

LULUCF and Climate Mitigation; Synergy/Tradeoff - Carbon Sequestration, Bio-fuel production, Food Production and Ecological Functions

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Outline

- Mitigation opportunities and potential in land use sectors
- Land use – competition for; food –fuel – carbon sequestration & ecological functions
- Synergy / Tradeoff – CC mitigation and Forest ecological functions
- Synergy / Tradeoff – CC mitigation and social and economic functions
- Strategy for SYNERGY; CC mitigation and other functions:
 - Food production
 - Ecological functions; biodiversity & water
 - Socio-economic roles
 - Other conventions & agreements

Decisions on land use for Climate change mitigation *versus* Other functions

- Climate change mitigation still not a major competitive use for land in developing countries – but could be in FUTURE
- No decision tool or approach available to assist land use policy decision makers
- Land use for climate mitigation is often seen as a competitive or conflicting strategy for land use
- Land use for mitigation is seen as a loss of other functions or benefits

Thus tradeoff assumed to exist between land use for climate mitigation and other functions

Mitigation options in land use sector

1. Carbon emission reduction
 - Halting / reducing deforestation)
2. Carbon Sequestration
 - Afforestation, reforestation and forest management
3. Fossil fuel / product substitution
 - Bioenergy / biofuels / wood products

Mitigation potential of forest and land use sectors

- IPCC assessments have shown a large mitigation potential
 - SAR = 66 to 87 GtC for 50 years
 - TAR = 2 GtC / year
 - AR-4= 1.2 GtC / year ??
- Bioenergy or biofuel potential
 - Very large: 150-200 EJ per year (Global energy use in 1997 was 280 GJ)
 - IEA projects: 60 EJ by 2020
- IPCC – limited literature ??

Implications of climate change on existing sink & mitigation potential

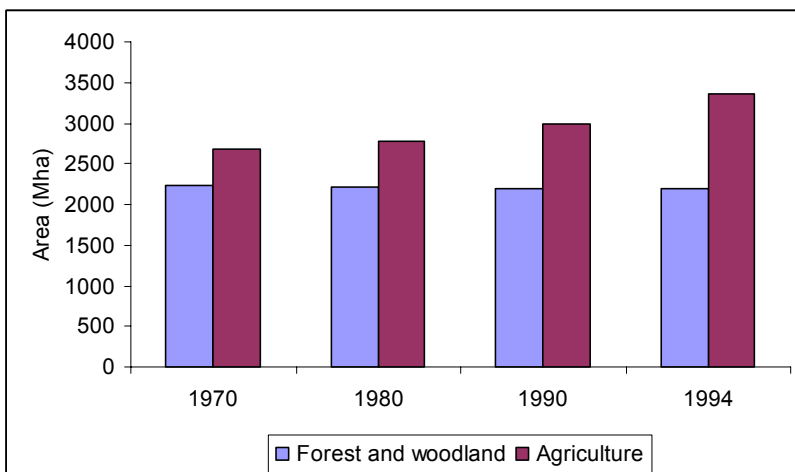
- Implications NOT clearly understood
- Sink likely to increase initially (upto 20s/30s)
- Sink may decline later and may even disappear?
- Still uncertainty on the direction of impacts
 - Surely there will be impacts on C-stocks and rates
- Need not have implications for immediate decisions on Lulucf activities

