GHG Mitigation Potential in Global Forests

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Contents

- GCOMAP Model Description
- Deforestation Processes and Costs
  - GCOMAP analysis ongoing for the UK Eliasch and the Australian Review
  - What is magnitude of costs? Do these vary by region? How good are the data?
- Post-Kyoto emissions trading and reducing deforestation
  - What is the fraction of 2020 Annex 1 emissions reduction that reducing deforestation can contribute? What is the impact of uncertain baselines?
- Summary and Conclusions

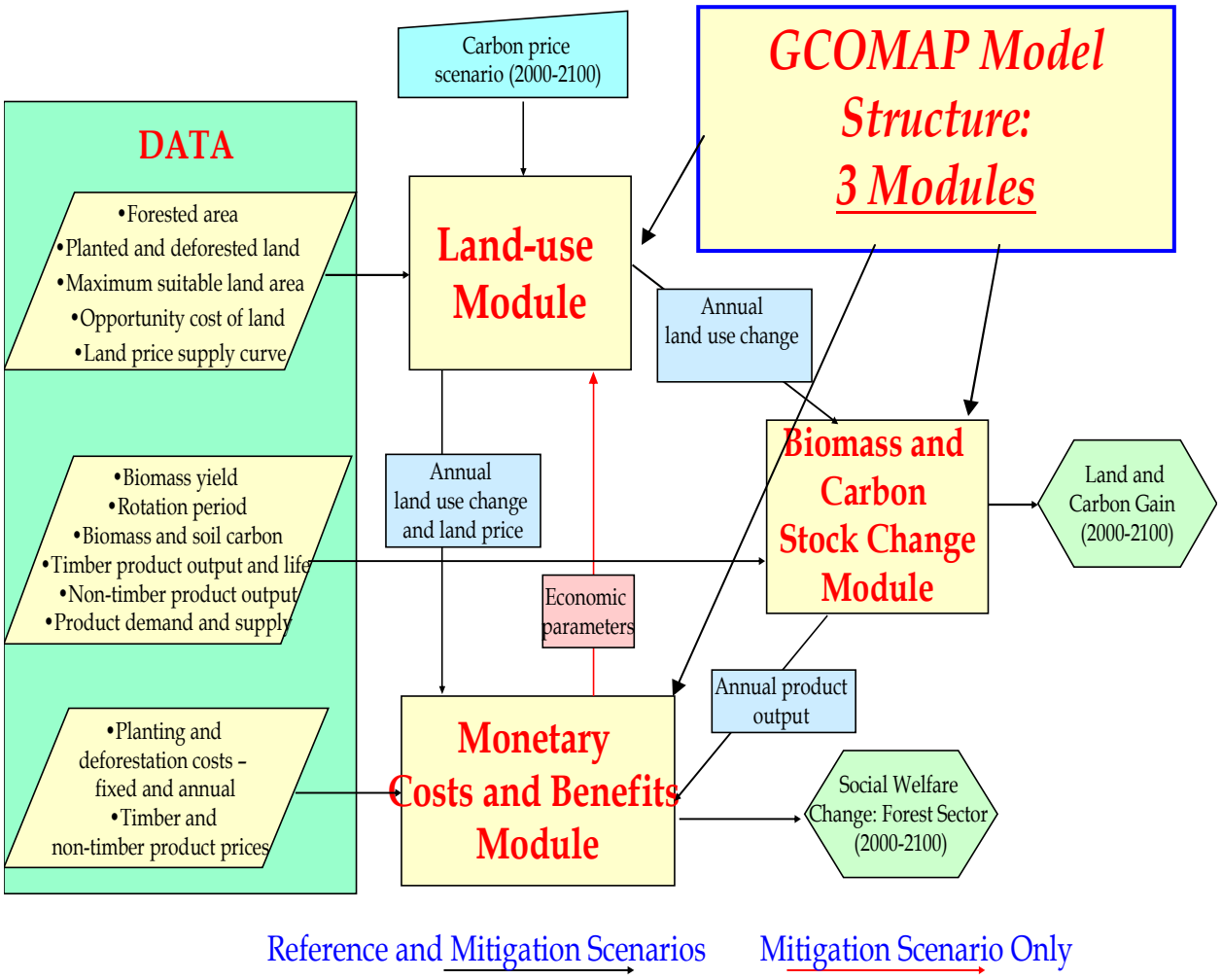
F7: *Tropical Forestry and Global Climate Change Research Network – Initiated in 1990*

- ASIA:
  - CHINA -- Prof. Xu, Deying and Dr. Xiao-Quan Zhang, IPCC Lead Authors, LULUCF Report, Forest Ecology and Environment Institute, Beijing
  - INDIA -- Dr. N.H. Ravindranath , IPCC Coordinator LULUCF Report, CLA for Tech Transfer, and LA for WGIII Report, Consultant to UNFCCC, Indian Institute of Science, Bangalore
  - INDONESIA -- Prof. Rizaldi Boer, Bogor Agriculture University, Bogor, GPG LA
  - MALAYSIA -- Dr. Roslan Ismail, ITTO Board, IPCC LA, SustechAsia.com Sdn Bhd.
  - PHILIPPINES -- Prof. Rodel Lasco, IPCC Lead Author, LULUCF Report, University of the Philippines, Los Banos
- AFRICA:
  - TANZANIA -- Dr.Willy Makundi, LULUCF, GPG CLA, and LA for Tech Transfer and WGIII TAR and AR4
- LATIN AMERICA:
  - MEXICO -- Prof. Omar Masera, IPCC CLA LULUCF and LA Tech Transfer and WG III reports, National Autonomous University of Mexico -UNAM
  - BRAZIL -- Dr. Philip Fearnside, IPCC, CLA LULUCF and LA WGII, National Institute for Research in the Amazon (INPA), Manaus

How much additional land area will be planted or avoided from being deforested in response to C price scenario?

