F7 PROJECTS:

The Tropical Forestry and Global Climate Change Research Network

Forestry Mitigation Carbon Potential and Costs:

Brazil, China, India, Indonesia, Philippines, Tanzania, and Mexico

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Importance of Sinks to Developing Countries

- Land use change = High percentage of total GHG emissions (e.g, 63% in the Philippines)
- Mitigation options in land use offer significant co-benefits -- rural employment, soil conservation, etc.
- Forestry mitigation can assist rural development
  - Chiapas, Mexico AIJ project is an example
- Many developing countries (DCs) plagued by inadequate investment in the forestry sector
- DCs will participate in the Kyoto Protocol largely through the Clean Development Mechanism (CDM)
  - Inclusion of LULUCF in CDM is not yet resolved
  - Forestry mitigation potential very large in some countries

Carbon emissions from forestry and energy sectors

Country	Net national carbon emissions (1990 MtC)	Carbon emissions from the energy sector and industrial processes (1990 Mt C)	Carbon emissions from the forestry sector (Mt C)		Total mitigation potential (Mt C)	Ratio Cols. 5/2 (Yrs.)
	1	2	1990 (3)	2020 (4)	5	
China	507	556	-61	-105	9740	17
India	146	141	1	21.0	8753	60
Indonesia	38	38	-94	-106	1745	41
S. Korea	62	66	1	_	119	2
Mongolia	5	3	1	-0.3	317	83
Myanmar	-2	1	-2	-1.4	582	647
Pakistan	20	17	2	19.0	161	9
Philippines	35	10	22	0.6	2380	205
Thailand	45	21	21	6.0	1259	54
Mexico	127	74	53	-	4115	55

Source: Asian Development Bank 1999. ALGAS Project,
Sathaye and Ravindranath, 1998. Ann. Rev. of Energy.

IPCC LULUCF Special Report:
Chapter 5 -- Project-based activities

- Report includes cost estimates ($/t C) for about 20 projects
  - Estimates were based on figures reported by project developers
  - Project reports did not clarify cost and carbon pool components
  - Methodology used to estimate costs and carbon was not reported, and was most likely inconsistent
- No estimates of LULUCF CDM potential exist
- The ongoing F7 study was initiated in early 1999 to address these and other issues

PARTICIPATING RESEARCH GROUPS

- ASIA:
  - CHINA -- Xu, Deying (IPCC Lead Author, 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 Bboer (UNFCCC Consultant), Bogor Agriculture University, Bogor (co-funding with EAP)
  - MALAYSIA -- Dr. Roslan Ismail (ITTO Board)
    Director, Regional Center for Forest Management, Kuala Lumpur (via EAP funding)
  - PHILIPPINES -- Prof. Rodel Lasco (IPCC Lead Author, LULUCF Report), University of the Philippines, Los Banos (via EAP funding)
- AFRICA:
  - TANZANIA -- (Yonika Ngaga, CEEST, Dar es Salam, and Dr.Willy Makundi, LBNL, LULUCF and WGIII Lead Author)
- LATIN AMERICA:
  - MEXICO -- Prof. Omar Masera, IPCC CLA LULUCF and LA Tech Transfer and WGIII reports, National University of Mexico
  - BRAZIL -- Dr. Philip Fearnside, IPCC, CLA LULUCF and LA WGII,
    National Institute for Research in the Amazon (INPA), Manaus

F7 Studies Background

- **F7 participants advise and counsel their respective governments and the UNFCCC, and lead several chapters of IPCC reports**
- **LBNL/EPA work on forestry and climate change began in 1990 and led to following outputs:**
  - **Development of widely used <u>quantitative tools</u> -- COPATH and COMAP models for inventory and mitigation analysis**
  - **COMAP/COPATH models described in IPCC SAR and distributed by UNITAR**
  - **Results cited in four chapters of the <u>IPCC Second Assessment Report</u>**
  - **Special issue of <u>Mitigation and Adaptation Strategies Journal</u> from Costa Rica forestry monitoring workshop, 1997**
  - **Special issue of <u>Climatic Change on forest emissions inventory</u>, 1997**
  - **Special issue of <u>Biomass and Bioenergy on mitigation costs and benefits</u>, 1995 (Vol.8/5)**
  - **<u>10 LBNL reports</u> published on mitigation potential, scenarios, and their costs and benefits for F7 countries**

