BOOK REVIEW

The Challenge of Sustainable Forest Management. Food and Agriculture Organization of the United Nations, Rome Italy, 1993 128 pp.

Sustainable development has become a key issue since publication of report of the World Commission on Environment and Development commonly called the Brundtland Commission in 1987. It was taken up immediately by the environmentalists the world over. Since then the question of sustainable forestry has also cropped up. Both sustainable development and sustainable forest management were discussed in great detail in United Nations Conference on Environment and Development (UNCED) held in Rio de Janciro, Brazil in June 1992. The world is now increasingly recognizing the linkages between these two issues. There is now a voluminous body of literature on general aspects of both, more on sustainable development and less on sustainable forest management. The reasons for this state of affairs are obvious. Forestry and forest management is least understood by the general public because most of the people do not come in contact with forests very often.

The environmentalist are presently actively promoting sustainable forest management especially in tropical countries in which forests were cleared for extension of agriculture for food production in the past. This process has accelerated tremendously during last few decades. The book under review explains the challenge of sustainable forest management. It is primarily aimed at non-technical audience, including policy makers and general public. A global view of forest management in the light of sustainability is presented is an easy to understand language. All aspects of present and future relationships between sustainable development and sustainable forest management are explored and discussed in detail. It would also prove useful for professional foresters to explain them to policy makers for promotion of sustainable forest management.

K. M. Siddiqui

NEWS AND VIEWS

1. MISCELLANEOUS FOREST NEWS AND DEVELOPMENTS

Forests are Oxygen Factories

- To grow a pound of wood, a typical tree
  Uses nearly 1½ pounds of carbon dioxide
  Gives off more than 1 pound of oxygen

- An acre of tree might grow 4,000 pounds of wood/year and
  Use 5,880 pounds of carbon dioxide
  Give off 4,280 pounds of oxygen

- When a forest gets old and overcrowded, the trees barely grow and begin to use oxygen rather than produce it.

- An old forest may also have more wood decaying than growing. When this happens, the process reverses:

  A pound of decaying wood = a pound of oxygen used and nearly 1½ pounds of carbon dioxide released into the air.

Source: Philomath Information Action Committee / Oregon Project.

2. FORESTRY SUPPORT PROGRAMME MEMO APRIL - JUNE, 1993.

Top Forest Products Exporters

The following figures show the world's top ten forest products exporters for 1989. These FAO statistics indicate that 81.4 percent of the global exports of forest products came from developed countries.

COUNTRY	US$BILLION
Canada	18.4
USA	12.4
Sweden	8.7
Finland	8.5
Germany (F.R.)	6.1
USSR	3.8
Indonesia	3.7
France	3.3
Malaysia	3.0
Austria	2.8

- ITTO Tropical Forest Management Update.

World Commission on Forests and Sustainable Development

An Organizing Committee chaired by Ambassador Ola Ullsten, former Prime Minister of Sweden, has been established for the purpose of creating an independent World Commission on Forests and Sustainable Development. A recent proposal developed by the Organizing Committee described the objectives of the Commission as follows:

> "The Commission would attempt to advance forest issues as part of the mainstream of economic development. It would marshall the most objective scientific information available on the stage of the world's forests and on the consequences of rapid changes now underway. It would examine land use practices, multiple forest uses, the causes of deforestation and forest degradation, and consider how to reduce the pressures on forests. It would assess the social, economic, political, and ecological issues surrounding forests and development and bring in practical proposals for improvement. In particular, it would propose measures to reform international economic relations, including measures to increase international trade in agricultural and manufactured products and thus both reduce pressures for forest exploitation and improve prospects for other forest uses, including biodiversity. It would propose improved policies and measures for multiple uses of forests in ways that are compatible with sustainable development. It would also look at existing forms of international cooperation, including the role of agencies of the United Nations system, and propose means of strengthening them and making them more effective. The Secretary General of the United Nations will be invited to appoint the Chairman and Vice Chairman of the Commission. The Commission will be responsible for securing funds from various government and non-government sources and it will be served by a small secretariat. It will draw upon the expertise of United National agencies and other experts and institutions. The Commission will submit its report in three years:.

