The role of forestry in poverty reduction, biodiversity conservation and Clean Development Mechanism in Viet Nam

Trieu Van Hung

ABSTRACT

In Viet Nam the forest area was 10.9 million ha in the year 2000, covering 33.2 percent of the county’s total physical area. Following a long period of forest degradation the situation has begun to stabilize after 1995. But the share of this sector in the national economy is not high and its trend is going down. Nevertheless, the sector plays an important role for more than 24 million people living in or around forests, especially the 8.5 million people of the ethnic minorities. The role of non-timber forest products (NTFPs) is very important for rural households, creating economic opportunities for communities, particularly for the poor in high mountainous and remote areas. Viet Nam is one of the most important centres of biodiversity with a very high potential of non-timber forest products. With the policy of sustainable development, the Forest Science Institute of Viet Nam is strengthening its capability in research and development, focusing not only in wood production, but also in stable/reasonable utilization of forest resources, biodiversity conservation and application of Clean Development Mechanism.

FOREST RESOURCES

Viet Nam has a total area of 32.89 million ha. The forest area was 10.92 million ha in the year 2000. Forests cover 33.2 percent of the land, of which natural forests occupy 86.52 percent and plantations 13.48 percent. There is a total woodstock of 751.5 million square meters and 8.4 billion bamboo stamps.

Before 1995, the natural forest was badly damaged. The number of high economic value trees and non-timber forest products was reduced remarkably. Reasons for forest loss were rapid increase of population, the need for economic development, shifting cultivation, uncontrolled migration and establishment of new economic areas. The forestry management mechanism is not effective and does not meet the purpose of forest protection and development; for example, there is a lack of effective mechanism to implement a sound conversion of forested land into agricultural land or other purposes. The motivation for forest protection and development is still weak.

The changes in the forest area through the years are shown in Table 1 (below):

Table 1: Forested area in Viet Nam, 1943–2000

<table>
<thead>
<tr>
<th>Year</th>
<th>Natural forest</th>
<th>Plantation forest</th>
<th>Total</th>
<th>Forest cover (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>9 444</td>
<td>1 471</td>
<td>10 916</td>
<td>33.2</td>
</tr>
<tr>
<td>1995</td>
<td>8 252</td>
<td>1 050</td>
<td>9 305</td>
<td>28.2</td>
</tr>
<tr>
<td>1990</td>
<td>8 430</td>
<td>745</td>
<td>9 175</td>
<td>27.8</td>
</tr>
<tr>
<td>1985</td>
<td>9 308</td>
<td>584</td>
<td>9 892</td>
<td>30.1</td>
</tr>
<tr>
<td>1980</td>
<td>10 486</td>
<td>422</td>
<td>10 908</td>
<td>32.1</td>
</tr>
<tr>
<td>1976</td>
<td>11 077</td>
<td>92</td>
<td>11 169</td>
<td>33.8</td>
</tr>
<tr>
<td>1943</td>
<td>14 300</td>
<td>0</td>
<td>14 300</td>
<td>43.0</td>
</tr>
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FOREST PRODUCTION

Since 1995, in line with the economic restructuring of the country, Viet Nam forestry has been developing smoothly with some changes and a shift in focus from utilization to conservation and development of the forest. The trend is reflected in the conversions of (i) the natural forest to plantation and development of forest industries, (ii) governmental and state forestry into social forestry with multi-organizations including the involvement of the private sector, (iii) centralized mechanism into decentralized mechanism; and (iv) economic purpose, domestic forestry market to a multi-purpose international market based on sustainable use of forest.

Besides meeting the domestic requirements, forestry has seen its export value increasing steadily:

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<tr>
<td>Export value (million US$)</td>
<td>71.6</td>
<td>126.5</td>
<td>153.9</td>
<td>200.0</td>
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</tbody>
</table>

Although the export value is increasing, the percentage of forestry production in the forestry–agriculture–fishery sector is going down:

<table>
<thead>
<tr>
<th>Year</th>
<th>1986</th>
<th>1990</th>
<th>1995</th>
<th>1999</th>
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</thead>
<tbody>
<tr>
<td>Value rate (%)</td>
<td>11.78</td>
<td>7.57</td>
<td>5.08</td>
<td>4.61</td>
</tr>
</tbody>
</table>

Compared with the total national economy, the value rate of forestry production is very small with a falling trend:

<table>
<thead>
<tr>
<th>Year</th>
<th>1995</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value rate (%)</td>
<td>1.22</td>
<td>1.0</td>
<td>0.99</td>
<td>0.93</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Forestry production is concentrated mainly in logging and forest products processing, which from 1985 to 1999, took up 72.72–79.6 percent of all forestry activities, forest plantation and forest tending 13.05–17.88 percent, and other activities 3.85–12.96 percent only.

In order to protect and develop the forest, the government has laid down a policy to limit logging:

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</thead>
<tbody>
<tr>
<td>Logging (1000 m$^3$)</td>
<td>1081</td>
<td>617</td>
<td>300</td>
<td>250</td>
</tr>
</tbody>
</table>

Although the forestry sector contributes only a very small portion to the national economy in Viet Nam and its direct economic value is not high, it plays an important role in the people’s livelihood, especially in forested and rural areas.

FORESTRY AND POVERTY REDUCTION

In 2002 the total population of Viet Nam was about 82 million people, of which more than 24 million people were living in or around forested areas. Over 8.5 million people come from the ethnic minorities. Although a rapid change is taking place in the economy and society at this moment, wood, fuelwood and non-timber forest products still play an important role in the livelihood of the ethnic minorities. According to the Administration Unit, Viet Nam has 61 provinces with approximately 10 500 communes, of which 57.1 percent are at mountainous, upland and remote areas. There are 1175 communes in deprived conditions. These are the poorest people and their livelihood depends on forests; nevertheless this group impacts strongly on the forest resources and forest degradation.

The Vietnamese Government has long encouraged the participation of the people in forestry activities for poverty reduction. In implementing forest and land allocation, thousands of farmer households have received long-term forest lands and rights to do business by themselves on the allocated land. Many national programmes have been carried out with good results, including:

- Programme 327 “Regreening denuded lands and bare hills”: From 1993 to 1998, it has allocated 1.6 million ha forest to farmer households, established new plantations of 638 500 ha and undertaken forest tending, protection and regeneration of 748 100 ha.
• Programme 661 “New forest plantations of 5 million ha.”: This is a continuing of Programme 327 from the years 1998–2010 with its objective to set up 5 million ha of new plantations of forest. After 4 years of implementation with the support of the local people, it has newly planted about 200 000 ha involving forest tending, protection and annual regeneration. The forest cover has increased by 2 percent.

• Fixed cultivation and settlement programme: It has contributed actively to a stable life of the high mountain people. After 20 years of implementation, there are 1185 communes belonging to 26 provinces with altogether 1.9 million people participating in the whole country. In many fixed cultivation and settlement areas, production development has created some concentrated forestry production zones such as bamboo plantation in Thanh Hoa with more than 20 thousand ha. In Yen Bai province, there are thousands of hectares of planted Cinnamomum trees. This has assisted over 132 000 households with more than 800 000 people having a stable living, and established many forest farms at new habitation areas.

• Programme 135 “Poverty reduction in socio-economic development” has been implemented in 2235 poor communes. Every year, the number of poor households has been declining by 1.5–2 percent. (28 000–30 000 households/year), creating 1.4 million jobs where the stabilization and development of forestry and agriculture are linked to products consumption.

FORESTRY AND BIODIVERSITY CONSERVATION

Viet Nam’s National Action Plan on Biodiversity was developed in 1995 by the former Ministry of Forestry in cooperation with the State Committee of Sciences and some international organizations such as the WWF, UNDP and IUCN. With the implementation of the Biodiversity Action Plan, investment in biodiversity has been improved, up to 1998 mainly on reforestation at 72 percent, buffer zone development 16.1 percent, biodiversity conservation 6.14 percent, and scientific research and basic investigation 2 percent.

The special-use forest system was established over a total area of about 2.1 million ha, including 17 national parks, 47 national reserves, 13 habitat/species areas and 18 land/seascape areas.

With more than 12 000 plant species and 7000 animal species, Viet Nam is one of the important centres of biodiversity in the world. The potential of non-timber forest products (NTFPs) is very high. However, although NTFPs have been properly exploited, their sustainable management is still limited.

Strengthening public awareness is one of the important achievements in improving biodiversity conservation and integration of forestry, biodiversity conservation and environment protection. In reforestation and forest enrichment, using indigenous tree species has been given more attention. Currently, there are more than 30 species, including rare, endangered species in use for plantation.

In forestry, the importance of NTFPs to rural households and upland areas in Viet Nam cannot be underestimated, especially for the poor and remote households. NTFPs can create economic opportunities for these communities, with simple technologies in collecting, planting and preprocessing. For example, households in Bac Ha district of Lao Cai province have begun to grow Amomum aromaticum, harvesting an average of 200–300 kg of fruit per year, in some cases, as much as 500–1000 kg, equivalent to 20–30 million VND, which is 10–20 times higher than rice cultivation on the same area (Nguyen 2001).

Table 2. NTFPs harvested from 1995 to 1999

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<tr>
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<tbody>
<tr>
<td>Bamboo</td>
<td>Thousand stems</td>
<td>67 026</td>
<td>720 858</td>
<td>174 189</td>
<td>172 649</td>
<td>171 000</td>
</tr>
<tr>
<td>Neohouzeaua dullooa</td>
<td>Thousand stems</td>
<td>108 500</td>
<td>104 779</td>
<td>105 175</td>
<td>248 310</td>
<td>150 000</td>
</tr>
<tr>
<td>Phyllostachys spp.</td>
<td>Million stems</td>
<td>15 600</td>
<td>24 664</td>
<td>2 649</td>
<td>12 197</td>
<td>100 000</td>
</tr>
<tr>
<td>Rattan</td>
<td>Tonnes</td>
<td>28 500</td>
<td>25 975</td>
<td>25 639</td>
<td>80 097</td>
<td>65 700</td>
</tr>
<tr>
<td>Pine resin</td>
<td>Tonnes</td>
<td>5 350</td>
<td>1 348</td>
<td>6 387</td>
<td>6 777</td>
<td>7 182</td>
</tr>
<tr>
<td>Anise fruits</td>
<td>Tonnes</td>
<td>1 870</td>
<td>6 672</td>
<td>9 896</td>
<td>9 500</td>
<td>5 000</td>
</tr>
<tr>
<td>Cinnamon</td>
<td>Tonnes</td>
<td>7 790</td>
<td>3 658</td>
<td>3 954</td>
<td>2 100</td>
<td>2 900</td>
</tr>
<tr>
<td>Bamboo shoots</td>
<td>Tonnes</td>
<td>32 500</td>
<td>30 887</td>
<td>13 789</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

After the seminar on “Opportunities and Perspectives for Implementation of Clean Development Mechanism in Asia–Pacific Countries” in Hanoi, 1999, CDM awareness has improved in Viet Nam. The practicality of CDM can be seen in its relationship to forestry issues. The potential of forestry CDM in Viet Nam is at the policy level in the orientation of forestry development in areas such as protection of existing forested areas, forest restoration, land rehabilitation, social forestry and commercial plantations for paper and pulp, timber and other products.

The National Five Million-Hectares Reforestation Programme holds an opportunity for CDM application with different types of projects: forest protection (watershed management, sand-dune stabilization, soil and water conservation); special-use forests (national parks, nature reserves, recreation forest); large-scale industrial/production forests (pulp and paper, particleboard, sawn-log plantations); community/farm-level plantations (majority).

As an example, the on-going project of the Research Centre for Forest Tree Improvement of the Forest Science Institute of Viet Nam, founded by the International Greenhouse Partnership Office (IGPO), is being implemented within the CDM framework. By using improved and selected seed sources of *Acacia auriculiformis* and *Eucalyptus tereticornis* for plantation at 1600 ha y⁻¹, the growth yield increases of 15–20 percent mean a carbon sequestration of 6000 tonnes y⁻¹ equivalent to 22 000 tonnes CO₂ y⁻¹ more than by using normal seed sources of the same species. More important is the raising of CDM awareness in forestry.

### ISSUES THAT NEED TO BE SOLVED IN FORESTRY FOR POVERTY REDUCTION, BIODIVERSITY CONSERVATION AND CLEAN DEVELOPMENT MECHANISM

1. **Enhancing awareness of the relationship between forestry, poverty reduction and biodiversity conservation**
   
   In forested areas, the division of labour is lower than that in other areas; therefore enhancement of the awareness of the role of forest for the local people is very important. To ensure sustainable socio-economic development, forest protection and development are basic conditions for long-term benefit. The need for poverty reduction, economic development and forest resource protection must be considered in harmony with Clean Development Mechanism. There are no two opposite issues.

2. **Stable land-use planning**
   
   In general, the Government of Viet Nam pays great attention to land-use planning. However, in practice the feasibility and effectiveness of land-use planning projects do not meet the requirements of sustainable development. There has been no clear definition of stable forestry for each region with three types of forests: production forest, protection forest and special-use forest. Therefore planning needs to be done initiatively and based on a need for economic restructuring in each region. Planning has to be made according to intersector approach to ensure a balanced and feasible implementation.

3. **Reasonable resource utilization**
   
   This is a need to develop effective production models like agriculture–forestry and agriculture–forestry–fishery farming systems, where appropriate technologies can be applied. Selecting crop structure, animals and farming techniques suited to the physical conditions and characteristics of each region (for example, cultivation on sloping land) must be linked to marketability to ensure high and sustainable effectiveness. In addition, new technical advances and traditional indigenous knowledge of each community should be combined for best results.

4. **Socio-economic and policy issues**
   
   Forest and land allocation policy has helped many farmer households to establish some effective production models. However, there are some problems such as improper distribution of settlements in the planning process, and poor economic and production states in some households. Policies for the three types of forest, protection forest, special-use forest and production forest, are not well defined with the benefits for the forest owners not clearly shown. In general, there is still lack of a sound forestry policy system to motivate active participation of the people in forest protection and development.

5. **Forestry research**
   
   In order to strengthen the role of forestry in poverty reduction, biodiversity conservation and application of Clean Development Mechanism, some questions need to be answered and constraints addressed for forestry research in Viet Nam. They include:
• Access to new information and technology, international integration and partnerships, new research fields (ecotourism, CDM, carbon trade, forest certification) and society awareness of forest multi-values.
• Lack of human resources, facilities and equipment; lack of finance, technology and research experience; lack of management mechanism of research such as planning, monitoring and evaluation; and lack of information, extension and dissemination of research results.
• Specific objectives of forestry research in Viet Nam in the coming years need to be developed to set the research priority to 2010, to enhance research capacities and networks, to improve the effectiveness of forestry research and improve the linkages between research and extension for forest managers, forest users and policy-makers.
• Specific themes that need to be examined:
  – basic investigations of the physical, economic and social conditions to select suitable tree species for planting; evaluation of the forest resources; and determining the promising species to produce commodities including non-timber forest products; investigating and evaluating the traditional indigenous knowledge of the communities and marketing possibility of the main products including the NTFPs;
  – studies on seed improvement, propagation, farming technique, products processing, and preservation technique aimed at raising productivity and economic effectiveness;
  – developing and establishing models towards good production, high effectiveness and sustainability (combined with ecotourism), agroforestry models for various zones such as ethnic minority areas;
  – studies on the management of the three types of forest: protection forest, production forest and special-use forest; formulating policies to attract the participation of farmers in forestry activities, policies to benefit forest owners, on tax, investment and credit;
  – strengthening forestry extension services in suitable forms to various target groups.
• Tasks of the Forest Science Institute of Viet Nam:
  – To undertake research in line with the priorities and issues mentioned above, linking research to practice within the national programmes on poverty eradication, especially in mountainous and remote areas.
  – In technology transfer, there is a need to establish pilot models at important zones, produce extension documents with background information and form suitable for farmers and organize training and technology transfer to farmers.
  – To meet the requirements of forestry development, it is necessary to strengthen the capacity building of the FSIV such as training and education of the staff, as well as development of an international cooperation and information network.

