Ghana
Forestry Sector Review

June 15, 1987
Western Africa Region

FOR OFFICIAL USE ONLY

Document of the World Bank

This document has a restricted distribution and may be used by recipients only in the performance of their official duties. Its contents may not otherwise be disclosed without World Bank authorization.
GHANA
FORESTRY SECTOR REVIEW

CURRENCY EQUIVALENTS

\[ \text{\£1.00} = \text{US$0.006} \]
\[ \text{US$1.00} = \text{\£150} \]

WEIGHTS AND MEASURES

Unless otherwise stated all weights and measures used in the report are metric.

1 metric ton = 0.98 long ton
1 long ton = 2,240 lb. = 1.016 metric ton
1 hectare (ha) = 2.47 acres
1 acre = 0.405 ha
1 kilometer (km) = 0.62 mile
1 mile = 1.609 km
1 cubic meter (m³) = 35.30 cubic feet

ABBREVIATIONS

CIDA - Canadian International Development Agency
FAO - Food and Agriculture Organization
FC - Forestry Commission
FD - Forestry Department
FPIB - Forest Products Inspection Bureau
FPRI - Forest Products Research Institute
GOG - Government of Ghana
GTMB - Ghana Timber Marketing Board
GWD - Ghana Wildlife Department
IITA - International Institute of Tropical Agriculture
LC - Lands Commission
LD - Lands Department
MLNR - Ministry of Lands and Natural Resources
MOA - Ministry of Agriculture
MRD - Ministry of Rural Development
ODA - Overseas Development Administration
PNDC - Provisional National Defense Council
SFS - School of Forestry, Sunyani
TEDB - Timber Export Development Board
UST - University of Science and Technology
WP - Working Paper
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>iii</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>iv</td>
</tr>
<tr>
<td>I. THE SECTOR</td>
<td>1</td>
</tr>
<tr>
<td>A. Forest and Land Area</td>
<td>1</td>
</tr>
<tr>
<td>B. Population Growth and Land Pressure</td>
<td>2</td>
</tr>
<tr>
<td>C. Importance of the Forestry Sector</td>
<td>2</td>
</tr>
<tr>
<td>D. Industrial Forestry</td>
<td>2</td>
</tr>
<tr>
<td>Natural Forests</td>
<td>2</td>
</tr>
<tr>
<td>Forest Plantations</td>
<td>5</td>
</tr>
<tr>
<td>Annual Allowable Cut</td>
<td>5</td>
</tr>
<tr>
<td>Forest Fees and Revenue</td>
<td>7</td>
</tr>
<tr>
<td>E. Rural Forestry</td>
<td>8</td>
</tr>
<tr>
<td>Trees and Farming</td>
<td>8</td>
</tr>
<tr>
<td>Fuelwood Balance</td>
<td>9</td>
</tr>
<tr>
<td>Alternative Household Fuels</td>
<td>9</td>
</tr>
<tr>
<td>F. Forest Industries</td>
<td>10</td>
</tr>
<tr>
<td>Mechanical Wood Industries</td>
<td>11</td>
</tr>
<tr>
<td>Future Industrial Production</td>
<td>13</td>
</tr>
<tr>
<td>Pulp and Paper Industry</td>
<td>14</td>
</tr>
<tr>
<td>II. INSTITUTIONS</td>
<td>15</td>
</tr>
<tr>
<td>A. The Forestry Department (FD)</td>
<td>15</td>
</tr>
<tr>
<td>B. The Game and Wildlife Department (GWD)</td>
<td>15</td>
</tr>
<tr>
<td>C. Forestry Education and Training Institutions</td>
<td>16</td>
</tr>
<tr>
<td>D. Forest Products Research Institute (FPRI)</td>
<td>17</td>
</tr>
<tr>
<td>E. The Forestry Commission (FC)</td>
<td>17</td>
</tr>
<tr>
<td>F. The Forest Products Inspection Bureau (FPIB) and the Timber Export Development Board (TEDB)</td>
<td>18</td>
</tr>
<tr>
<td>III. MAJOR ISSUES</td>
<td>18</td>
</tr>
<tr>
<td>A. Resource Depletion</td>
<td>18</td>
</tr>
<tr>
<td>B. Insufficient Forest Revenues</td>
<td>19</td>
</tr>
<tr>
<td>Fees on Industrial Forest Harvesting</td>
<td>19</td>
</tr>
<tr>
<td>Fuelwood Tax</td>
<td>23</td>
</tr>
<tr>
<td>C. Evaluation of Program Priorities</td>
<td>24</td>
</tr>
<tr>
<td>Industrial Forestry</td>
<td>24</td>
</tr>
<tr>
<td>Rural Forestry</td>
<td>24</td>
</tr>
<tr>
<td>Pulp and Paper</td>
<td>26</td>
</tr>
</tbody>
</table>
IV. AN AGENDA FOR PUBLIC POLICY

A. Prospects 26
B. Role of Government 27
C. Core Programs 27
   Forest Management 27
   Rural Forestry 30
D. Associated Programs 33
E. Forest Industry 34

Appendix 1 - Forestry Sector Institutions
Appendix 2 - Budget Estimate Core Programs
Appendix 3 - Budget Estimate Supplementing Programs

List of Working Papers

Volume I
I - Role of Forestry and the Forest Industry Sector in Ghana
II - The Forest Resource Base
III - Forestry Sector Institutions
IV - Forest Concessions
V - Fees and Taxes on the Forestry and the Forest Industry Sector
VI - Forest Policy and Forest Management
VII - Forestry for Rural Development

Volume II
VIII - Forest Industries
IX - Forest Products Trade and Consumption
X - Wildlife Management
XI - Forestry Research
XII - Forestry Education and Training

Maps No. - IBRD 15116R2
          IBRD 18469R1
          IBRD 18475R1
          IBRD 18470R1
          IBRD 18472R
          IBRD 18393R1
1. The principal objective of the Ghana Forestry Sector Review Mission was to identify constraints to long-term sustained development in the forest and forest industry sector and to recommend measures which would help in overcoming such constraints. For this purpose a program strategy for the forestry sector (including wildlife) has been proposed in this report. The working papers give a more detailed description of the sector.

2. The review was carried out following a request by the Ghana Government and was undertaken as a multidonor sectoral review with the Bank as lead agency. Participants were the British Overseas Development Administration (ODA), the Canadian International Development Agency (CIDA), and the Food and Agriculture Organization of the United Nations (FAO). The Mission liaised with the Tropical Forestry Action Plan Office of FAO.

3. The findings are the result of a field mission carried out in April 1986 in which participated H. Hvidberg-Hansen (Bank), W.J. Howard (ODA), M. Laverdiere (CIDA), A. Sene (FAO) and consultants B. Palmer (Bank), J. Gray (CIDA), R. Henriksen (CIDA), R.J. Palmer (ODA), T.P. Dodd (ODA). In Ghana, the Mission worked in close cooperation with the Ministry of Lands and Natural Resources (MLNR), the Forestry Department (FD), the Forestry Commission (FC) and with other government agencies. Ms. Bagai provided the secretarial support.

4. In January-February 1987 a combined World Bank, ODA and FAO mission discussed the report in Ghana with the MLNR, FD and FC. The report was accepted by the government and comments received have been incorporated in the present version.
Executive Summary

The Sector

1. Contribution to the Economy. The forestry sector in Ghana is important for both economic and environmental reasons. The 1985 industrial log production was about 900,000 m$^3$ representing a value of about US$22 million on stump. The value of industrial forest products was US$65 million of which US$30 million was foreign exchange. The value of fuelwood and poles used annually is equivalent to US$200 million. Forestry's and forest industry's share in GDP was 7 percent in 1985. 14,000 people were employed in the industrial sector and many more in the rural sector. In addition to wood products, trees provide a long range of benefits such as local medicines, edible fruit and leaves, and meat from wild animals contributes about 12 percent to the animal protein consumed by the human population. The maintenance of tree cover is important to maintain farm yields, avoid erosion of farmlands and siltation of dams, and is a necessity for a long term sustained agricultural production.

2. The Trend. Pressure on the resource is increasing. At the beginning of the century practically all of the southern forest zone (8.2 million ha) was covered by closed forest. Since that time owing mainly to shifting cultivation the closed forest has been reduced to about 1.7 million ha. In addition to the impact of shifting cultivation, forest resources in Ghana have been harvested for industrial exports and domestic woodfuel. The annual industrial log production in the early 1970's was as high as 1.8 million m$^3$. Due to the economic decline, logging deteriorated after 1980 but is again increasing, and in 1986 log production is estimated to be about 1.0 million m$^3$. The Forest Zone and the northern savanna zone still hold considerable fuel and resources. However due to increasing demands for fuelwood, there are wide corridors of cleared areas along roads and open spaces around major settlements. In the intensively farmed areas in the Upper Eastern Region there are only few farm trees left for fuelwood and the same is the case in isolated areas of the north eastern part of the Northern Region. In such areas, erosion is on the increase resulting in decreasing soil fertility and beginning desertification. The annual consumption of woodfuels is at present about 12 million m$^3$ and is forecast to reach 17 million m$^3$ by the year 2000; this would exceed the annual volume increment by 3-4 million m$^3$, and result in a negative fuelwood balance, accelerating the downward ecological trend.