Carbon sequestration and Fossil fuel substitution – Land use options

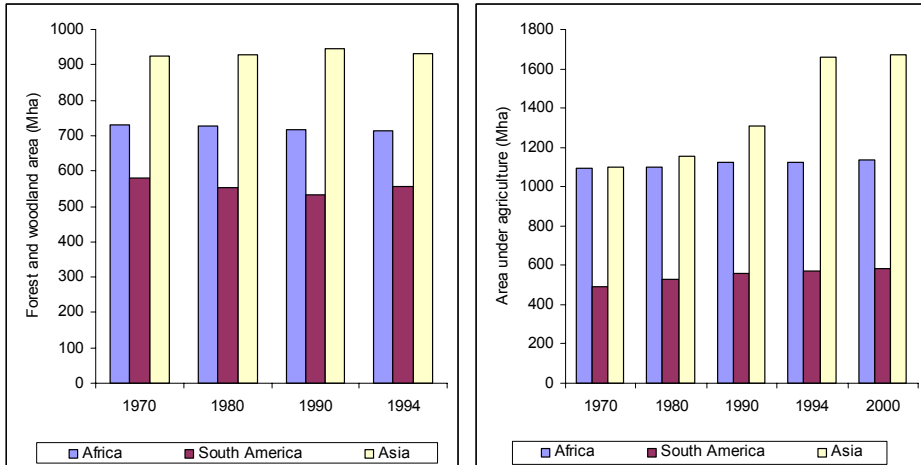
- Challenge of alternative and competitive uses for Lands in Annex-I & NAI
 1. Food production
 2. Climate change mitigation
 - Fossil fuel substitution through bioelectricity or liquid fuel
 - Carbon mitigation
 3. Ecological functions; biodiversity, watershed
 4. Traditional Socio-economic functions

Need for promoting SYNERGY for multi-functional forestry; C mitigation and other utilities

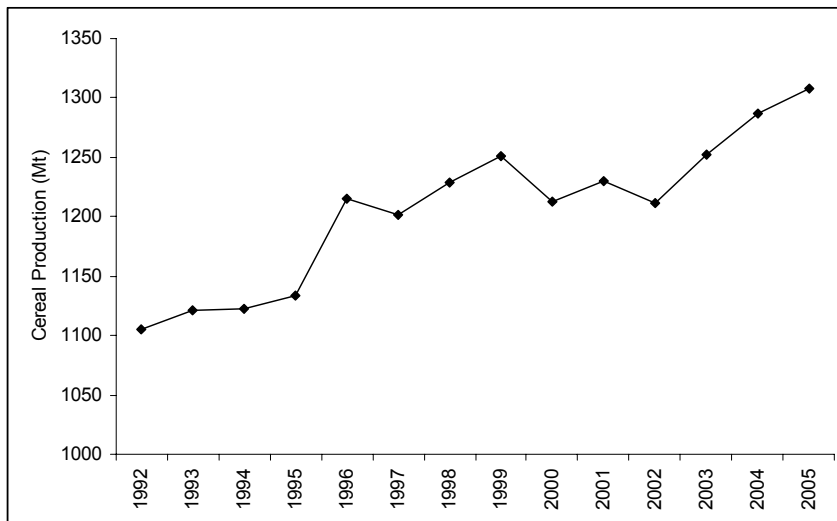
Area under forest & woodland and agriculture in Asia, Africa and South America



Trends in global area under forests and food production



Total cereal production in Asia, Africa and South America



Extent of land potential for climate change mitigation

- Factors determining land available for climate change mitigation projects – **competitive**
 - Need for land for food production
 - Need for land for fuelwood, industrial wood, sawn timber, etc.
 - Land for other Ecological or Socio-economic functions
- Financial incentives for mitigation
- Economic, institutional and policy factors

GOAL should be to avoid competition and promote SYNERGY between addressing climate change and other roles or functions of forests

Extent of land available for Mitigation

- Houghton et al. (1993)
 - 750 Mha of forest land cleared in DCs, of which 90% inefficiently managed or used for marginal agriculture
- IPCC SAR
 - Global area - 700 Mha; A&R-345 Mha, 138 Mha – slowing deforestation & 217 Mha for NR
- Bekkering (1992)
 - 11 tropical countries – 483 Mha for A&R
- Ravindranath & Sathaye (1998) – 13 countries
 - 191 Mha – A&R; 179 Mha – AF; 75 Mha - NR

Multiple options for land-use in addressing climate mitigation

1. C Sequestration
 - i) Afforestation and reforestation in degraded forest land
 - ii) Agro-forestry on crop lands
2. Biofuels or bioenergy
 - i) **Biomass power**; Energy plantations for wood combustion or gasification – marginal or degraded lands
 - ii) **Liquid fuels**
 - Biodiesel from ex. Jatropha, Pongamia, Rape seed
 - Ethanol from Sugarcane, corn, sugarbeat
 - Methanol from biomass
3. Wood products substituting FF intensive products