GCOMAP Model Characteristics

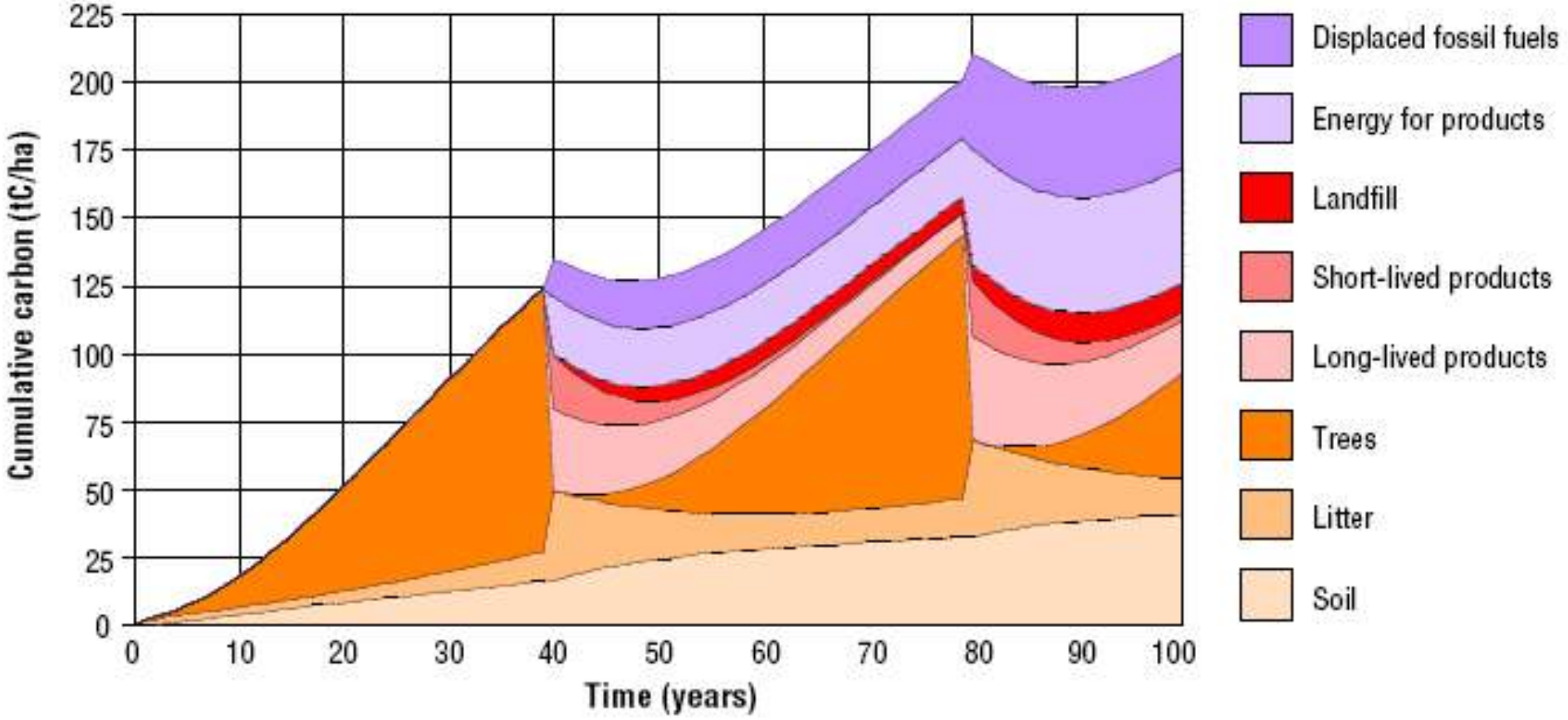
- Perfect foresight based on investment theory
- Data mostly from F7 tropical country studies and FAO global statistics
- Time horizon annual up to 2100
- 10 carbon pools tracked annually
- 10 global regions; 4 deforestation regions



GCOMAP Scope

Mitigation Options	Geographic Regions	Carbon Pools
Forestation – Short-rotation Long-rotation • Without biofuels • With biofuels (not analyzed yet)	North America South / Central America Europe Russia (not FSU) China India Australia/NZ Asia-Pacific Africa	• Above/below ground biomass • Soils • Litter • Post-harvest residue • Domestic timber products • International timber products • Fuelwood • Mill-waste products • Biofuels – used as a substitute for coal in power plants
Avoided deforestation (no biofuels)	South / Central America Asia-Pacific Africa	

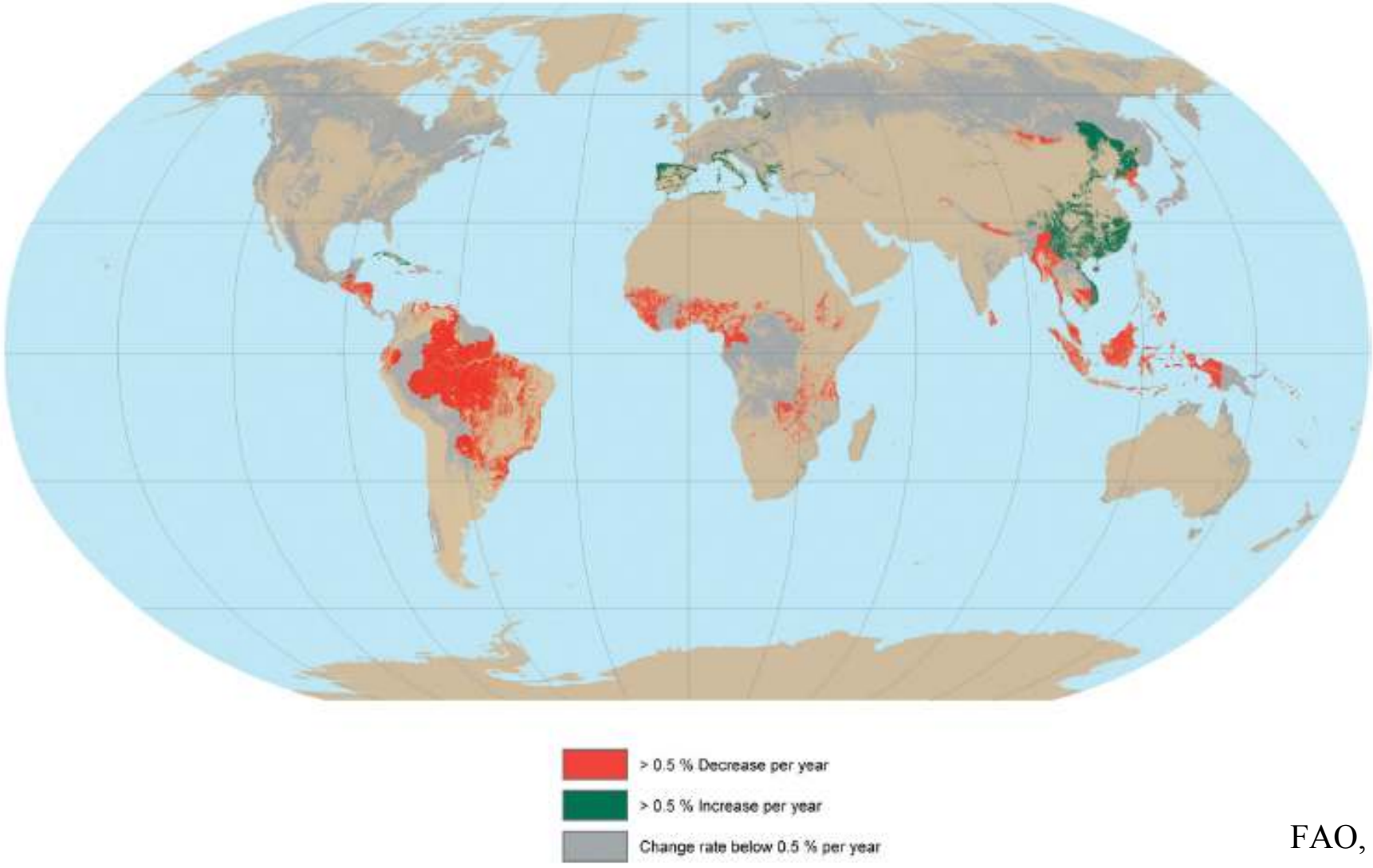
GCOMAP Simulates Carbon Balance for Forestation and Deforestation Activities: Hypothetical Forestation Project



2. Deforestation
Drivers, Processes and Costs

Areas with high net change in forest area between 2000 and 2005

- Global forest cover -- 3,952 million ha, about 30 percent of the world's land area
- Net forest area loss was 7.3 million ha/yr compared to 8.9 million ha/yr in the 1990s