BIBLIOGRAPHY

A policy review on watershed protection and poverty alleviation by the Grain for Green Programme in China

Li Zhiyong*

ABSTRACT

The rapid development of the Chinese economy is still confronted with constraints from deteriorating environment and rural poverty issues. It has become a significant policy option in maintaining the high growth, efficiency and sound development of the Chinese economy to rehabilitate forest resources, improve ecological conditions, increase farmers' incomes in a coordinated development of population, resources and environment. The Grain for Green Programme, as a CDM activity of Chinese style, launched on trial in 1999 and implemented in 2002 across the country, is the biggest land-use transition, watershed management and poverty alleviation programme involving the largest population in Chinese history and across the globe. It covers 25 provinces/regions/cities over 1600 counties, involving 15 million households and 60 million farmers. Hence the Grain for Tree policy has a significant bearing on the ecological protection and poverty alleviation of the farmers in the soil erosion- and water erosion-prone regions. A review and assessment of the backgrounds, essentials, effects, problems and trends in the Grain for Tree policy are of great significance for both China and the other developing countries in the world in their efforts to combat the deteriorating environment and alleviate poverty.

POLICY SETTING

Ecological improvement and poverty alleviation make demands on the Grain for Tree policy

China is a big mountainous agricultural country. In the past five decades vast forest lands and grasslands have been reclaimed into farmlands due to pressure arising from increasing population and grain demand. This practice has aggravated soil and water erosion and land desertification. There are more than 6 million ha of farmland with a slope of over 25 degrees in China. The annual volume of silt flowing into the Yangtze River and Yellow River reaches over 2 billion tonnes, among which two-thirds come from sloped farmlands.

The findings of the Second National Remote Sensing Inventory on Soil and Water Erosion released in 2002 indicate that the area prone to soil and water erosion in China accounts for 37.5 percent of the national territory and the annual volume of soil erosion reaches over 5 billion tonnes. In addition, China is suffering from a serious shortage of water resources, with per capita share of water resources reaching merely 2000 tonnes. It has become one of the 13 water-poor countries in the world. Although China’s poverty reduction policy has helped the 220 million poverty-stricken population solve the problem of food and shelter, currently a rural population of 30 million is still well below the poverty line.

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Economic development and a good harvest of grain have offered policy support for the Grain for Green Programme

China’s enhanced economic strength offers a sound economic basis for it to map out and implement the Grain for Green Programme. Since the policy of reform and opening up was initiated in 1978, China has maintained a sustained and rapid economic development for over two decades. Its GDP in 2002 exceeded RMB1 trillion for the first time, with a remarkable growth in its overall national strength and fiscal revenue, thus making it possible for the government to contribute certain financial and material resources to ecological improvement for such programmes as the Grain for Green Programme.

Consecutively good harvests of grain offer favourable conditions for the implementation of the Grain for Tree policy. First of all the policy would not produce a great impact on national grain security because of the abundant storage of grain. Since 1995 China has experienced consecutive years of good harvest, with the grain output exceeding 500 billion kg for three consecutive years (1996, 1998 and 1999), thus giving rise to a situation where supply exceeds demand in a successive and structural manner. If 14.67 million ha of farmland were to be converted into forest land and grassland by the year 2010 and 2250 kg ha\(^{-1}\) y\(^{-1}\) and 1500 kg ha\(^{-1}\) y\(^{-1}\) of grain were to be subsidized for the Yangtze River catchment and southern region as well as the Yellow River catchment and northern region respectively, the grain subsidies in peak years would amount to 23.37 billion kg, taking up merely 4.7 percent of the average grain output nationwide during the 9th Five-Year-Plan period. Secondly, sloped farmland has a low grain yield, which would not have a great bearing on the national grain output. Sloped farmland is mostly impoverished land with poor water supply and fertility, serious soil and water erosion threats as well as low and unstable yield. A farmland with a slope of over 15 degrees produces on average only 1770 kg of grain per hectare. Even if all of the 14.67 million ha of sloped farmlands and sandificated farmlands were converted into forests according to the plan, only 26 billion kg of grain would be reduced annually across the country, taking up only 5.2 percent of the average grain output nationwide during the 9th Five-Year-Plan period. It is obvious that conversion of sloped farmlands and sandificated farmlands into forests would not produce a significant impact on the equilibrium of supply and demand for grain nationwide.

POLICY ESSENTIALS

In order to ensure the successful implementation of the Grain for Green Programme, the Chinese Government has issued the Regulation of Grain for Green in 2002 and has adopted a range of innovative and operational policy measures with Chinese characteristics.

Grain and cash subsidy policy

Criteria for grain subsidy: 2250 kg of grain are subsidized annually for each hectare of converted farmland in the Yangtze River catchment and southern region and 1500 kg of grain are subsidized annually for each hectare of converted farmland in the Yellow River catchment and northern region. Criteria for cash subsidy: RMB300 are subsidized annually for each hectare of converted farmland. The duration for grain and cash subsidies: subsidy for conversion of farmland into grassland is valid for two years, subsidy for conversion of farmland into economic forest is valid for five years and subsidy for conversion of farmland into ecological protection forest is temporarily valid for eight years. The cost for grain subsidy is borne by the national revenue. During the period of grain and cash subsidies farmers must continue their afforestation efforts under the unified leadership of the county or township government in barren hills where conditions permit after they have converted their existing farmlands into forests.

Subsidy policy for seeds and seedlings as well as afforestation cost

Subsidies for seeds and seedlings as well as afforestation cost for the Grain for Green Programme and barren hills are borne by the government, calculated in terms of RMB750 per ha. The sloped farmlands which have not been contracted out to individual households and fallow sloped farmlands would not be eligible for grain and cash subsidies, but can be afforested as barren hills. Subsidies are given for afforestation costs that are used only for seeds and seedlings, and the lands are closed for regeneration and maintenance instead of for other purposes.
Preferential taxation policy

If the converted farmland is subject to agricultural tax and grain subsidy reaches the previous annual yield, grain subsidy would be handed out to farmers after the agricultural tax has been deducted by the state as of the year when the conversion programme is implemented. If the grain subsidy does not reach the previous annual yield, agricultural tax would be deducted accordingly and in a reasonable manner. If the converted farmland is not subject to agricultural tax, agricultural tax must not be deducted from the grain subsidy regardless of the previous annual yield. For the counties where the Grain for Green Programme is implemented, the drop in collection of the agricultural tax would be subsidized properly by the national revenue in the form of transfer payment.

Guarantee policy for forest tenure

The government is implementing a policy of “those who convert sloped farmlands into forests and manage the forests would benefit from them”. It adheres to the mechanism of contractual operation by individuals with a combination of responsibility, power and interests. Following the implementation of the Grain for Green Programme, farmers’ tenure to tree crops established on converted farmland and barren hills must be guaranteed. Farmers are entitled by law to go through procedures for changes in land use and be provided with certificates of tenure to tree crops by the People’s Government above county level. The contracting-out duration would extend to 50 years after farmers have established plantations on farmlands and barren hills. Farmers are entitled by law to inherit and transfer the contract and extend it upon expiration in conformity with relevant laws and regulations.

An ecological protection forest-biased policy

The proportion of ecological protection forest must not be lower than 80 percent when counties are regarded as accounting units. Only seeds and seedlings and afforestation subsidies, rather than grain and cash subsidies, are provided for the economic forest established by exceeding the prescribed proportion.

POLICY ACHIEVEMENTS

During 1999–2002, 7.7 million ha of farmland were converted into forest nationwide, including 3.72 million ha of farmland-turned forest and 3.98 million ha of plantations established on barren hills. In 2002 alone the Grain for Green Programme involved 5.162 billion kg of grain and RMB458 million, from which 10.31 million farmer households benefited. Implementation of the Grain for Green Programme has altered the traditional farming practices of the Chinese farmers, achieved agricultural restructuring, increased the farmers’ incomes, improved the ecoenvironment and promoted the local economic development and poverty reduction process in poverty-stricken areas.

Some achievements have been made in the grain for ecology programme and the deteriorating ecological conditions in some programme areas have been improved to varying degrees. The implementation of the Grain for Green Programme has also alleviated soil and water erosion and land sandification. The serious soil and water erosion in some southern areas, where trials of the Programme were first undertaken, has been mitigated, with water in some river catchments turning clear and the ecoenvironment improved. Some relevant industries like tourism and animal husbandry have been boosted and local economies further developed. The area prone to soil and water erosion in the Grain for Green Programme area in Tianshui City, Gansu Province, has been reduced from the previous 314.3 km² to 90.74 km², a drop of 71.1 percent, and the forest and grass cover has risen from 14.5 percent to 41.8 percent. Over 90 percent of the farmer households under survey contend that the ecoenvironment in the vicinity of the village has been improved or will be able to be improved following the implementation of the Programme.

Remarkable social benefits have been achieved in opening the granaries to relieve the poor, and the farmers’ poverty reduction process has been accelerated. Over one-third of farmer households in most programme provinces (or regions) are involved in the conversion of farmlands into forests. Some farmers engaged in the conversion programme have obtained not only a reliable supply of grain but also increased their income by engaging in diverse economic undertakings and sideline production.

The Grain for Green Programme is also the largest project for poverty alleviation. The rural households that convert their farmlands can be directly subsidized with grain and cash, and the poor rural households, especially those from ecologically deteriorating areas, benefit more than the rich rural households. Among the 180 pilot counties covered by the Programme across the country in 2000, 104 counties were poverty counties
by national standard, taking up 57.8 percent of the total. Among the 333,000 rural people of Minhe County in Qinghai Province, there are about 100,000 under absolute poverty with an annual income of less than RMB625. The poverty in Minhe County was mainly caused by ecological deterioration, which had resulted in no crop harvest for consecutive years, and thus no grain ration for rural households. Under the Programme, this county has converted 8000 ha of cropland. The cash and grain subsidies provided by the Programme have immediately released the hunger problem of these rural poor.

The agricultural industry structure has been readjusted effectively and the rural economy has further developed. The Grain for Green Programme has helped to change the traditional way of extensive cultivation with little harvest and to readjust the inappropriate land-use structure. Since the Programme started, government agencies at all levels have prompted the development of farmland infrastructure, captive breeding, green food, forest ecotourism, and green industry. Thus an economy with specific characteristics has been boosted which also facilitated a shift from agricultural production to tree crop production, stockbreeding and other secondary and tertiary industries. The rural industrial structure has been adjusted appropriately and farmers’ economic income has been increased. The Grain for Green Programme at Longhui County in Hunan Province adopted a model of combining forestry with medicinal plants so that water and soil have been well conserved while achieving a high economic value. An output value of RMB60,000 per ha can be secured when the medicinal plants mature. The county has established a total area of 1200 ha of medicinal plants, which will bring an income of RMB72 million for local farmers four years from now.

The policy of conversion of cropland to forests policy has received extensive support and participation by local farmers, and has become the largest and most successful community forestry project. Since its pilot phase started in 1999, the Grain for Green Programme has covered altogether 25 provinces (autonomous regions and municipalities) which include more than 1600 counties, 20,000 plus towns and townships, more than 100,000 villages, over 15 million rural households and more than 60 million farmers. The programme has already become the largest participatory community forest project in China. The design of the Programme was transparent and open, and therefore won extensive support and participation by the rural households. The Luding County in Sichuan Province assigned the task of converting 2667 ha of cropland down to 10 towns and townships, 50 villages, 9909 households and 18,301 plots: such a well-organized forest programme was unprecedented. According to the survey of one hundred households that converted their croplands, about 94 percent of them signed contracts with the village, around 93 percent acknowledged that the village had revealed information on converted area and cash and grain subsidies of each household, and about 89 percent agreed that the information was accurate.

POLICY CONSTRAINTS

The Grain for Green Programme is a new policy in China. There have been some difficulties and problems with the policy that jeopardized the effective implementation of the policy and the fulfillment of the policy goal.

The policy inconsistent and unstable

Firstly, local governments and farmers fear that there will be changes to the Grain for Green Programme. In order to fully benefit from the preferential policy at an early stage, they competed with each other to convert their croplands and also converted more than what was planned in the Programme. Secondly, although it was stated very clearly in the policy that “people who convert their croplands should plant trees, and those who manage the forests should benefit”, it has remained to be an issue of great concern as to how farmers could reap economic benefit from the trees especially those ecological forests that were established under the Programme when the subsidy ends. Thirdly, the forest management and utilization policy eight years after the Grain for Green Programme is unclear. Also constrained by the logging quota, the rural households that converted their croplands and other planting units lost interest in establishing ecological forests. All these have hampered the timely achievement of the policy’s ecological goal.

Watershed management not emphasized

The main objective for the Grain for Green Programme is to increase vegetation cover, bring water and soil erosion under control, and improve the ecosystem through providing grain for green in return. Therefore the Programme should cover sources of big rivers, river banks, steep slope cultivation areas around lakes and reservoirs, and sandy cultivation areas that are severely threatened by sandstorms. There are some problems emerging during the implementation of the Programme so far. Firstly, the focus of ecosystem restoration is
not prominent in general. In some areas, the conversion task was designated on an equal benefit sharing basis; therefore the distribution of conversion areas was segmented and the Programme was not able to bring large areas of degraded land under control. Secondly, some ecologically fragile areas and key areas of ecological importance were not assigned with conversion tasks or with very few tasks; thus the watersheds along some big rivers were not harnessed as priority areas. This breaches the principle of putting key ecological areas in the first place.

**POLICY RECOMMENDATIONS**

Aiming at the problems emerging during the implementation of the Grain for Green Programme, there will be need for further improvement of the policy in three areas in the future given that the current policy is implemented effectively by the central and local governments. The proposed improvement will contribute to the long-term effectiveness of the policy, the realization of watershed management, poverty alleviation and the achievement of the economic development target.

The rural industrial structure needs to be further adjusted and optimized in order to ensure the long-term effectiveness of the conversion of cropland to forests policy. Firstly, the land-use structure needs to be readjusted to change the traditional way of extensive cultivation with little harvest. Grain production on steep slope cultivation land that has low yields because of deteriorating natural conditions should be further reduced. Instead, trees and pasture grass should be established to increase land-use efficiency. Likewise, grain production can be replaced by growing fruit trees, medicinal plants and other tree crops, so as to readjust the internal structure of the planting business. In areas that have tourism resources, forest ecotourism should be developed with local characteristics. Secondly, farmland infrastructure needs to be further developed to improve grain productivity. At the same time the conversion of cropland is taking place, rural households that participated in the programme should be left with a certain amount of farmland for subsistence. Grain productivity in those reserved farmland should be greatly increased through technological improvement and intensified management. Thirdly, the growing of high quality and new variety of products such as fruit trees should be promoted to increase the farmers’ incomes. Fourthly, the traditional way of grazing should be improved and captive breeding should be promoted. Livestock species should also be restructured and the integration of captive breeding, half grazing and half breeding, and grazing during summer and breeding during winter should be adopted to effectively protect natural pasture and forests. Fifthly, township enterprises should be promoted to release the reliance of local farmers on land resources. Township enterprises of forest industry, tourism industry and processing industry in the areas covered by the Programme should be greatly developed to increase the farmers’ incomes.

Rural energy structure needs to be further improved for the effective conservation of forests established under the conversion programme. The strategy of concerted economic and environmental development should be followed to integrate rural energy development into the conversion programme and to release the energy reliance of local farmers on the newly established forests. Based on the overall objectives of energy and environmental development and through integrated planning, the resources need to be allocated rationally, fuelwood forests need to be established, and renewable energy industry needs to be developed. Supportive economic policies should be adopted to enhance the development of rural energy such as methane supply, energy-saving kitchen range, and small-scale hydroelectricity projects. A rational energy consumption system with multiple energy sources supplementing one another should be established and an organizational structure and service system for rural energy consumption needs to be completed. Therefore energy use for rural livelihoods and the issue of rural energy can be solved comprehensively and systematically, with the ecological environment being protected and concerted development of economy, environment and society being achieved.