3. Existing farming practices and demands for woodfuel have combined in reducing forest and farm tree resources. Increased demand for industrial roundwood, threatens the industrial forest within forest reserves (1.7 million ha), because the Forestry Department's (FD) control has deteriorated due to insufficient funding for transport and equipment and a decline in supervision and management.
4. **Institutions.** The Forestry Department manages the national forest estate and the forestry program. The Lands Department (LD) is responsible for forest concessions outside forest reserves and for collection of revenues from such areas. The Forestry Commission (FC) advises the Provisional National Defense Council (PNDC) and other government agencies on forestry matters. Forestry is taught at the Institute of Renewable Natural Resources (IRNR) and at technical level at the Sunyani Forestry School (SFS). The Forest Products Research Institute (FPRI) is responsible for all forestry research. The Forest Products Inspection Bureau (FPIB) obtains statistics on log production and ensures that exports conform with product value and standards. The Timber Export Development Board (TEDB) is responsible for export promotion. The Game and Wildlife Department (GWD) is responsible for national park and wildlife management.

**Proposed Programs**

5. The major issues in the sector are the unmanaged depletion of the forest resource, the low level of fees on timber harvested, insufficient formulation of policies, and the urgent need to establish program priorities.

6. **Core Programs.** If the present trend of resource depletion is reversed, and the industrial forest brought under sustained yield management, it is estimated that the existing forest could produce 1.1 million m³ of industrial roundwood annually, worth about US$25 million on stump and resulting in a forest product value of about US$77 million. The potential government revenue from forest fees (stumpage fees) from the harvest of 1.1 million m³ would exceed the cost of managing the resource by 78 percent (if the fees are raised as proposed in this report) and it is recommended that the Government of Ghana (GOG) gives immediate priority to bringing the industrial forest under sustained yield management so that the forest industry can be maintained. A forest management program with three components is proposed: (a) forest inventories and elaboration of management plans combined with better control of boundaries and forest management in 1.7 million ha of forest reserves; conservation of remaining virgin high forest; (b) rehabilitation of 52,000 ha of forest plantations; and (c) bringing 0.3 million ha of forest under sustained yield management through cooperation with local communities.

7. The decline in fuelwood availability is a serious threat to the economy in the long term, and it is recommended that the GOG gives high priority to addressing that problem. Because of the scale involved in maintaining fuelwood supplies locally and because of the ecological necessity of trees on farms, the rural population would need to be involved if tree planting and conservation is to be successful. This would suggest a rural forestry program, where fuelwood is grown by farmers for their own use and for sale, rather than being supplied by the government. The key to a successful agroforestry program is local involvement in its implementation. In addition to growing fuelwood, farmers, if given the right incentives, should be interested in preservation and regeneration of
timber trees, thus expanding the industrial resource base. The GOG should support such a program by making available seedlings, and extension service in management of woodlands, tree planting, and improved charcoal burning. It is also recommended that GOG encourage commercial tree plantations, by making available land, giving security of tenure and other possible incentive measures.

8. To implement the proposed core programs in forest management and rural forestry, it would be necessary to strengthen the FD's operational and monitoring capacity through regular funding, training programs and technical assistance. The core programs plus FD's regular funding would require an annual budget of about $1,000 million and should be accompanied by improvements in forestry research, education, wildlife and national park management. The rural forestry program would require coordination between government agencies and in particular between the FD and the MOA which would carry out the farm forestry extension program. A lead agency should be established. At present agricultural staff do not receive training in agroforestry and the newly formed agroforestry unit in the MOA could play an important role by introducing agroforestry into the agricultural education at both university and technical level.

9. Support Programs. An applied research program in agroforestry, silviculture and forest products should have a high priority if the forestry sector in Ghana is to make continued progress. The PPRI is presently not giving adequate attention to setting priorities and management of a research program. The work program and staff requirements should be reviewed and a list of research priorities established as part of a rehabilitation program under which the most necessary vehicles and equipment would be provided. Subsequent to the proposed rehabilitation, an agroforestry research program in conjunction with the rural forestry program is recommended.

10. FD's success in the management of forest reserves will depend on the adequate provision of well educated staff. The IRNR is functioning quite well but would benefit from more forestry specialization and inclusion of agroforestry in the course program. In addition it needs more staffing and some basic equipment.

11. The GWD lacks senior staff, vehicles and equipment and is presently not in a position to adequately protect the national heritage of original fauna and flora in the protected areas. It is recommended that the department be rehabilitated.

Policy Recommendations

12. The proposed programs would ensure a sustained yield of 1.1 million m³ of industrial roundwood and reverse the downward ecological trend by managing the forest reserves and tree populations outside forest reserves. If successful the rural forestry program may also contribute to increased sustainable output of industrial wood and the annual allowable cut could be increased beyond the 1.1 million m³. Within the next five to
ten years, it is proposed to give priority to the proposed core - and support programs. This should be accompanied by a policy which would stimulate establishment of private industrial plantations. In the medium and longer term, when the GOG has come to grips with the most pressing problems, investments in additional government plantations could still be an attractive alternative for increasing the resource base. Investment in a pulp and papermill is less attractive than investing in the forest resource base and requires a high capital investment. The Government should refrain from such an investment.

13. The existing forest policy gives a broad mandate to FD and is very general. It would be useful to draw up a forestry action plan stipulating the strategy, targets and how to achieve them. It is recommended that the MLNR formulate such a forest policy and be strengthened so as to ensure better program coordination and monitoring of its departments. This would include better integration of forestry with wildlife management.

14. The proposed programs should be supported by appropriate policies in relation to pricing of wood, forest management and industrial development:

15. **Forest Fees.** The GOG should ensure that the right to harvest timber is taxed in a way that reflects the value of timber taken and is sufficient for renewal of the resource. The analysis carried out during the sector review indicates that the current forest fees would only capture about 9 percent of the estimated net stumpage value per m³ of industrial timber harvested. Furthermore, changes in the relative fee rates would shift emphasis from area-based fees to fees charged per tree taken. This change in forest fee composition is undesirable because area-based fees are the easiest to administer and more difficult for concessionaires to evade. Furthermore one of the area-based fees, the silvicultural fee, would be diminished to about 2 percent of total potential forest fee assessment compared to previously 16 percent. As the proceeds from silvicultural fees are used for forest management, this is undesirable. It is recommended to raise forest fees upwards about four times. This would raise fee revenues (to about $1,300 million) for improved forest management and increase incentives for more efficient timber harvesting and utilization. Revision of fees requires PNDC approval and while such revision should be done frequently, possibly every third year, it is proposed that the MLNR should be authorized to index fees every six months based on changes in log prices. The Government should review the present distribution of forest fees and examine if the proportion of proceeds withheld at local level is uniform throughout the country and who should benefit from such funds. The FD needs better funding and it is recommended that a significant portion of forest fees be made available for forest management.

16. **Fuelwood Tax.** The forest fees described above, refer to industrial roundwood harvested in concessions. Fuelwood harvesting is not affected by these regulations and is mainly harvested outside of forest reserves. Fuelwood and charcoal are mainly produced by farming communities
who sell to commercial dealers and it is recommended under the rural forestry program to organize producer groups and authorize them to charge a tax to fuelwood dealers. Monies collected should be administered by the fuelwood producer groups for tree planting and for community development.

17. **Land Tenure.** The usufructuary rights of farmers to trees varies with local customs from one locality to the other. The GOG should promote a policy of giving user rights of trees to the farmer cultivating the land or to local communities when land is not under cultivation.

18. **Forest Management.** To avoid depletion of the forest until forest management plans can be brought into use, Ghana should revert to a 25-year felling cycle and to control girth limits strictly. Concessionaires should be obliged to carry out stock mapping and enumeration before annual logging plans for forest reserves are approved by FD.

19. **Protected Forests.** Remaining unlogged virgin forest should be protected. About 0.5 million ha of forest are under the so called protection working circle and are for topographical reasons not meant to be logged. However logging of such areas now frequently takes place. When management plans are prepared these areas should again be set aside for full protection and conservation.

20. **Concessions.** The present concession structure is a patchwork of small units too small for optimum forest management. To rationalize forest management it is proposed to form new optimum size concessions units within forest reserves, cancel remaining concession tenure and reallocate concessions based on tendering procedures. This should be a well planned and staged operation. Present concession holders could be paid compensation on a per hectare basis on a portion of proceeds from the sale of their previous concession.

21. **Regulations on Fire.** By better range management and bush burning practices, the number of fires can be reduced. The GOG should promote the establishment of fire regulations at regional and district levels.

22. **Government-owned Industries.** The Government should pursue its plans of obtaining private ownership participation in the state-owned mills. These generally have experienced management and cash flow problems and a strategy should be prepared to avoid future government investment in the forest industry and to obtain private participation in the existing government owned mills.

23. **Control of Annual Allowable Cut.** The proposed forest fee increases would have a positive impact on forest industries by encouraging a better utilization of the trees already felled and paid for and thereby reducing waste. They should lead to investments in replacement machinery which can achieve higher conversion rates and to better care in processing. Similarly they should stimulate interest in installation of value adding equipment such as drying kilns, treatment plants and woodworking machinery. Higher fees and better forest management as proposed may however not be
sufficient to keep harvesting within the prescribed annual allowable cut. In addition it may be helpful to control annual felling through regulation of log exports and industry's primary processing. The Forest Products Inspection Bureau's (FPIB) log export data should be monitored closely by the MLNR and if industrial processing in the country continues to be economical and expanding, the Government should consider either to extend the existing log export ban or to put stiff value added taxes on log exports. Industrial primary processing capacity is already above the allowable cut and it is recommended that all industries be registered and expansion of capacity only granted after application and in case it is justified.