3. IUCN Forest Conservation Programme Newsletter

CIFOR

The Center for International Forestry Research (CIFOR) within the CGIAR system became a legally constituted entity in March with the signing of the Establishment Agreement by the sponsors, Australia, Sweden, and Switzerland. Jeffrey Sayer was appointed the first Director General, who will be temporarily located in Washington with the CGIAR Secretariat. The headquarters for CIFOR will be established on the premises of the Forest Research and Development Center in Bogor, Indonesia.

INFO Research Newsletter

According to a study in 1992 by Meridian Corporation, the use of wood and other biomass resources to produce electricity resulted in a net impact of more than $1.8 billion in personal and corporate income throughout the United States economy. More than 66,000 jobs are presently being supported by this income. By the year 2010, the economic benefits are anticipated to be far greater as advanced biomass power technologies and energy crops are commercialized, resulting in $6.2 billion in personal and corporate income and 284,000 jobs annually. With much of this activity in the rural sector, biomass power can be a substantial pathway for revitalizing rural America.

The term "biomass energy" in this study includes wood, agricultural residues, and energy crops. Use of municipal solid waste and landfill gas for power production were not included in the scope of the study. The category of wood includes both sawmill and papermill residues (in the form of wood solids and practices), residues and thinning from commercial forestry operations, orchard pruning, and urban wood residues.

Biomass power production in the U.S. grew rapidly after the oil price shock of 1973 and then slowed in the late 1980's, due in part to lower oil prices. Now, the industry is once again poised for significant growth due to environmental regulations, more attractive economic conditions, and promising new biomass power technologies. In the near term, utilities are showing increased interest in confirming biomass with fossil fuels to lower sulfur emissions. Facilities which currently use biomass to produce electricity include papermills, sawmills, furniture manufacturers, small power producers, and other industrial operations, as well as a few electric utilities. Using biomass residues for energy significantly reduces the volume of material that must be landfilled. By decreasing the volume of wasters that must be landfilled, disposal costs are also dramatically lowered.

Biomass energy also benefits the quality of the atmosphere. When biomass (such as trees and grass) grows it absorbs CO_2 from the atmosphere. The same CO_2 is emitted up when biomass is burned for power. The result is no notable increase in global CO_2.

In addition, since biomass feedstocks are low in sulfur, their combustion results in virtually no SO_2 emissions. This makes biomass attractive to utilities, since displacing coal with biomass can help them comply with Clean Air Act requirements. The study assumes some expanded market penetration for biomass power due to

confirming of biomass and coal in utility boilers to meet Clean Air Act requirements.

Forest Products Conservation and Recycling
Review Newsletter

4. **International Forestry: Organizations, Policies, and Funding Workshop**

This workshop was held on June 1-2, 1993 in Bethesda, Maryland. Primary sponsors were the International Society of Tropical Foresters, the Society of American Foresters, the American Forest and Pulp Association, Auduon Society, American Forests, and the TEAP. Forestry Advisors Group. Funding for the workshop was provided by USAID and USDA Forest Service. Approximately sixty persons attended, representing several countries and organizations, including multilateral, bilateral, industry and NGOs. Presentations were made by: UN/FAO, UNDP, World Bank, Canada, Germany, and the United States. There was also a presentation made concerning the Forests for the Future Initiative. Small group discussions focussed on major issues.

In advance of the workshop two papers were completed. They include: "An Overview of International Forestry Funding" and "Principles for Sustainable Management of Global Forests: Review of the Forest Principles and Agenda 21 - Chapter II Combatting Deforestation". For copies of these papers please contact: Howard Heiner, International Society of Tropical Foresters, 5400 Grosvenor Lane, Bethesda, Maryland 20814.