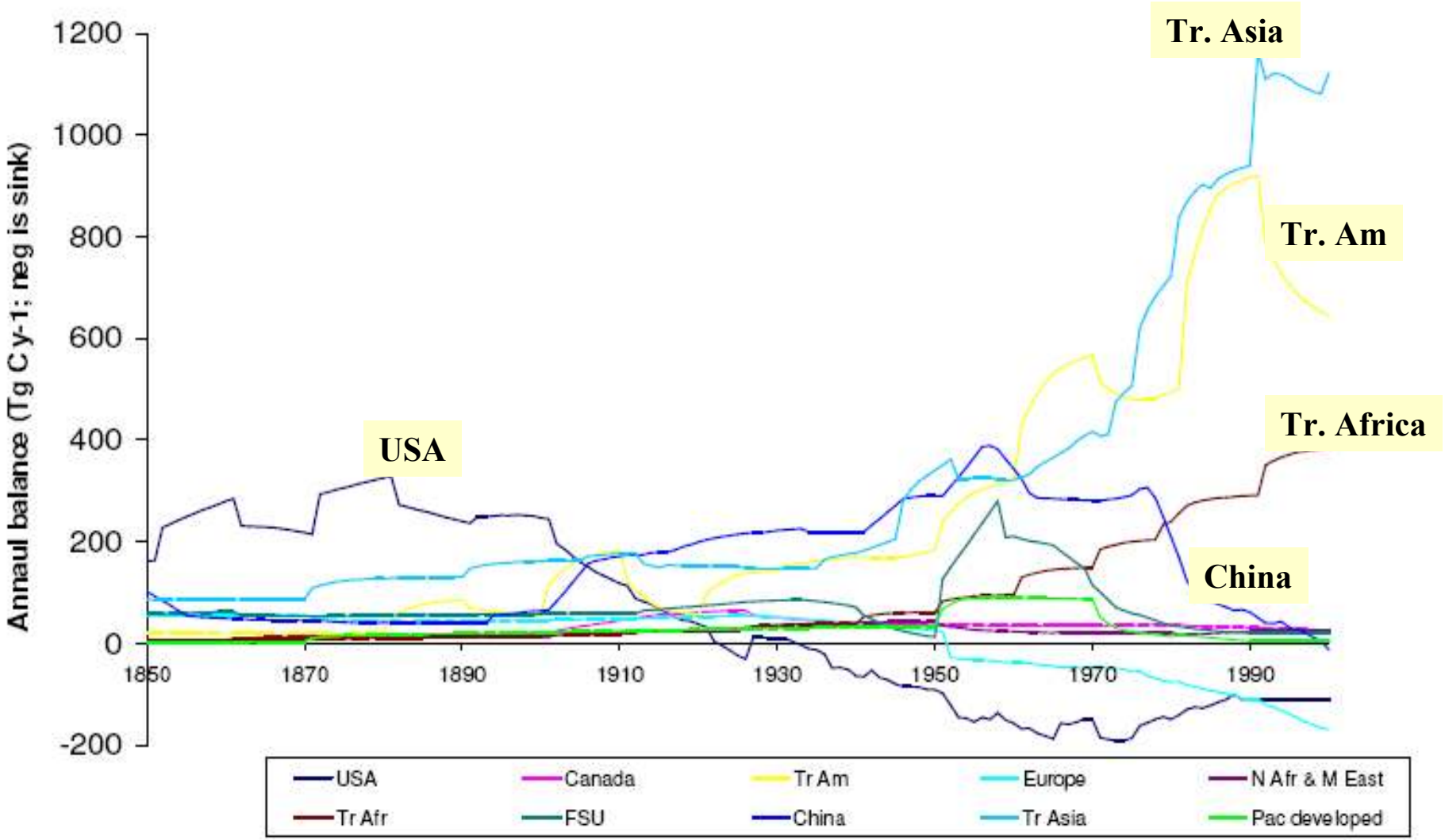


FAO, 2006

Long-run Baseline Setting a Challenge:

Carbon balance of the land use change and forestry sector by region

(Positive Values = Emissions)



Source: Houghton (2003)

GCOMAP Deforestation Rate: Historical and Projected

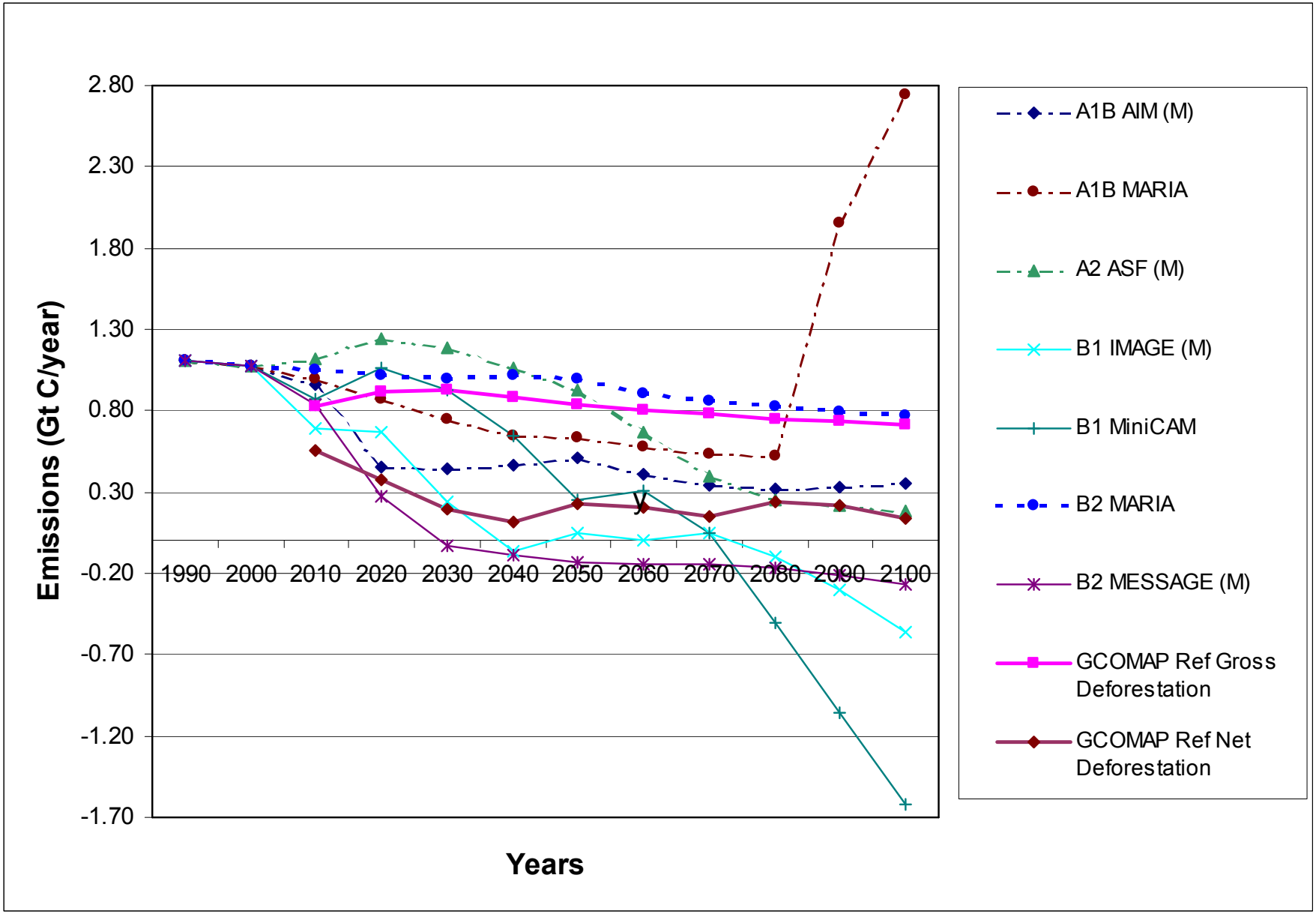
- Global deforestation 17 Mha/yr in 1990s; 13 Mha/yr in 2000-05 (FAO)
- Projected rate is an extrapolation of historical deforestation rate