24. **Foreign Exchange Requirements.** Much of the forest industry machinery is old and requires replacement to achieve improved recovery rates and efficiency. There is need for a current modernization of the industry as well as procurement of spare parts and investments in equipment to allow further processing. It is therefore important that the industry continues to have access to foreign exchange so as to allow the widest possible choice in procurement.

25. **Improvements in Statistical Records.** Statistical data on log production and product manufacture are insufficient and FPIB should request companies to report production.
1. In 1985 forestry and forest industries contributed 7 percent to GDP and $30 million to export receipts. Employment in the forest product industries was 14,000, 1/ with many others employed in the informal sector as wood gatherers, charcoal makers, suppliers of poles and building materials and craftsmen. Given proper policies and management, there is scope for increased employment and value added in the industrial forestry sector. Forests and farm trees also play a vital ecological role in Ghana in maintaining soil fertility and sustaining supplies of wildlife, fruit and local medicine.

A. Forest and Land Area (Working Paper II)

2. Ghana covers an area of 23.9 million ha and is divided into two major vegetation zones, the high forest zone covering 8.2 million ha and the savanna zone covering 15.7 million ha. The modern sector forest industry is concentrated in the high forest zone, while informal sector exploitation occurs in both zones.

3. The high forest zone covers the central and southwestern parts of the country and is divided into (a) the moist evergreen forest (including the moist montane forest); (b) the moist semi-deciduous forest; and (c) the dry semi-deciduous forest. The increase in shifting cultivation caused by rapid population growth (2.5% between 1970 and 1984 in the forest zone), and probably exacerbated by the economic decline since the late 1970's (affecting the commercial and export sectors including cocoa), has transformed closed forests into open forests and fallowlands. The closed forest is presently estimated at 1.7 million ha - about the size of the reserved forest 2/ which covers 1.68 million ha or 20.4 percent of the forest zone.

4. The savanna zone covers parts of the Brong Ahafo and Volta Regions and includes the Northern and Upper Regions. The savanna zone is divided into four vegetation types: derived savanna, southern guinea, northern guinea and sudan savanna. The savanna forest covers an estimated 9 million ha (58% of the zonal area) but cannot be distinguished easily from late fallow state. The reserved forest covers 5.6 percent of the savanna zone.

1/ Enterprises employing more than 10 people.

2/ Reserved forest are areas used for permanent forestry production.

5. In the forest zone, the 1984 population density varied between 30 people per km$^2$ in Brong Ahafo and 117 people per km$^2$ in the Central Region. When uninhabited forest reserve areas are excluded these figures increase to 32 and 140. With the progressive destruction of the forest by shifting agriculture, pressure from farmers to move into the reserved forest has increased. In the savanna zone, the high population density particularly in the Upper East Region (87 people per km$^2$ in 1984), has resulted in pressure on the fuelwood resource and the ecology as a whole. Fuelwood shortages are most serious in areas such as in the North East and on the Accra-Tema plains where population pressure is combined with relatively low vegetative growth rates.

6. Because of emigration associated with the deteriorating economy, Ghana's annual population growth rate was relatively low during the period 1965-83 (2.2 percent). With economic resurgence and natural population expansion, however, it is expected to accelerate markedly to 3.5 percent from 1985-2000. More important, Ghana in the next 15 years is projected to have the second highest growth rate among Sub-Saharan African countries in the agriculture labor force (3.8 percent). This has important consequences for forest management. Even in years of relatively low population growth, pressure on the land from shifting cultivation led to the disappearance of virgin forest by 1980. By 1985 27 percent of the former forest area had become forest fallow or degraded forest. Pressure on the land will increase through the year 2000.

C. Importance of the Forestry Sector (Working Paper I)

7. The forest products industry earns foreign exchange for Ghana, produces most of the wood products consumed in the country (import substitution), and provides employment and government revenues in the form of various fees and taxes. Export earnings declined from a peak of US$91.4 million in 1976 to US$14.8 million in 1983. The 1976-1983 decline in official exports was partially offset up to 1980 by increased overland exports (smuggling), registered as domestic sales. As from 1980, the unavailability of spare parts caused a decline in apparent log production from an average of 1.6 million m$^3$ between 1975-79 to an average of 772,000 m$^3$ between 1980 and 1984. In 1985 the production of industrial roundwood was about 927,500 m$^3$, - 143,000 m$^3$ of which were exported as round logs (unprocessed logs). The balance (784,500 m$^3$) was processed into lumber and other wood products in Ghana. Exports of wood products (including logs) rebounded to about US$30 million and the value of industrial wood products consumed in Ghana to about US$34 million. The value of fuelwood and poles from rural forestry in 1985 was about US$200 million.

8. Forestry's share (excluding manufacture) in total GDP in the decade before 1985 varied modestly between 4.6 percent and 6.2 percent annually. Even with strong and competent management it is unlikely to contribute more than between 6-10 percent on a consistent basis. To do so would imply an unacceptable longer run mining of the forest resource. This
is apparently what occurred in the early 1970s when 19.5 percent of 1973 total exports was accounted for by forest products and the apparent log production averaged 1.8 million m$^3$ annually, 64 percent above the estimated annual allowable cut of 1.1 million m$^3$ (defined as the sustainable felling volume). Forestry's share in GDP was in 1985 about 6 percent (excluding manufacture) and is expected to increase somewhat when production reaches the 1.1 million m$^3$ allowable cut. Official exports are expected to increase from the 1985 level of US$30 million because of the increased production and a gradual shift from smuggling to recorded exports. However, it is unlikely that forest product exports would ever exceed US$70 million in 1985 constant prices if the annual allowable cut is not exceeded.

9. The forest sector also has important though less quantifiable environmental benefits through its impact on crop yields and agricultural development. Although no one knows exactly what the mechanisms affecting the overall climate are, some think that the presence of a continuous belt of high forest has a stabilizing effect on the climate. Because it increases surface run off, widespread deforestation leads to lower soil moisture regimes, less recycling and declining rainfall. In the local environment, the ecological benefits from farm trees are mainly in reducing the wind speed (shelter) and the ability to recycle nutrients from deeper layers of the soil. The lowering of wind speed reduces wind erosion and physiological damage to crops resulting from high wind velocities and sand blow. Shade and shelter affect the micro climate resulting in higher soil moisture content. Using their deep roots, farm trees recycle nutrients from deeper layers of the soil and deposit them on the ground surface in the form of leaf litter, thus making plant nutrients available to annual crops with less penetrating root systems. The most important role of farm trees is the prevention of overall ecological degradation which causes soil erosion and declining fertility and inevitably reduces arable land areas. Shelter typically increases plant production by about 20 percent providing more crops and stover for human and animal consumption. Conservation of the forest habitat is important for the preservation of wildlife and plant species. Trees produce edible leaves, fruit and livestock fodder, and wildlife meat is important in the population's diet.

D. Industrial Forestry (Working Papers II, IV, V and VI)

Natural Forests

10. Logs for the wood products industry are produced in the forest zone. They are extracted from forest reserves (1.68 million ha) and from the diminishing tree stocks in forests and farmlands outside the reserves. During 1970–74 log production averaged 1.85 million m$^3$ per year but declined to 680,000 m$^3$ during the low point in 1983. It is expected to reach about 1.0 million m$^3$ in 1986, which is close to the annual allowable cut of 1.1 million m$^3$.

11. In Ghana there are two types of cutting rights. Cutting rights to the high forest are allocated through concessions (timber leases), while timber licenses are short-term harvesting rights intended for salvage
logging and are of minor importance. Concessions (4.08 million ha) cover practically all forested land, including the forest reserves and 2.4 million ha outside of the reserves. Although concessions initially were very large and granted to a few companies, they have gradually fragmented (median size 3,900 ha; mean size 6,680 ha) and have more frequently been allocated to small loggers not involved in the manufacturing of forest products. There are still however, 10 concessions in the 38,000 - 52,000 ha bracket and 92 out of 366 concessionaires hold more than one concession. Nearly half of the concessionaires have holdings of between 1,300 ha and 5,200 ha, but the large state-owned forest industries still hold large concession areas. Many concessions are too small to sustain year-round logging operation, and are not ideally situated in relation to the processors. This results in wasteful exploitation of the forest resources. The small size (below 10,000 ha) is a disincentive to developing professional logging companies prepared to make adequate investments, and limits the scope for rational management of forest reserves. Outside forest reserves, there is no policy of sustained yield management. The general presumption is that after logging most of the high forest will be converted to farmlands.

12. **Concession Management** in forest reserves involves three important components: (a) management of the forest itself to achieve a sustained yield, (b) supervision and control of concessionaires' logging operations, and (c) assessment and collection of revenues.

13. Natural forest management is ideally controlled by the following instruments:

(a) the felling cycle, which is the period between logging an area of the concession and re-entry to the area for the next felling;

(b) felling plans, designating areas to be cut each year based on a forest management plan;

(c) enumeration of areas to be logged and establishment of the yield to be harvested; and

(d) minimum girth limits of trees to be cut.

14. All of these principles of sound forest management are in place in Ghana but are not being fully implemented. Although the principle of sustained yield management prevails in theory, measures to enforce it are not taken. Felling plans are rarely based on a forest management plan and the volume cut is not based on yield calculations. The felling cycle and the minimum girth limits are, therefore, the only tools available for managing the forest until the Forestry Department prepares management plans and allocates annual felling volumes based on yield calculations.