Second Interim Report of the State of Tropical Forests

Preliminary estimates prepared by FAO's Forest Resource Assessment 1990 Project show there are 1.7148 billion hectares of forest land in 87 countries in the tropical region in 1990. The area deforested annually for the same countries since 1981 is estimated to be 17 million hectares. Forests are defined as having a minimum of 10 percent crown cover of trees (minimum height 5m.) and/or bamboos, generally associated with wild flora, fauna and natural soil conditions, and not subjected to agricultural practices. Deforestation refers to the change of land use or depletion of the crown cover to less than ten percent. Work is in progress on monitoring forest degradation. Indications are that the loss of biomass in the tropical forest is occurring at a significantly higher rate than the loss of area due to deforestation. For further information contact: Forest Resources Assessment 1990 Project, FAO Via delle Terme di Caracalla, 00100 Rome, Italy.

- SPDC Information Bulletin for Developing countries

Agroforestry Today is a quarterly publication of the International Centre for Research in Agro-forestry (ICRAF). Subscriptions are free and contributions are welcomed. Contact: ICRAF, P.O. Box 30677, Nairobi, Kenya.

5. TROPICAL FOREST UPDATE
Volume 3, No.5 October, 1993
David Bengston

What is Ecological Economics?

Ecological economics is not traditional natural resource and environmental economics. Ecological economics is a departure from the traditional ways economists view environmental issues - it represents a new paradigm (i.e. world view).

The following statement by John Proops is a good summary of the rationale for ecological economics: "Economists are increasingly coming to recognize that the study of human activities of a finite planet, in the long-run, requires a different set of concepts to those useful for the economic analysis of households, firms, and nation states in the short and medium-run. In a complementary way, ecologists, and other natural scientists, are increasingly recognizing that economic activity is here to stay; human activities are coming to dominate the global ecosystem, and ecosystem analysis which does not explicitly include economic activities makes less and less sense. The stage seems to be set for a coming together of these two disciplines so that problems of resource use and pollution in the global ecosystem can be discussed and assessed in a conceptual framework worthy of these problems" (Proops 1989).

There are at least 6 major themes of ecological economics that distinguish it from conventional (neoclassical) economic approaches to nature resources and the environment.

Sustainability: Traditional economic analysis focuses on the goals of allocative efficiency and growth. Ecological economists maintain that the integrity and sustainability of the ecosystem are essential to future economic well-being, and that the criterion of sustainability should be built into economic models and policies.

Multiple values, broader notions of value: Economic value is limited to two narrow types: Value in exchange (market price) and value in use (willingness to pay or willingness to accept compensation). As someone once observed "Economic value is a species of the genus value". Ecological economics proposes sa much broader theory of value that includes social, aesthetic, life support, intrinsic, and energy values, in addition to traditional economic value.

Some ecological economists - notably Howard Odum of the University of Florida at Gainsville have proposed a theory of value for ecological economics based on the energy content or energy cost of production of goods and services. Energy-based valuation yields some interesting economic insights, but most ecological economists view this as one approach to valuation among many and recognize that all of the values of the environment cannot be reduced to a single index.

International equity: In conventional economics, decisions about how to use resources over time are treated as investment questions, as if all resources belong to the present generation. The practice of discounting future values in economics means that a resource 10 years from now is only about half as valuable as that same resource today (depending on the discount rate). Ecological economists believe that the future should not be so heavily discounted, and that we need to make decisions that won't compromise the quality of life (or life itself) for future generations.

Uncertainty: Another theme of ecological economics is uncertainty-recognition that there are fundamental uncertainties and high levels of risk surrounding large scale or irreversible changes in

the environment. For example, we don't know with any precision what the future impacts of increased concentrations of greenhouse gases in the atmosphere will be. In the face of such uncertainty, the prudent course is to proceed with caution. "One does not run blindly through fa dark landscape that may contain crevasses. One assumes they are there and goes gingerly and with eyes wide open, at least until one can see a little better" (Costanza 1989).