The development of small townships should be boosted to encourage ecological immigration and to release the pressure of population and agriculture in water and soil erosion areas. The conflict between population and land has become more prominent since the Grain for Green Programme was implemented. Although the policy requires grain subsidy being provided by the national government, such subsidy is limited to certain time frame. If follow-up measures are not well considered, once the subsidy is stopped, farmers will resume cultivation on even steeper slopes for survival. This will lead to more severe ecological deterioration. Therefore, the conversion of croplands to forests should be linked to ecological immigration. By doing this, not only the ecological environment can be harnessed and improved, but the newly established forests in the key ecologically fragile areas can also be well maintained. Ecological immigration should be carried out together with the development of small townships, the creation of employment opportunities and new skills training in order to improve the adaptability of the immigrants. The investment on ecological immigration should be mainly from the central and local governments. It is also possible for the national or local governments to establish a special fund for ecological immigration within the ecological programmes such as the Grain for Green Programme.
BIBLIOGRAPHY


ABSTRACT

The loss of biodiversity has been taking place since humans first learned to harvest natural resources and to manage the land to increase its productivity. Depletion of natural resources and rapid loss of biodiversity have occurred over time to meet the basic needs of the growing population. Bangladesh is far behind in raising public awareness of the ecological, economic and sociocultural value of biodiversity and promoting local community participation in its sustainable conservation and management programmes. Biodiversity being a major source of food, fibre, fuel, fodder and other useful things needs adequate attention and increased knowledge for its conservation and wise use in a sustainable manner. Sustainable management and conservation of ecospecific biodiversity through the poor people’s active participation can contribute substantially to poverty alleviation in the context of environmental conservation. Poverty alleviation programmes should be aimed at creating common property management such as common forestry, common horticulture, common fruit gardens and community-based common wildlife management for conserving biodiversity.

INTRODUCTION

Country profile

Bangladesh has a population of about 131.6 million, with a very low per capita gross national product (GNP) of US$370 (World Bank 2000). Bangladesh has a comparatively low natural resource base, but a high growth rate of population with almost half of the population below fifteen years of age. Most of the people are among the poorest in the world, and depend mainly on the natural resource base for their livelihood. But now the resource base is under serious threat, as many natural resources are either being overexploited or used suboptimally. Besides the effects of anthropogenic stresses, the low ‘land-man’ ratio in the country is often further threatened by natural hazards. Thus, for the survival of Bangladesh’s dense population, it is essential to have environmental planning and management that conserve and sustain the ecosystems that support their livelihoods.

The high population density, low economic growth, lack of institutional infrastructure, an intensive dependence on agriculture and agricultural products, geographical settings, and various other factors, all contribute to make the country weak in its economic development and quality of life. Table 1 is a summary of the social, economic and environmental indicators in Bangladesh from 1981 to 1995.
Table 1. Statistics of the social, economic and environmental indicators in Bangladesh from 1981 to 1995

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (millions)</td>
<td>89.9</td>
<td>111.5</td>
<td>119.8</td>
</tr>
<tr>
<td>Land area (km²)</td>
<td>144 000</td>
<td>147 570</td>
<td>147 570</td>
</tr>
<tr>
<td>Forest (%)</td>
<td>15.0</td>
<td>12.8</td>
<td>12.7</td>
</tr>
<tr>
<td>Agriculture (%)</td>
<td>60.5</td>
<td>55.1</td>
<td>52.1</td>
</tr>
<tr>
<td>Urban population as % of total population</td>
<td>15.2</td>
<td>17.2</td>
<td>22.0</td>
</tr>
<tr>
<td>Population below poverty level (%)</td>
<td>73.0</td>
<td>47.0</td>
<td>45.8</td>
</tr>
<tr>
<td>Life expectancy at birth (years)</td>
<td>55.0</td>
<td>56.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Literacy rate (%)</td>
<td>23.8</td>
<td>32.4</td>
<td>37.2</td>
</tr>
</tbody>
</table>


Quality of life in Bangladesh

Population

Bangladesh has a population of 131.6 million in 2001, and with more than 830 persons km² it is the most densely populated country in the world. Population growth is identified as perhaps the most serious problem inhibiting the sustainable use of resources. Increases in development or productivity are eroded by population growth. At present over 50 percent of the population in Bangladesh are below 15 years of age. Hence in the next 10 years, there will be a dramatic rise in demand for employment, but opportunities in agriculture appear to be limited, and other sectors are not creating sufficient new jobs. The demand for land is enormous, because of the population density, and the very low land-man ratio intensifies the competition for the very limited land resources for different uses. Conversion of the vast population to a productive human resource remains the greatest development challenge.

Poverty

It is estimated that more than 40 percent of the population regularly consume less than the absolute critical minimum of 1800 kilocalories per day. These 50 million people are amongst the poorest in the world by any standard of development. Furthermore, it has been estimated that the number of absolute poor has risen significantly. The poverty of these deprived people is deep rooted, pervasive and multi-faceted, relating not just to the absence of reliable incomes and productive assets, but also to food, safe water, sanitation, education, shelter, inequities, injustice and lack of power. These deprived people are also extremely vulnerable to disaster and disease. The challenges posed by this massive poverty are enormous for a country with accelerating environmental degradation of an overpopulated land base.

The human development indicators for Bangladesh are also staggeringly low. Bangladesh has an adult literacy rate of 37 percent, life expectancy of 58 years and population below poverty level of 45 percent. Urban slum dwellers now account for some 15 percent of the population and this is still growing by 6 percent per year.

STATUS OF FORESTS

According to the Department of Environment, Bangladesh, 24 percent of its land area was forested in 1947. This has been reduced to only 6.5 percent in 1980 as estimated by the World Resources Institute. The reduction of forest cover in Bangladesh between 1947 and 1980 is thus estimated to be 75 percent.

The neighbouring countries in South and Southeast Asia are relatively better off in this respect. The proportion of land area with closed forest in Nepal is 13 percent, in India 16 percent, in Sri Lanka 26 percent, in Bhutan 45 percent and in Myanmar 47 percent. The proportion of area under closed forest would be only 5.8 percent of the total area of Bangladesh in 1991 (Figure 1) with an estimated annual deforestation rate of 8000 ha. The actual proportion is likely to be lower as the extraction of forest resources has increased in recent years.

1 The figure for the forest cover in Bangladesh appears to vary, depending on the source. The Bangladesh Bureau of Statistics has reported a figure of 12.7 percent for 1995 (Table 1), and the Forest Department a figure of 17.8 percent (Table 7).
Ecological harmony necessitates a certain balance between resource endowment and population. Viewed in this context, the situation in Bangladesh is extremely critical. Based on the forestry figure of 1980 and population figure of 1980–90, per capita availability of closed forests is estimated to be 1.4 ha in Bhutan and 0.8 ha in Myanmar. In Nepal, 10 persons are endowed with one hectare of forest on the average whereas it is 17 persons in India, but 125 persons in Bangladesh have to share one hectare of closed forest.

The area of Bangladesh is about 147,570 km². Except for the hilly regions in the northeast and the southeast, the country consists of low, flat and fertile land with a network of rivers flowing to the Bay of Bengal. The forests comprise 17 percent of the total area of the country. Of this, the Forest Department manages about 10 percent and off-forest land covered by trees is about 7 percent. In recent decades, there has been a great decline in forest resources. Only 7.7 percent of the total areas of Bangladesh are under close tree cover (Tables 2 and 3).

Table 2. Land use in Bangladesh

<table>
<thead>
<tr>
<th>Land classification</th>
<th>Area (million ha)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land under cultivation</td>
<td>9.12</td>
<td>63.33</td>
</tr>
<tr>
<td>Land under national forests</td>
<td>1.32</td>
<td>9.51</td>
</tr>
<tr>
<td>Unclassed state forests</td>
<td>0.74</td>
<td>5.14</td>
</tr>
<tr>
<td>Khas forest land</td>
<td>0.03</td>
<td>0.21</td>
</tr>
<tr>
<td>Village/homestead forests</td>
<td>0.27</td>
<td>1.87</td>
</tr>
<tr>
<td>Land under tea garden</td>
<td>0.11</td>
<td>0.76</td>
</tr>
<tr>
<td>Cultivable/uncultivable land</td>
<td>0.35</td>
<td>2.43</td>
</tr>
<tr>
<td>Land under rural &amp; urban houses</td>
<td>0.63</td>
<td>4.38</td>
</tr>
<tr>
<td>Land under ponds</td>
<td>0.13</td>
<td>0.90</td>
</tr>
<tr>
<td>Land constantly under water</td>
<td>1.64</td>
<td>11.47</td>
</tr>
<tr>
<td>Total</td>
<td>14.39</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Anonymous (1982).
Table 3. Forest land and tree cover as percentage of total land of Bangladesh

<table>
<thead>
<tr>
<th>Classification</th>
<th>Total forest area (million ha)</th>
<th>Percent of total land</th>
<th>Total area</th>
<th>Tree cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hill forest land</td>
<td>1.38</td>
<td>9.6</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>Littoral forest land</td>
<td>0.65</td>
<td>4.5</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Plains (sal) forests</td>
<td>0.11</td>
<td>0.7</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Total state forest land</td>
<td>2.14</td>
<td>14.8</td>
<td>5.8</td>
<td></td>
</tr>
<tr>
<td>Village forests/homestead</td>
<td>0.27</td>
<td>1.9</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>2.41</td>
<td>16.7</td>
<td>7.7</td>
<td></td>
</tr>
</tbody>
</table>

Source: Anonymous (1982).

There are three major natural forest types in Bangladesh (Kamaluddin and Shamsuddin 1977). These are semi-evergreen forest occurring on the eastern hills, deciduous sal (*Shorea robusta*) forest on the central and northwestern terraces and the mangroves littoral forest facing the Bay of Bengal (Figure 2). Additionally, there are human raised village forests all over the country which cover an area of 1.87 percent, but are highly productive. Besides, fresh water swamp forest occurs in low-lying areas of Sylhet and also in depressions within semi-evergreen forest. Recently several authors have discussed various forest types of Bangladesh (Chaffey and Sandom 1985, Das 1990, Khan and Alam 1996, Siddiqi 2001).

![Figure 2. Major natural forest types of Bangladesh](image)

**STATUS OF BIODIVERSITY IN BANGLADESH**

Once Bangladesh had rich species diversity. The natural forests were virtually undisturbed and used to support a heterogeneous vegetation. Due to the raising of plantations with single crops following the harvesting of the natural forests and the introduction of exotic species in some areas, the floral diversity has been reduced over a greater part of the country. A rich heterogeneous flora is ideal habitat for wildlife. Reduction in floral diversity has caused damage to animal habitat, existence and abundance.
Biodiversity research initiatives in Bangladesh

A number of projects having biodiversity components are being implemented in Bangladesh. Some of the noteworthy ones are described below:

National Conservation Strategy (NCS)

The idea for a National Conservation Strategy (NCS) emerged in September 1986. Its primary goal was the sustainable use of natural resources. The National Conservation Strategy Implementation Project I (1994–1999) was a five-year project implemented by the Ministry of Environment and Forest (MoEF), with financial and technical support from NORAD and IUCN. Through this NCS Phase 1, one major programme was implemented in four distinct ecosystems—tropical and mangrove forest areas, St. Martin’s Island, Tangour Haor and Barind Tract. The main objectives of all these activities is conservation of biodiversity.

Coastal and Wetland Biodiversity Management

Bangladesh has completed a Pre-Investment Feasibility (PRIF) study in the “Coastal and Wetland Biodiversity Management Project” funded by the Global Environmental Facility (GEF). It was a preparatory initiative to develop a project proposal to implement a reserve, and a multiple-use management programme for the protection, sustainable management, and integration of at least three-priority biodiversity sites in Bangladesh. The primary focus was to integrate conservation and development, in order to protect and manage the priority areas in a sustainable way. The duration of the project was 15 December 1997 to 31 December 1999. The Project Brief and the outcome of the said PRIF study project have already been approved by the Project Steering Committee, and subsequently accepted by the GEF. The product of the follow-up project entitled “Coastal and Wetland Biodiversity Management in Cox’s Bazar and Hakaluki Haor (BGD1991G31)” has also been prepared, and approved by the GEF council for funding. This project is under process of execution by the Government of Bangladesh.

Integrated Coastal Zone Management (ICZM)

In December 2000 the Minister of Water Resources announced the Government’s intention to develop an ICZM policy. Among other objectives, the ICZM policy will attempt to rationalize and coordinate more effectively a number of environment and development initiatives taking place in the coastal zone. A number of donors, including the World Bank and the Netherlands Government, will be supporting the development of the policy over the coming years.

National Biodiversity Strategy and Action Plan

The GEF headquarters has already approved the project document; the project is under execution.

Conservation and management of medicinal plants

A project on the conservation and management of biodiversity of medicinal plants for their sustainable utilization will be executed in Rangamati Hill district. This project is in the process of final approval by the GEF. The specific objectives of the project are:

- development of an inventory of medicinal plants in the project area;
- documentation of traditional uses by the local people;
- conservation of medicinal plants and their ecosystem;
- capacity building of concerned agencies in the sustainable use of the medicinal plants.

Sustainable Environment Management Programme (SEMP)

The SEMP is the response evolved from the concerns, needs and actions identified through the National Environment Management Action Plan (NEMAP) process. It focuses on community-based resource management in wetlands. In the NEMAP several major priority areas of environmental concern were identified, and the SEMP has been designed to address these priorities. The programme consists of 26 components on five major themes, and is implemented by 22 organizations from the government, non-government organizations (NGOs) and private sector. The community-based “Haor and Floodplain Resource Management Project” is being
implemented by the IUCN with the Ministry of Environment and Forest, in two well-defined degraded areas of haor and floodplain ecosystems. The major focus of the programme is to involve community people in the planning and implementation of activities for the management of natural resources that maintain biodiversity and human well-being.

**Management of Aquatic Ecosystem through Community Husbandry (MACH)**

The natural resources in the floodplains and wetlands throughout Bangladesh are in decline. Thus, to conserve these resources the Government of Bangladesh and the United States of America have jointly developed a programme called MACH. An agreement to implement this programme was signed in May 1998. Its goal is to ensure the sustainable productivity of all wetland resources such as water, fish, plant and wildlife over an entire wetland ecosystem.

**Sundarbans Biodiversity Conservation Programme**

The Asian Development Bank funded the project “Biodiversity Conservation in the Sundarbans Reserved Forest.” The objective of the project was to establish an effective system for the participatory and sustainable management of the ecosystem of the Sundarbans Reserved Forest. The scope of the project included biodiversity conservation, sustainable resource management, community development, participatory resources management programme, development of ecotourism infrastructure, and establishing a new multisectoral management agency that will work for an integrated conservation and development approach.

**Forest Resources Management Project**

The World Bank funded a programme on “Forest Resources Management Project” in 1992. The primary objective of the project was to establish and maintain a forest management system that was fully responsive to the economic, environmental and social goals of the country; and to improve the productivity of government-owned forests in order to meet the country’s wood and energy needs as much as possible while still protecting the environment.

**Biodiversity survey in 13 protected areas**

A biological survey study was conducted in 13 protected areas by the Bangladesh Centre for Advanced Studies, in collaboration with the Forest Department. The survey was conducted to assess the biological resources available in the designated areas. The potential value of each protected area was evaluated through determination of the species present, the relative abundance of the species and the species diversity. The critical habitats in each of the protected areas were identified for protecting the threatened species, and also for developing protective area management plans.

**Floral diversity**

The vegetation of Bangladesh has been discussed under forest types. But the species include mainly those which are of commercial importance. The greater bulk of plant species for Bangladesh are yet to be recorded for different forest types. It is believed that 5000 species of angiospermic plants occur in Bangladesh. There are 750–800 tree species including indigenous, exotic and naturalized ones. The number of shrubs and woody climbers is 1500–2000 species and the remaining are herbs. Bangladesh has approximately 15 percent tree, 35 percent shrub and woody climber, and 50 percent herb species (M.K. Alam, personal communication, 2002).