15. The forest reserves in general have adequate infrastructure with a compartment grid (1 x 1/4 sq. mile) and logging roads. There is, then a basis on which to build a sound management system based on sustained yield. This requires management plans based on an inventory of standing volume.
combined with knowledge of increment, and control of logging operations. The British Overseas Development Administration (ODA) is assisting Ghana with inventory work and planning. Improved control of logging requires enumeration of compartments prior to logging and preparation of stock maps, as still done by some large concessionaires. Although there is still a policy of stock mapping, it is now mainly done by some large concessionaires. FD's lack of mobility has resulted in inadequate forest management, concession control and revenue assessment.

Forest Plantations

16. In addition to sound management of natural forests, most countries undertake plantation development as part of their forest management strategies. In the 1960s a major plantation program of 590,000 ha was planned mainly for the high forest and the transition zone between the high forest and savanna. In the period 1968–1977 about 40,000 ha were planted with peak annual targets of 5,000 ha per year. Since the late 1970s, the planting program has been reduced gradually to its present level of about 1000–2000 ha per annum because of budgetary constraints and a renewed interest in natural forest management.

17. It is difficult to obtain accurate data on plantations because official records tend to report areas planted rather than areas successfully established. With increasing resource constraints, quality control in plantation establishment deteriorated and failures were frequent. In addition, inadequate weeding and fire maintenance has resulted in losses. Based on FD data, there is a total plantation area of 76,000 ha. 52,000 ha are for the production of saw timber while the remaining 24,000 ha are woodlots and plantations in the savanna zone. Stocking is unknown, net areas could be lower.

Annual Allowable Cut

18. The annual allowable cut is the industrial log volume that can be harvested annually on a sustained yield basis. Thus, the annual volume felled should not exceed the annual volume increment. The national allowable cut should be calculated by adding the felling volumes planned for the various forest areas as calculated in their forest management plans. But since management plans are not up to date, the national allowable cut will have to be based on "global" estimates of forest areas and volume increments.

19. Forest volume increment is derived from three sources: (a) the natural forest in forest reserves, (b) the natural forest outside reserves, and (c) forest plantations. Estimates of the annual allowable cut from the natural forests are complicated by uncertainties as to the extent of forest areas and by the heterogenous nature of the tropical forests. The latter factor has two implications: (a) it is not well known what effect the harvesting will have on the long-term species composition in the forest, and (b) not all species are marketable and can be included in the allowable cut.

20. For the forest reserves, FAO during 1980-82 carried out inventory in 12 forest reserves (WP II). Silviconsult (1985) used this data for estimating increments and standing volumes for the total productive forest reserve area (WP II). Species were grouped into three major categories A, B and C. Group A comprises 40 species presently considered commercial; group B comprises 20 species which are potentially commercial but are presently harvested only to supply specific orders. Group C contains the remaining species that grow to a utilizable size. The total volume of group A species was estimated at 58.2 million m³ and the volume above prescribed girth limits at 29.4 million m³. The increment and allowable annual cut were estimated as indicated:

<table>
<thead>
<tr>
<th>Species Group</th>
<th>Annual Increment (m³/ha/yr)</th>
<th>Total Increment (million m³/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A Species</td>
<td>0.866</td>
<td>1.024</td>
</tr>
<tr>
<td>Group B Species</td>
<td>0.466</td>
<td>0.551</td>
</tr>
</tbody>
</table>

Note: Allowable cut estimated at 70% of increment. Per ha figures combined with 1.18 million ha in production working circle.


21. For the areas outside forest reserves, the situation is more complex. No policy exists to maintain these forests or to manage them on a sustained yield basis. Perhaps then, volume harvested should not be
included in the allowable sustainable cut. Such areas, however, would contribute to the annual harvest for at least the next 10-15 years even if they are gradually mined for their timber and, therefore, need to be included in the estimate. Although mining is likely to take place in some areas, it is recommended that the GOG bring additional forest areas under sustained yield management and also promote the regeneration of trees on farmlands. The forest outside reserves covers about 0.3 million ha (forest reserve equivalent). The annual allowable cut from this source has been estimated at 0.12 million m³ (group A species) per year on a pro rata basis assuming the same increment on the 0.3 million ha as in forest reserves.

22. Forest plantations are presently not managed on a systematic basis although some thinning for poles occurs. With improved management, this resource has potential for both domestic and export markets. The annual increment on teak is estimated at 157,000 m³ and that of other species at 103,000 m³, totalling 260,000 m³.

23. The national annual allowable cut is estimated as follows:

<table>
<thead>
<tr>
<th>Source of Forest</th>
<th>Allowable Cut (million m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest in reserves (based on group A Species)</td>
<td>0.72</td>
</tr>
<tr>
<td>Forest outside reserves (&quot; &quot; )</td>
<td>0.12</td>
</tr>
<tr>
<td>Timber plantations</td>
<td>0.26</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1.10 million m³</strong></td>
</tr>
</tbody>
</table>

In order to maintain an annual allowable cut of 1.1 million m³ beyond the year 2000, the management of all three sources must be improved. Furthermore, the marketing of group B and C species should be increased as the number of class A species may diminish due to changes in natural regeneration patterns.

Forest Fees and Revenue

24. Forest fees are important as a means of generating revenue for forest management and establishing incentives for environmentally sound use of forests. As far as the modern sector is concerned, the purpose of forest fees is to allow the government to collect as wide a margin as possible in rent from leasing the forest resource to the concessionaire, while ensuring that the rent collected is not so high that it inhibits industry profit and modernization. Forest fees in Ghana are of three types: (a) concession lease – an area charge levied annually, based on the area of the concession; (b) silvicultural fee – an area charge levied on the area logged each year; and (c) royalty – a stumpage fee levied per tree at rates which vary by species.

25. Concession lease fees were set at £2.0 per ha in 1983. A 1985 FD proposal to raise the fee to £10.0 per ha was not approved. At £2.0 per ha annual fees would amount to £8.2 million while at £10.0 per ha the fees would equal £41.0 million. Fees collected are shared among the central government, the tribal and local authorities. Silvicultural fees are levied on the area logged each year. Present charges (£50 per ha in forest
reserves and $20 per ha outside) have been in force since April 1983 and a 1985 FD proposal to double fees was not approved. FD figures indicate a revenue of $1.4 million from silvicultural fees in 1984. Fees are supposed to be credited to the Forestry Improvement Fund to meet silvicultural expenses, but because fee levels are out of date they do not serve this purpose. Royalties vary according to tree species. The royalty schedule gives the rates per tree for about 50 species (Working Paper V). A proposal for a new schedule prepared by FD in 1984 was forwarded by the MNLR to the PNDC in 1985 and approved in 1986. New levels per tree vary from $1,000 to $9,000. Data on total royalties collected is difficult to obtain but about $7.3 million was obtained from inside forest reserves in 1984. Collected royalties go to the government treasury.

26. The present system, a combination of area based fees and a fee per tree is a good one. Area based fees are easier to administer and control than fees that vary with trees or volume taken. A rate per tree (as the one existing) is also simpler to control than fees levied on a volume (m$^3$) basis. Because area based fees are the easiest to administer it would be advisable to structure the combination of fees allowing at least 60-70% of the total charge to be based on area.

E. Rural Forestry (Working Paper VII)

Trees and Farming

27. Farming in Ghana largely follows the traditional pattern of shifting cultivation but its impact on the two main zones differs. Farmers usually leave a canopy of trees on their cleared land, but in the forest zone tree species are not fire tolerant and the tree cover disappears following successive fires. In the savanna, trees are more fire resistant. Areas cultivated for a long time, grow into a parkland-type landscape with scattered trees used mainly for their fruit. This system is relatively stable ecologically if young trees are allowed to regenerate and replace the old generation. But in areas of intense population pressure this regeneration is not occurring.

28. Fuelwood and charcoal are the main sources of household energy in both rural and urban areas in Ghana. The combination of land clearing for agriculture and fuelwood harvesting is diminishing the capital stock of trees, and in areas that combine high population pressure with relatively low rainfall, fuelwood is already in short supply. In the densely populated and intensively farmed Upper East Region and in isolated areas in the Northern Region tree populations are reduced to the extent that desertification is occurring locally. Farmers in the Upper East Region are responding to the increasing fuelwood shortage by planting of neem and teak, but not on a sufficiently large scale. In the Accra-Thema plains much fuelwood is now supplied by the neem tree grown on farms. There are a number of constraints to getting farmers involved, and these vary with locality and with local customs. Tree planting tends to give permanent rights to the land and, therefore, interferes with the chief's customary right of allocating land for farming. As farming becomes more permanent,
however, the importance of this factor diminishes. Other constraints are the animal husbandry system (free ranging animals after crop harvest), bush fires, conflicts with loggers (in the forest zone) and the farmer's focus on his crops (which often leads to maximizing sun and water to the crop and thus reducing trees) at the expense of the sustainability of the system as a whole. The interaction of these constraints has inhibited tree planting from taking place on a larger scale.

Fuelwood Balance

29. The national fuelwood balance is forecast below:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-----</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>Fuelwood consumption 1/</td>
<td>12.0</td>
<td>13.4</td>
<td>15.4</td>
<td>17.6</td>
</tr>
<tr>
<td>Industrial wood consumption 2/</td>
<td>1.5</td>
<td>1.5</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Total</td>
<td>13.5</td>
<td>14.9</td>
<td>17.4</td>
<td>19.6</td>
</tr>
<tr>
<td>Wood increment 3/</td>
<td>17.6</td>
<td>16.9</td>
<td>16.6</td>
<td>16.0</td>
</tr>
<tr>
<td>Fuelwood Balance</td>
<td>+ 4.1</td>
<td>+ 2.0</td>
<td>(0.8)</td>
<td>(3.6)</td>
</tr>
</tbody>
</table>

1/ Source Working Paper VII.
2/ Industrial wood consumption includes only the wood used for log exports, industrial manufacture and energy generation.

