Managing Tropical Forest Landscapes in a Changing Global Scenario with special reference to India

International Workshop
Forestry and Forest Sciences in an ever more complex global context
(16-22 March 2014)
Jakarta, Indonesia

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INTRODUCTION

- Forests cover almost 30% of the continental surface area of the world and provide basic sustenance to about 1.6 billion people

- Approx. 3000 million ha (23% of the continental surface area) is classified as productive forest (Solberg, 1996)

- About 1.2 billion people (20% of the world's population) depend directly on agro-forestry products and services in rural and urban areas of developing countries

- The rapid growth of the human population and technological change has threatened the ability of the forest to recover from intervention in many places

INTRODUCTION

- Much of the world's remaining tropical forest, rich in biodiversity, survives, though increasingly a little, in remote regions

- In Southeast Asia, the bulk of Asia's tropical forest survives

- Though the forest of mainland and insular Southeast Asia are famous for their highly prized tropical hardwood timber, they are extraordinarily rich in great variety of plant and animal species

Forest degradation

- The current extent of the world's forest landscape is 5587.6 million ha (Mha), or 37.3% of the Earth's total land surface

- This is divided into closed forests, open forests & woodlands, and naturally treeless areas, based on tree canopy cover (Hansen *et al.*, 2003)

- The global deforestation and forest degradation rates remain alarmingly high (FAO, 2010)

- Only 22% of the world's old growth original forest cover remains intact (Potapov *et al.*, 2008)

Forest degradation

- Currently, the global forest land base (which covers almost 4 billion hectares) is shrinking at a rate of 13 million hectares per year, mainly because of land-use change in the Tropics and Oceania (FAO, 2010)

- Hence, it is of immense importance not only to conserve but also to restore forest ecosystems

- About 30 percent of global forest cover has been completely cleared and a further 20 percent has been degraded (Minnemeyer *et al*., 2011)

Forest degradation

- The first high-resolution global map of 21st century changes in forest cover depicts the areas of the world which are losing and gaining the forests

- The study built the map using satellite images of the Earth's surface on a 30-metre resolution scale

- Between 2000 and 2012, 2.3 million square kilometres of forest were lost while 0.8 million square kilometres were reforested in that time (Hansen *et al*., 2013)

- The tropics were the only climate domain to show a significant trend with forest loss increasing by 2101 square kilometres per year

Forest degradation

- Brazil had the largest annual decline in forest loss over this period, cutting annual forest loss in half from 40,000 sq. km. in 2003 to 20,000 sq. km. in 2010

- Indonesia had the largest increase in forest loss, more than doubling its annual loss during the study period to nearly 20,000 sq. km. in 2011

- In the United States, the 'disturbance rate' of south-eastern forests was four times that of South American rainforests, more than 31% of the forest cover was either lost or re-grown (Hansen *et al.*, 2013)

Forests in India-Brief Overview

- India's forest sector has been through interesting policy and management changes since 1950
- The goals of 1952's National Forest Policy could not be fully achieved and the sustained yield management principle failed to some extent
- In 1960s and 1970's, there was rush for more and more timber extraction
- In 1970s, there was a boom to clear-fell and plant fast growing tree species which was supported by national development plan schemes

Forests in India-Brief Overview

- In1970s, Forest Corporations were set up for tree felling and development of forests hoping to attract institutional finance
- As experience later showed, most of these corporations became a failure
- In mid-seventies, the social forestry era started and financial resources for forest management were diverted to social forestry
- In 1990s, Joint Forest Management (JFM) was initiated with initial resistance from forest managers

Forests in India-Current Scenario

❑India with 2.5% of the land area of the world supports nearly 15% of the world's human population.

❑Forests in India have very low ($65 \text{ m}^3\text{ha}^{-1}$) growing stock compared to the world average ($110 \text{ m}^3\text{ha}^{-1}$).

❑Likewise, MAI is very low at $0.5 \text{ m}^3\text{ha}^{-1}\text{yr}^{-1}$ compared to the world average ($2.1 \text{ m}^3\text{ha}^{-1}\text{yr}^{-1}$).

❑The fuel wood and green & dry fodder for livestock requirement is to the tune of 1061 MT and 589 MT, besides 75 million m^3 of timber (Veena, 2010).

❑About 20 Mha is covered under private tree planting (agro-forestry, farm forestry, social forestry etc).

❑India's total Forest and Tree cover of the country is 78.29 Mha, which is 23.81% of the geographical area of the country.