**Faunal diversity**

Bangladesh shares similar ecological conditions with the neighbouring countries. So it is unlikely to have ecologically adapted species, especially of higher groups of plants and animals. Biodiversity has three components: species, genetic and ecosystem. Considering the available information and time constraint only species diversity in relation to habitat will be discussed. With forests disappearing rare wildlife and biological diversity has also been reduced quite rapidly. Many species have gone totally extinct, and some wildlife species have also been severely affected because of the shrinking forests.
Causes for depletion of wildlife diversity

Till to end of the 19th century, wildlife was holding ground over a sizable area of Bangladesh (Husain 1974). All the forest types and village groves had a rich fauna. According to Husain (1992) at least 18 species of vertebrate animals became extinct during the last century from their natural habitats in Bangladesh (Table 4). Still species diversity is quite good (Table 5) although the population status of important species is unsatisfactory. However, information on the high diversity of invertebrate animals is insufficient owing to the lack of studies and limited resource personnel. Nevertheless, the author has identified 12 species of wildlife as extinct in Bangladesh (Table 6). There are presently 22 species of amphibians, 109 species of reptiles, 628 species of birds including migratory ones, and 110 species of mammals. A sharp decline of wildlife has taken place for various reasons such as:

- indiscriminate hunting;
- poaching of animals;
- export of animals;
- habitat destruction;
- lack of people’s awareness;
- poor management of protected areas and reserved forests;
- lack of a plan for compatible forest and wildlife management;
- inefficient implementation of law for wildlife conservation;
- natural calamities like flooding, tidal surge, etc.

Table 4. Animal species extinct from Bangladesh during the last century

<table>
<thead>
<tr>
<th>Wildlife class</th>
<th>English name</th>
<th>Scientific name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammalia</td>
<td>Great one-horned rhinoceros</td>
<td>Rhinoceros unicornis</td>
</tr>
<tr>
<td></td>
<td>Lesser one-horned/Javan rhinoceros</td>
<td>Rhinoceros sondaicus</td>
</tr>
<tr>
<td></td>
<td>Asiatic two-horned rhinoceros</td>
<td>Dicerorhinus sumatrensis</td>
</tr>
<tr>
<td></td>
<td>Blue bull/nigal</td>
<td>Boselaphus tragocamelus</td>
</tr>
<tr>
<td></td>
<td>Wild buffalo</td>
<td>Bubalus bubalis</td>
</tr>
<tr>
<td></td>
<td>Gaur</td>
<td>Bos gaurus</td>
</tr>
<tr>
<td></td>
<td>Banteng</td>
<td>Bos banteng</td>
</tr>
<tr>
<td></td>
<td>Swamp deer/barasingha</td>
<td>Cervus duvauceli</td>
</tr>
<tr>
<td></td>
<td>Marbled cat</td>
<td>Canis lupus</td>
</tr>
<tr>
<td></td>
<td>Hog deer</td>
<td>Axis porcinus</td>
</tr>
<tr>
<td></td>
<td>Wolf</td>
<td>Canis lupus</td>
</tr>
<tr>
<td></td>
<td>Golden cat</td>
<td>Felis temmincki</td>
</tr>
<tr>
<td>Aves</td>
<td>Pinkheaded duck</td>
<td>Rhodonessa caryophyllacea</td>
</tr>
<tr>
<td></td>
<td>Greater adjutant</td>
<td>Leptoptilos dubius</td>
</tr>
<tr>
<td></td>
<td>King/black vulture</td>
<td>Sarcogyps calvus</td>
</tr>
<tr>
<td></td>
<td>Bengal florican</td>
<td>Euphodotis bengalensis</td>
</tr>
<tr>
<td></td>
<td>Burmese peafowl</td>
<td>Pavo muticus</td>
</tr>
<tr>
<td>Reptilia</td>
<td>Marsh crocodile</td>
<td>Crocodylia palustris</td>
</tr>
</tbody>
</table>


Table 5. Status of inland and resident vertebrates (species diversity) of Bangladesh

<table>
<thead>
<tr>
<th>Group</th>
<th>Total No. of living species</th>
<th>Extinct</th>
<th>Critically endangered</th>
<th>Endangered</th>
<th>Vulnerable</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphibians</td>
<td>22</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Reptiles</td>
<td>109</td>
<td>1</td>
<td>12</td>
<td>24</td>
<td>22</td>
<td>58</td>
</tr>
<tr>
<td>Birds</td>
<td>388*</td>
<td>2</td>
<td>19</td>
<td>18</td>
<td>4</td>
<td>41</td>
</tr>
<tr>
<td>Mammals</td>
<td>110</td>
<td>10</td>
<td>21</td>
<td>13</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>629</td>
<td>13</td>
<td>52</td>
<td>48</td>
<td>38</td>
<td>147</td>
</tr>
</tbody>
</table>

Source: IUCN (2000).
* Excluding migratory birds.
Table 6. Animal species extinct from Bangladesh at present

<table>
<thead>
<tr>
<th>Wildlife class</th>
<th>English name</th>
<th>Scientific name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammalia</td>
<td>Great one-horned rhinoceros</td>
<td>Rhinoceros unicornis</td>
</tr>
<tr>
<td></td>
<td>Lesser one-horned/Javan rhinoceros</td>
<td>Rhinoceros sondaicus</td>
</tr>
<tr>
<td></td>
<td>Asiatic two-horned rhinoceros</td>
<td>Dicerorhinus sumatrensis</td>
</tr>
<tr>
<td></td>
<td>Blue bull-nilgai</td>
<td>Boselaphus tragocamelus</td>
</tr>
<tr>
<td></td>
<td>Wild buffalo</td>
<td>Bubalus bubalis</td>
</tr>
<tr>
<td></td>
<td>Gaur</td>
<td>Bos gaurus</td>
</tr>
<tr>
<td></td>
<td>Banteng</td>
<td>Bos javanicus</td>
</tr>
<tr>
<td></td>
<td>Swamp deer/barasingha</td>
<td>Cervus duvauceli</td>
</tr>
<tr>
<td></td>
<td>Marbled cat</td>
<td>Canis lupus</td>
</tr>
<tr>
<td>Aves</td>
<td>Pinkheaded duck</td>
<td>Rhodonessa caryophyllacea</td>
</tr>
<tr>
<td></td>
<td>Common peafowl</td>
<td>Pavo cristatus</td>
</tr>
<tr>
<td>Reptilia</td>
<td>Marsh crocodile</td>
<td>Crocodylia palustris</td>
</tr>
</tbody>
</table>


PROTECTED AREAS FOR WILDLIFE MANAGEMENT

Protected areas (PAs) of Bangladesh

Owing to the growing human population and agriculture expansion, there is heavy pressure on forest and forest resources. A good number of species are endangered and threatened. They are also likely to be extinct unless adequate measures are immediately taken. Merely declaring and demarcating some places as protected areas will not serve the purpose.

To save wildlife fauna we have in all ten wildlife sanctuaries, six national parks and one game reserve (Table 7), However, the management of PAs is improper for conservation and improvement of wildlife fauna. Socio-economic impact of the surrounding population is too great for the management of the PAs. Scientific and socio-economic studies must be undertaken to address the problem.

Table 7. Protected areas for wildlife conservation under the management of the Forest Department

<table>
<thead>
<tr>
<th>Name of protected area</th>
<th>National category</th>
<th>IUCN category</th>
<th>Area (ha)</th>
<th>Year of notification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhawal</td>
<td>National park</td>
<td>V</td>
<td>5 022</td>
<td>1982</td>
</tr>
<tr>
<td>Himchan</td>
<td>National park</td>
<td>V</td>
<td>1 729</td>
<td>1980</td>
</tr>
<tr>
<td>Lawachara</td>
<td>National park</td>
<td>V</td>
<td>1 250</td>
<td>1996</td>
</tr>
<tr>
<td>Madhupur</td>
<td>National park</td>
<td>V</td>
<td>8 436</td>
<td>1982</td>
</tr>
<tr>
<td>Kaptai</td>
<td>National park</td>
<td>V</td>
<td>5 465</td>
<td>1999</td>
</tr>
<tr>
<td>Ramsagar</td>
<td>National park</td>
<td>Unassigned</td>
<td>52</td>
<td>1974</td>
</tr>
<tr>
<td>Nijhum Dwee</td>
<td>Wildlife sanctuary</td>
<td>Unassigned</td>
<td>16 352</td>
<td>2001</td>
</tr>
<tr>
<td>Chunati</td>
<td>Wildlife sanctuary</td>
<td>IV</td>
<td>7 764</td>
<td>1986</td>
</tr>
<tr>
<td>Pabriakhali</td>
<td>Wildlife sanctuary</td>
<td>IV</td>
<td>42 087</td>
<td>1983</td>
</tr>
<tr>
<td>Rema-Kalenga</td>
<td>Wildlife sanctuary</td>
<td>IV</td>
<td>1 095</td>
<td>1981</td>
</tr>
<tr>
<td>Sundarbans East</td>
<td>Wildlife sanctuary</td>
<td>X</td>
<td>31 227</td>
<td>1996</td>
</tr>
<tr>
<td>Sundarbans South</td>
<td>Wildlife sanctuary</td>
<td>X</td>
<td>36 970</td>
<td>1996</td>
</tr>
<tr>
<td>Sundarbans West</td>
<td>Wildlife sanctuary</td>
<td>X</td>
<td>71 502</td>
<td>1996</td>
</tr>
<tr>
<td>Char Kukri Mukri</td>
<td>Wildlife sanctuary</td>
<td>Unassigned</td>
<td>40</td>
<td>1981</td>
</tr>
<tr>
<td>Hazarikihl</td>
<td>Wildlife sanctuary</td>
<td>Proposed</td>
<td>2 903</td>
<td>1967</td>
</tr>
<tr>
<td>Rampahar-Sitapahar</td>
<td>Wildlife sanctuary</td>
<td>Proposed</td>
<td>3 026</td>
<td>–</td>
</tr>
<tr>
<td>Hail Haor</td>
<td>Wildlife sanctuary</td>
<td>Proposed</td>
<td>1 427</td>
<td>1983</td>
</tr>
<tr>
<td>Teknaf</td>
<td>Game reserve</td>
<td>VII</td>
<td>11 615</td>
<td>1983</td>
</tr>
</tbody>
</table>

Total land area of the country—147 570 km²
Total forest area of the country—26 300 km²
Total area of PAs—2406 km²
Percent of PAs (on the basis of the area of the country)—1.63%
Percent of PAs (on the basis of the total forest area of the country)—9.14%.
ECOTOURISM: TOOLS FOR POVERTY ALLEVIATION

Ecotourism is a sustainable form of land use which contributes to environmental conservation while providing accrued socio-economic benefits to the indigenous people through the non-consumptive uses and indirect values of the natural biological resources. The goal of ecotourism is to promote an environmentally friendly business and to generate local income. In reality, ecotourism is an economically viable industry at the national and local levels.

The forest of Bangladesh is a peculiar type of ecosystem because of its interesting environmental conditions. It offers a wide range of outdoor recreational opportunities. These opportunities may include power boating, canoeing, fishing, collection of invertebrates like mollusks and crustaceans, picnicking, swimming, bird watching, wildlife observation, photography on wildlife, nature education and others.

Naturally, some forest areas can attract a large member of tourists and be a source of earnings through national and overseas tourism. In various countries, tourism in the forestry environment has been developed. It is important to note that the preservation of mangroves and some hill forests can be compatible to ecotourism if well planned. With this in view, the Bangladesh Forest Department can develop tourism facilities in mangrove and hill forest areas.

The strategy of the Forest Department’s tourism and recreation initiative will be to adopt a higher publicity profile, to strengthen its forest development efforts and to gain new constituencies in forest conservation. For instance, to develop Nijhum Dweep as a tourist spot the Forest Department will endeavour the following:

• Develop the Nijhum Dweep Wildlife Sanctuary as a visitors’ destination on a limited scale. A sanctuary office will be built there to serve both as office and visitor centre.
• Develop facilities in areas designated as converging points for visitors. Such areas are the Division Office, the Central Nursery, and destination areas for visitors to witness designated forest operations.
• Invite visitors to visit well-established forest plantations and also to witness forest nursery operations, planting, harvesting, and other forest operations to make them aware of the various field activities of the Forest Department.
• Develop promotional materials highlighting the Department’s forest development activities and accomplishments in the coastal territory. Videos of the Department’s field activities, especially in plantation development, will be produced, distributed and shown to local audiences and sent to international aid agencies. Conservation slogans will be echoed through posters, postcards, maps, brochures and souvenir items to be disseminated to local visitors and commercial establishments. An internet web-site will be set up by the Department so that its programmes can be disseminated much faster to the intended clients on the web.

Unless the poor forest dwellers can increase their income, it is difficult to get their active support and involvement in forest and wildlife conservation. The income of the people can be improved through further development of ecotourism all over the country. The rich fauna and floral biodiversity and also beauty of nature like in the Dulhazara Safari Park will definitely attract local and foreign tourists.

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Poverty reduction and forestry sector: towards the sustainable management of natural resources

Lic Vuthy*

ABSTRACT

Forests are crucial for socio-economic improvement and poverty alleviation in Cambodia. They not only provide food and raw materials, but also serve an important life support function by generating oxygen and regulating fresh water through preserving watersheds. As part of Cambodia’s approach to using, protecting and managing forests for sustainable development, uses and threats need to be weighed against each other and managed appropriately. In Cambodia natural resources are in danger of being overexploited. The Royal Government of Cambodia has taken important steps in mitigating threats to forest through increased community management and good governance. The greatest challenge is lack of human resources and finances for implementing these forest protection measures. Sustainable management of forest resources ensures that commercial forest operations are carried out efficiently; preserves soil; identifies and protects sites of high traditional, historical and archaeological value; maintains the logging productivity of those sites designated for logging in perpetuity; identifies, maintains and protects a broad range of natural habitats with potential scientific and ecological values; protects water resources; allows continued exploitation of non-timber forest resources in a way that permits continued productivity with respect to these resources; ensures that forest activities are carried out in a safe and legal manner; allows existing recreational uses as appropriate and minimizes the adverse effects of forest operations on people and environment. A possible solution to dealing with development and preservation of forests is through Special Management Areas for special purposes such as watershed or soil conservation, wildlife or biodiversity conservation, preservation of seed sources, historical or cultural sites, and areas to be retained in their pristine state and those supporting community livelihoods. The Royal Government of Cambodia and many international agencies have recognized the significance of Cambodia’s tropical forest, and are showing increased interest in conducting activities that reduce forest degradation or depletion. Many activities currently being undertaken are concentrating on the important links between forests and sustainable development, while at the same time encouraging the protection of representative components of Cambodia’s forests through a system of protected areas. These approaches will help to ensure the ability of Cambodia to use, protect and manage the forests for sustainable development and prosperity into the future.

INTRODUCTION

Among the ASEAN countries Cambodia is one of the most important sources of tropical hardwood forests, which are a significant renewable natural resource. These forests not only assume an important role in protecting the environment, but are also of critical importance to the socio-economic development of these countries. The management and harvesting of forest resources in a sustainable manner to provide current as well as future needs is an important goal of the Cambodia Government. In order to achieve this goal, however, increased attention must be focused on forest management, especially on forest harvesting practices and poverty reduction. The sustainability of forests will be affected dramatically if proper logging guidelines are not developed, understood and enforced.

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Forests have significant roles in the development of Cambodia’s agriculture, socio-economic, environmental and tourist sectors – especially in the subsistence of local communities. Forests also provide a major source of fuel and building materials for the local populations. Cambodian forests contain substantial biological resources, including valuable plant and wildlife species such as birds, reptiles and mammals, which are among the richest in biological diversity among the countries in the region. Sustainable management in forest use and development is one of the crucial constraints that countries around the world are facing. Among the ASEAN countries, forest criteria and indicators are being developed and used. Each country needs to find a way to prevent its own forest from being destroyed. In Europe, countries are encouraged to implement Forest Certification to help manage and develop forest sustainably. Forest Certification is one of the models with which country members can help one another to curb illegal logging and wood market. Cambodia may choose this method to minimize forest destruction.

**BACKGROUND**

**Revenue**

In 1970 forest cover was about 13.5 million ha (73 percent of the total land area); however, a study by the FAO in 1997 showed that forest cover is approximately 10.5 million ha (58 percent). The main reasons for deforestation are:

- population increase, requiring more land for agriculture and housing;
- booming timber demand for local and international markets.

The export of wood and non-timber forest products has been changing from year to year; 41 574 m³ of semi-wood products and 38 tonnes of non-timber forest products were exported in year 2001 (Department of Forestry and Wildlife (DFW) 2001). The majority of the local villagers depend on non-timber forest products (NTFPs) for their livelihood subsistence and timber for house construction. Cambodian hardwoods have been exported to Thailand, Malaysia and Viet Nam for re-export. Raw material like resin is only exported to Viet Nam so far.