The table shows that the situation is getting progressively more critical. The increasing deforestation is diminishing the capital stock of trees which in turn affects the increment. If this process continues, the result will be decreased supply of fuelwood, sawntimber, housepoles and fruit, less browse for livestock, and less effective bush fallow through smaller recuperation of macronutrients and organic matter. The desertification process will thus be accelerated.

Alternative Household Fuels

30. Woodfuels make up 70 percent of Ghana's total energy consumption (Report No. 6234-GH). In urban areas both kerosene and LPG are cheaper fuels than fuelwood and especially charcoal, but they are often unavailable. Economic prices of fuelwood and kerosene, adjusted for utilization efficiency, are equal (LPG is cheaper) while charcoal is considerably more expensive. If the availability of LPG and kerosene improved, there would presumably be increased consumption of petroleum
products, particularly in urban areas. The tradition for using woodfuels is strong, however, and it is unlikely that they will be replaced by fossil fuels in a foreseeable future, at least in rural areas. As fuelwood can be grown economically in all parts of Ghana, its growth locally should be promoted.

F. Forest Industries (Working Paper VIII and IX)

Mechanical Wood Industries

31. The forest industry sector was affected by the decline in the economy between 1975 and 1983. The industry was unable to secure sufficient foreign exchange earnings to procure equipment and parts, resulting in a severe deterioration of processing capacity. Since then the stimulus of the export rehabilitation program has increased log production to an estimated 927,500 m$^3$ in 1985 distributed as follows:

<table>
<thead>
<tr>
<th>End Use</th>
<th>Roundwood Volume (m$^3$)</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export logs</td>
<td>143,000</td>
<td>15.4</td>
</tr>
<tr>
<td>Export lumber</td>
<td>213,300</td>
<td>23.0</td>
</tr>
<tr>
<td>Domestic lumber</td>
<td>432,100</td>
<td>46.6</td>
</tr>
<tr>
<td>Export rotary veneer</td>
<td>4,400</td>
<td>0.5</td>
</tr>
<tr>
<td>Domestic rotary veneer</td>
<td>15,500</td>
<td>1.7</td>
</tr>
<tr>
<td>Export plywood</td>
<td>2,500</td>
<td>0.3</td>
</tr>
<tr>
<td>Domestic plywood</td>
<td>75,400</td>
<td>8.1</td>
</tr>
<tr>
<td>Export sliced veneer</td>
<td>24,500</td>
<td>2.6</td>
</tr>
<tr>
<td>Domestic sliced veneer</td>
<td>16,800</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>927,500</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Note: Mission estimate based on statistical records for finished products converted by estimated conversion factors. Most logs are used for manufacturing domestic lumber (46.6 percent), lumber for exports (23 percent) and directly for export (15.4 percent).

32. Forest industries were originally privately owned. In 1972 the government took over the four largest privately owned integrated wood industries: the MIM Timber Company, the Takoradi Veneer and Lumber Company, Gliksten VA Ltd. and African Timber and Plywood Company. Except for MIM, which is Ghana's leading exporter, these companies have experienced severe management problems, been closed part time, and are burdened by debts. The Government wishes to seek private participation in these industries.

33. Sawmills: There are 85 sawmills which had a log intake in 1985 of about 645,000 m$^3$. The installed capacity is estimated at 1.1 million m$^3$ (MLNR estimate based upon 250 days and two shifts per day). In 1985 the
lumber exports were 86,000 m$^3$ and 175,000 m$^3$ were sold in the local market. With adequate emphasis on quality control and accurate grading, export prospects are good. Similarly, local demands are expected to grow during the economic recovery. Plywood Industry: There are eight plywood mills which in 1985 produced 27,000 m$^3$ of plywood. The plywood capacity is estimated at 70,000 m$^3$. The peelers are generally in a good condition but the plywood manufacturing equipment is not, resulting in relatively poor quality which cannot easily compete in the European market with Southeast Asian plywood. Most plywood is thus sold locally or in the West African market. Veneer: There are 10 sliced veneer plants which produced an estimated 18,600 m$^3$ of veneer in 1985. Production capacity is estimated at 30,000 m$^3$. Most is exported and both the demand and prices have been good. Furniture and other Wood Products: There are about 200 furniture manufacturers that belong to the Furniture Manufacturers Association. The production technology ranges from semi-automatic machinery producing for export to the cottage industry. The industry supplies the local market with furniture, and export sales in 1985 accounted for US$442,000. Wood products also include profile boards, mouldings, broomsticks, door frames and doors, the exports of which amounted to US$392,000 in 1985.

34. The estimated log intake capacity and actual intake in primary manufacture is shown below:

<table>
<thead>
<tr>
<th></th>
<th>Production Output m$^3$</th>
<th>Roundwood Intake m$^3$</th>
<th>Capacity in Roundwood Intake m$^3$</th>
<th>Capacity Utilization %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumber 1/</td>
<td>261,400</td>
<td>645,400</td>
<td>1,141,000</td>
<td>57</td>
</tr>
<tr>
<td>Plywood</td>
<td>27,000</td>
<td>77,900</td>
<td>200,000</td>
<td>39</td>
</tr>
<tr>
<td>Sliced Veneer</td>
<td>18,600</td>
<td>41,300</td>
<td>72,000</td>
<td>57</td>
</tr>
<tr>
<td>Total</td>
<td>307,000</td>
<td>764,600</td>
<td>1,413,000</td>
<td>54</td>
</tr>
</tbody>
</table>

1/ Some of the peeling capacity is used in the production of rotary veneer as an end product.

The total processing capacity (1.4 million m$^3$) is almost double the actual roundwood intake and exceeds the annual allowable cut by 27 percent. From an economic perspective, investment in new primary processing would appear unwarranted in the short-term; recognizing, however, that investment in replacement equipment, particularly in sawmill and plywood manufacture, would improve recovery rates and product quality. Given the limited forest resource and the investments already made in primary processing, it would be more desirable if the industry would invest in product improvement and value added. Investments in drying kilns, treatment plants, and wood working machines are relatively small compared to the sunk cost already invested in the primary manufacture.
35. It is beyond the scope of this report to determine the relative merit of different types of processing from an economic point of view. But given the sunk cost in the industry, the financial profitability of various types of processing has been estimated. The calculation is based on a model of an integrated wood industry with an annual log intake of 54,000 m³ per year. The model assumes a gradual improvement in recovery rates resulting in four different scenarios (WP VII). The cost of wood consumed in the manufacture and the variable processing costs per m³ were deducted from the net sales. The net residual value (financial contribution) per m³ of different products indicates the relative profitability of various types of production:

<table>
<thead>
<tr>
<th>Estimated Financial Contribution Per m³ of Product 1/</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
<th>Scenario 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export Logs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whitewoods</td>
<td>35.5</td>
<td>1.0</td>
<td>35.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Redwoods</td>
<td>50.8</td>
<td>1.0</td>
<td>50.8</td>
<td>1.0</td>
</tr>
<tr>
<td>Export Lumber</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whitewoods</td>
<td>32.5</td>
<td>0.405</td>
<td>43.0</td>
<td>0.460</td>
</tr>
<tr>
<td>Redwoods</td>
<td>157.3</td>
<td>0.405</td>
<td>169.5</td>
<td>0.460</td>
</tr>
<tr>
<td>Domestic Lumber</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whitewoods</td>
<td>29.3</td>
<td>0.405</td>
<td>39.8</td>
<td>0.460</td>
</tr>
<tr>
<td>Rotary Veneer</td>
<td>146.0</td>
<td>0.500</td>
<td>150.3</td>
<td>0.530</td>
</tr>
<tr>
<td>Sliced Veneer 3/</td>
<td>52.7</td>
<td>0.450</td>
<td>64.5</td>
<td>0.515</td>
</tr>
<tr>
<td>Plywood</td>
<td>127.1</td>
<td>0.350</td>
<td>148.8</td>
<td>0.400</td>
</tr>
<tr>
<td>Flooring</td>
<td>62.4</td>
<td>0.270</td>
<td>84.4</td>
<td>0.310</td>
</tr>
<tr>
<td>Furniture Blanks3/</td>
<td>148.6</td>
<td>0.320</td>
<td>168.2</td>
<td>0.370</td>
</tr>
</tbody>
</table>

1/ Contribution is the sales price minus variable costs; the figure indicates contribution to administrative costs and other overhead charges, as well as to profit.

2/ Scenario 1 represents present conversion factors, conversion factors in scenario 2, 3 and 4 are expected to be reached in 1990, 1995 and 2000.

3/ The contribution from production of sliced veneer and furniture blanks appears unrealistically low and could be caused by an excessively low sales price being informed by the TEPB ($223 for veneer and $182 for furniture blanks).

The above estimates indicate that log processing for an already established industry is generally financially more attractive than log exports and that the financial advantage of processing increases dramatically with improvements in recovery rates. The analysis shows that production of redwood lumber, furniture blanks, rotary veneer and plywood are among the most profitable ventures, but further work would be required to analyze specific investments.
Future Industrial Production

The future industrial production is forecast in the table shown below and is based on the assumption that the annual allowable cut will not be exceeded. The forecast increase in production is within the existing processing capacity limits. Estimates of future exports are based upon the assumption that the domestic demand will be met first. The local consumption was based upon 1985 figures and adjusted for projected changes in population growth and GDP. An annual increase of 2.2 percent in lumber consumption and an increase of 3.5 percent in consumption of other wood products was projected. Ghana has increased its exports by 66 percent from 1984 to 1985, and provided that infrastructure and quality controls improve, export prospects continue to be good. Volume estimates of both local consumption and exports are shown below.