❑The forest Cover accounts for 69.20 Mha (21.05%), out of which 28.78 Mha is degraded (FSI, 2011).

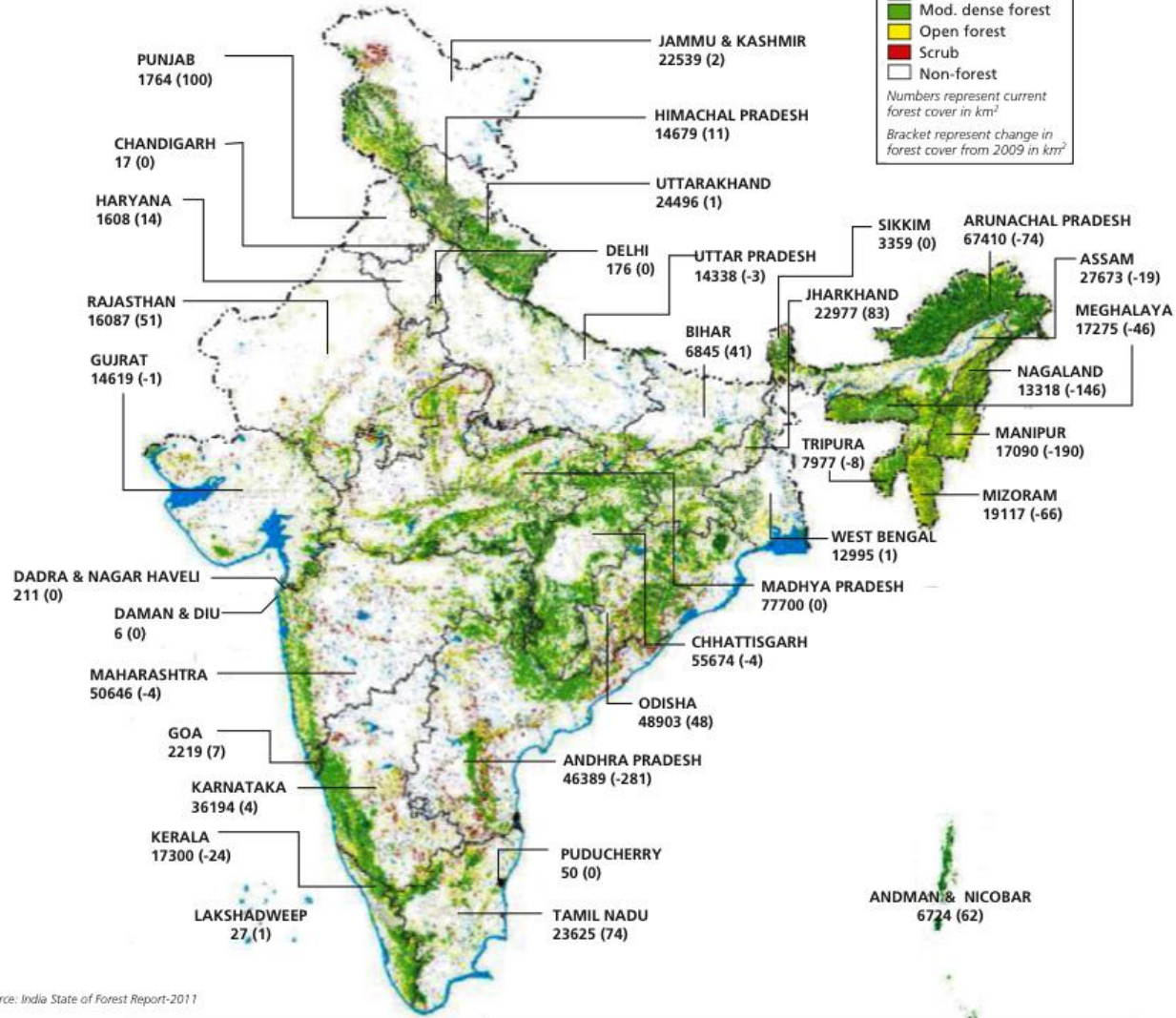❑The total bamboo bearing area in the country is estimated to be 13.96 Mha and the total carbon stock in the forests is estimated to be 6663 MT.

❑The total growing stock is estimated as 4998.73 m³ inside the forests and 1548.42 m³ outside the forests.

❑The annual estimated production of wood from forests (recorded production) and Trees outside Forests (TOF) is estimated to be 3.18 and 42.77 m³.