FORCLIMIT Project

- Goal: Focus on Indonesia, Philippines, and Malaysia
  - help develop in-country technical capacity to assess LULUCF projects and activities -- transfer of models and tools
  - assess the potential of national-level policies and projects to provide sustainable forest management and GHG mitigation benefits
  - evaluate climate change forestry projects
- Activities:
  - Workshops in Bogor, Manila, and Kuala Lumpur organized in October 2000
    - » Inform governments, private industry, NGOs, and other stakeholders about the IPCC LLUCF report
    - » Engage in discussions about the role of forestry in CDM
    - » Train foresters in mitigation analysis and the use of COMAP
  - Ongoing mitigation analysis of forestry options in each country

COMAP and PROCOMAP Models

- COMAP -- *Comprehensive Mitigation Assessment Process*
- Approach:
  - Develop land-use scenarios by option
  - Estimate carbon stock changes by option in four pools
    - » Live and dead biomass, soil, and products
  - Estimate costs and benefits of each option
    - » Investment, recurring, opportunity, and monitoring costs
    - » Timber, fuel wood, honey, etc. revenue sources
  - Compare and integrate costs and carbon estimates
    - » Model uses equilibrium carbon approach, but can track changes in carbon and costs / benefits annually
  - Estimate macroeconomic impacts (based on model results)
- PROCOMAP -- Project-level COMAP under development

Land Use Characteristics

Country	Total land area (Thous. Ha)	Forested Area (Thous. Ha)	Net Deforestation Rate in Study Area (Thous. Ha/yr.)	Land Suitable for forestation (Thous. Ha)
Brazil	845,700	390,000[n]	1113 – 2906[m]	85,000[l]
China[a]	963,296	158,941 [k]	60	31,953 [d]
India	328,760	63,300[b]	274[c]	53,200 [d]
Indonesia[f]	190,401	109,540	750-1500	31,000 [e]
Mexico	196,700	115,652	720 [I]	21,000 [j]
Philippines	30,000	5,200	99 [h]	4,400 [g]
Tanzania	89,161	41,857	750	7,500

Options selected for study in each country

Study Country	Options Included in the Study
Brazil	Afforestation (Short- and long-rotation plantations)
China	Afforestation (Short and Long Rotation), Agroforestry, Regeneration, Protection, Bioenergy
India	Afforestation (Short and Long Rotation), Regeneration, Forest Protection
Indonesia	Forest plantation and timber estate, Afforestation, Reforestation, Enhanced natural regeneration, Forest Protection, Bioelectricity, Reduced Impact Logging
Philippines	Afforestation (Short- and Long), Natural Regeneration, Forest protection, Bioenergy
Mexico	Long- and Short-Rotation Plantations, Forest restoration, Agroforestry, Bioenergy, and Sustainable Forest management
Tanzania	Community woodlots (short rotation), Softwood and Hardwood Plantations (Long-rotation)

Forestry Mitigation Options In Study Countries: Key Assumptions

Option	Initial Cost ($/ha)	Rotation Period (yrs)	Mean Annual Increment (t/ha/yr)
Short-rotation	150 – 450	7 –8	3.8 – 19.2
Long-rotation	450 – 700	25 – 40	1.6 – 11.1
Regeneration/Management	18 – 40	40 – 80	0.8 – 3
Protection/Conservation	5 – 10*		