Forecast distribution of industrial forest products harvesting

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lumber</td>
<td>432</td>
<td>175</td>
<td>424</td>
<td>195</td>
</tr>
<tr>
<td>Other wood Products</td>
<td>107</td>
<td>39</td>
<td>111</td>
<td>46</td>
</tr>
<tr>
<td>Sub-total</td>
<td>539</td>
<td>214</td>
<td>535</td>
<td>241</td>
</tr>
<tr>
<td>Exports</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lumber</td>
<td>213</td>
<td>86</td>
<td>270</td>
<td>124</td>
</tr>
<tr>
<td>Other Wood Products</td>
<td>32</td>
<td>13</td>
<td>37</td>
<td>18</td>
</tr>
<tr>
<td>Export Logs</td>
<td>143</td>
<td>143</td>
<td>258</td>
<td>258</td>
</tr>
<tr>
<td>Sub-total</td>
<td>388</td>
<td>242</td>
<td>565</td>
<td>400</td>
</tr>
<tr>
<td>TOTAL</td>
<td>927</td>
<td>456</td>
<td>1100</td>
<td>641</td>
</tr>
</tbody>
</table>

Note: This scenario assumes an improvement in conversion factors from roundwood to products as indicated in the previous table, page 12.

Consumption of lumber and other manufactured wood production in Ghana was more than double the export volume in 1985. Part of local consumption may be smuggled. Over time, it is expected that the proportion of manufactured wood products will increase and the roundwood exports decline. The value of forest products exports and domestic consumption is estimated below:
Projection of Value of Output from Industrial Wood Industries
(Volume in '000m$, Value in million US$)

Export Values (foreign exchange earnings)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Volume</td>
<td>Value</td>
<td>Volume</td>
<td>Value</td>
</tr>
<tr>
<td>Lumber</td>
<td>86</td>
<td>15.1</td>
<td>124</td>
<td>22.8</td>
</tr>
<tr>
<td>Other Wood</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Products</td>
<td>13</td>
<td>3.9</td>
<td>18</td>
<td>5.7</td>
</tr>
<tr>
<td>Logs</td>
<td>143</td>
<td>10.5</td>
<td>258</td>
<td>19.9</td>
</tr>
<tr>
<td>Total</td>
<td>242</td>
<td>29.5</td>
<td>400</td>
<td>48.4</td>
</tr>
</tbody>
</table>

Estimated Value of Domestic Wood Consumption

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>34</td>
<td>40</td>
<td>50</td>
<td>57</td>
</tr>
</tbody>
</table>

Note: 1985 constant dollars.

37. A six percent ad valorem tax on forest products exports was abolished in 1986. The Timber Export Development Board (TEDB) charges three percent (one percent in hard currency, two percent in cedis) on fob value of exports to finance its operation. Local sales taxes and import duties go directly into government revenue.

38. Ghana imports all its paper products. Annual paper consumption was 6,000 tons in 1984 and is estimated to reach 8,000 tons in 1990 and 12,000 tons in year 2000 (FAO 1986 4/).

39. In order to reduce its dependence on imported paper and foreign exchange, the GOG commissioned a study in 1977 to determine the technical and economic feasibility of constructing a pulp and paper mill. The study recommended a 60,000 tons capacity mill (CTMP process) of which 60 percent would be consumed locally. Although the domestic consumption is now forecast at 12,000 tons (year 2000), the GOG wants to implement the program, and an updated feasibility study for a mill at Daboase in Western Region financed by the African Development Bank (ADB) is in progress.

4/ Forest Products, World Outlook Projections, FAO, 1986
II. INSTITUTIONS 5/

A. The Forestry Department (FD) (Working Paper III)

40. The FD manages the forest estate and the national forestry program. It is headed by the Chief Conservator of Forests, and has 1,934 technical employees: 28 professionals, 3 semi-professionals, 590 technical staff and 1,313 sub-technical staff. The professional and semi-professional levels are understaffed. In the past decade, FD has suffered from diminishing budget allocations in real terms and from shortage of foreign exchange. As a result, FD was unable to maintain its fleet of vehicles and most field activities were halted. Despite these difficulties FD has been able to keep up the forest reserve boundaries quite well, although control of concession operations has slipped. The decline in the FD's field mobility coincided with the decline in logging and this helped preserving the forest. FD's management and fiscal control are weak and there is no effective monitoring of field activities. With renewed demand for logs it will be necessary for the GOG to revitalize the FD if a rapid resource depletion is to be avoided.

41. The FD's budget in current values has increased yearly but in constant terms the budget has been reduced. The 1984 budget was only 20 percent of what it was in 1975. The FD 1986 budget was 244 million (1140 for capital and 104 for recurrent). The recurrent expenditures are mainly for salaries and travel allowances (94 percent of total), while wages for daily paid labor is the main cost item under capital budget (84 percent in 1986). In 1985, 58.2 million of the capital budget was released (62 percent). Daily laborers are not adequately supervised because of insufficient mobility of the technical staff. The GOG in the short term should examine whether the numbers of FD's lower level and daily paid staff are appropriate, or whether they should be reduced to a more efficiently manageable number, thereby cutting costs in the capital budget. In the medium term a revival and expansion of FD activities is necessary to (a) bring the industrial forest under better management, and (b) halt the ecological deterioration and the reduction of fuelwood in the North.

42. The FD has mainly been concerned with the management of forest reserves. The LD is responsible for concessions outside forest reserves where there are no forest management practices. Their main aim has been to collect revenues. Both institutions belong under the MLNR.

B. The Game and Wildlife Department (GWD) (Working Paper X)

43. Preservation of virgin forests and other original habitats is of vital importance to ensure the survival of indigenous species of plants and

5/ See Appendix 1.
wildlife. Conservation is needed to preserve gene pools. The forest vegetation supplies medicinal plants, edible leaves, fruit and nuts. Meat from wild animals makes up a significant proportion of the populations diet (wildlife meat alone 12 percent of protein intake). The extent of remaining virgin forests (if any) is unknown. Steps should now be taken to ban further destruction of virgin forest lands, and forest surveys should be directed specifically at determining if genuine virgin forests do remain.

44. Conservation efforts, started in the early 1970s, created a significant number of specially protected areas for the preservation of flora and fauna. These are: (a) five national parks totalling about 1.0 million ha including tropical forests covering 61,910 ha; (b) two animal sanctuaries covering 12,430 ha; and (c) one nature reserve and five game production reserves covering 36,010 ha. It is difficult to assess how effectively these areas are protected, but it is obvious that financial constraints and lack of sufficient skilled manpower limit the GWD's control. In addition to these protected areas, the natural forest, if well managed for production of timber, would also be very important for the conservation of wildlife by maintaining the forest cover. Fees charged for game licenses, visits to National Parks and accommodations are too low.

45. GWD is a small department of MLNR with only 12 professional staff. Field staff are placed in the major national parks. The Department has only two vehicles in operating condition and is at present unable to protect the conservation areas effectively. The network of protected areas must be consolidated through better management and control, and better wildlife management is needed in areas outside of national parks.

C. Forestry Education and Training Institutions (Working Paper XII)

46. Forestry is taught at two institutions in Ghana, the Institute of Renewable Natural Resources (IRNR) at Kumasi and the School of Forestry, Sunyani (SFS).

47. The IRNR is located on the campus of the University of Science and Technology (UST). It awards degrees in the name of the university, but formally belongs under the Forestry Commission (FC) (see para 50-51). It has four departments: (a) silviculture and forest management, (b) wood science and wood technology, (c) wildlife and range management, and (d) freshwater fisheries and watershed management. The Institute provides education for both professional and sub-professional personnel and offers courses leading to (a) a B.Sc. in renewable natural resources (three years), (b) a diploma in renewable natural resources (two years), and (c) a M.Sc. in wood technology and industrial management (two years). The B.Sc. course syllabus is well balanced but agroforestry is not yet included. The IRNR plans to include an agroforestry option and expand its enrollment to 45 B.Sc. students and 25 diploma students. At present IRNR is understaffed with only four teachers at the M.Sc. level. There are 17 vacant positions. The IRNR benefits from the nearby UST and Forest Products Research Institute (FPRI). Those facilities supplement IRNR's
own, and FPRI and UST staff assist with lecturing. The management of the IRNR appears enthusiastic and dynamic. Its budget for 1986 was $37 million. While salaries and allowances are funded in full, budget items under other recurrent expenditure usually are funded only up to one-third. The physical plant requires rehabilitation.

48. The SFS belongs under the FD. It offers a three-year course designed to educate personnel at the technical level. With an annual student intake of about 25, the present student enrollment is 74. The staff consists of two professional officers, seven sub-professional diploma holders (ex IRNR) and one technical level person. Office administrative staff, drivers, etc. totals 76. Facilities are good but in need of repair. The FD in 1986 budgeted $10 million for SFS, of which about $6.0 million was for capital expenditure normally not received. The requirement for vehicles and equipment is estimated at US$328,700 (Appendix 2). Technical assistance would be desirable in the fields of agroforestry, forest management and silviculture, forest engineering, and utilization and marketing.