India Forest Map

India's forest cover

LEGENDS
- ■ Very dense forest
- ■ Mod. dense forest
- ■ Open forest
- ■ Scrub
- □ Non-forest

Numbers represent current forest cover in km²

Bracket represent change in forest cover from 2009 in km²

PUNJAB 1764 (100)

CHANDIGARH 17 (0)

HARYANA 1608 (14)

RAJASTHAN 16087 (51)

GUJRAT 14619 (-1)

DADRA & NAGAR HAVELI 211 (0)

DAMAN & DIU 6 (0)

MAHARASHTRA 50646 (-4)

GOA 2219 (7)

KARNATAKA 36194 (4)

KERALA 17300 (-24)

LAKSHADWEEP 27 (1)

JAMMU & KASHMIR 22539 (2)

HIMACHAL PRADESH 14679 (11)

UTTARAKHAND 24496 (1)

DELHI 176 (0)

UTTAR PRADESH 14338 (-3)

BIHAR 6845 (41)

SIKKIM 3359 (0)

ARUNACHAL PRADESH 67410 (-74)

ASSAM 27673 (-19)

JHARKHAND 22977 (83)

MEGHALAYA 17275 (-46)

NAGALAND 13318 (-146)

MANIPUR 17090 (-190)

TRIPURA 7977 (-8)

MIZORAM 19117 (-66)

WEST BENGAL 12995 (1)

MADHYA PRADESH 77700 (0)

CHHATTISGARH 55674 (-4)

ODISHA 48903 (48)

ANDHRA PRADESH 46389 (-281)

PUDUCHERRY 50 (0)

TAMIL NADU 23625 (74)

ANDMAN & NICOBAR 6724 (62)

Source: India State of Forest Report-2011

❑The total annual consumption for 'housing & construction', 'furniture & fixtures' and agricultural implements is estimated to be 48.00 m^3.

❑The annual estimated production of fuel-wood from forests (recorded production) and TOF (from harvested trees) is estimated to be 1.23 and 19.25 MT, respectively.

❑The total annual consumption of fuel-wood is estimated to be 216.42 MT out of which 58.75 MT comes from the forests (including recorded and unrecorded removals).

❑Of the total population using fuel-wood, 23% of population is obtaining fuel-wood from the forests (FSI, 2011).

Efforts for Conserving biodiversity

❑The developmental activities require diversion of forest areas for non-forestry purposes.

❑Mining, sand mining, un-sustainable eco-tourism etc. also contributes to forest degradation.

❑This has not been the case only in usual forest areas but also in biodiversity hot-spots like famous Western Ghats which cover an area of 1, 64, 280 km^2 (1500 km in length) across 6 states.

❑About 50 million people are residing in this region and 58 rivers emanate from the Western Ghats.

❑About 27% of the country's total species is known to be from the Ghats.

❑Between 1920 and 1990, 40% of the original vegetation cover in the southern region of the Ghats was lost.

❑Currently, only about 7% of the area is under primary vegetation cover.

- ❑ The MoEF constituted a Western Ghats Ecological Expert Panel in March 2010.

- ❑ The panel was asked to assess the current status of the Western Ghats and demarcate areas to be notified as ecologically sensitive for their conservation, protection and rejuvenation.

- ❑ It was also asked to recommend modalities for the establishment of a Western Ghats Ecology Authority under Environment (Protection) Act, 1986.

- ❑ The panel submitted its report to the government in August 2011.

- ❑ The ministry set up another high-level Working Group to study and modify the report submitted by the expert panel to protect this famous biodiversity hot-spot in the country.

- ❑ The group submitted the report on 15th April 2013 which distinguishes between cultural and natural landscape.

- ❑ It said that cultural landscapes, which include human settlements, agricultural fields and plantations, covered 58.44% of the Ghats.

- It identified 90% of the remaining natural landscape area marked as an ESA i.e. 37% of the total area of the Western Ghats is ecologically sensitive, covering about 60,000 sq. km, including the existing protected areas, spread across the six states.

- It recommended not to allow thermal power projects in the ESA and hydropower projects be allowed only after "a cumulative study on the impact of each project on the flow pattern of the rivers and forest and biodiversity loss" is conducted.

- All red category industries, which are identified as heavily polluting by the environment ministry and include fertilizer plants, oil refineries, tanneries and copper smelters (a list of more than 60 items), be strictly banned.

- However, normal activities like agriculture and plantation may continue.

- The MoEF recently launched an ambitious project entitled 'National Mission for a Green India' under the National Action Plan on Climate Change, co-terminus with 12th & 13th five-year plan.