Region	Change in Deforestation Rate (%/yr)	Deforestation Rates (% / year)				
	1990 –00	2000	2020	2040	2050	2100
Africa	+ 0.026	0.80	1.29	0.78	0.65	0.26
Rest of Asia	- 0.005	1.03	0.82	0.60	0.52	0.12
Central America	- 0.011	1.19	0.97	0.75	0.65	0.37
South America	- 0.030	0.40	0.26	0.21	0.20	0.13

The deforestation rate gives the percent decline in the forest area per year
(-) rate is an annual decline in the deforestation rate

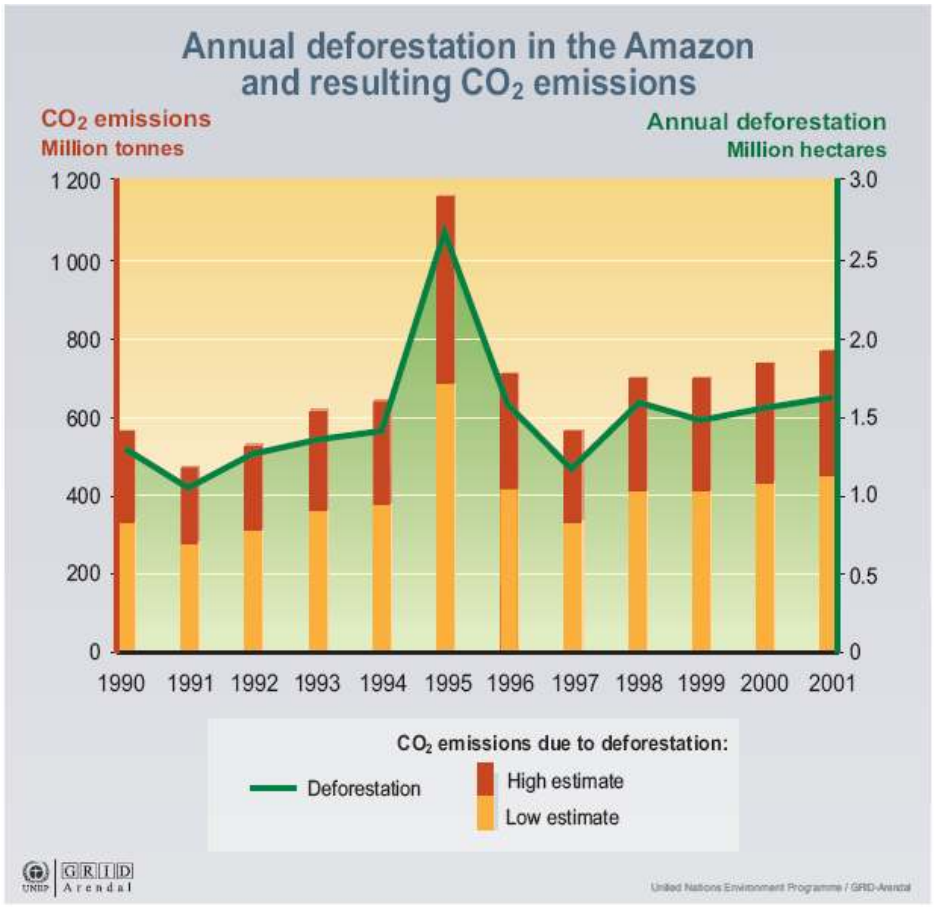
Based on FAO 2001 – Forest Resource Assessment-2000; Kaimovitz 1996 Livestock and deforestation in Central America in 1980s and 1990s; Barraclough and Ghimire 2000. Agricultural Expansion and Tropical Deforestation

Carbon Emissions from Deforestation: Reference Cases (Zero Carbon Price)
GCOMAP and IPCC SRES Scenarios
(Africa, Asia, Latin America, and the Middle East)

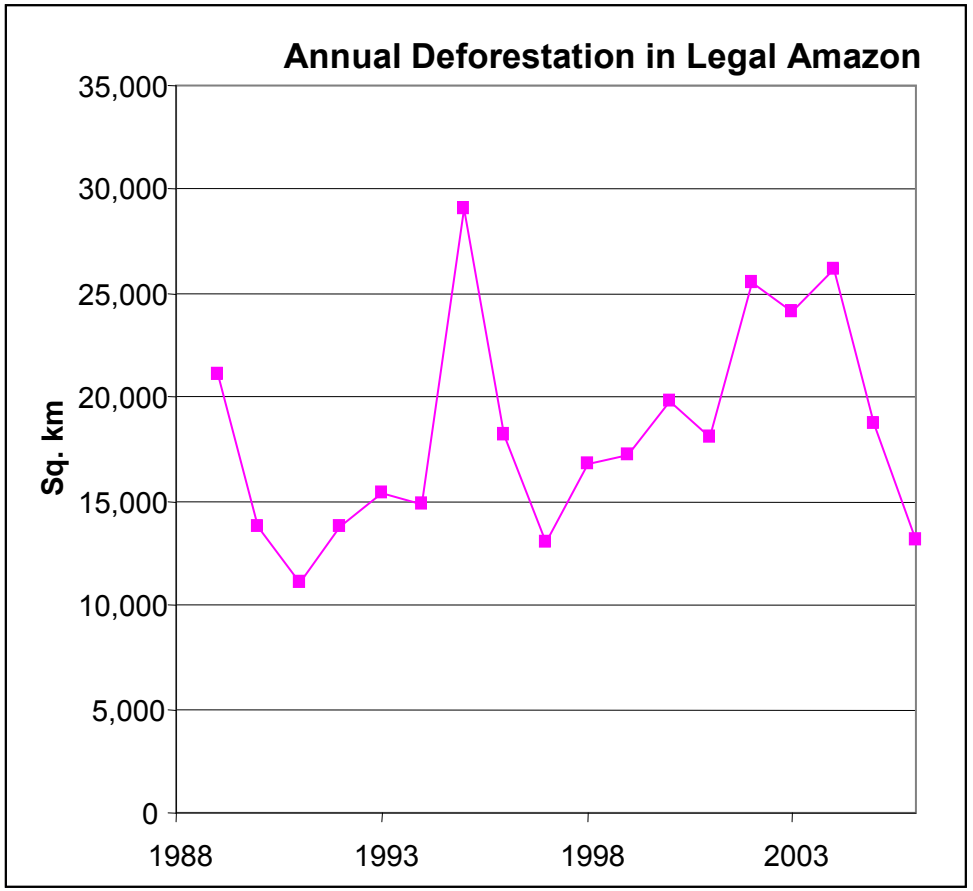


Annual Deforestation Rates Can Fluctuate Widely

Brazil Example: Price of agricultural products (soy) a key driver?



Sources: UNEP 1999; La Rovere 2000; Cramer 2004.