Methodological pluralism: Sole reliance on any one analytical framework or method would provide an incomplete picture of the relationships between ecosystems and economic systems. As Christopher Stone (1988) notes, summarizing the view of Paul Feyerabend, "...the history of sciences reveals an incompleteness and even inconsistency of each framework which should be regarded as routine and inevitable, and... a pluralism of theories and metaphysical viewpoints should be nourished as a means of advancing on the truth".

Land ethic: Utilitarianism-the philosophical doctrine that considers utility as the criterion of action and the useful as good is the philosophical base of traditional economics and traditional forestry. In contrast, the philosophical underpinning of ecological economics is an environmental or land ethic: "When we see land as a community to which we belong, we may begin to use it with love and respect" (Leopold 1966).

6. FORSPA: QUARTERLY NEWSLETTER
Volume 2, Number 4
October-December 1993

Re-examining People, Environment & Forestry Interaction

In keeping with the recommendations of the 1992 Rio Conference, and the dominant role of forests in alleviating environmental degradation, the 14th Commonwealth Forestry Conference, highlighted an appropriate and timely theme -- People, the Environment and Forestry -- Conflict or Harmony. Delegates from nearly forty countries, representing virtually every known type of forest ecosystem and every continent gathered in Kuala Lumpur for a week (13-18 September 1993) to share the richness of their experiences and strive for innovative solutions to meet the new challenges.

The subject comprehends a plethora of issues that straggle interrelationships between forestry and environment, environment and development, and forest and non-forest linkages encompassing forests and global society. To focus the deliberations, four sub-areas on specific local concerns, with sustainability as the lead, were created, viz., Conservation and Environmental Management, Forest Management for Sustainable Production of Multiple Benefits, Forestry and Climate Change and Environmental Accounting and Mechanisms for Reconciling Land Use Pressure on Forests. Sustainability, though accepted as essential, drew a lot of attention in terms of the mechanisms to achieve it and the development objectives that would ensure its attainment.

* Conservation and Growth

Normally speaking, Development sans Conservation is aa prescription for human misery and a detriment to economic well-being. The practical evidence of international progress, however is contrary; ironically, environmental degradation seems to be the rule, making the development process appear as a model of internecine growth. The principle of sustainability is the approach to withstand the threats of global warming and loss of biodiversity. The international

framework, it was repeatedly stressed, is essential (B.C.Y. Freezailah). We need a global cooperative effort (Martin Holdgate; Freezailah), that on the one hand is aware of the close interrelationships of terrestrial forests -- whether tropical, sub-tropical, temperate or boreal -- and on the other hand allows flexibility to address specific environmental problems arising from particularities of socio-economic, cultural, and political differences.

*** Multiple Benefits and Sustainability**

Sustainable management of forests for multiple benefits is meaningful irrespective of the perspective it is considered from - social, economic, technical, equity or equality. Multi-purpose forest management (with minimal deleterious effects on the environment) is an established concept that although repeatedly emphasized, is yet to be applied effectively. The reasons stem from changing social expectations, evolving technology, gaps in knowledge, and inertia or lack of application of the foresters.

Integrated forest management - a demand-based forest strategy - has been suggested as an alternative (Syed Shea) that could maximize the collective benefit of all values for different community preferences. This approach is based on supporting the physical and biological processes necessary to sustain forest ecosystems and maintenance of biodiversity. Advances in overall knowledge have provided access to skills sand tools of management that, in principle, make us proficient at fulfilling the complex expectations and demands imposed on forests. The forestry community has to take responsibility for our decisions and be accountable for our reactions. There is a pressing need for innovative thinking and enterprise to convert the rhetoric of policies into successful and replicable field practices.

*** Forestry and Climate Change**

The relation between deforestation and global warming is based on the carbon cycle that links forests to climate change. Forests are fundamental features in both sources and sinks of the carbon cycle. Carbon dioxide, methane, etc., may also influence the climate change through a heightened greenhouse effect.