- The draft document was put on website on 23rd May 2010 for comments and 7 regional consultations, attended by the Union Minister for E&F, were held during June-July 2010.

- The focus is on improving the quality of forests and ecosystem services, ensuring democratic decentralisation, creating a new cadre of young foresters and adopting a landscape-based approach to forest design.

- The aim of the Green India Mission is to respond to climate change by a combination of adaptation and mitigation measures.

- The total outlay for the next 10 years is Rs. 460 billions which has been approved by CCEA on 20th Feb. 2014 out of which Rs. 130 billions have been year-marked during 12th five-year plan.

The Green India Mission envisages five Sub Missions:

- Sub Mission 1: Enhancing quality of forest cover and improving ecosystem services (4.9 m ha): It covers moderately dense forest cover but showing degradation (1.5 m ha), eco-restoration of degraded open forests (3m ha) and restoration of Grasslands (0.4 m ha).

- Sub Mission 2: Ecosystem restoration and increase in forest cover (1.8 m ha): It includes rehabilitation of Shifting cultivation areas (0.6 m ha); and restoring scrublands (0.8 m ha), Seabuckthorn (0.1 m ha), mangroves (0.10 m ha) and abandoned mining areas (0.10 m ha); and ravine reclamation (0.10 m ha).

- Sub Mission 3: Enhancing tree cover in Urban and Peri-urban areas including institutional lands (0.20 m ha).

- Sub Mission 4: Agro-forestry and Social forestry (increasing biomass and creating carbon sink) (3 m ha).

- Sub Mission 5: Restoration of Wetlands (0.10 m ha).

Forest monitoring for REDD+

❑FSI modified the forest inventory design in 2001, to make the NFI operational, generate national estimates and meet changing information needs.

❑New parameters required under the UNFCCC, such as the estimation of soil organic matter, were included and a two-stage sampling design was adopted.

❑In the first stage, the country is divided into 14 homogeneous physiographical zones based on climate and vegetation, where civil districts form the sampling unit.

❑A sample of 10% of the districts (about 60) is then randomly selected from across all the zones, in proportion to their size, for use in the forest inventory, which is to be completed in two years.

Physiographic map of India
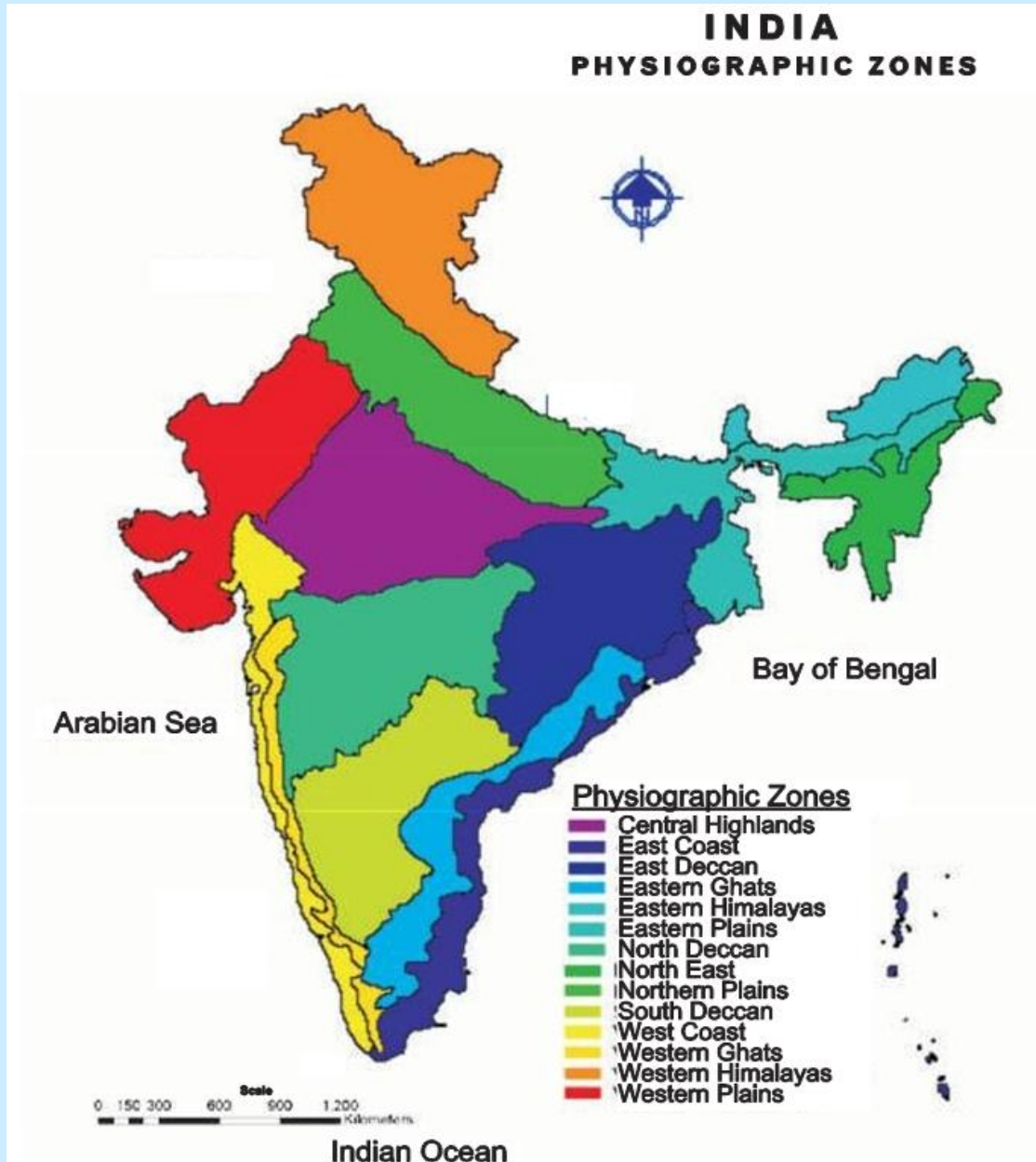
Forest monitoring for REDD+