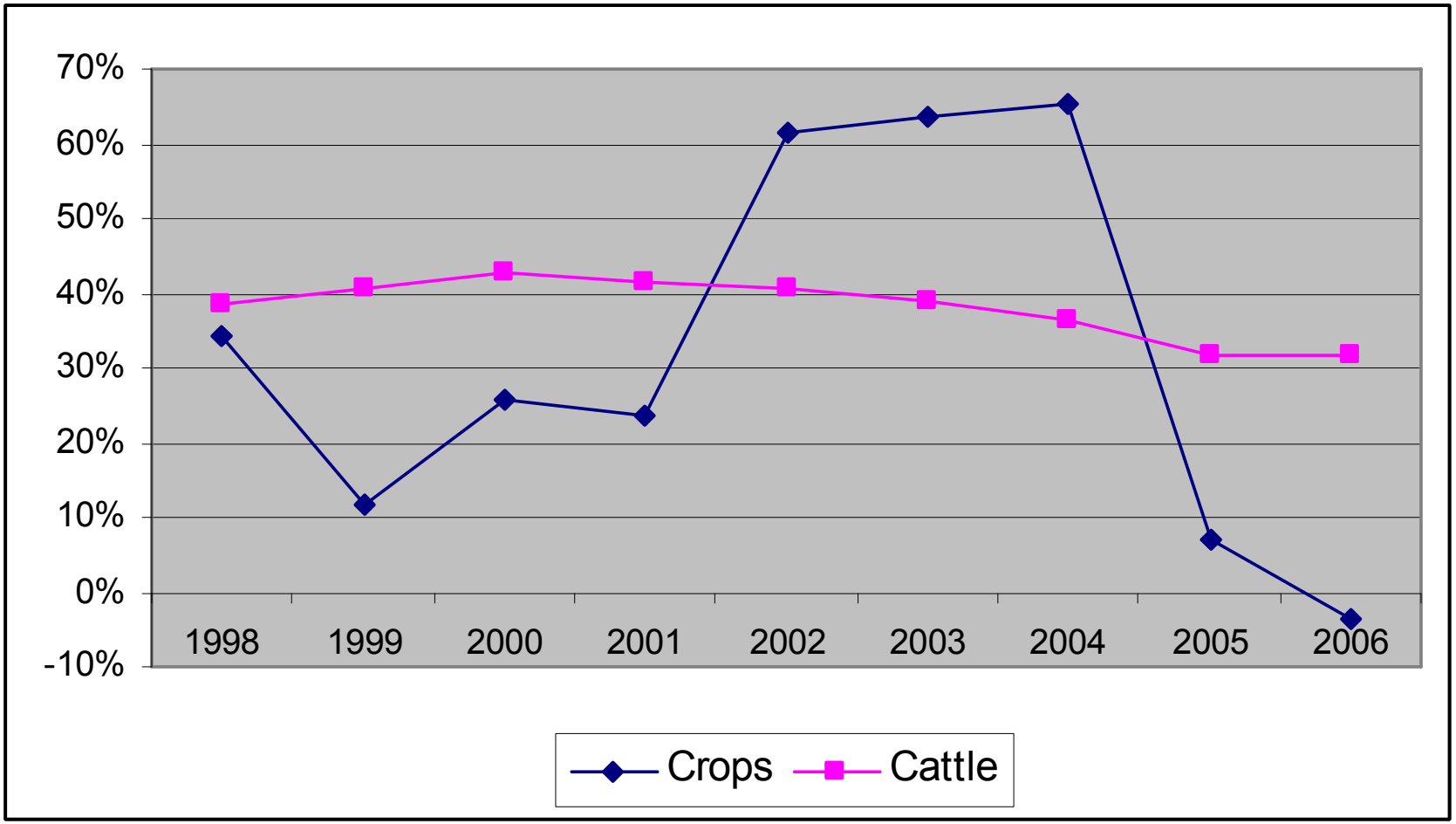
Source: INPE, Brazil

Deforestation Drivers and Land Use

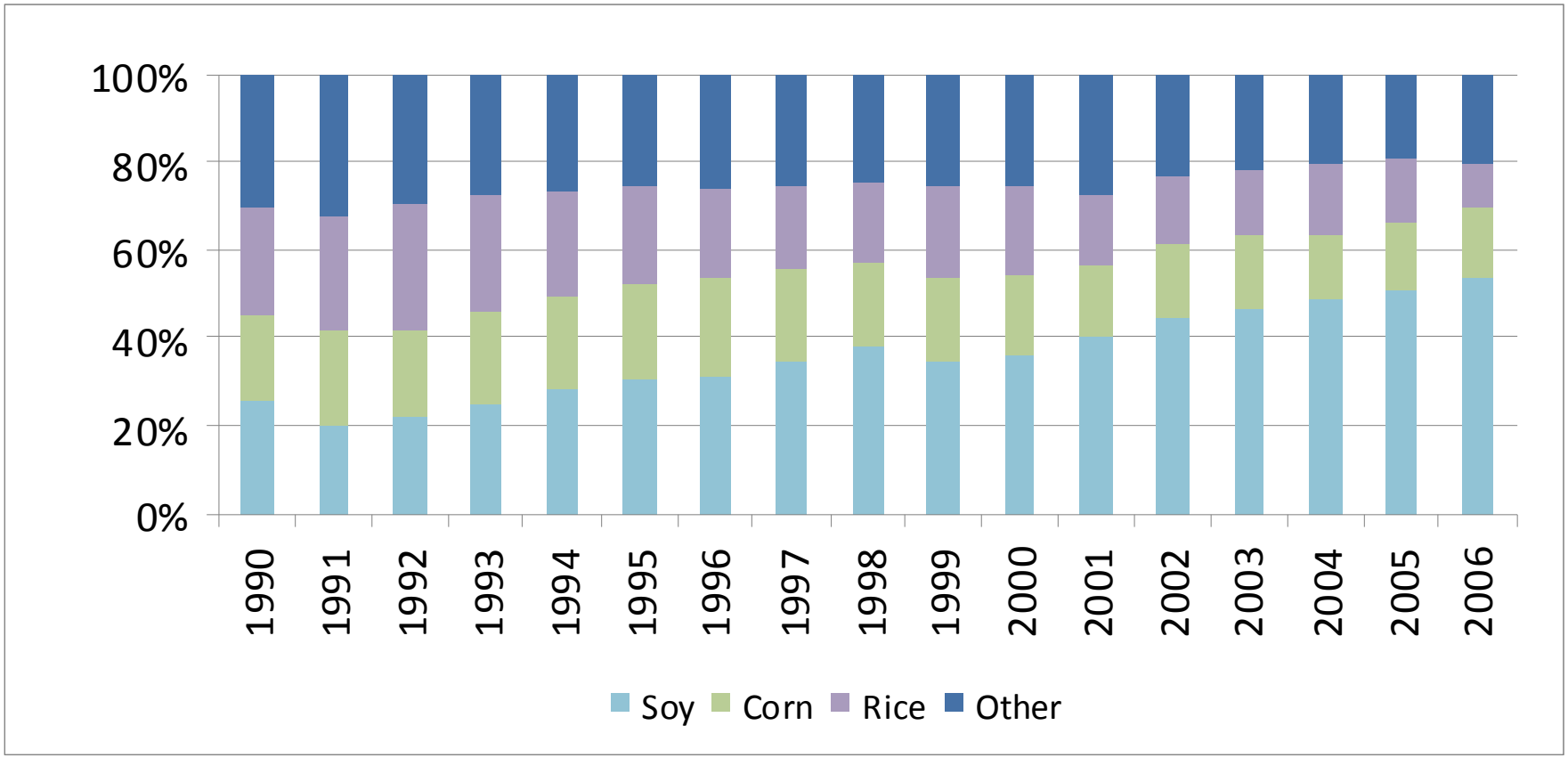
- Initial Causes:
  - Land settlement
  - Shifting cultivation
  - Infrastructure construction (roads, navigable rivers, dams, etc.)
- Logging (timber harvesting)
  - May release significant carbon emissions
  - Can be a high revenue activity
- Crops –
  - Minimal carbon mitigation potential
    - Grains – soy, rice, corn
    - Other crops – cocoa, coffee
  - Significant carbon mitigation potential
    - Perennials – mango, oil palm, rubber
    - Plantations – rubber, eucalyptus
    - Agroforestry
- Cattle ranching – pasture land

Annual profit margins based on variable costs only:

Cattle revenue is stable but lower over time
compared to crop revenue in Legal Amazon in Brazil