Although studies predicting climate changes are uncertain (particularly for smaller spatial configurations, and in estimating the size of climate sensitivity), the consistency between model predictions and behavior is very encouraging for estimating future changes. In spite of the difficulties in predicting the future emissions of greenhouse gases, it is therefore worthwhile to create scenarios. The Intergovernmental Panel on Climate Change (PICC) has developed six schemes (IS92a-f) for the period 1990-2100. A scenario with a continued and substantial amount of forest clearing (land-use changes) in the future predicts that while net emissions drop to zero late in the 21st century, gross emissions become substantial (T.M.L. Wigley). Net emissions are distinguished from gross emissions by the (natural or managed) regrowth term. The "halt deforestation scenario indicates a progressive lowering of carbon dioxide levels". It also affirms that halting deforestation by 2020 would have a 0.14^0C reduction in warming by 2100 and a corresponding reduction in rise of the sea level.

***Economics of Climate Change**

The role of forests as substantial carbon sinks is an area where further research is necessary. The long-term production process is pivotal to forestry, and so is the impact of forests on climate change. Some of the carbon-fixing benefits start early and should contribute significantly to improved dates of return from a

forest stand (Colin Price, 1990). The carbon fluxes associated with a forest rotation may be separated from carbon fixing by large time intervals, not to mention the magnitude. For instances, the burning of fossil fuels provides immediate benefits while the outcome of carbon dioxide that is released accumulates over centuries. Discounting is therefore important for studying the economics of climate change.

Even a simple discounting approach for values of carbon sources and sinks associated with forests provides evidence that carbon fixing contributes significantly to the benefits of forestry (Colin Price and Rob Willis). Estimation of an appropriate discounting rate is complex but nevertheless important for studying the relationship of forests and climate change.

*** Environmental Accounting**

A lack of detailed and explicit economic analysis for most environmental projects makes it difficult to attract investment in forestry under competing demands from other sectors. Projects to be implemented must demonstrate financial profitability, net social benefits, and satisfy the constraints of decision making criteria that may include political environmental factors (Philip R. Kio and J.E. Abu). The decision takers must acknowledge the reality and importance of politician's role and possess the capability to achieve their objectives under the constraint of political expediency (Syd Shea).

In addition, the National Income Accounts can no longer ignore the costs of environmental degradation caused by the benefits from depletion of resources. A variety of approaches to National Resources Accounting (purely economic; purely physical; mixed) have been developed to compute ecological accounts in association with economic accounts for an economy. An economic-environmental interface describing the use of natural resources stock is also created to present a resource users account. Natural Resources Accounting (NRA) therefore presents a wide variety of information that is pertinent and of interest to a diversity of disciplines and therefore can be an aid for effective aid for both monitoring and decision making.

It is important that forestry policies, whether for sustainable use of biodiversity, or for eliminating deleterious climatic changes, or for reducing pressures on forest land, reflect cooperative efforts and be based on multidisciplinary linkages. Effective institutional structures, that provide forums for different interest groups at all levels, local, national, regional and international, are indispensable. A persistent and cooperative effort will enable us to effectively blend traditional with newer knowledge, and empower us to address the apparently irreconcilable objectives of economic growth and environmental conservation on a sustainable basis.

Of Boreal Forests and Global Warming

There is bad news for all those who expect future logging to be concentrated in northern boreal forests - the bulk of conifers and other softwoods stretching across Eurasia and North America (New Scientist, 11 September 1993). The boreal forests haver stopped absorbing the huge quantities of carbon dioxide they have been known to do with great deficiency.

The data for over a century from Europe, North America and Russia on forest area, tree girth and spacing has provided evidence for the theory that boreal forests have been crucial in damping down the greenhouse effect. Research (by Allah Auclair et al at Science and Policy Associates- an environmental consultancy based in

Washington D.C.) based on the estimate of the volume of wood as an indicator of carbon dioxide locked in boreal and temperate forests, compared the varying volume of the boreal forest with the changing amount of CO_2 believed to be soaked up by land plants. It was sat about 1976, Auclair contends, that the boreal forest slipped from net growth to net depletion. Since the 1960s, an increase in the number of pests and fires as well as substantial increases in tree dieback phenomena and intensive logging have all reduced the volume of boreal wood considerably. Statistical analysis reveals a strong correlation between boreal forest volume and terrestrial carbon dioxide flux.