D. **Forestry Products Research Institute (FPRI)** (Working Paper XI)

49. Forestry research in Ghana is carried out by the FPRI. FPRI has had different institutional connections. In 1982 it became a statutory body under the FC with direct funding from the Ministry of Finance. The FPRI is not limited to product research, and is divided into three divisions: (a) silviculture and forest management, (b) forest production, and (c) forest utilization. Each division has its own research projects, reviewed periodically by a Research Advisory Committee. There are 10 ongoing projects and 23 investigations. Of senior staff there are the director, 22 research officers and 5 assistant research officers. If Ghana is to maintain and develop its forestry resource, there is a need for an active ongoing applied research program relevant to agroforestry, industrial forestry and forest products. Such a program is not in place now and the lack of priorities at the institution is obvious. The overall institution, its management and research priorities need to be reviewed. Following the FPRI's revival, it would be useful to embark on agroforestry research. A program paralleling the proposed FD rural forestry program has been outlined (WP VII). The FPRI recurrent budget for 1986 was $57.0 million of which $46.4 million was for personal emoluments. Taking into account 1986 salary increases, recurrent expenditure level can be estimated at $75.0 million.

E. **The Forestry Commission (FC)** (Working Paper III)

50. The first FC was established in 1980 under the 1979 Constitution of Ghana. It was to incorporate the Ghana Timber Marketing Board (GTMB), the FD and the GWD into a single operating body. The FC was abolished following the revolution in December 31, 1981 and the suspension of the 1979 constitution. The second FC was established by PNDC Law 42 of December 1982. The new commission is responsible for monitoring the entire forestry sector and advising the PNDC and the secretary of the MLNR and
other relevant government bodies. The Commission is headed by a Chief Administrator while seven commissioners are part-time appointments with no fixed terms. In addition to the Chief Administrator there is only one professional forester and a few clerical and secretarial staff.

51. The FC is in an awkward position. It does not have the staff to monitor the sector, and to build up the staff to meet this requirement would be an expensive duplication. The FC is responsible for advising the PNDC and the secretary of the MLNR who himself has technical staff in the FD and GWD. There is a need to improve the monitoring and evaluation capability within the sector. Policy monitoring and evaluation might be better placed, however, at the ministerial level, and operational monitoring of programs and projects at the departmental level.

F. The Forest Products Inspection Bureau (FPIB) and The Timber Export Development Board (TEDB) (Working Paper III)

52. Both of these bodies were established in 1985 following the abolition of the GTMB. FPIB and TEDB each have a managing director and separate boards of directors representing both GOG and the industry.

53. The FPIB has two major functions: to introduce standardization and conformity with grading rules and to ensure that exports meet such standards, and that invoice prices conform with product value. The TEDB's role is to promote sales and exports of Ghana's timber products and to compile and publish statistical information on the trade. The TEDB has a number of listed agents in importing countries and a London office to promote trade and provide market intelligence. It is a major challenge for TEDB to increase the use of group B and C species. When the forest inventories are more advanced and the species composition better known, the TEDB and FPIB should design a strategy for increased research and marketing efforts for such species. TEDB provides the industry and FPIB with price information. Both institutions are now functioning well but would benefit from some continued technical assistance in training of graders and setting up a data base on forest industries.

III. MAJOR ISSUES

54. The major sector issues are (a) the critical depletion of forest resources, (b) insufficient forest revenues, and (c) establishment of program priorities.

A. Resource Depletion

55. At the beginning of the century most of the high forest zone (8.2 million ha) was covered by closed forest which has now dwindled to about 1.7 million ha. The rise in fuelwood consumption will lead to a negative fuelwood balance (i.e. consumption will exceed increment) by the turn of the century unless countermeasures are taken. The desertification process has already begun in parts of the Upper and Northern Regions.
The deforestation is a result of the population increase which between 1970 and 1984 averaged 2.6 percent annually and is expected to increase. The population growth creates demand for new land for shifting agriculture and increases demand for fuelwood. In the long run, control of population growth is necessary to halt the ongoing resource depletion.

A re-evaluation of land use, taking into account both economics and sustainability, is necessary for reversing the downward ecological trend. This suggests a land use program placing high priority on perennial crops (tree crops and forestry) and minimizing the ecological damage of growing annual crops by increased use of mulching, leguminous crops and intercropping with trees, particularly nitrogen fixing species. Bush burning practices must be improved. More dynamic programs are necessary in agroforestry, extension and industrial forestry than those going on at present.

In 1970, the felling cycle was reduced from 25 to 15 years, in order to utilize overmature trees before their loss by disease and defects. Although this recovery may have been valid from an economic and forest management point for the initial felling, it would not be valid for a second or subsequent cut if the overmature trees were removed in the first cutting cycle as intended. The fact that poorly formed and overmature trees are often left now questions the reasoning behind the 15-year felling cycle, and reverting to a 25-year felling cycle should be implemented.

Minimum girth limits are set to avoid the cutting of undersized trees. The girth limit is 11 feet (3.35 m) for the most valuable species and 7 feet (2.13 m) for the remaining species. Enforcement of girth limits by the FD requires timely on-the-ground inspection of logging operations. Due to the prevailing constraints, such controls are not adequate and concessionaires tend to take the trees regardless of girth limit if it is financially worthwhile to do so. With the decline in field mobility, FD no longer effectively controls the concession operations, and this also affects the assessment of forest fees that concessionaires pay for the wood harvesting rights. Forest management and stumpage fee assessment should be improved.

B. Insufficient Forest Revenues (Working Paper V)

Fees on Industrial Forest Harvesting

Forest fees could be an important source of government revenue and could be used partly for maintaining and expanding the resource. It is important to ensure that forest fees reflect the changing market value of forest products. For this purpose it is useful to apply the derived value method which most directly relates the value of a standing tree to the value of end products derived from it. It represents the maximum price the buyer is willing to pay. The sales value per m³ of log is determined either through its direct value in the local or export market or indirectly from the value of converted products (sawntimber, veneer, etc.) minus the costs of conversion. Felling, skidding and transportation costs are
deducted from the log value at factory gate or log market to obtain the value per m³ of the standing tree (stumpage value). The derived value is very sensitive to the price of the finished end product, and this price varies for each tree species and with log quality. Logging and processing costs also vary considerably. In Ghana, it is sometimes difficult to obtain reliable data on sales prices and production costs. The examples of derived values made in this study (WP V) give an indication for some specific species and end uses. To get more precise data requires more detailed studies of sales prices and costs and a wider coverage of tree species, log quality and end use.

61. Another way to obtain an indication of appropriate stumpage fee levels is to examine the prices that are paid per m³ of logs between concessionaires who enter into felling agreements with each other. Prices in felling agreements will usually tend to be lower than derived values because profits are shared between buyer and seller. Prices in felling agreements have the advantage of representing an average log quality while derived values are based on a specific log quality (sawlog, veneer log, export log, etc.).

62. Below the new MLNR royalty rates are compared with prices in felling agreements:
Comparison of Standing Timber Stumpage Prices from Representative Felling Agreements and Royalty Rates

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15m³/tree (¢/tree)</td>
<td>10m³/tree (¢/tree)</td>
<td>(¢/tree)</td>
<td>(¢/tree)</td>
</tr>
<tr>
<td>Edinam</td>
<td>(</td>
<td></td>
<td>4,500</td>
<td>400</td>
</tr>
<tr>
<td>Mahogany</td>
<td>(</td>
<td></td>
<td>9,500</td>
<td>400</td>
</tr>
<tr>
<td>Makore</td>
<td>(15,000–30,000)</td>
<td>(10,000–20,000)</td>
<td>9,000</td>
<td>450</td>
</tr>
<tr>
<td>Sapele</td>
<td>(</td>
<td></td>
<td>6,000</td>
<td>450</td>
</tr>
<tr>
<td>Utile</td>
<td>(</td>
<td></td>
<td>9,000</td>
<td>500</td>
</tr>
<tr>
<td>Candollei</td>
<td>15,000–26,000</td>
<td>10,000–17,500</td>
<td>6,000</td>
<td>400</td>
</tr>
<tr>
<td>Odum</td>
<td>12,000–16,500</td>
<td>8,000–11,000</td>
<td>5,000</td>
<td>400</td>
</tr>
<tr>
<td>Asanfina</td>
<td>(</td>
<td></td>
<td>2,500</td>
<td>300</td>
</tr>
<tr>
<td>Danta</td>
<td>(</td>
<td></td>
<td>3,000</td>
<td>200</td>
</tr>
<tr>
<td>Dahoma</td>
<td>(12,000–12,400)</td>
<td>(8,000–8,250)</td>
<td>1,500</td>
<td>200</td>
</tr>
<tr>
<td>Guarea</td>
<td>(</td>
<td></td>
<td>3,000</td>
<td>200</td>
</tr>
<tr>
<td>Kusia</td>
<td>(</td>
<td></td>
<td>3,500</td>
<td>350</td>
</tr>
<tr>
<td>Ofram</td>
<td>(</td>
<td></td>
<td>3,000</td>
<td>300</td>
</tr>
<tr>
<td>Wawa</td>
<td>7,500–12,400</td>
<td>5,000–8,250</td>
<td>2,000</td>
<td>200</td>
</tr>
<tr>
<td>Other Secondary</td>
<td>7,500–9,000</td>
<td>5,000–6,000</td>
<td>1,000–2,000</td>
<td>100–200</td>
</tr>
</tbody>
</table>

Note: The per m³ charges in felling agreements have been converted to a per tree basis assuming 15 m³ per tree and 10 m³ per tree.