Although forest still covers 58 percent of the country area, to some extent, these forests are degraded due to selective cutting of healthier trees rather than the sick or unhealthy ones. Having seen this unsustainable exploitation of forest resource, the DFW has cooperated with the World Bank and the Asian Development Bank to establish several projects including:

- forest policy reform;
- Forest Concession Management Unit;
- logging control and verification;
- Legal Council Assignment.

**Land clearing**

Although forests were destroyed for agriculture during the Khmer Rouge regime (1974–1979), forests continued to be destroyed in the war that followed to expose Khmer Rouge guerrillas who hid in the mountains and forested areas. Since many farmers could not return to their former paddy fields due to the guerrillas and land-mines, new areas of land were cleared for agricultural production (Chan Sarun 1997). As the post-war population in Cambodia increased rapidly, more and more forested areas were cleared for firewood and to make way for rice paddies.

Slash and burn is a very common technique since logging “dead” wood is legal in Cambodia. Deliberately lit forest fires can be seen burning frequently in the national parks in Cambodia, including Kirirom and Bokor. Sections along the new road to the Koh Kong in the Cardamom Mountains are being slashed and burnt to make way for new homes, agricultural plots and building materials for homes and the new road.

Crop cultivation is also common in Cambodia, and farmers commonly cut down forest areas to serve as new plantation regions. This can been seen in the forests of Bokor National Park where banana farmers bordering the park clear the forests to move the plantations between regions.
Reserves

Angkor Wat and its surrounding forests were established as a National Park in 1925—the first ever in Southeast Asia. Before 1957, about one-third of the country was classified into 173 forest reserves and six wildlife sanctuaries. These accounted for 3.9 and 2.2 million hectares of Cambodian territory respectively (Ashwell 1996).

The forest and wildlife reserves for production were designed to sustainably exploit timber and non-timber forest products (Kol. Touch, Former Forestry Director, 1970, personal communication, 1993–94). Hunting and non-timber forest product (NTFP) collection were allowed only in the buffer zone areas or in production forest areas. Forest rangers would stop any people entering the forest reserves who possessed hunting equipment such as snares or traps. The lighting of forest fires was also very strictly controlled (Chan Sarun, personal communication).

Since 95 percent of the Khmer people believe in Buddhism, pagodas have played a crucial role in wildlife and forest protection—especially in rural areas (pers. observation). Water pools surrounded by small forests are built at most pagodas and serve to sustain local wildlife populations, including fish and amphibians. The forests around pagodas are also used to supply local firewood.

Forest concessions

Tree species conservation is of major concern to the forest sector. Cambodia has forest concession areas that allow supervised logging. The concessionaire is responsible and accountable for protection and maintenance of productivity in the production zone within the forest concession area (DFW 2000).

DANIDA has been working closely with the Royal Government of Cambodia (Department of Forestry and Wildlife) to maintain endemic commercial tree species (Cambodia Tree Seed Project/DANIDA, 2001). DANIDA’s goal is to protect forests though collaboration with the Department of Forestry and Wildlife (DFW) in forest concession areas, and with the Ministry of Environment (MoE) under the Royal-Decree Protected Areas. For the long-term sustainable use of forests and wildlife within the DFW forest jurisdiction areas, the DFW has endorsed that wherever forests are indigenous and valuable to the economy and regional ecology, forest concessions should be cancelled.

Cambodia has a relatively long history of supplying NTFPs and construction timbers to neighbouring countries such as Thailand, Viet Nam, China and Japan. Cambodia continues to provide timber to local, regional, and international markets – legally and illegally.

FOREST MANAGEMENT

Policies

In order to cope with forest destruction, the Royal Government of Cambodia has implemented management policies as follows:

- Act (Prakas) No. 03 Pr.K. Dated 28 April 1995. Forest Policy (Government Guideline for Forest Reform Policy);
- Act No. 02 S.Pr.K. Dated 26 December 1996. Ban on timber (round and sawn) export;
- Letters to the Prime Ministers of Lao PDR, Thailand and Viet Nam. Dated 26 December 1996. Log ban cooperation with neighboring countries;

In order to provide the foundation for achieving sustainable forest management, the Cambodian Code of Practice for Forest Harvesting was prepared in 1997 with technical assistance from the World Bank Project on Forest Concession Management in cooperation with FORTECH, a forest-consulting firm.

The Code of Practice is a legal instrument for achieving sustainable forest management on forest concession lands. Its primary purpose is to prescribe harvesting practices that protect the environment, conserve biodiversity and promote forest development consistent with the principles of sustainable development. The Code of Practice also provides guidance for protecting sites of cultural significance, maintaining forest regenerative capacity, improving the economic and social contributions of forestry, and ensuring the health and safety of forest workers. The initial development of the Code was completed in mid-1999 and distributed to forest concessionaires and other relevant stakeholders.
The Cambodia Code of Practice was developed in the following series of stages:

• a preliminary assessment of existing technical guidelines;
• the development of a code based on experiences of other countries in the region and FAO guidelines;
• field surveys in the forest harvesting areas of forest concessions;
• the organization of workshops, and discussions with forest concessionaires.

The Code of Practice provides prescriptive guidelines for harvesting operations that include:

• harvest planning;
• construction associated with logging operations;
• timber felling and extraction;
• log landing operations;
• transportation;
• the effects of weather constraints on logging;
• camp hygiene;
• stabilization of logged areas;
• training;
• supervision of operations;
• equipment and safety;
• harvesting assessments.

A selective logging system has been developed to manage the country’s dipterocarp forests. Practices that are included in this selective logging system include:

• tree marking, the practice of marking the trees that will be left as residuals to compose future crop trees, and the trees that will be harvested for the manufacture of plywood and other wood products;
• timber harvesting, in which the volume of timber that may be harvested within production young growth forests is determined by an allowable, cut formula;
• residual inventory, the field evaluation of marked residual trees left after logging;
• forest stand improvement, the post-logging practice composed of refining and liberating components to improve the growth, quality and composition of the growing residual stock; and effective forest protection.

**Forest harvesting**

Subsequent to adopting the Code of Practice, the Ministry of Agriculture, Forestry and Fisheries (MAFF) has initiated several programmes to facilitate its implementation by:

• increasing awareness among forest concessionaires and other stakeholders with respect to understanding the benefits of the Code, and the implementation of harvesting operations in accordance with the Code to ensure sustainable forest management in forest concessions;
• strengthening political support from provincial governors and relevant Ministries, particularly in the preparation and adoption of a Sub-Decree on Forest Concession Management that includes provisions to increase local community participation in activities to protect and manage forests in compliance with the Code;
• training by field forest officers for logging operation planners, logging supervisors, and forest machine and chainsaw operators;
• preparing technical guidelines for implementing the Code, including guidelines providing directives on forest concession management planning systems, inventories associated with the forest management cycle, biodiversity conservation in managed forests, issues associated with social forestry, timber theft management, forest engineering, environmental impact assessments, special management areas, the selection of suitable systems of silviculture, and forest improvement;
• forest reservation and reforestation systems for the management of wildlife habitats, water catchment protection and forest monitoring;
• preparing a forest concession management planning manual in order to provide the foundation for implementing the Code’s basic regulations and guidelines in a consistent manner;
• establishing a forest concession management and control pilot project funded through a World Bank Learning and Innovation Loan that will be providing technical assistance for developing comprehensive forest concession management plans, including environmental and social impact analyses consistent with international standards;

• conducting harvesting assessments of forest concessionaires in compliance with the Code at the closure of annual harvesting operations on 31 December of each year.

The initial results of implementing the Code of Practice for Forest Harvesting in Cambodia indicate that there have been several immediate benefits, particularly the increased understanding of sustainable forest management practices by those who plan and supervise logging operations, as well as by forest machine and chainsaw operators.

**Law**

The DFW has been using the Forestry Kret-Chbap No. 35 for forest management since 1998. The new Law on Forestry was ratified in August 2002. The Law clearly defines the rights of use of NTFPs for the local people either outside or inside forest concession areas. The Community Forestry Law is in the consultation phase with government and private forest sectors such as the Cambodia Timber Industry Association (CTIA). The law allows more forestry rights to local communes for their use of timber and non-timber forest products. Moreover, local commune members will have more rights to manage the forests of their own communes, either natural or plantation forests.

**FORESTRY REFORM**

**Community forestry management**

Reforestation efforts are following the Royal Government of Cambodia’s policy to reform the forestry sector at provincial levels. Trees have been planted in 8325 ha of state areas and the DFW has a five-year rehabilitation strategy for 250 000 ha of degraded land. This strategy includes planting state tree farms, developing commercial tree plantations in degraded areas and encouraging individuals and the private sector to participate in agroforestry and community forestry.

To ensure the supply of fast growth seedlings, seed quality and sources need to be considered. Natural seed-trees (mother trees) are in great demand and protected areas should be enforced wherever these seed-trees occur. Part of forest concessions may be allocated to protected areas if necessary. Through the DANIDA Tree Seed Project (Cambodia Tree Seed Project Workshop, 2001), the DFW has distributed 2 million seedlings through cooperating with a number of NGOs and students.

The DFW has been cooperating with national and international agencies to develop community forestry programmes, to develop and improve human resources and to encourage the local people to participate in sustainable forest management and in forest protection. Also, national and international agencies and donor agencies have supported and actively participated in encouraging community forestry practices.

**Forest policy implementation**

In July 1996 the Royal Government of Cambodia established a Secretariat of National Committee for Forest Policy Reform. The Secretariat, which was established under a World Bank loan, has reviewed and identified four main forestry issues to be addressed:

- forest policy reform;
- forest concession management;
- logging control and verification; and
- legal council assignment.

Implementing the new Law on Forestry has been started since early 2003. The DFW/MAFF is leading the implementation. It is hoped that full enforcement of the new Law would be in the year 2004.
Law enforcement

In order to effectively eliminate illegal forest activities the Royal Government of Cambodia has been developing and implementing a number of policies and regulations, including:

- Regulation No.0213.CH. Dated 06 January 1999. Action strategies to cope with illegal logging activities;
- Prakas No.01 Pr.K. Dated 25 January 1999. Forest management and elimination of illegal activities in forestry sector;
- Prakas No.06 Pr.K. Dated 27 September 1999. Elimination of illegal land encroachment.

Patrols need to be conducted in both towns and within forest areas. Provincial foresters often work in forest regions, especially along the international borders. However, they lack the financial support to investigate and act on illegal logging activities. Insufficient equipment and financial support have caused difficulty in coping with illegal activities in the jungle. Moreover, rogue military based in the remote areas get involved in the illegal activities.

In 2002 there were about 800 staff members in the DFW and about 1000 forestry staff members countrywide. In general, the capacity of the DFW staff is limited and there is insufficient training provided to do the work—this is further affected by the lack of funds for forestry operations.

Communities and forests

The local people collect NTFPs and timber both in and around protected forest areas for local subsistence including:

- resins used for sealing boats;
- rattan, bamboo and nypa (wild) palm leaves for building houses;
- reeds, berries and mushrooms for eating;
- barks, mushrooms and berries for medicine;
- wood for fuel and charcoal production.

The new Law on Forestry allows the local ethnic minority consumption of natural resources. However, some NTFPs such as rattan and bamboo are occasionally harvested for commercial purpose.

FORESTS AND PROTECTED AREAS

Forest protection and conservation

Forest protection/protected areas may offer a significant contribution to sustain forest development. Communities depend on forests for many resources, including water, NTFPs, timber and wildlife. Forest protection areas play a very important role as sources of tree pollination and animal refuge to the adjacent forest areas. The Department of Forestry and Wildlife, under the guidance of the Ministry of Agriculture, Forestry and Fisheries, has been concerned very much with sustainable forest and wildlife management.

Community-based management of the Mondulkiri Protected Forest and Transboundary Conservation is being considered in the allocation of the area as a forest preserve for production. The ITTO considers the site as a sole area for long-term forest management in northeast Cambodia along the Viet Nam border in cooperation with the Vietnamese government (Gasana & Sun Hean, in press). The WWF Cambodia receives financial funding for a two-year (2003–2004) project to develop the area for sustainable use based on ecotourism (Goodman et al. 2003). The area contains large waterbirds such as crane and raptor (meat eating bird), lots of small streams where luxury tree species are found, and large mammals such as water buffalo, elephant, tiger and deer. Many species of reptiles including turtle and monitor lizard can be encountered within the area. NTFPs such as rattan and wild fruit tree also occur in this area.

Forestry and water catchments

The provinces surrounding the Cardamom Mountains (Koh Kong, Kampong Chhnang and Pausat) rely heavily on the forest for resources. In addition, the Cardamom Mountain range is a crucial water catchment in Cambodia and affects the Tonle Sap. Cambodian people depend on the fish protein from the Tonle Sap Lake and fish...
from Tonle Sap is exported every year. Deforestation can lead to increased sedimentation in waterways, and cause sedimentation in the Tonle Sap. Attention needs to be paid to forests and protected areas as essential water resource regulators.

**Wildlife conservation**

Cambodia has seven national parks, ten wildlife sanctuaries, three protected landscapes and four multiple-use areas. On 25 January 2000, the Prime Minister of Cambodia officially inaugurated the Phnom Tamao Zoological Park, Wildlife Rescue Centre (1200 ha). The Phnom Tamao Zoological Park is also used as a breeding-release centre and will be a captive breeding centre in the future. An area of 12 650 ha in Banteay Meancheay Province has been designated as a crane conservation area. These designations have a significant effect on biodiversity conservation aspects, both *in situ* and *ex situ*. People near and around the zoo and sanctuaries have been aware of conservation and sustainable development within their own communities. Moreover, the Phnom Tamao area, which had once been cleared, has now become reforested both naturally and artificially.

CITES held a four-day regional meeting on the International Treaty on Trade in Endangered Plant and Wildlife Species in Phnom Penh from 21 to 24 February 2000, to discuss and find appropriate solutions to CITES in the Asian region. Restriction on wildlife export has been improved since Cambodia became a CITES member. Government agencies such as the Customs are aware of strict control of the trade in wildlife.

**Achievements**

After ten years effort by the Department of Forestry and Wildlife and improvement of the internal political situation, the Cambodian government has become aware of the importance of biodiversity conservation. The Central Cardamom Mountain area of 330 923 ha was declared a Forest Protection and Water Catchment Site in 2001. Among others the Central Cardamom Protection Forest might be proposed to be a World Heritage Site (DFW; CI; and Tim Wong, IUCN, personal communication.). Ang Tra Peang Thmor, the Crane Sanctuary, also was designated by the MAFF to be protected. At the moment the Sanctuary is getting financial support from the Wildlife Conservation Society and small support also from the Crane International Foundation. The other two proposed forest protected areas are the Mondulkiri and Preah Vihear sites. These two are in the process of submission for final declaration from the cabinet of the Prime Minister.

**CONCLUSION**

Forests are crucial for socio-economic improvement and poverty alleviation in Cambodia. They not only provide food and raw materials, but also serve as an important life support function by generating oxygen and regulating fresh water through preserving watersheds. As part of Cambodia’s approach to using, protecting and managing forests for sustainable development, uses and threats need to be weighed up against each other and managed appropriately.

Cambodia has achieved some progress in this direction. However, natural resources are in danger of being privatized and overexploited. The Royal Government of Cambodia has taken important steps in mitigating threats to forests through increased community management and good governance. The greatest challenge is lack of human resources and financial funding for implementing these forest protection measures. Sustainable management of forest resources ensures that commercial forest operations are carried out efficiently to preserve soil value; identify and protect sites of high traditional, historical and archaeological values; maintain the logging productivity of those sites designated for logging over many cutting cycles; identify, maintain and protect a broad range of natural habitats with potential scientific and ecological values; protect water resources; allow continued exploitation of non-timber forest resources in a way that permits continued productivity with respect to these resources; ensure that forest activities are carried out in a safe and legal manner; allow existing recreational uses as appropriate; and minimize the adverse effects of forest operations on people and environment (DFW 2000).

A possible solution to dealing with development and preservation of forests is through special management areas. The objective is to recognize the unique value of select forest resources within the forest concession area and designate them as special management areas excluded from commercial logging and annual allowable cut. The principal types of special management area include watershed or soil conservation; wildlife or biodiversity conservation; preservation of seed sources; historical or cultural sites; areas to be retained in their pristine state and those supporting community livelihoods (DFW 2000).