Land-use Scenarios

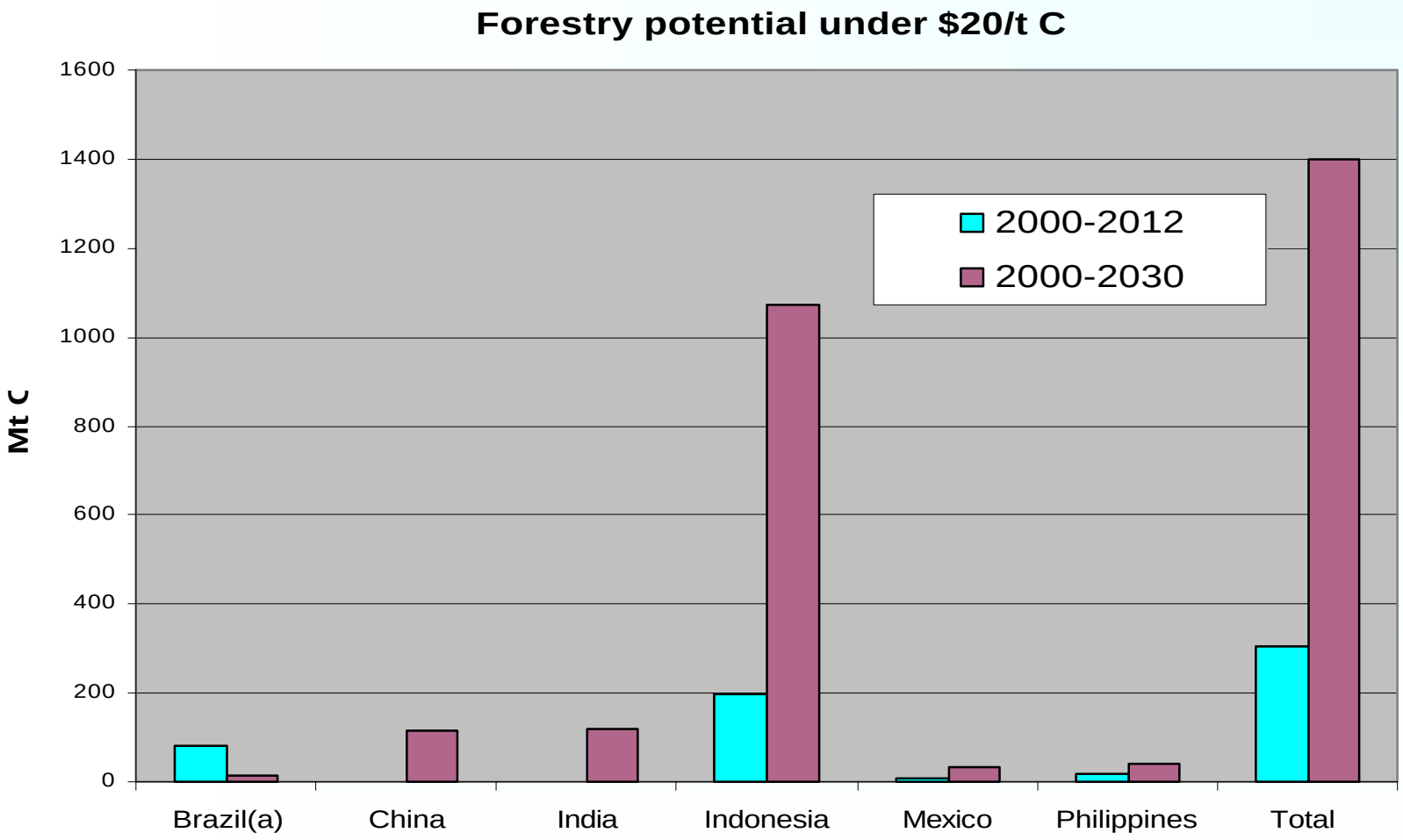
- Brazil -- Scenarios based on potential identified in literature
- China -- Two scenarios based on government plans
  - Forestation of 80% and 60% of suitable land area in 30 years in three regions -- South West, South East, and North East.
- India -- Sustainable and commercial forestry scenarios analyzed
- Indonesia -- Government plans scenario, and a mitigation scenario were analyzed. The latter meets all wood demand by 2010.
- Philippines -- Forestation rates of 100% and 50% of government plans in two scenarios.
- Mexico -- Baseline (likely trends) and mitigation scenario analyzed
  - Mitigation consists of reduced deforestation rates, better forest management, and plantations meet commercial wood demand
- Tanzania - The Tropical Forest Action Plan (TFAP) scenario, assuming that 3.5 Mha and 1.7 Mha land area is converted are analyzed.

Carbon Benefit Potential of Forestry Mitigation Options

	Energy emissions	Cum.Forestry	Cumulative Forestry		Cumulative Forestry	
	1990	Potential	Potential (Mt C)		Potential (Mt C) < $20/t C	
Country	(Mt C)	(Mt C)	2012	2030	2012	2030
Brazil(a)	40		83	320	16	81
China	556	9740	37	199	1.5	114
India	141	8753	233	753	0	120
Indonesia	38	1745	381	1561	196	1074
Mexico	74	4115	17	99	7	34
Philippines	10	2380	19	62	18	41
Total	859	26733	770	2994	239	1464
Fraction of 1990						
energy emissions=		31.1	0.9	3.5	0.3	1.7

a. Slowing deforestation not included.