Proportion of planted area in Brazil: Soy share has increased from 2000 onwards



Deforestation Processes Opportunity Costs

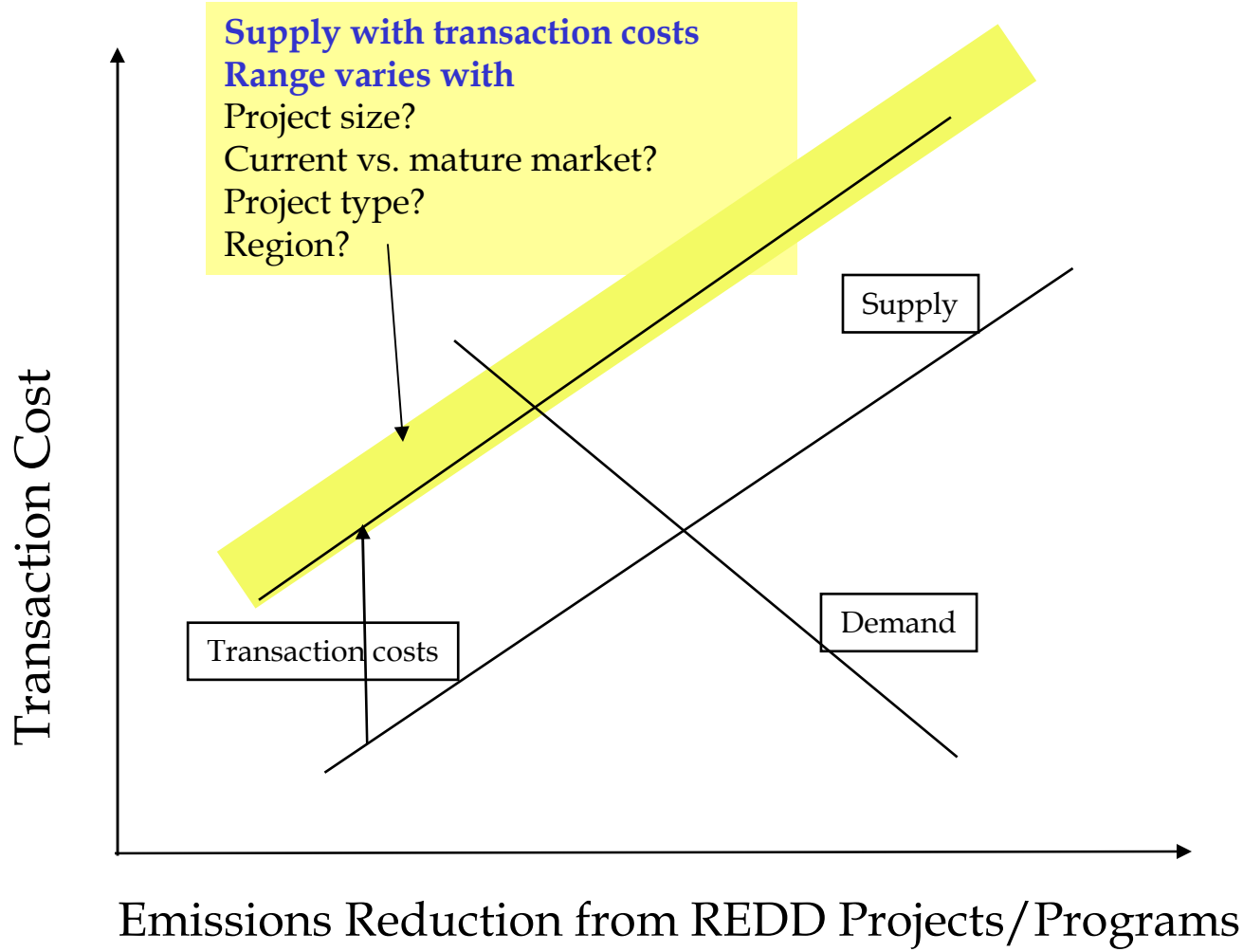
- Shares of forest land that are undergoing these processes?
  - Yucatan – Large fraction of the land is already logged, subsistence agriculture and cattle ranching are being practiced, opportunity costs could be low
  - Sumatra – Combination of illegal logging and planting of crops ongoing, opportunity costs could be high but so could the mitigation potential
  - DR Congo – Logging, exports of logs and subsistence agriculture is ongoing, opportunity costs could be high
  - Tanzania – Subsistence agriculture, low opportunity cost
- Preliminary Findings:
  - Across Africa, Central America, SE Asia, and South America opportunity costs for agricultural products range around $300 per ha
    - Subsistence agriculture by itself has much lower opportunity cost
  - Big uncertainty -- % of area harvested for timber and current status of areas that are deforestation candidates

Carbon choke price to theoretically halt deforestation (i.e., C price > opportunity cost) varies across tropics

- Feasibility of stopping deforestation complicated by many barriers
- Choke price depends on opportunity cost of land
  - Particularly sensitive to percentage area harvested and timber price
    - Harvested area also affects emissions from deforestation

Region	Carbon choke price to theoretically halt deforestation ($/ t C)
Africa	$ 39
Central America (incl. Mexico)	$ 127
South America	$ 147
Rest of Asia (Asia without China, India and Japan)	$ 281

Transaction Costs (TC) Influence Supply of Traded Carbon*



** TC includes search, feasibility studies, regulatory approvals, monitoring and verification, negotiation, and insurance.*

Findings: Transaction Costs of Projects

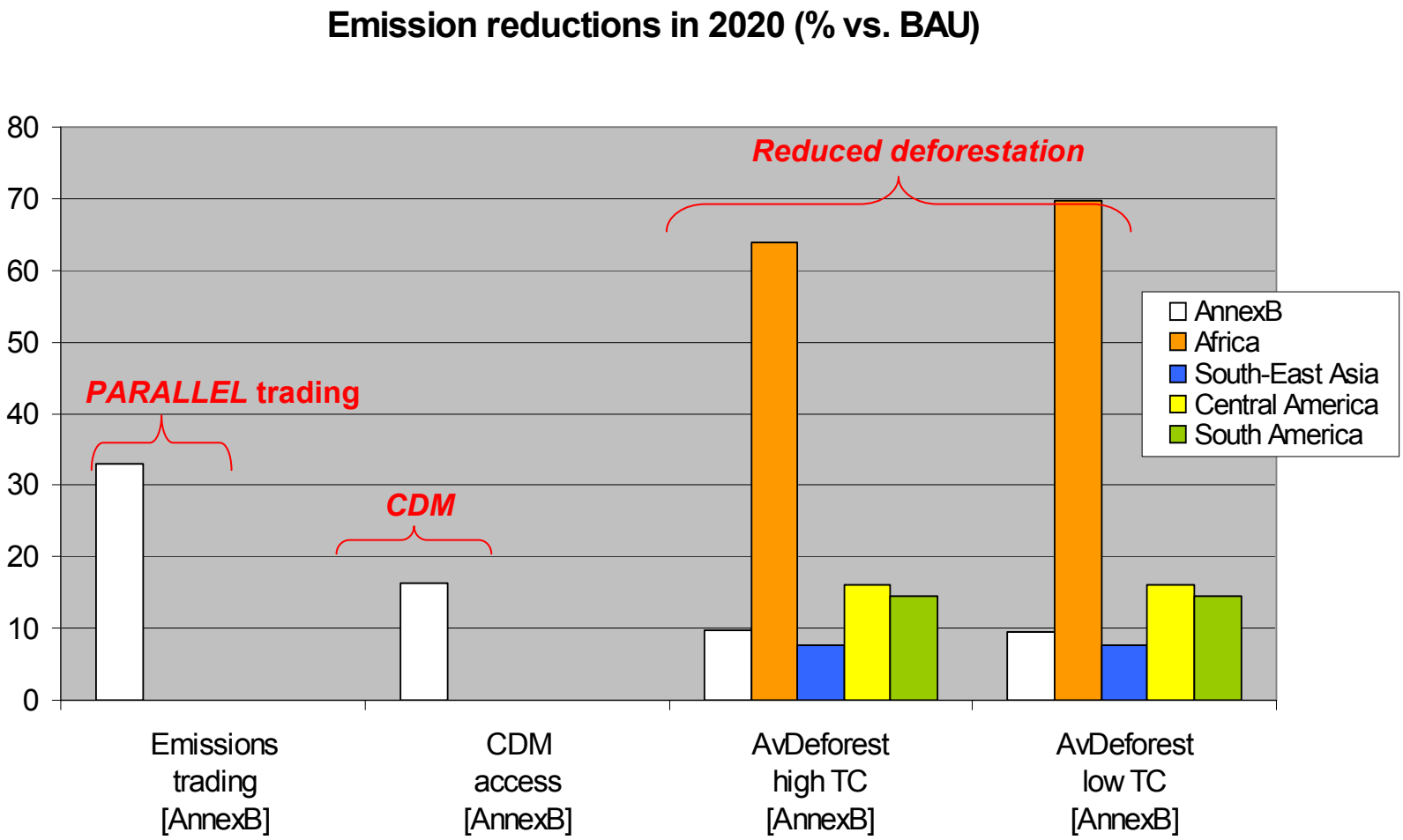
- Project sizes range from 0.02 to 6.0 million t C over project life
- Transaction costs range from
  - $0.18/t C for large forestry projects to $ 4.5/t C for smaller ones
  - Transaction costs are lower in US and higher in developing countries
  - 1% to 19% of project costs for forestry projects
- Implications
  - Programmatic approaches and large scale projects are to be preferred
  - Relative to carbon prices of projects to date TR costs are small
  - Carbon mitigation potential is not likely to be reduced significantly by TR costs