The Royal Government of Cambodia and many international agencies, including ASOF (Asian Senior on Forestry), have recognized the significance of Cambodia’s tropical forest, and are showing increased interest
in conducting activities that reduce forest degradation or depletion. Lots of activities currently being undertaken are concentrating on the important links between forests and sustainable development, at the same time encouraging the protection of representative components of Cambodia’s forests through a system of protected areas. These approaches will help to ensure the ability of Cambodia to use, protect and manage forests for sustainable development and prosperity into the future.

**RECOMMENDATIONS (STRATEGIES FOR BETTER MANAGEMENT)**

Since some work has been done both on paper and on the ground, the immediate needs are as follows:

- increasing management activity on the ground rather than doing more work on paper;
- raising local people and national awareness on sustainable use of forests and development;
- getting long-term support from the government;
- upgrading human resources on sustainable use of forests;
- introducing CDM initiatives in Cambodia.

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Biodiversity for poverty alleviation in Indonesia

Suhardi*

ABSTRACT

Indonesia has one of the most diverse megadiversities in the world. Although its land area is only about 1.3 percent of the world’s, Indonesia has about 17 percent of all species. If the diversity in the sea is also included then Indonesia would be regarded as the greatest megadiverse region in the world. The 47 ecosystem types in Indonesia can be divided into seven biogeographic regions which are centered on the major island groups and include their surrounding seas. Despite its megadiversity, Indonesia has great problems with poverty. Poverty in Indonesia may be related to the destruction of the biodiversity since about 1.6 million ha of forests are destroyed annually. Every single species loss is believed to be followed by that of 10 to 30 other species. It is very important therefore to manage the biodiversity sustainably for the benefit of the people.

INTRODUCTION

Strategy to alleviate poverty

Management of biodiversity to alleviate poverty should be based on biogeographic regions or specific site conditions. Biogeographic regions in Indonesia are as follows:

- Java and Bali: rain forests; natural monsoon forests; montane forests, temperate herbaceous formation, limestone karst, fresh water swamp forests; and mangroves;
- Kalimantan including the Natuna and Anambas islands: lowland evergreen forests; montane forests; extensive mangroves; peat and fresh water swamp forests; and large heath forests;
- Sumatra and offshore islands: dipterocarp forests; peat swamp forests; mangroves; montane rain forests; natural pine forests;
- Sulawesi and offshore islands including Sulu: montane rain forests; lowland rain forests; karst limestone, swamp forests; and mangroves;
- Nusa Tenggara: monsoon forests and extensive grasslands; natural sandalwood forests; and some montane rain forests;
- Maluku: lowland and montane forests; mangroves; and fresh water swamps;
- Irian: monsoon forests; savanna woodlands; tropical rain forests; lower montane forests; mangrove forests; upper montane forests; alpine heath land, fresh water swamp forests; peat swamp forests; limestone, grassland and beach forests.

Rifai (1983) (cited by Tri Sunarto (1988)) said that about 28 000 plant species are present in the whole of Indonesia but only about 6000 have been utilized in Indonesia, viz.

- for ornaments about 1100 species;
- medicinal plants about 940 species;
- fruits about 400 species;

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• vegetables about 340 species;
• tannin about 228 species;
• timber about 267 species;
• spices about 54 species.

There are so many species that need to be explored in the interest of world biodiversity but the problems in Indonesia are serious, for example illegal logging destroys about 1.6 million ha of forests per year. Even in the national park in Central Kalimantan, at Gunung Leuser in north Sumatra and Aceh, forest degradation is taking place. It has been said that the loss of one species of tree will be followed by that of 10–30 other species such as insect and mamalia species and other types of plants.

The Government of Indonesia limits the supply to about 6 million m$^3$ of logs per year for the wood industries in Indonesia although the demand of the timber industries (excluding pulp and paper) is about 50 million m$^3$ per year. About 1.5 percent of the wood industries in south Kalimantan and only about 30 percent in Jambi Sumatra and 39 percent in east Kalimantan of these industries are still operating; east Kalimantan was the biggest timber producer in Indonesia until recently.

**HOW TO SAVE THE BIODIVERSITY AND ALLEVIATE THE POVERTY IN INDONESIA?**

Most of the destruction of biodiversity is due to several factors and one of the most important is that Indonesian people in fact depend on forest or biodiversity directly or indirectly for their needs such as food, clothing, medicine, education, culture and income.

People should therefore be aware of the importance of biodiversity and how to sustain the biodiversity. Most people only understand that they will earn money from logging but in Indonesia wood or timber actually provides a minor income. During the Dutch colonial period the forests in Java were utilized for the purpose of the Dutch Government, for example in their conversion into monocultures of coffee, cocoa, sugar cane and teak. The conversion benefited the Dutch Government but not biodiversity or the local people.

The problems of biodiversity became worse when the government, aiming for more income in a short period, started monoculture of *Acacia mangium* for their pulp industries without considering the need for biodiversity and for food, housing, clothing, health, culture and income.

Integrated farming management is a tool for sustainable biodiversity and for it to succeed, monocultures should be implemented only in limited areas in Indonesia. Integrated farming management for sustainable biodiversity should profit all stakeholders in the short, medium and long terms. Several cases have shown that mixed planting of forest with crops would benefit all stakeholders, as in the case of home gardens of farmers where the area could supply all their needs.

Teak forest dominates most of the forest areas in Java, mostly as monoculture. It has been suggested that integrated farming of teak could contribute to better biodiversity and nutrient availability, less risk of fire, and higher production of cattle, fruits, vegetables and other crops. There is also an increase in income for the farmer utilizing integrated farming of teak.

**MANAGEMENT OF BIODIVERSITY BY INTEGRATED FARMING OF TEAK TO ALLEVIATE POVERTY**

Teak has been planted widely in Java not only in state forests but also in the Hutan Rakyat. In PT Perhutani with a total area of about 1.5 million ha, most of the area is planted with teak and pine. Hutan Rakyat with an area of about 42 965 521 ha is planted with several trees including teak, mahogany and also food crops.

Teak forest is usually utilized by the timber companies but in fact the people living near the forest and other communities should utilize more of it for their needs. The teak forest especially should be designed to support such needs, with food as the first priority. Food is very important as the population in Java is the most dense in the country. Teak can be planted with food crops such as ganyong, garut (arrow root), sweet potatoes, cassava and corn. Table1 below shows the forest and non-wood products excluding food products from a teak dominated forest in Gunung Kidul area of Yogyakarta.
Table 1. Products from the teak forest community in Gunung Kidul area in year 2000/2001

<table>
<thead>
<tr>
<th>Product</th>
<th>Volume</th>
<th>Value ( Rp ) (US$1 = Rp 8 800)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bamboo</td>
<td>2 857 802 poles</td>
<td>8 573 406 000</td>
</tr>
<tr>
<td>Charcoal</td>
<td>10 935 tonnes</td>
<td>5 467 500 000</td>
</tr>
<tr>
<td>Fire wood</td>
<td>2 294 082 stapels</td>
<td>573 520 500</td>
</tr>
<tr>
<td>Teak</td>
<td>69 359 400 m³</td>
<td>62 423 460 000</td>
</tr>
<tr>
<td>Non-teak</td>
<td>4 400 m³</td>
<td>190 000 000</td>
</tr>
<tr>
<td>Log</td>
<td>289 591 m³</td>
<td>86 877 300 000</td>
</tr>
<tr>
<td>Honey</td>
<td>237 558 litres</td>
<td>11 877 900</td>
</tr>
<tr>
<td>Silk</td>
<td>91 250 kg (cocoon)</td>
<td>167 118 750 860</td>
</tr>
</tbody>
</table>


Note: Bamboo, 1 pole = Rp3000; Charcoal, 1 kg = Rp5000; Fire wood, 1 unit = Rp3500; Teak log, 1 m³ = Rp900 000; Non-teak log, 1 m³ = Rp725 000; Honey, 1 liter = Rp50 000; Silk, 1 kg = Rp20 000.

Table 2 shows a comparison between a monoculture of teak and a mixed forest of Dalbergia latifolia. The heteroculture or mixed forest could contribute better to soil fertility than the monoculture of teak. P contents of root and leaves in the mixed forest are 1.23 percent and 1.21 percent respectively compared with only 1.21 percent and 1.20 percent in the teak forest. Available P in the soil is also higher in the heteroculture which is 0.0226 ppm compared with only 0.0134 ppm in the monoculture. Organic matter too is much higher in the heteroculture of teak than monocultures (4.51 vs. 1.51 percent respectively). This means that the former condition is better for soil microorganisms.

Table 2. Analysis of P, organic matter content and litter layer thickness

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Monoculture of teak</th>
<th>Heteroculture of teak</th>
</tr>
</thead>
<tbody>
<tr>
<td>P content of root (%)</td>
<td>1.213</td>
<td>1.233</td>
</tr>
<tr>
<td>P content of leaves (%)</td>
<td>1.197</td>
<td>1.207</td>
</tr>
<tr>
<td>P available (ppm)</td>
<td>0.0134</td>
<td>0.0226</td>
</tr>
<tr>
<td>Organic matter content (%)</td>
<td>1.51</td>
<td>4.5133</td>
</tr>
<tr>
<td>Litter layer (cm)</td>
<td>1.227</td>
<td>1.600</td>
</tr>
</tbody>
</table>


Mixed teak forest with Dalbergia latifolia could reduce fire problems. Humidity increases but the microtemperature wind velocity decreases. The data below show fire damage to forests in Indonesia:

- 1982–1983: about 3 200 000 ha
- 1987: about 66 000 ha
- 1994: about 500 000 ha
- 1997–1998: about 10 000 000 ha

Biodiversity for Food Production

Many species can grow well under teak which provide food, cosmetics and medicine. An example is ganyong (Canna edulis) which is a source of carbohydrates, capsule filter, cure for stomach ache and others. Food production can be developed not only after Tumpang Sari which lasts only about two years but for the whole forest rotation. Dioscera allata (uwi) and Dioscera hispida (gadung) are among the approximately 35 species that could thrive under teak forest after fire and they are sources of food, medicine, fertilizer, cattle feed and also vegetable (Adriyanti 1994). Several food crops even form synergism with teak in providing nitrogen and land cover. Examples are Dalbergia latofolia, Acacia arabica, Clitoria ternatea, otok-otok, tekik, Leucaena lecocephala and Acacia villosa (Sumardi and Winastuti 1993).
Tumpang Sari, which involves teak planting for two years, was introduced in Java, Indonesia, in 1883 when the population was still only 20 million; it has since then increased, by 2003, to more than 100 million. Therefore it is very important that land under teak forest is utilized as a source of food, medicine, vegetable and cattle feed; at the same time this cultivation can increase the productivity of the teak. The biggest forest area is under Perum Perhutani in Java, where the population has become the biggest in the country and utilizing the land under the teak forest has become urgent while conserving the water status of the forests.

Soybean for food industries has also been planted in trials in the teak forest. The results showed that the local variety is better than other exotic species (Team Peneliti Tumpang Sari UGM 1974b). *Arachis hypogaea* was also tested after two years Tumpang Sari to increase the benefit of teak forest for the whole rotation. By using Rhizobium inoculation the trials gave better production of *A. hypogaea* (Winastuti 1993).

The trails to increase food production involve not only increasing the area under cultivation but also planting different plant varieties. For rice, for example, varieties such as C-4, IR 127, Gama 318, O 56, IR 661-1-170-1-3; IR 1545-339, IR 1614-330-1 and galur IRRI have been tested (Team Peneliti Tumpang Sari UGM 1974a). Total volume in 3 ha is 100.1791 m³. Therefore volume per ha is 33.3930 m³ or 3.33 m³ ha⁻¹ y⁻¹. At Rp500 000 m⁻³ the estimate value is Rp 1 650 000 ha⁻¹ y⁻¹.

![Table 3. Total volume of tree species in each plot (plot size 100 m x 30 m) at Bubung Village (m³ y⁻¹).](image)

![Table 4. Number of tree species in each plot (100 m x 30 m)](image)

Table 4 shows that the average number of trees per ha is about 174. However, for a 15-ha teak forest interplanted with other crops with cattle rearing (Tables 5 and 6), the average number of tees per ha is 481 with an additional value of Rp32 624 000 per year.

![Table 5. Total product or income per year of 15-ha plot of fruit trees, vegetables, tuber (yam group), medicinal plants and cattle](image)

Biodiversity for poverty alleviation in Indonesia
From the above, it is clear that planting teak in combination with other timber and non-timber crops would bring better returns than planting teak alone. Higher income would also come from the lower cost of maintenance. For the monoculture of teak, the maintenance cost is about Rp2,000,000 per ha but that of the heteroculture of cassava with teak is only Rp400,000 per ha (report from Inhutani V Kotabumi).

**FRUITS AND ESTATE CROPS**

Planting fruits and estate crops among teak could give more income (Table 6), and also earlier income which would help most of the farmers and companies concentrate on their activities. There is also better chance to get credit from the bank.

<table>
<thead>
<tr>
<th>Type of tree</th>
<th>Number of trees</th>
<th>Total product (kg)</th>
<th>Price per kg (Rp)</th>
<th>Total value (Rp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cacao</td>
<td>3500</td>
<td>8,000</td>
<td>12,000</td>
<td>115,200,000</td>
</tr>
<tr>
<td>Clove</td>
<td>100</td>
<td>200</td>
<td>50,000</td>
<td>10,000,000</td>
</tr>
<tr>
<td>Coconut</td>
<td>600</td>
<td>18,000</td>
<td>500</td>
<td>9,000,000</td>
</tr>
<tr>
<td>Coffeea</td>
<td>200</td>
<td>150</td>
<td>200</td>
<td>1,200,000</td>
</tr>
<tr>
<td>Rambutan</td>
<td>400</td>
<td>1,500</td>
<td>200</td>
<td>400,000,000</td>
</tr>
<tr>
<td>Parkia spp.</td>
<td>200</td>
<td>20,000</td>
<td>2,000</td>
<td>40,000,000</td>
</tr>
<tr>
<td>Gnetum gnemon</td>
<td>500</td>
<td>5,000</td>
<td>3,000</td>
<td>15,000,000</td>
</tr>
<tr>
<td>Durio zibethinus</td>
<td>25</td>
<td>1,500</td>
<td>5,000</td>
<td>75,000,000</td>
</tr>
<tr>
<td>Pepper</td>
<td>1,500</td>
<td>750</td>
<td>30,000</td>
<td>22,500,000</td>
</tr>
<tr>
<td>Mango</td>
<td>200</td>
<td>2,000</td>
<td>1,500</td>
<td>3,000,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7,225</strong></td>
<td><strong>75,650</strong></td>
<td></td>
<td><strong>263,400,000</strong></td>
</tr>
</tbody>
</table>

In addition to allowing more trees per ha and bringing better income, the heteroculture provides better shading from the trees for better growth to the non-timber crops as can be seen from the nutrient distribution in Table 2.

What needs to be developed?

- formal and informal education to the local community on the proper crop combination and establishment of home industries;
- more simple and appropriate technology, and local management;
- more credit from the bank.

**MANAGEMENT OF BIODIVERSITY BY INTEGRATED PLANTING OF OIL PALM WITH DIPTEROCARPS**

In Indonesia, there is also the conversion of large areas of forest into oil palm estates. The government and also most of the farmers are interested in planting oil palm due to the higher income from oil palm and thus also higher revenue for the government. As a result, oil palm estates have been established wherever the palms could be planted. Trials have shown that the growth of timber, especially of dipterocarps, is excellent and gives so little competition to oil palm production. The cost of management of dipterocarps in oil palm estate is cheaper than that of planting timber alone as plantation. Oil palm also plays a role as shading for the dipterocarps. Integrated oil palm estates can also act as a source of biodiversity, food and also medicinal plants.

**BIODIVERSITY IN RUBBER PLANTATION**

More than 600,000 ha of rubber plantations in Sumatra have matured and need to be replanted. Planting dipterocarps under rubber should be considered. If rubber is planted together with dipterocarps as shade trees then the farmers would have the two benefits of rubber and wood. There would be wood supply for the industries and the world could get more oxygen and more carbon would be fixed. Planting dipterocarps under rubber would therefore bring more income to farmers, and more biodiversity and probably better conservation of water and wildlife.
MANAGEMENT OF BIODIVERSITY UNDER SECONDARY FOREST

There are several issues that need to be clarified with more research to show that if secondary forest is not too much disturbed by illegal logging then the biodiversity will return. Certainly some plant species can grow well and faster, and some species of fauna can only thrive, under undisturbed conditions. However, how much the biodiversity is affected by the degree of forest disturbance has yet to be demonstrated.