Choice of land categories & extent of land for mitigation activities

- **Varies with the country & even regions**
 - Most countries have surplus land
- **Varies with status of economic development**
 - Demand for food, livestock grazing, ecological functions
 - Both developing and developed have surplus lands
- **Depends on the financial incentives - mitigation**
 - Carbon payments likely to be an incentive
 - Carbon payments per hectare
- **National and local land use policies**
 - Could change and favor mitigation, depending on carbon price

Strategy for multifunctional mitigation projects

- Need for Guidelines for Bioenergy or C sequestration projects for addressing
 - Biodiversity conservation
 - Local biomass demands; fuelwood, grazing, etc
 - Not affect water balance or compete for water
 - Sustaining the benefits; carbon & sustainable development
 - Possibly address local environmental issues; water pollution, reclaiming degraded lands,..
 - Local food production or security not affected
 - Adaptation to climate change
 - Compliment other conventions & agreements

Currently such issues are inadequately considered under mitigation projects

TRADE-OFF: C seq & Bioenergy projects for environmental & economic services

Environmental / Economic services	Carbon sequestration	Bioenergy
Food production	- Only if cropland converted - If land meant for crops converted to C- seq	- tradeoff only if cropland used
Biodiversity	- If forest land used - If monocultures adopted	- No trade-off if non-forest land
Water supply	- No trade-off - Rarely irrigated	- Trade-off only if irrigated
Local biomass supply	- No trade-off - Largely degraded land used	- Trade-off only if forests replaced

Synergy; C seq & bioenergy projects for Environmental & economic services

Envni / Econo. Service	C – Seq	Bioenergy
Food production	-SYNERGY -if Deg lands leads to Land reclamation	SYNERGY: If deg lands TRADEOFF: if cropland
Biodiversity	-SYNERGY -If Deg lands used -BD incorporated	TRADEOFF -If deg forest land -If only mono plantations
Water supply	-SYNERGY: if A&R in Deg lands, leads to watershed protection	TRADEOFF: if cropland used & irrigated SYNERGY: if deg land
Local biomass supply	-SYNERGY: If Deg land used, biomass needs incorporated	SYNERGY; if multi-species planted & local needs incorporated

How to promote synergy in land use for mitigation

- Under current Kyoto Protocol activities under Articles; 3.3, 3.4 and 12
- **Any emerging mechanisms; Post-Kyoto Protocol**
- **Multilateral and bilateral mitigation projects**
- National A&R and Forest Development programmes

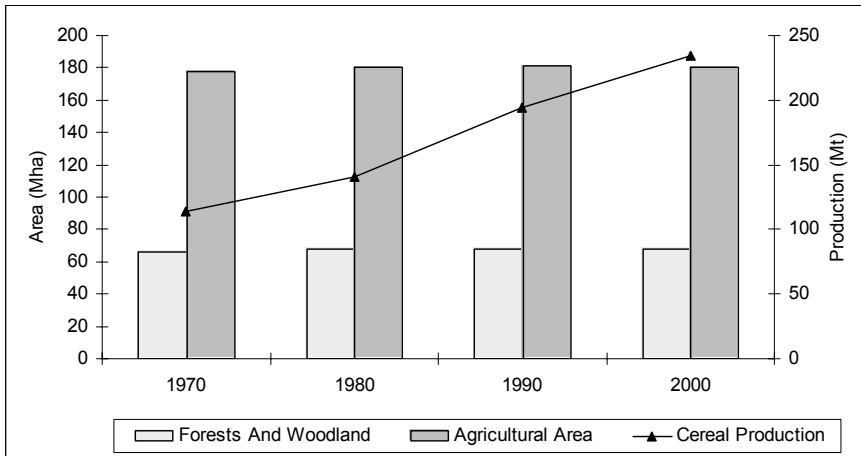
Strategy to promote synergy

1. Countries to prioritize land use policies
 - depending on competitive uses for land
2. Develop Guidelines to promote land use for mitigation with multiple functions
 - Synergy, mitigation and Sustainable development
 - Synergy between different functions
 - Mitigation + Biodiversity + Watershed Protection + ..
3. Mechanisms to enforce the 'Synergy Guidelines'
 - Kyoto Protocol and Post-Kyoto
 - Multilateral and bilateral land use related projects