Auclair failed to observe fa strong correlation between temperate and tropical plant cover (UN data) and terrestrial CO_2 flux thereby suggesting that "global (terrestrial) flux this century has been driven uniquely by changes in the boreal forests". The results have policy implications despite the analysis being sensitive to the accuracy of the geophysicists's estimates of carbon dioxide flux. The latter in turn depend on an estimate of the amount of CO_2 absorbed by phytoplankton in the oceans.

7. FAO FOREST RESOURCE ASSESSMENT 1990

The final report of the FAO Forest Resources Assessment 1990 for the Tropical World (referred to here as FRA 1990) was released earlier this year. The objectives of the assessment were to:

- make an assessment of the forest resources of the tropical countries for the reference year 1990, and estimate changes that have taken place during 1981-90;
- prepare vegetation and eco-floristic zone maps, and integrate these with socio-economic data, the FAO soil map and the protected area map of IUCN/WCMC in the form of a geographic information system (GIS);
- study the environmental impact of deforestation and forest degradation in the tropics;
- disseminate the database and the methodology of assessment to national and international institutions.

Rates of Deforestation

FRA 1990 defined 'deforestation' as a change in land use with depletion of tree crown cover to less than 10%. Changes within the forest class (from closed to open forest) which negatively affect the stand or site and, in particular, lower the production capacity; are termed 'forest degradation', and are not reflected in the estimates.

Table 1: Estimatese of forest cover area and deforestation by ecological zone

Ecological	Land Area	Forest Cover 1990		Annual deforestation 1981-90	
	Million ha	Million ha	& land area	million ha	% per annum
Forest zone	4186.4	1748.2	42	15.3	0.8
Lowland formations	3485.6	1543.9	44	12.8	0.8
Rainforest	947.2	718.3	76	4.6	0.6
Moist deciduous	1289.2	587.3	446	6.1	1.0
Dry and very dry	1249.2	238.3	19	2.2	0.9
Upland formations (hill & mountain forest)	700.9	204.3	29	2.5	1.1
Non-forest zone (Alpine areas, deserts)	591.9	8.1	1	0.1	1.0
Total Tropics	4778.3	1756.3	37	15.4	0.8

Table 2: Estimates of forest cover area and deforestation by geographical sub region

Geographic sub-region/ region	No. of countries	Land area	Factor Cover		Annual Deforestation 1981-91	
		million ha	1980 million ha	1990 million ha	million ha	%per annum
Africa	40	2236.1	568.6	527.6	4.1	0.7
West Sahelian Africa	6	528.0	43.7	40.8		
East Sahelian Africa	9	489.7	71.4	65.5		
West Africa	8	203.8	61.5	65.5		
Trop. Southern Africa	10	398.3	215.5	55.6		
Insular Africa	1	558.1	159.3	204.1		
Acia & pacific	17	892.1	17.1	145.9		
South Asia	6	412.2	349.6	15.8		
Continental SE Asia	5	190.2	69.4			
Insular SE Asia	5	244.4	88.4			
Pacific	1	45.3	154.7			
Latin America & Caribbean	33	1650.1	37.1			
C. America & Mexico	7	239.6	992.2	68.1	1.1	1.5
Caribbean	19	69.0	79.2	47.1	0.1	0.3
Tropical S America	7	1341.6	48.3	802.9	6.2	0.7
Total	90	4778.3	1910.4	1756.3	15.4	0.8

Tables 1 and 2 show the amount of forest cover in 1980 and 1990, and the change in forest cover between 1981 and 1991 by ecological zone and by geographical region. Overall, the rate of deforestation was 15.3 million hectares per year, 1.2% per year in the Asia and Pacific region, 0.8% per year in Latin America and the Caribbean, and 0.7% in tropical Africa. Combining the three regions, most deforestation occurred in lowland rainforest and moist deciduous forest (4.6 million hectares and 6.1 million hectares respectively), although the highest rate of deforestation was in hill and mountain forest (1.1% per year).