Note; Cost refers to the present value per t C

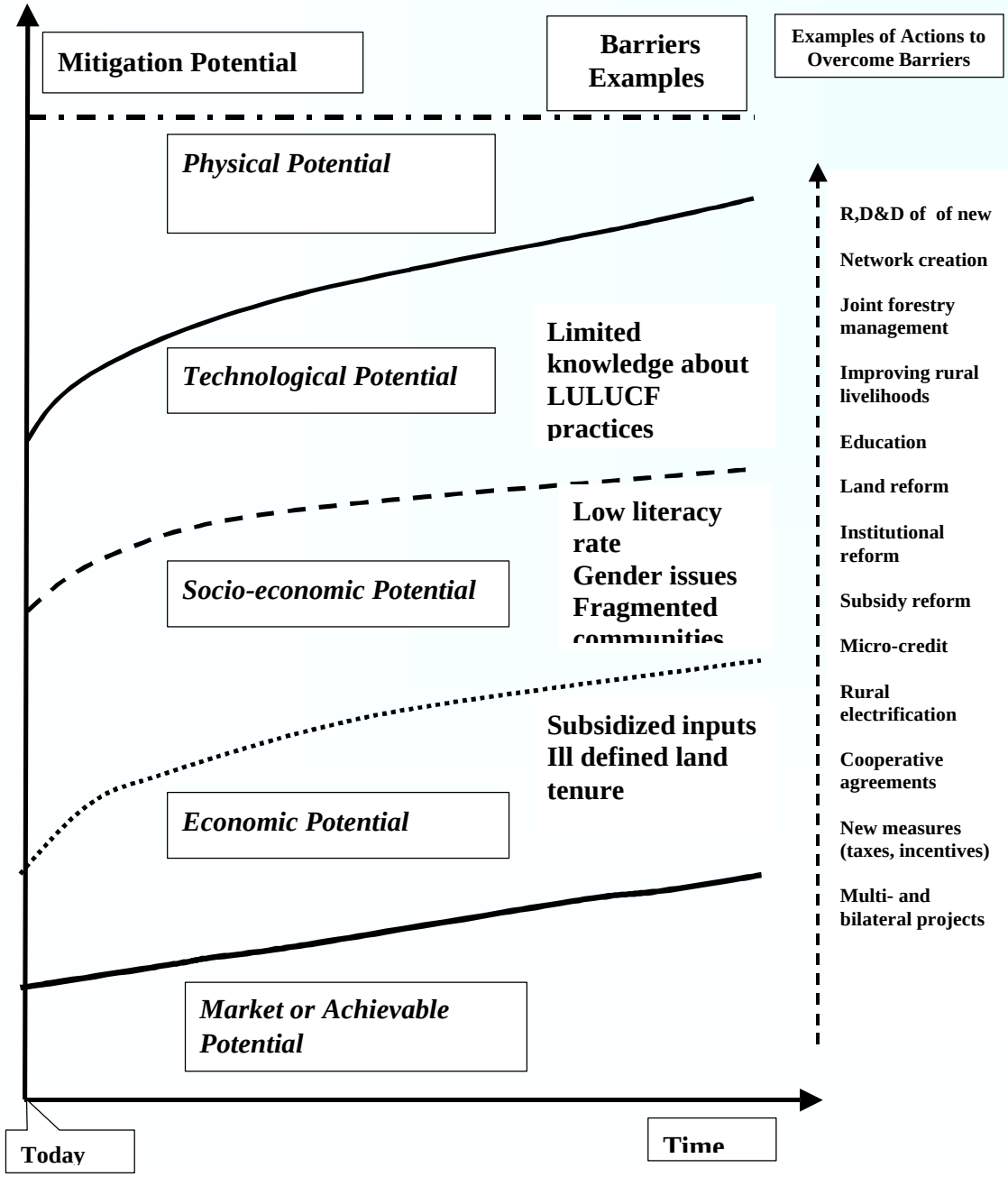


Note: Cost refers to the present value per t C

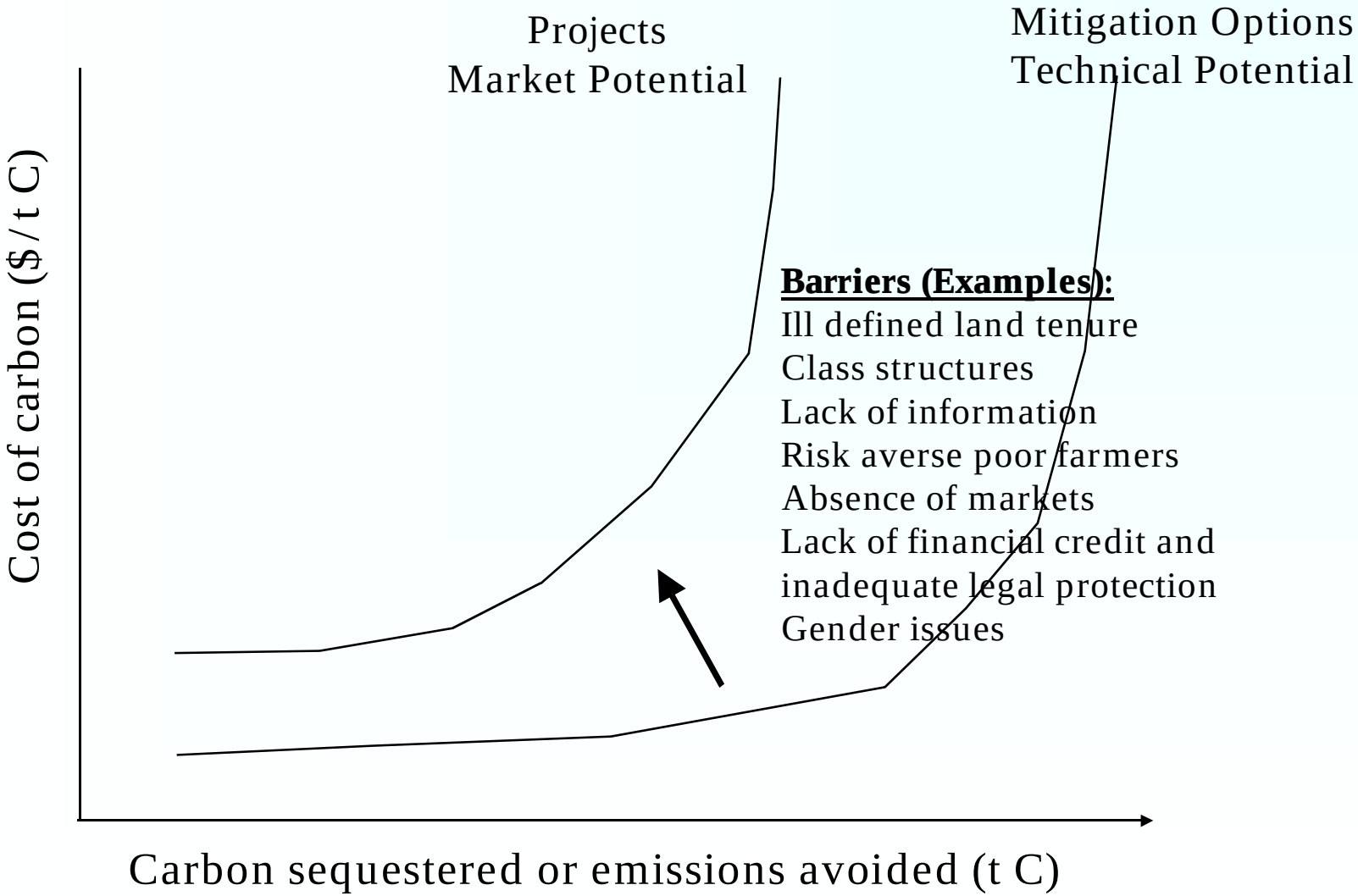
Future Work

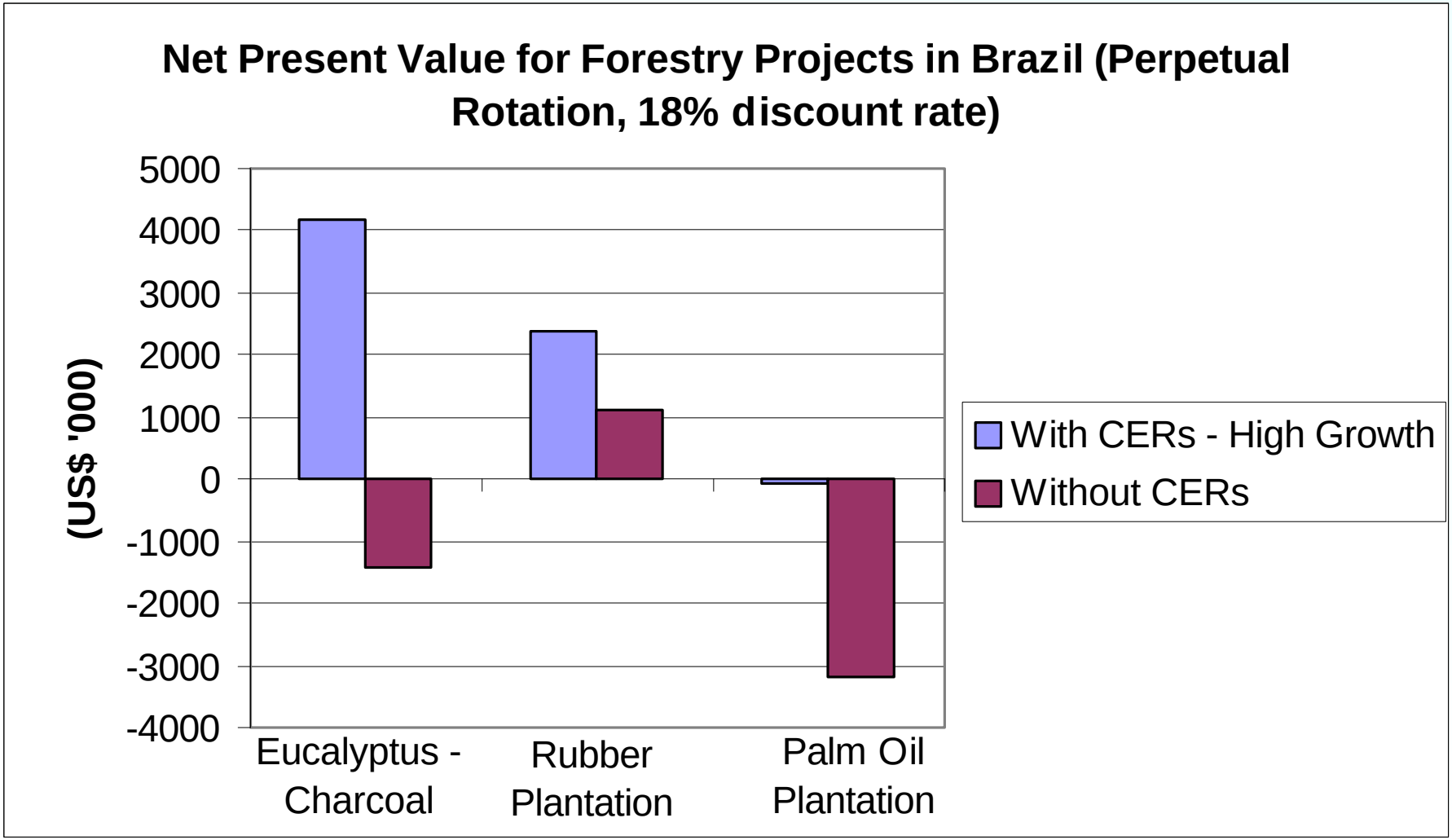
- Estimating CDM potential taking barriers into consideration
  - Land tenure, rural cultures, risk-averse behavior, lack of product markets, etc.
- Project-specific analysis of forestry mitigation options
  - Financial analysis of projects considering CERs
- FORCLIMIT Project
  - Evaluation of one case study to better understand key LULUCF issues about leakage and permanence
  - Workshops in March, and summer 2001 on case studies and mitigation potentials

Forestry Mitigation Options Potentials



Cost Curves


Projects
Market Potential
Mitigation Options
Technical Potential
Cost of carbon ($ / t C)
Barriers (Examples):
Ill defined land tenure
Class structures
Lack of information
Risk averse poor farmers
Absence of markets
Lack of financial credit and
inadequate legal protection
Gender issues
Carbon sequestered or emissions avoided (t C)


Net Present Value for Forestry Projects in Brazil (Perpetual Rotation, 18% discount rate)
(US$ '000)
5000
4000
3000
2000
1000
0
-1000
-2000
-3000
-4000
Eucalyptus - Charcoal
Rubber Plantation
Palm Oil Plantation
With CERs - High Growth
Without CERs