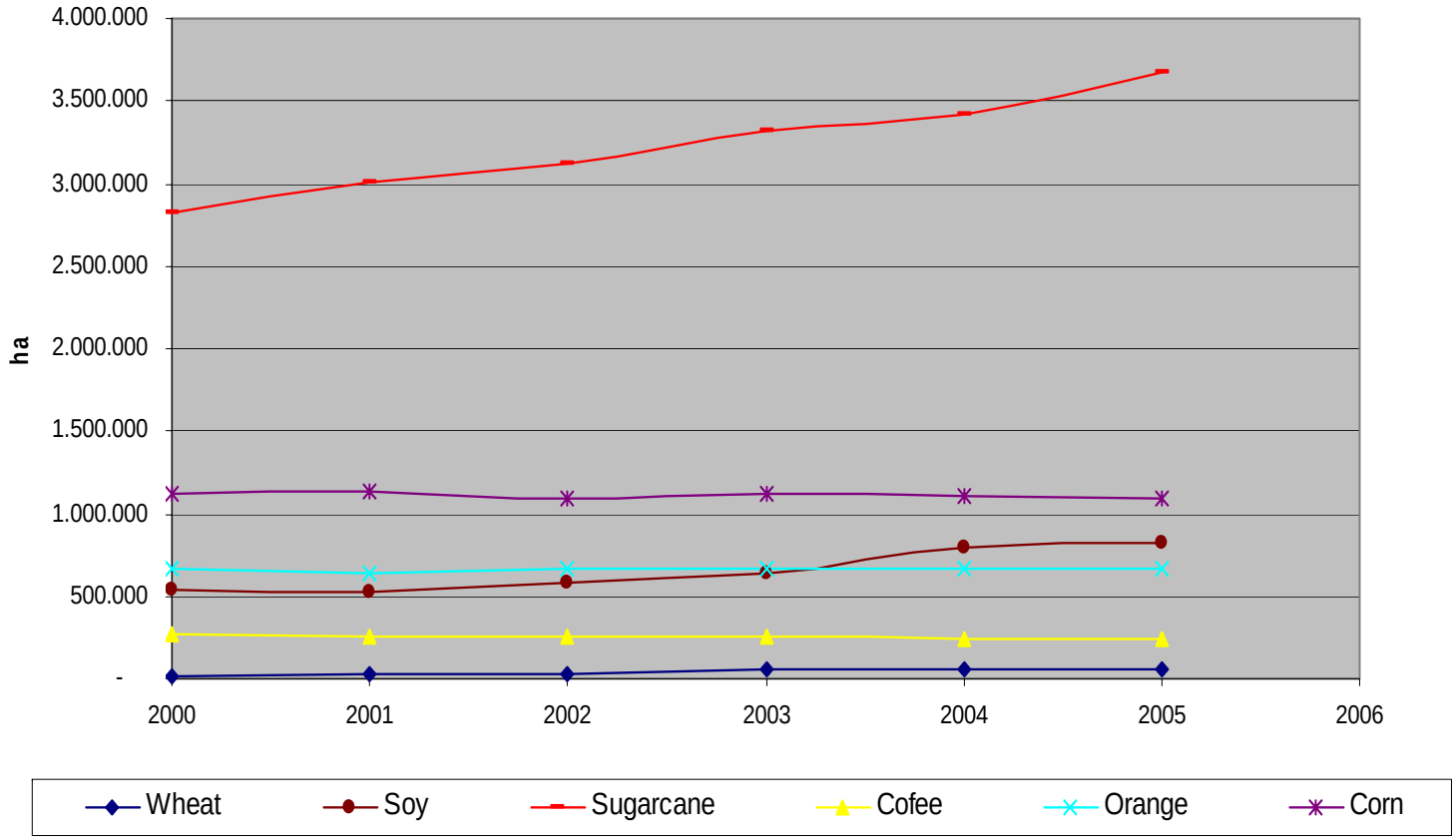


CEUTERICK, SPIRINKX, 1997, in Puppan 2002

Will the World Go Hungry?

- Cereal grains (including corn) make up 80% to 90% of the food of people worldwide.
- 826 million people are affected by malnutrition (WHO)
- With increasing demand for biofuels, there is a high risk that energy security could lead to food insecurity in net food importing countries.
  - Price of US corn increases from $2.40/bushel to $2.82/bushel when the RFS is doubled to 15 billion gallons (WRI, 2006).

Sugarcane vs Food Crops
Case of Sugarcane Expansion in São Paulo



Source: São Paulo State Agriculture Secretariat-Database (www.iea.sp.gov.br), In Coelho, 2006

Environmental and Social Balance of Biofuels

Positive	Negative
• Closed carbon cycle, reduced CO2 and GHG emissions • No sulfur content, SO2 emissions, very low NOx • Better energy balance • Biologically degradable • Revenue generation	• Fossil fuel input • Tendency towards monoculture • High use of fertilisers/ pesticides • Water/air pollution, soil erosion • May not be least-cost option for CO2 emission reduction • Competing land uses (food)

Adapted from Dániel PUPPÁN, 2002, table 3

Early Assessments Not Very Conclusive: PROALCOOL-Brazil

Issue		Remarks
Water use		Dependant on local situation
Water pollution		Dependant on local situation; criteria available
Biodiversity		Indirect impacts?; research required
Erosion		Dependant on local situation
GM cane		No GM cane is used
Cane burning		Complex issue: link with employment, erosion, GHG
GHG/emission		Soil carbon is crucial
Competition with food		Indirect impacts?; research required
Employment		Indirect impacts?; research required
Wages/working conditions		
Child labour		Easy to check; limited impact

 **Significant impact**

 **Limited impact**

Environmental and Social Sustainability Criteria

Domestic and international demand

- *Competition with food production*
- *Deforestation*
- *Biodiversity*
- *Soil erosion*
- *Chemical pollution*
- *Freshwater*
- *Employment*
- *Child labor*
- *Wages*

Maximum land available + Level of production

Concluding points

- Real Potential for Energy Import Substitution and Exports
- Need for safeguards on land use, forests and biodiversity
- Social equity and benefit sharing
- What role for the international trade system?

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Thank you

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