Source: Antinori and Sathaye (2007)

Post-Kyoto Emissions Trading and Reducing Deforestation

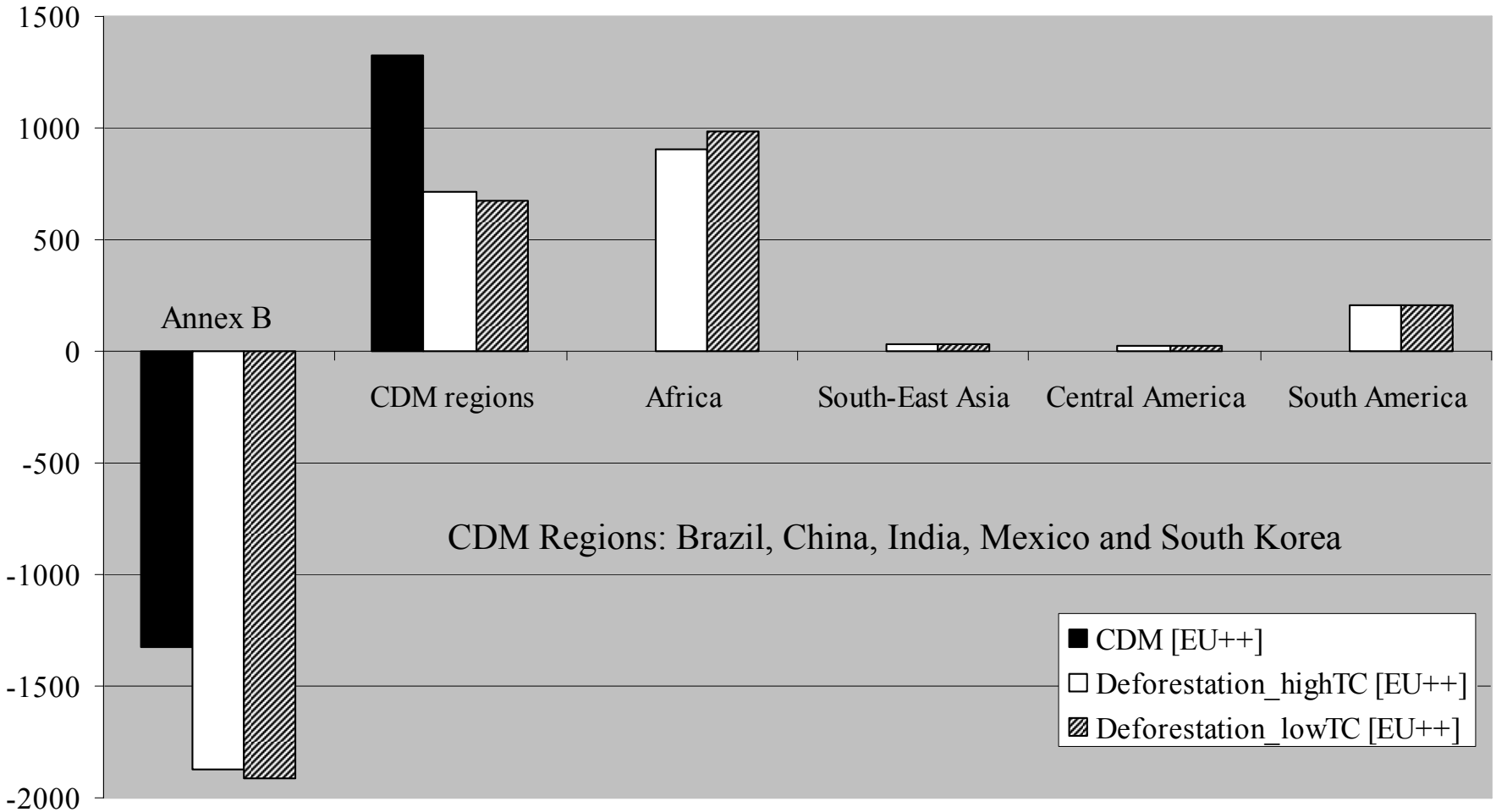
- Analysis evaluates the benefits of CDM trading and reducing deforestation assuming that EU and selected large Annex I countries reduce emissions by **33% by 2020 relative to 1990**.
- Models used:
  - SIMAC: Numerical multi-country partial equilibrium model of the global carbon market in 2020 (Anger 2007, Böhringer et al. 2005)
  - GCOMAP