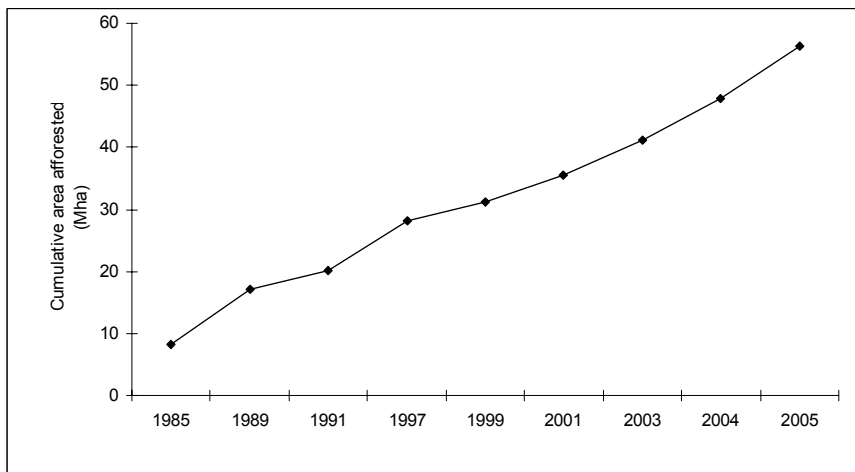
Issues for future negotiations

1. Improve scientific understanding
 - Impacts, mitigation potentials
 - Synergy, tradeoff,
 - Methods for estimation, monitoring, etc
2. Developing guidelines for promoting synergy
3. Building capacity for promoting synergy

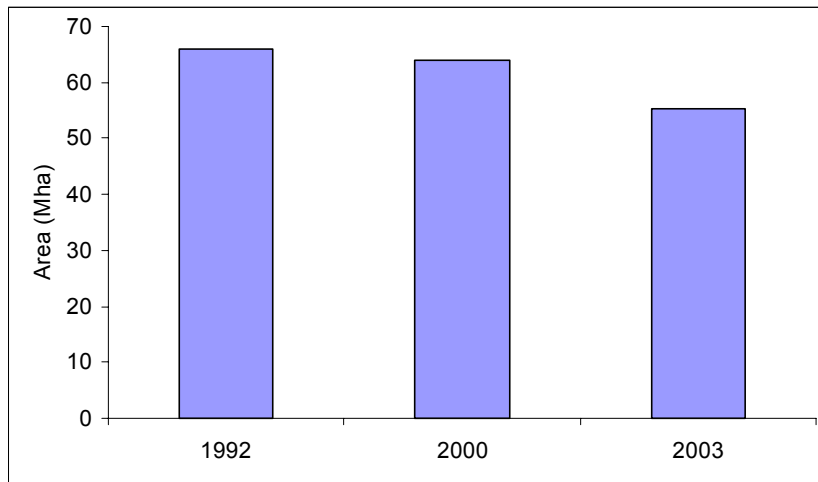
Trends in area under forests and food production in India



Area afforested in India



Extent of degraded land available for forestry mitigation in India



Comparison of mitigation Potential Case Study from India

	Biomass for bioenergy		C sequestration via A&R	
	A. Coal	B. Diesel	Short rotation	Long rotation
Total C-benefit per 30 year period (t C)	503	455	478	1054
Annual mitigation potential (t C/ha/yr)	0.84	0.76	0.80	1.76
Mitigation potential_30 years (t C/ha/30 yrs)	25.2	22.8	23.9	52.7
Mitigation potential_100 years (t C/ha/100 yrs)	46.5	38.7	23.9	45.2

^a Present value of all cost of the plantations/t C, with a 6% discount rate.