CONCLUSION

- Teak forest planted in combination with non-wood crops suitable for food production and animal husbandry can alleviate poverty.
- Integrated farming of teak increases nutrient availability, reduces fire risk, increases income for the farmers and companies, and enhances food production.
- In areas with acidic soils, more diversity could be developed under oil palm and rubber, especially where the main trees are dipterocarps.
- While little is known about the fragility of biodiversity in a disturbed secondary forest, it is still important to protect this forest from illegal logging.

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Nature conservation and biodiversity for poverty reduction – case of Bhutan

Lungten Norbu*

ABSTRACT

Forests and biodiversity in Bhutan play a significant role in the national and local economy of the country. Also, the protection of fragile watersheds by forests for soil protection and water discharge maintenance are critical to offset any negative impacts on settlement, agriculture and hydropower. Bhutan Vision 2020 expresses a need to balance economic development with cultural and environmental conservation. The Royal Government of Bhutan emphasizes that biodiversity and natural resource conservation do not constitute a constraint to development but also serve as opportunity for development and return of adequate benefits to the local people. The opportunities for nature conservation and biodiversity contributing to reducing poverty are great, but they will remain as ever a wishful list of opportunities if they are not converted to tangible benefits for the poor.

INTRODUCTION

Bhutan is one of the least developed countries with a population estimated at 700,000. Most people live in rural areas with settlements concentrated in the southern foothills and in the inner broad valleys while the northern parts remain virtually uninhabited. Land area suitable for agriculture is estimated to be about 8 percent and employs about 80 percent of the population (Dorjee 1995). The current population growth rate is 3.1 percent and it is likely to double by 2020 in view of improved medical services and health infrastructures (RGoB 2001).

Bhutan is lucky in that there exists no big gap between the rich and poor due to its late entry to the development arena and because of its low population. Poverty assessment using a comprehensive set of indicators was not done; a rapid quality assessment done in 2000 shows that average income per person per day is as low as Nu.40 which is less than the equivalent of US$1 per person per day. The income figure is definitely incorrect as Bhutanese economy is subsistence and all household incomes cannot be accounted in the calculation. However, there is no room to be complacent. With the advent of development programmes and commercialization, there is growing trend of disparities between individuals/households in income earnings. The Planning Commission Report (RGoB 2000a) states that the household income is significantly less in rural areas (Nu.33) than in urban areas (Nu.70).

NATURAL RESOURCES AND BIODIVERSITY

Lying in the lap of the young and growing mountain range of the Eastern Himalayas, Bhutan is endowed with rich natural resources. Forests, representing the biological resources, the ecosystems and the diversity of plants and animals, cover 2,904,500 ha, corresponding to about 72 percent of the land area. For Bhutan, keeping a large part of forests intact is important to protect its fragile watersheds and farmlands for sustaining the well-being of the people. Realizing this, the government in its policy has given high priority to conservation functions of forests over its economic functions and has endorsed a policy to maintain 60 percent of the land under forest cover for all times. About 34 percent of the country is set aside as protected areas represented by four national parks, four wildlife sanctuaries and one nature reserve located across the country (Table 1). The varied flora and fauna include 7500 species of vascular plants, 700 species of birds and 165 species

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of mammals (RGoB 2003). Bhutan forests are internationally significant for their rich biodiversities and Bhutan has been recognized as one of the 10 “hotspots” in the world.

Forests and biodiversity in Bhutan play a significant role in the national and local economy of the country. According to the Master Plan for Forestry Development (MoA 1991), the average allowable cut (AAC) is estimated at around 1.2 million cubic meters per annum from an operable area of 902,000 ha. Forestry contributes about 11 percent towards the Gross Domestic Product and generates 3 percent government revenue through royalty collection and sales of wood and wood products. Logs, sawtimber, veneer and other non-wood products account for 20 percent of the exports. It is estimated that about 25,000 people are employed in the forestry sector, mainly in non-monetized fuelwood collection (MoA 1991, World Bank 1997). Also, the protection of fragile watersheds by forests for soil protection and water discharge maintenance is critical to offset any negative impact of settlement, agriculture and hydropower. More important, forests are sources of livelihood for 85 percent of the population as they provide food, wood, fodder, fuelwood, leaf-litter and other non-wood forest products. The well-being of the local people is directly linked to how well forest resources are conserved and managed for all times.

Table 1. Protected area system

<table>
<thead>
<tr>
<th>Protected area</th>
<th>Area (km²)</th>
<th>Ecosystem representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Royal Manas National Park</td>
<td>1000</td>
<td>Subtropical forest, habitat for tiger, elephant, leopard and golden langur</td>
</tr>
<tr>
<td>Jigmi Dorji National Park</td>
<td>4200</td>
<td>Habitat for takin, snow leopard, blue sheep, rare plant species</td>
</tr>
<tr>
<td>Jigmi Singye Wangchuck National Park</td>
<td>1400</td>
<td>Pristine upland broadleaf forest, habitat for clouded leopard and tiger</td>
</tr>
<tr>
<td>Bomdeling Wildlife Sanctuary</td>
<td>1300</td>
<td>Upland broadleaf forest, winter roosting area of black-neck crane</td>
</tr>
<tr>
<td>Thrumsingla National Park</td>
<td>768</td>
<td>Old growth fir forest with rhododendrons, habitat for red panda, tragopan and monal pheasant</td>
</tr>
<tr>
<td>Sakten Wildlife Sanctuary</td>
<td>650</td>
<td>Pristine mixed coniferous forests, highest number of rhododendron plant species</td>
</tr>
<tr>
<td>Phibsoo Wildlife Sanctuary</td>
<td>278</td>
<td>Natural sal forest, habitat for spotted deer</td>
</tr>
<tr>
<td>Toorsa Strict Nature Reserve</td>
<td>644</td>
<td>Pristine temperate forest</td>
</tr>
<tr>
<td>Khaling Wildlife Sanctuary</td>
<td>273</td>
<td>Temperate forests, only habitat for pigmy hog</td>
</tr>
</tbody>
</table>


CLEAN DEVELOPMENT MECHANISM (CDM) INITIATIVES IN BHUTAN

With improvement in the economy, urbanization is growing steadily which results in problems such as traffic congestion, sewage disposal and rural–urban migration. Vehicle emission-testing programme is being developed and standards established while waste disposal management system is in its initial stage confined to establishment of landfill for disposing solid waste. Due to rural–urban migration, the expanding urban population is exerting pressure on natural resources. The land available for urban growth is limited by topography and government policies to maintain the present forest cover and restriction to land conversion. Bhutanese economy is estimated to be expanding (approximately by 6.5 percent in 1994) and the traditional sector (agriculture, livestock and forestry) roughly contributing 40 percent to the GDP while the modern sector (mining, construction and electricity) grew to about 30 percent of the GDP and the manufacturing industries increased to 20 percent.

Clean Development Mechanism (CDM) is one of the flexibility mechanisms authorized in the Kyoto Protocol 1997 as follow-up to the 1992 United Nations Framework Convention on Climate Change (UNFCCC). Bhutan is fully committed to the UNFCCC objectives and prepared to fulfill its obligations. Despite its new initiative in this aspect, Bhutan has built its capacity. To implement an appropriate and effective response, priorities such as improvement of databases in all ministries, devising of robust policies for sustainable development, meeting national imperatives as well as global environmental issues and studies on impacts of climate change were identified (RGoB 2000b). A menu of mitigation options identified relevant to Bhutan are (RGoB 2000b):

- Renewable energy technology options –
  Although mainly dependent on hydropower, which is a relatively clean source of energy, it is expensive due to extension of grid to scattered settlements. In this connection, it is worthwhile to explore mini-hydel, solar and biomass gasifiers.
- Improved technology to reduce fuelwood consumption –
  A majority of Bhutanese use wood for cooking and heating purposes. Improved stoves are introduced to reduce fuelwood consumption and air pollution. Electric heaters are being introduced but they are expensive and beyond the reach of the average household.
• Introduction of fuel-efficient vehicles –
The present vehicles are not fuel-efficient and they are major sources of CO₂ emission. Monitoring systems to check emissions are in place and import of reconditioned cars is banned.

OPPORTUNITIES WITH CDM, ENVIRONMENTAL SERVICES AND BIODIVERSITY FOR POVERTY REDUCTION

Bhutan Vision 2020 expresses a need to balance economic development with cultural and environmental conservation. The Royal Government of Bhutan emphasizes that biodiversity and natural resource conservation do not constitute a constraint to development but instead serve as opportunity for development and return of adequate benefits to the local people. The existing policy and legal frameworks with respect to forest, conservation, biodiversity and land provide supportive bases for management, control and use of the natural resources through involvement of the local people and communities (Table 2). As a large part of the country is virtually under “conservation”, a number of opportunities exist to reduce poverty based on the natural resources and biodiversity values.

Table 2. Legal framework supporting peoples’ participation in management and use of natural resources and biodiversity

<table>
<thead>
<tr>
<th>Framework</th>
<th>People concerns addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Act 1998</td>
<td>Land entitlement, grazing land and compensation for crops</td>
</tr>
<tr>
<td>Forest and Nature Conservation Act 1995</td>
<td>Protected areas, soil and water conservation, people participation in community and private forestry</td>
</tr>
<tr>
<td>Social Forestry Rules 2000</td>
<td>Implementation criteria and formalities: community forestry and people participation</td>
</tr>
<tr>
<td>Biodiversity Act 2003</td>
<td>Use of natural resources and biodiversity, patenting and ownership</td>
</tr>
</tbody>
</table>

CARBON TRADING

Due to low industrialization, Bhutan has relatively insignificant emission of Green House Gases (GHG) by world standards but it will definitely increase with population growth and advent of economic development (RGoB 2000a). There is general lack of clarity on the contribution that forests make towards poverty alleviation resulting in unappreciation of the globally emerging trend such as carbon trading that could bring immense benefits for the poor. For instance, farmers could trade carbon credits with companies for trees grown on private land or in community forestry and for intact natural forests existing due to community efforts in their forest plantation and conservation.

ECOTOURISM AND NATURE-BASED TOURISM

In Bhutan, tourism is increasingly being seen as one of the major opportunities for economic diversification. At the same time, Bhutan does not wish to compromise the fast economic return of tourism with erosion of cultural heritage and biodiversity. Thus the policy of high return and low impact tourism targets rich individuals and countries in order to limit the ill-effects of tourism on physical and cultural environments. Ecotourism and nature-based tourism are increasingly becoming popular with the people living in the industrialized countries. Thus Bhutan, endowed with bountiful nature and rich-unique culture and tradition, has a big potential to benefit from this growing market. The plan of establishing ecotourism or agrotourism (FSD 2002) based on ecologically friendly, culturally acceptable and economically viable principles should be implemented involving all stakeholders including the local people from where concrete benefits should go to local communities as compensations for restricted use of local resources in promoting tourism.

NON-TIMBER FOREST PRODUCTS (NTFPs)

Recent studies show that non-timber forest products (NTFPs) are indispensable at the household level for medicine, food, cash and employment. Also, a substantial amount of revenue is brought into the country through export of NTFPs. Bhutan Trade Statistics (1991–1999) indicate the export value of NTFPs to range from Nu.14.29 million to Nu.44.04 million. The most important NTFPs that are exported are bamboo, cane, chirata (Swertia chirata), plipa (Piper spp.), resin and turpentine oil (from Pinus roxburghii), lemon grass oil (Cymopogum flexuosus), mushrooms, incense sticks and hand-made papers.

Non-timber forest products (NTFPs) such as medicinal plants, mushrooms, bamboo and local handicrafts constitute a growing market worldwide as scarcity for such niche products increases. There is a growing demand...
for ecological nature-based products offering attractive prices mainly in industrialized countries. The rich forests of Bhutan will provide a wide range of these NTFPs with benefits to both conservation and development efforts. NTFPs can be managed sustainably by the local people under the Community-Based Natural Resource Management Programme (CBNRM). The CBNRM is becoming a popular concept and mechanism to manage natural resources such as NTFPs in Bhutan. CBNRM would enhance the rural economy while natural resources are conserved, managed and marketed through community empowerment and participation. Research initiatives such as bringing chirata (Swertia chirata), masutake (Tricholoma masutake) and Cordyceps sinenis under CBNRM initiatives are underway. Community-based management and product development are under consideration for other important NTFPs such as bamboo, lemon grass, pasture grazing and water through rural enterprises projects.

**BIOPROSPECTING**

The rich biodiversity and its relatively unexplored current status represent a big potential for bioprospecting in Bhutan. Bioprospecting is a growing endeavour that involves search for new genes or chemicals of great value. The local people use different plants and animal products for medicine, dyes, spices and aromatics. If carefully undertaken, bioprospecting may offer an opportunity for substantial economic benefits. However, patenting and ownership of the products should be carefully considered so that benefits also go to the local people for their efforts and pains they have taken to preserve the valuable resources and indigenous knowledge (IK) on their uses that lead to the development of the useful commercial products. The recently approved all Biodiversity Act 2003 protects farmers’ rights and guarantees equitable benefit sharing from the use of such resources.

**HYDROPOWER**

Agriculture and hydropower are two pillars of the Bhutanese economy. But because of the rugged terrain, dependence of economic development solely on agriculture is hard to imagine. Bhutan is rich in water resources and hydroelectricity projects are built to generate electric power. The surplus power is exported to India, generating about 40 percent of the government revenue.

Therefore, to sustain hydropower generation, keeping intact the forest and environment close to nature is a crucial task which in turn will need the cooperation of the local communities to optimize the use of forest resources. Ploughing back part of the revenue from electricity to improve the living conditions of the local people staying within the hydropower catchments would help sustain both power generation while human communities and plant/animal communities prosper side by side.

**WATER RESOURCES**

Water resources are abundant in Bhutan and this represents a growing economic value. The continuous availability and quality of water depend on proper ecosystem management. Promoting community forest management and putting a price tag on the intangible services from forests such as water and recreation and sharing these benefits with the rural communities are some of the potential areas that would enhance rural income.

**CONCLUSION**

The opportunities for nature conservation and biodiversity to contribute to reducing poverty in Bhutan are great as they are being recognized and valued by foresters, researchers, environmentalists and development workers. They will remain as ever a wishful list of opportunities if they are not converted to tangible benefits for the poor people.

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Opportunities in using the conservation of biodiversity to alleviate poverty in Thailand

Suchitra Changtragoon*

ABSTRACT

Improving the living status of disadvantaged rural people is one of the main policies of the Government of Thailand, which is firstly to decrease their expenditure, secondly to increase their income, and lastly to enhance their economic opportunities. Most of the rural people in Thailand rely on agriculture and forests for their living. In this paper the prospects of alleviating their poverty based on biodiversity conservation through ecotourism management and food banks from forest community establishment as well as forest plantations for medicinal and natural product investment are proposed. The opportunity of future benefits from Clean Development Mechanism (CDM) contribution in Thailand is also discussed.

BIODIVERSITY AS THE SOURCE OF ECOTOURISM BENEFITS

Natural forests are the source of biodiversity which can provide income and benefits to rural people through ecotourism. At present ecotourism involves travelling to natural areas with specific objectives of studying, admiring and enjoying the scenery and its wild plants and animals while conserving the biological diversity and natural condition of the environment as well as improving the welfare of the local people. This is in line with the world conservation movement, and also with the policy and planning of the National Park, Wildlife and Plant Conservation Department of Thailand for natural resources and biodiversity conservation and sustainable development with people participation.

USAID (1995) has identified ecotourism as an enterprise with potential positive contributions to the conservation of endangered biological resources. Contributions of ecotourism include raising local awareness about the value of biological resources, increasing local participation in the benefits of biodiversity conservation (through new sources of jobs and income), and generating revenues toward conservation of biologically rich areas (Anonymous 2002). Wood (2002) pointed out that ecotourism is a growing niche market within the larger travel industry, with the potential of being an important sustainable development tool. With billions of dollars in annual sales, ecotourism is a real industry that seeks to take advantage of market trends. At the same time, it frequently operates quite differently from other segments of the tourism industry, because ecotourism is defined by its sustainable development results: conserving natural areas, educating visitors about sustainability and benefiting local people.