CDM + reduced deforestation: Emission reductions



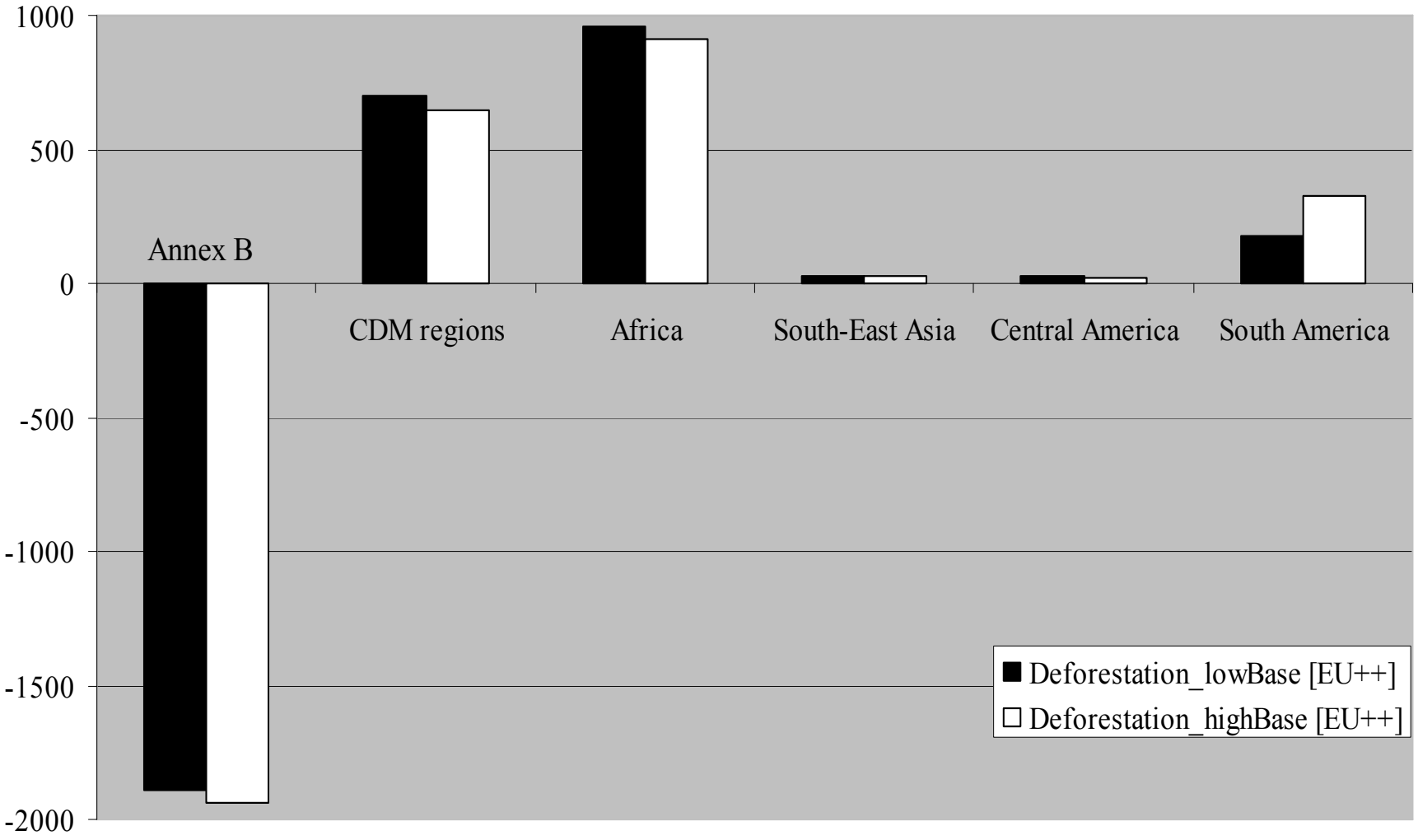
TC: Transaction Costs

Offset credit exports (positive) and imports (negative) by region (Mt CO2)



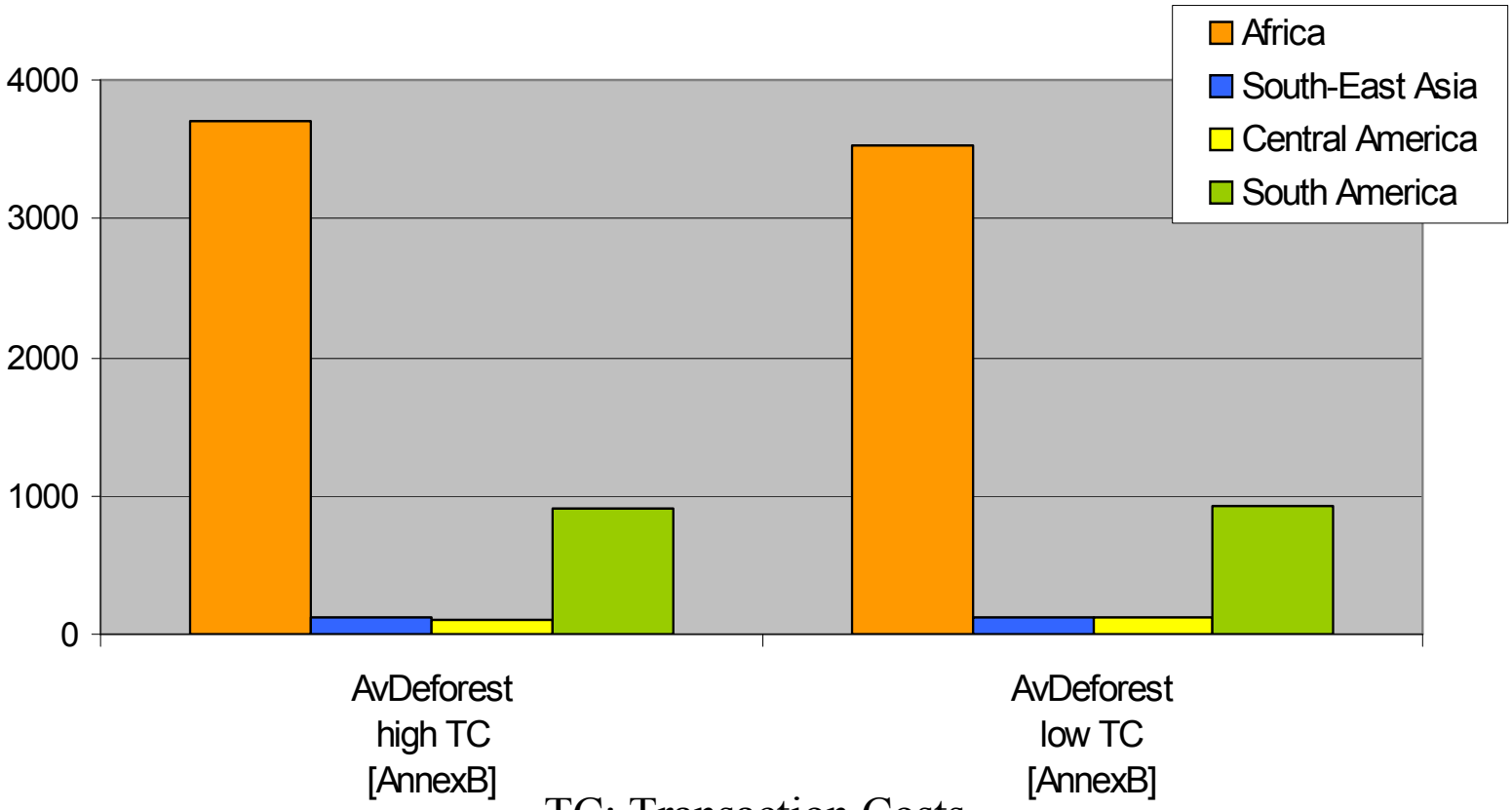
TC: Transaction Costs

Alternative deforestation baselines: Net offset-credit exports by region (Mt CO_2)



Reducing deforestation: Net economic benefits by region

Net benefits for rainforest regions (million €2005)



TC: Transaction Costs

Summary and Conclusions

- Annual deforestation rates vary as much as 100%
  - Short-term changes are closely linked to agricultural and wood product demand and price, and land access
  - Drivers change over time
- Level of reduced deforestation is sensitive to carbon price and path
  - Reducing deforestation accounts for 51% to 78% of additional forest sector emissions reduction by 2100
- Choke prices range widely from low in Africa to several times higher in SE Asia
  - Timber price and % area harvested are main reasons for the difference
- Project transaction costs range from $0.18/t C to $ 4.5/t C
  - These are higher relative to Africa choke prices and much lower elsewhere
  - High transaction costs reduce deforestation reduction potential in Africa by 10%
- Adding REDD reduces 2020 CDM offset credits from five large CDM host-countries by almost 50%
- Doubling South America baseline deforestation level benefits that region, but has limited impact on global carbon trade and carbon price

Thank you

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http://ies.lbl.gov