❑This period coincides with forest cover monitoring by satellite imagery.

❑In the second stage, selected districts are divided into grids of latitude and longitude to form the sampling units.

❑ Sample plots are laid out in each grid to conduct field inventory using a systematic sampling design.

❑After completing an inventory of 60 districts in two years, a new set of 60 districts is selected and the process is repeated (FSI, 2010).

❑Parameters of national forests, such as growing stock and species distribution, began to be estimated after the first two cycles.

❑In 2008, FSI launched a new biomass study, which followed two approaches, to measure those components of forest biomass that are not measured by NFI, as required under REDD+.

❑First, the biomass of herbs, shrubs, climbers, dead wood and litter was measured by revisiting about 100 sample plots in each physiographical zone inventoried during 2007–2008.

❑Second, 20 to 30 trees of each species were selected in each zone, in a range of diameter classes above 10 cm, and the branches and leaves were cut according to a sample design; a similar number of young trees with a diameter of less than 10 cm were cut flush to the ground.

❑The biomass of the trees was then measured to generate biomass equations for:

      (1) the diameter of NFI trees vs. the biomass of branches with a diameter of less than 5 cm, bole wood of less than 10 cm and leaves, as these components are not measured in the standard NFI

      (2) the collar diameter of small seedlings and saplings vs. the total biomass of these small trees.

❑The new biomass study led to the estimation of the carbon stock in India's forests in 2009, following the Tier 2 approach of the IPCC guidelines (IPCC, 2006).

❑To estimate changes in the carbon stock for the purpose of REDD+, 'post-sampling stratification' is done.

❑This involves laying the map of forest types over the forest cover map, which has three canopy density classes.

❑Thus, forest cover is stratified by two variables viz., type and density.

❑The sample plots in each stratum characterised by a specific forest type and density are analysed to give the average amount of carbon stock per ha of the stratum (Pandey, 2012).

❑To estimate the change in carbon stock, only the area in each stratum is required; this is obtained by laying the map of forest types over subsequent assessments of forest cover.

Scenario of Asia's Tropical Forests

❏Asia's tropical forest is of special concern to both conservation and commercial interests not only because it is smaller (316 Mha) than other tropical areas (Americas with 916 Mha and Africa with 527 Mha), but also because it has experienced the highest rate of deforestation and logging .

❏It is predicted that by 2100 Southeast Asia will have lost 74% of forest and between 13 and 42% of plant and animal species in the region.

❏Deforestation often contributes to or aggravates the loss of local languages and thus the knowledge and culture they represent.

❏The colonization of deforested areas by politically and culturally dominant populations and the displacement, removal of resettlement of indigenous populations from national parks, forest reserves and timber concession to urban and other areas leads to linguistic 'swamping' by the dominant groups, resulting in increasing bilingualism and eventual language loss, especially among school children (Headland, 2004).

❏About 6, 00,000 tribal people have been displaced in India alone.