Table 3: Estimated harvesting intensities and areas (000 ha) of broadleaved forests harvested an

Period	Africa			Asia/Pacific			Latin America/Caribbean			All Tropical Countries		
	Average Harvest Intensity (m^3/ha)	Area of Forest Harvested Annually		Average Harvest Intensity (m^3/ha)	Area of Forest Harvested Annually		Average Harvest Intensity (m^3/ha)	Area of Forest Harvested Annually		Average Harvest Intensity (m^3/ha)	Area of Forest Harvested Annually	
		Primary	Secondary		Primary	Secondary		Primary	Secondary		Primary	Secondary
1961-65	14	394	91	42	510	78	7	1247	57	17	2152	226
1966-70	14	506	137	43	750	135	8	1260	76	20	2516	348
1971-75	14	593	166	35	1343	221	8	1485	119	20	3422	505
1975-80	14	612	215	33	1732	319	8	2011	183	19	4356	717
1981-85	14	634	239	32	1718	369	8	2297	251	18	4648	859
1986-90	13	723	248	33	1861	453	8	2287	320	19	4871	1020

Table 4: Tropical areas under total protection

Region	Areas under Total Protection		
	Number	Area (million ha)	Land Proportion (%)
Africa	245	74.6	3.3
Asia & Pacific	2135	47.1	5.3
Lat. America & Caribbean	659	61.9	3.8
Total	3039	183.6	3.8

Table 5: Reported and net forest plantations in the tropics in 1990 (000 ha)

Region	No. of countries under assessment	Reported plantation area by 1990			Estimated net plantation area	Area planted annually	
Africa	40	1400	1600	3000	2100	130	90
Asia & Pacific	17	9200	2310	32300	22600	2100	1450
Lat. America & Caribbean	33	5100	3500	8600	600	370	260
Total	90	15700	28200	43900	30700	2610	180

Harvesting Intensity

Table 3 shows the estimated harvesting intensities and areas of broadleaved forest harvested annually in the three tropical regions from 1961-1990. All three regions exhibit a slow but steady increaser in the share of harvesting operations that occur in secondary (previously logged) forest. According to the FRA 1990 report, this increase in logging in secondary forests is due in part to the fact that less primary (unlogged) forest remains each year, but also because changing markets increasingly improve the economic feasibility of re-logging areas that were harvested two or more decades previously. This is especially true with respect to the increase in market acceptability of 'lesser known' tree species.

Conservation Areas

Table 4 shows the amount of land under total protection by 'controlling departments' in the forestry, wildlife and other institutions. According to the FRA 1990 report, the data suggest that a significant proportion of the tropics is under management for conservation or protection. However, this must be tempered by fa realistic appraisal of on-the-ground management effectiveness and the threats to existing sites. The FRA 1990 report notes that "throughout the tropics there tends to be inadequate legislation and ineffective application of the legal measures that do exist... Consequently, there is a strong tendency towards 'paper parks' whose existence is largely theoretical and is not reflected by substantive and durable conservation reserves on the ground".

Forest Plantations

Table 5 shows the reported and net forest plantation areas in the tropics in 1990. The FRA used reported plantation areas and a survival rate of 70% to estimate the net plantation area. The countries with the largest reported area under plantations were India (18.9 m ha), Indonesia (8.8 m ha), Brazil (7.0 m ha), Vietnam (2.1 m ha) and Thailand (0.8 m ha). The average annual plantation area established in the tropics was about 2.6 m ha, corresponding to a net plantation establishment of 1.8 m ha.

Figure1: Change in area of broadleaved forest harvested annually over time (5 year periods) for the three major tropical regions