Chettamart (2003) mentioned in his paper concerning ecotourism resources and management in Thailand that the current Government of Thailand is keen on tourism development, as stressed by the Prime Minister Thaksin Shinawatra in his official declaration of the government policies to the National Assembly in early 2001. The Prime Minister said that the tourism industry could very well be the country’s substantial income earner and, in turn, could help to solve its current economic problems. He then pledged to increase the diverse forms of tourism and to upgrade the quality of all tourism products, targeting ecotourism, health tourism, nature tourism and services to ensure their long-term competitiveness with other countries. He also stated that new tourist sites must be developed and promoted. Communities must be able to play a greater role in tourism management (Emphandhu 2002).

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The Tourist Authority of Thailand (TAT) has run a campaign “Unseen Thailand” to promote the exploration of 54 unseen places including nature-based ecotourism spots in Thailand, in addition to the previous “Amazing Thailand” campaign. This input is one way to distribute income to the local people who rely on natural forest and so far is a very successful project. The National Park, Wildlife and Plant Conservation Department has also encouraged people participation in nature-based ecotourism by training the local people, youths and students who rely on the natural forest to act as ecotourism guides, conversant in both Thai and English. This project is also very successful and is ongoing since the local people and the young generation can get income as tour guides as well as cultivate awareness on natural forest conservation and its value (Changtragoon 2003).

There are 1385 nature destinations for ecotourism in Thailand (Saetharuk 2001). Most of them are located in national parks and protected areas. In Thailand there are 319 protected areas comprising 145 national parks, 53 wildlife sanctuaries, 52 non-hunting areas and 69 forest parks (Chettamart 2003). Income from the entrance fees and accommodations for the ecotourists visiting the national parks in Thailand has increased gradually from 1993 to 1999, and steeply thereafter as shown in Figure 1. It is a normal practice that five percent of the income from these fees go to a community fund. The people living near or inside the natural forest derive additional income by providing accommodations, meals, drinking water, food, traditional cultural entertainment and guided tours for the ecotourists. Some communities can manage ecotourism on their own, some get income through ecotourism companies. However, a problem still remains in the proper management of the local people’s participation and a fair distribution of income for their involvement.

![Figure 1. Income from entrance fees to national parks managed for ecotourism in Thailand during 1993–2002](image)

**Figure 1.** Income from entrance fees to national parks managed for ecotourism in Thailand during 1993–2002.

**BIODIVERSITY AS A SOURCE OF FOOD BANK AND ECONOMIC INVESTMENT ON MEDICINAL PLANTS AND NATURAL PRODUCTS**

Most of the local people in Thailand rely on forest products as sources of food, medicine plants and other uses. It is estimated that about 80 percent of at least 18 000 forest trees and plants in Thailand are medicinal plants. Bhumibhamon and Kamkong (1997) reported that 242 multipurpose tree species are edible and are being consumed by the local people. At least 300 plant species are aroma trees (Kamkong 2002). At present, medicinal plants and their application are very popular in Thailand. Both government and non-government organizations are encouraging rural people to establish medicinal plants in their gardens and communities for their own use. Besides, under the campaign of the Government of Thailand on “one (tambom) district one product”, medicinal plants and natural products are also sources of their additional income. On a broader scale, at least 80 private companies and a number of hospitals in Thailand have invested in medicinal plants as sources of local medicines and natural products for local consumption and export. Figures 2 and 3 show the business trends of medicinal plants and spices for export from 1995 to 2001. The decline in the recent years may be due to the economic crisis and shortage of materials. Because of the high demand for plant materials in this business, it is known that some of the materials have come from harvesting of medical plants and trees in the natural forests.
Therefore, there should be a proper plan for the conservation and sustainable utilization of plants for medicine and as a source of local food bank through the establishment of plantations and management of forest communities. Investment on plantations of medicinal and aroma as well as spice plants to supply the medicinal and natural products business is encouraged for the local people. The Government of Thailand has also identified 2512 forest communities (Table 1) as sources for the production of food and medicinal plants as well as natural products and to increase their income. To maintain these sources in a sustainable way, one example is the project on the exploration of biodiversity through local people participation which has been planned to start in October this year stretching to 2007 by the Ministry of National Resources and Environment. By this means local people from 4088 districts of 70 provinces in an areas of 164 018.78 km² will know the status of plants and forest trees as well as the wildlife stock in their communities and can manage these resources with the assistance of experts to conserve and utilize the biodiversity more efficiently and sustainably (National Resources and Environment 2003).

Table 1. Numbers and areas of approved forest communities in Thailand

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of communities</th>
<th>Number of projects</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>402</td>
<td>382</td>
<td>13 709.76</td>
</tr>
<tr>
<td>North</td>
<td>761</td>
<td>735</td>
<td>57 720.96</td>
</tr>
<tr>
<td>South</td>
<td>265</td>
<td>260</td>
<td>4 367.84</td>
</tr>
<tr>
<td>Northeast</td>
<td>1084</td>
<td>926</td>
<td>43 367.68</td>
</tr>
<tr>
<td>Total</td>
<td>2512</td>
<td>2303</td>
<td>119 166.24</td>
</tr>
</tbody>
</table>
Thailand ratified the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol on 28 December 1994 and 28 August 2002 respectively. According to the Thai cabinet resolution on 10 September 2002, every governmental department involved with CDM activities has been assigned to initiate projects and activities related to CDM, firstly to decrease consumption to reduce air pollution and gas release that cause green house effect, and secondly to sequester carbon by increasing and sustaining green areas by reforestation and afforestation.

In the case of developed countries that would like to participate in carbon credit projects in Thailand, every CDM project proposal has to be submitted to the cabinet for approval, case by case (Policy and Planning of Natural Resources and Environment 2003).

Actually, the Royal Forest Department and the National Park, Wildlife and Plant Conservation Department of Thailand have continually implemented reforestation and afforestation to enrich the green area (Table 2) as well as encouraged the private sector and local people to invest in forest plantations for wood and fiber production since several years ago, before the CDM of the Kyoto Protocol was set up. Getting the local people and private companies to invest in forest plantations to benefit from the CDM projects may take some time due to their lack of understanding and information of CDM contribution and also their unclear comprehension of CDM regulations and management from the Kyoto Protocol. However, this year the Government of Thailand has planned to initiate the incentive project on setting up sustainable green zones in towns and communities as botanical and community gardens by reducing land property tax for the local people who use their own lands for this purpose.

Table 2. Annual reforestation by objective

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Afforestation by government budget</td>
<td>645 184</td>
<td>6 203</td>
<td>6 592</td>
<td>9 283</td>
<td>5 477</td>
<td>3 840</td>
</tr>
<tr>
<td>The reforestation campaign in commemoration of the Royal Golden Jubilee</td>
<td>299 885</td>
<td>30 268</td>
<td>10 211</td>
<td>15 348</td>
<td>12 972</td>
<td>16 005</td>
</tr>
<tr>
<td>By Forest Industry Organization (FIO)</td>
<td>27 025</td>
<td>0.00</td>
<td>0.00</td>
<td>59.24</td>
<td>710</td>
<td>0.00</td>
</tr>
<tr>
<td>By Thai Plywood Co., Ltd.</td>
<td>1 174</td>
<td>701</td>
<td>619</td>
<td>694</td>
<td>378</td>
<td>341</td>
</tr>
<tr>
<td>Reforestation according to Ministry’s regulations</td>
<td>12 564</td>
<td>234</td>
<td>971</td>
<td>1 337</td>
<td>1 478</td>
<td>1 914</td>
</tr>
<tr>
<td>Reforestation by concessionaire budget</td>
<td>20 869</td>
<td>651</td>
<td>898</td>
<td>40</td>
<td>54</td>
<td>138</td>
</tr>
<tr>
<td>Total</td>
<td>1 006 701</td>
<td>38 057</td>
<td>19 291</td>
<td>32 626</td>
<td>21 069</td>
<td>22 238</td>
</tr>
</tbody>
</table>

The carbon dioxide exchange characteristics and biomass of tropical tree species under various environmental conditions have been investigated. The results show that the gross carbon dioxide uptakes by deciduous forest and teak plantation were 86.65 and 59.83 tonnes ha\(^{-1}\)y\(^{-1}\) respectively (Puangchit 2001). The carbon dioxide emission and sequestration from forest in 1990 and 1994 have been compared by Puangchit (1994) using secondary data on forest area and biomass. The results show that the net emission has been reduced in 1994 compared with 1990 (Table 3). These results may be improved by the reforestation programmes in Thailand. If this assumption is correct, the net carbon dioxide emission in Thailand may have dropped in recent years due to the increasing forest area as shown in Figure 4. Research on carbon sink on above- and below-ground biomass in different natural forest types and plantations is ongoing (Laengjame and Diloksampan, personal communication).
**Table 3.** Carbon dioxide emission and sequestration from forest, 1990 and 1994 (Gg)

<table>
<thead>
<tr>
<th></th>
<th>1990</th>
<th>1994</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon sequestration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uptake from plantation</td>
<td>–812.50</td>
<td>–17,457.26</td>
</tr>
<tr>
<td>Uptake from secondary forest</td>
<td>–24,151.60</td>
<td>–21,644.34</td>
</tr>
<tr>
<td>Total</td>
<td>–24,964.10</td>
<td>–39,101.60</td>
</tr>
<tr>
<td>Change in woody biomass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood and fuelwood consumption</td>
<td>+21,160.59</td>
<td>+40,180.51</td>
</tr>
<tr>
<td>Forest conversion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomass burning on site</td>
<td>+6,455.61</td>
<td>+13,650.78</td>
</tr>
<tr>
<td>Biomass burning off site</td>
<td>+68,321.84</td>
<td>+14,508.08</td>
</tr>
<tr>
<td>Decay of timber biomass</td>
<td>+6,946.28</td>
<td>+31,237.98</td>
</tr>
<tr>
<td>Total</td>
<td>+81,723.73</td>
<td>+59,396.84</td>
</tr>
<tr>
<td>Total emission</td>
<td>+102,884.32</td>
<td>+99,577.35</td>
</tr>
<tr>
<td>Net emission</td>
<td>+77,920.22</td>
<td>+60,475.75</td>
</tr>
</tbody>
</table>

**Figure 4.** Percentage of forest area in Thailand from 1988 to 2000

**DISCUSSION AND CONCLUSION**

Biodiversity can be used to provide benefits to the rural people which can be summarized as shown in Figure 5. However, proper management should be carried out to improve benefit sharing and distribute the opportunities to earn the new income for the rural people, so that their living standard will be upgraded. At the same time, the conservation of biodiversity should be managed properly and efficiently so that the forest resources can be maintained and used in a sustainable way.

Concerning CDM, at this stage the potential for poverty reduction in terms of carbon credit contribution may take some time with respect to reforestation and afforestation in Thailand. However, the activities relating to CDM are ongoing and encouraged by the Thai Government, case by case. The input of CDM based on biodiversity from standing natural forests and green zones as well as public parks in developing countries deserve consideration.
**Figure 5.** Opportunities for poverty alleviation through biodiversity conservation

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GROUP DISCUSSIONS

What are the opportunities offered by global initiatives such as the CDM, environmental services and biodiversity that could benefit the poor? How can these opportunities be tapped to benefit the poor? What are the strategies, policies, mechanisms or procedures that must be put in place to tap these opportunities? The workshop has incorporated four group discussions during which the participants discussed several issues, trying to find answers to these and many other related questions.

The issues that were discussed during the group discussions include:

• establishing an information clearing-house on the CDM in the Asia Pacific region,
• encouraging small CDM projects to aid poverty alleviation,
• institutional arrangements for mobilizing inputs from private industry in implementing the Convention on Biological Diversity (CBD),
• economic incentives for private investment in conservation.

The outputs and recommendations are as summarized below:

• It was generally agreed that there is a need to establish an information clearing-house on CDM in the Asia Pacific region.
  – The establishment of this information clearing-house could begin with establishing an informal network and seeking more formal government agreement.
  – A web site could be launched and to be maintained by contributions from focal points nominated by participating countries.
  – A regional network, such as APAFRI, could manage the web site and clearing-house with appropriate support from participating countries.

• The workshop generally concluded that enhancing carbon sequestration in forests and reducing fossil fuel demand, being a global responsibility, presented opportunities for small landowners of the developing countries of the region to increase their incomes.
  – Policies and guidelines, however, would need to be developed to enable the smallholders to utilize the opportunity.
  – As the smallholders are often poor people with few economic opportunities, and carbon sequestration alone may not significantly enhance their incomes, it would be necessary to integrate the CDM with other environmental goods and services to maximize their incomes and make tree growing an economically attractive option.
  – Tree growing with long gestation is particularly prone to high risks of fire, theft, insect attacks, diseases and natural disasters, as well as price fluctuations due to changing economic conditions and consumer preferences. It is necessary to develop appropriate risk management strategies involving risk evaluation, risk reduction and risk sharing between state and the tree growers, covering risks by appropriate insurance instruments.
- Measuring, verification and certification of carbon sequestration are costly processes involving scientific, technological and managerial skills beyond the reach of the small landholders. The governments would need to provide these services.

- Likewise, meeting the legal, procedural, methodological and technological requirements of the Kyoto Protocol related to the issues of leakage, additionally and biological diversity, would be beyond the capacity of the individual small landholders. The governments would need to assist to meet these requirements by laying out appropriate guidelines.

- Appropriate research strategies should be developed in measurement and economic valuation of environmental goods and services produced by growing trees.

- Governments should remove legal and fiscal barriers discouraging tree growing on private lands.

- Governments should encourage networking and cooperation among smallholders to enhance their bargaining power and prevent under-cutting.

- Governments should define the role of the bureaucracy and adopt institutional reform with better accountability and transparency in CDM management.

- The workshop recommended that an institutional mechanism be developed at the regional level to attract private industry investment to support biodiversity conservation.

  - This could be in the form of an Asia Pacific Regional Biodiversity Fund that may be established to channel all private investments to ensure a flow of minimum sustained financing for biodiversity conservation in the region.

  - Such a fund could internalize, at least partially, some of the externalities, and reward countries for conserving biodiversity. Organizations such FAO-RAP and APAFRI may lead in establishing such fund.

  - Country studies would need to be conducted to assess private investment opportunities for biodiversity conservation.

  - It is also essential that structural and policy reforms at international, regional and national levels should be attempted to provide the institutional and policy environment that will facilitate private capital flows to biodiversity conservation in the region.

  - The national governments need to not only remove barriers but also provide incentives and encourage private investment in biodiversity.

  - Private industry should assume a good corporate citizenship role and develop and internalize codes of conduct conducive to sustainable development.

  - Sufficient safeguards should be put in place to ensure protection of intellectual property rights and the rights of indigenous people in particular.

  - Establishing of new institutional mechanism for private industry’s investment in biodiversity encompassing timber, energy, carbon sequestration, land and water conservation, in situ and ex situ conservation, and ecotourism as outputs will require the cooperation of private industry and governmental and non-governmental organizations with the support of international agencies.

  - It is necessary to build mechanisms to promote better coordination and cooperation between the private and public sectors to facilitate private investment in biodiversity conservation.

  - Private industry’s involvement can effectively complement other approaches to biodiversity conservation and will add value to make it an economic activity. Biodiversity conservation must start to pay for itself and the governments alone can no longer fund it.

- Governments should consider introducing tax-breaks or other tax incentives to attract private investments in conservation.

  - Governments should initiate public education programmes for environment awareness.

  - Clearly quantified environmental benefits will attract private investments.

  - Opportunities are to be identified of for public-private partnership.

  - Rights to services and land are to be secured.
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What are the opportunities offered by global initiatives such as the Clean Development Mechanism (CDM), environmental services and biodiversity that could benefit the poor? How can these opportunities be tapped to benefit the poor? What are the strategies, policies, mechanisms or procedures that must be put in place to tap these opportunities? This publication is a compilation of presentations and discussions on these and other related issues during a workshop, held at the Seoul National University, Seoul, Korea, from 27 to 29 August 2003.