The changing global context

❖ The key factors to consider when accessing the future of the forest must be those underlying political, social and economic forces (Puri and Donovan, 2005).

❖ The environmental changes that scientist identify today echo the accumulated impact of long list of activities, past and present.

❖ Some of the key factors in each category that may be expected to affect the fate of Asia's tropical forest are:

Political factors
- Insurgencies
- Internal conflicts for natural resource extraction (e.g., Conflict timber) and often fuelled by the competition for resources
- Increasing role for regional institutions
- Decentralization with or without devolution
- Increased participation and public-private sector collaboration
- Civil society becoming more proactive and involved in public interest litigation
- Increased recognition of collective rights and free, prior and informed consent as a principle in international law, private sector, NGO and national policies

Social factors

- Increasing urbanization

- Changing demographic structure

- Widening inequalities between rich and poor, rural and urban

- Widespread rural poverty

- Increasing awareness (via international organizations, media, internet etc.)

- Increasing in social activism and importance of NGO's

- Improving position of urban and managerial workers

- Emergence of district urban middle class

- Rural-urban migration

Economic factors

▪Expanding global market with increasing economic integration and independency

▪Improved telecommunications and infrastructure

▪Increased commercialization of local crops

▪Increasing level of materials consumption

▪Increased demand for consumer goods, increasing demand for raw materials

▪Continued development of the biotechnology and IT sectors with convergence developing

▪Market developing for environmental services or public goods, including water, ecotourism and wildlife habitat

▪'Precision' forest production for niche markets

Environmental factors

▪Decreasing area of natural forest while plantation area expands

▪Climate change, with higher temperature possibly reducing productivity given increased respiration rates

▪Increasing awareness of environmental issues

▪Environmental degradation contributing to poverty

▪Loss of habitat and pushing many wild species of plants and animals to extinction

▪Increased air pollution with increased car population

▪Trans-boundary nature of environmental issues

Managing the Forests: thinking ahead

▪For tropical and developing countries, forestry issues are inseparable from the fundamental challenges of development, and the environmental consequences of population growth, economic growth, and industrialization (Brooks, 1992).

▪Developing countries, in recognizing long-term global environmental problems, face a challenge even greater than that of developed countries in trying to balance concern for environmental conditions with critical, short-term, economic needs.

▪The major forestry issues are :

- Identifying an appropriate and sustainable role for forest resources and commodity trade in a framework of policies that are consistent across sectors of the national economy

- Establishing a more equitable distribution of resources, a more stable set of property rights, and a system of incentives and rewards that begins to achieve broad-based social objectives

- Strengthening institutions for resource management, including both the public and the private sector

- Understanding social, economic, and ecological factors that determine the extent to which the resource endowments of forested developing countries can be transformed into development assets consistent with management of local, regional, and global environmental systems

- These issues are not recent or unanticipated.

- However, they are dominated by concerns that are typically outside the boundaries of forest and natural resource policy.

- Designing and implementing programs require skills that are not typically acquired by natural resource management professionals.

- Although a better understanding of biological and technical issues is needed, the research and policy agenda must nevertheless focus on social and economic questions.

Concluding Remarks

➢Forests have a major role in the global carbon cycle and in climate change as they store a large amount of carbon in vegetation and soils.

➢Considering their environmental and social importance, it seems that the managed forest ecosystems are not receiving as much scientific attention as the few remaining unmanaged ones.

➢This is especially true for the managed wooded areas within urban landscapes where forests represent a last remnant wilderness that is not only used commercially, but also for outdoor recreation and other important uses.

➢The appropriate management of a forested landscape requires ongoing empirical research to improve growth and hazard predictions for different climate scenarios.

➢Given the rapid growth of Asia's new market economies, the increasing demand for raw materials is expected to put increasing pressure on Southeast Asian forest resources.

➢Technological responses, including plantation timber, only may not be sufficient to produce the innovations and efficiencies needed to avoid a heavy toll on tropical high forest.

➢Southeast Asia, because of its proximity to the world's fastest growing markets and the massive development of new road and rail systems in this region, feels the heaviest pressure on forest resources.

➢Understanding local people's needs is vital to the conservation & sustainable development of the tropical forests.

➢Most developing country researchers, NGO activists, planners and policy-makers are still struggling to understand how to reduce rural poverty and at the same time halt environmental degradation, including forest loss.

➢There is a need to strike a balance between conserving forest and finding way to employ forest resources to enhance the lives of the millions of people and societies who depends on them.

THANK YOU