The 1985 MLNR proposal was approved by the PNDC subsequent to the April 1986 Sector Review Mission.

63. The table illustrates that although the new royalty rates are 10-15 times higher than the 1983 rates, they are still about 2-5 times lower than prices charged in felling agreements, and were thus too low when they were introduced. This results in inadequate forest revenues. As expected, the estimates of derived values resulted in higher values than prices in felling agreements. The margin is about 45-90 percent. However, introduction of stumpage fee rates based on values in felling agreements would be an improvement until more precise rates based on derived values could be calculated. In fact, more important than to find the absolute rate level would be to keep rates current with changes in product prices and cedi value. Frequent indexing of fees is therefore necessary. Below is the analysis of the totality of the forest fees:
### Analysis of Revenue Potential from Forest Fees based on 1985 Industrial Wood Harvest (927,500 m³)

<table>
<thead>
<tr>
<th>Composition of Fees</th>
<th>Concession Lease</th>
<th>Silvicultural Fees</th>
<th>Royalties</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Collected amounts 1/</td>
<td>NA 2/</td>
<td>1.4</td>
<td>7.3</td>
<td>NA</td>
</tr>
<tr>
<td>2. Potential collection based on April 1986 fee rates</td>
<td>8.2</td>
<td>5.3</td>
<td>19.5</td>
<td>33.0</td>
</tr>
<tr>
<td>3. Potential collection based on newly introduced royalty 3/</td>
<td>8.2</td>
<td>5.3</td>
<td>262.0</td>
<td>275.5</td>
</tr>
<tr>
<td>4. Potential assessment based upon prices in felling agreements (April 1986) 4/</td>
<td>41.0</td>
<td>11.5</td>
<td>1,100.4</td>
<td>1,152.9</td>
</tr>
<tr>
<td>5. As above - redistributed 5/</td>
<td>508.0</td>
<td>184.0</td>
<td>461.0</td>
<td>1,153.0</td>
</tr>
<tr>
<td>6. Approximate economic value (total rent) 6/</td>
<td>41.0</td>
<td>11.5</td>
<td>1,870.5</td>
<td>1,923.0</td>
</tr>
<tr>
<td>7. Percentage of forest fee capture of total rent</td>
<td></td>
<td></td>
<td></td>
<td>60.0</td>
</tr>
<tr>
<td>8. Potential assessment adjusted due to exchange rate change (US$: 150) 7/</td>
<td>571.0</td>
<td>207.0</td>
<td>520.0</td>
<td>1,298.0</td>
</tr>
</tbody>
</table>

**Note:** Line 1 to 7 refer to cedi values as per April 1986.

1/ In 1984 7.3 million of royalties inside forest reserves and 1.4 million of silvicultural fees were collected.

2/ NA - data not available.

3/ New royalty rates were introduced in 1986. Royalties have increased by a factor of 13.4.

4/ Introduction of rates based on prices in felling agreements (using the 15 m³/tree model) would increase royalties by a factor of 4.2 compared to newly introduced rates. Concession lease and silvicultural fees have been increased based on the FD proposal.

5/ Redistributed so that area based fees make up 60 percent and silvicultural fees 16 percent of total.

6/ Based on unchanged area fees and estimates of derived value on stump being 70 percent above values in felling agreements. The value per m³ at stump would be 2,073 or US$23.0.

7/ Exchange rate adjustment of total charge 1,153 million. Local sales 58% of volume correspond to a share of 669 million which is not adjusted. Fee value 484 million corresponding to export share adjusted by factor of 1.3 resulting in 629 million.
64. Using the FD proposals on area fees and the newly introduced royalty rates, revenues would increase from $33 million to $276 million (line 2 and 3). But if royalty rates based on the moderate level of felling agreements were introduced, fees would increase to $1,153 million (line 4). In addition to being too low and resulting in inadequate government revenues, the new rates distort the proportion between area-based fees from 41 percent of total to 5 percent of total, and the silvicultural fees (to be paid into the forest improvement fund) would drop from 16 percent to 2 percent of the total. In this review, the total fee amount was, redistributed so that area based fees would amount to 60 percent of total and silvicultural fees to 16 percent of total (line 5). Adjusting the total stumpage fee amount for cedi devaluations since April 1986 (line 8) suggests that the overall potential revenue should be about $1,298 million, more than four times what would be collected using the newly introduced rates. This would result in the following fee levels:

Concession rent $140 per ha
Silvicultural fees based on area logged: inside Forest Reserve $288 outside " " $144
Royalties: Doubling of the rates introduced in 1986.

65. The value on stump of the 927,500 m$^3$ wood volume harvested (1985) has been estimated (line 6) at $1,923 million - about US$21 million (April 1986) - which represents a stumpage value per m$^3$ of US$23.0. The proposed stumpage fees would capture 40 percent (US$9.3 per m$^3$) of this estimated value while the system presently in force would capture only 9 percent (US$1.98 per m$^3$).

**Fuelwood Tax**

66. The proportion of fuelwood harvested in forest reserves is a minuscule part of total consumption. Fuelwood is not, therefore, affected by stumpage fees as is the industrial wood harvest, and fuelwood prices are determined largely by the cost of extraction and transportation, while the standing wood is regarded as a free resource. The GOG should consider taxing fuelwood to generate funds for the management of woodlands and to plant trees. The fuelwood tax should relate to the stumpage value considering long term afforestation costs. It would be levied only on fuelwood merchants and not on individuals gathering wood for own consumption. Fuelwood taxes could be administered in two different ways: (a) local communities who do large-scale fuelwood harvesting and charcoal production could be grouped into associations and allowed to charge a fee, set by the FD, to fuelwood merchants, or (b) the FD could collect taxes at road blocks leading to major cities and channel funds into the government treasury. The scale necessary for rural afforestation would make the involvement of local farming communities absolutely necessary, as they
would be more interested and involved in managing and renewing the resource by natural regeneration and planting. The former option of channelling revenue to these communities would, therefore, be much more attractive and effective. FD and MOA would then advise such communities on tree planting and the management of savanna woodlands (rotational cutting systems). The proposed system would give local communities an incentive to manage the resource. The FD staff would be less involved in "policing" at checkpoints and could be used more productively in resource management.

C. Evaluation of Program Priorities

Industrial Forestry

67. As previously shown, the present resource base, if adequately managed, could produce 1.1 million m$^3$ annually on a sustained yield basis. Applying the April 1986 value per m$^3$ on stump of US$23.0, an annual harvest would be worth US$25.3 million or £3,795 million. After processing by the forest industry the value of forest products would be about US$75 million (1985 dollars). It is estimated that the 1.1 million m$^3$ can be achieved from an area of 1.7 million ha of existing forest reserves plus additional 0.3 million ha of forests which would be brought under sustained yield management. The average annual net yield would thus be £1,898 per ha (value on stump).

68. It is of interest to compare the above figures with the FD operational costs and the additional costs, necessary under the proposed forest management program to achieve the above forest yield:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD annual expenditure</td>
<td>£ 390 million</td>
</tr>
<tr>
<td>Cost of the proposed Forest Management Program (incl. SFS) Annually</td>
<td>£ 395 million</td>
</tr>
<tr>
<td>Total</td>
<td>£ 785 million</td>
</tr>
</tbody>
</table>

Revenues from forest fees (as proposed) would be about £1,395 million with the potential for increase, and would also supply the industry with foreign exchange, employment and a basis for sales taxes. It should therefore be a high priority of GOG to rehabilitate the FD and ensure that the existing forest resources are managed on a sustained basis.

69. Expanding the resource base as to achieve a production above 1.1 million m$^3$ could be done in different ways:

(a) by either the government or private industries establishing industrial plantations; and

---

6/ Present FD expenditure is only partly spent on industrial forestry.
(b) promoting the growth of trees on farms with both annual crops and cocoa. Such a program would promote farmers' interest in conserving existing tree stocks and supplementing it by planting.

70. Investment in industrial forest plantations is expected to yield a rate of return of about 10-15 percent. The government should encourage timber companies to establish plantations by providing land on reasonable financial terms and by providing security of tenure (such a development is beginning to take place in Nigeria). It is important, however, that such schemes are well planned and would serve specific industries. However, in Ghana there are more natural forest timbers available than in Nigeria and the private sector here would possibly at this stage not be as ready for investing in industrial plantations. Because of the long term nature of timber production the government therefore has a pioneering role to play and should therefore study possibilities with the purpose of formulating an incentive policy.

71. Growing an increasing amount of industrial timber on agricultural lands in the forest zone could be an alternative to expanding the industrial forest estate and should be promoted by the government. A rural forestry program would promote conservation and better use of the considerable volume of valuable tree species on farmlands. Shifting agriculture is gradually diminishing this asset, but the trend could be reversed by a rural forestry program. Farmers would plant new trees at a lower cost than the government and the economic return on rural forestry, for industrial wood production, would therefore be higher than direct government planting. The risk of such a program would be the uncertain farmer response, and expansion of government industrial plantations should thus always be an alternative in the long run while the short and medium term priorities for government investments should be on rehabilitating the existing industrial resource base (the proposed forest management program) and on supporting rural forestry programs which could supply sawlogs, poles, fuelwood and fruit.

Rural Forestry

72. The value of fuelwood and charcoal consumed annually is about US$197 million. Because of the magnitude of the effort involved in maintaining and planting trees, and the need to have trees growing on farms throughout the landscape for ecological reasons, it would be necessary to involve the local population in rural forestry. The Government could support such programs by providing seedlings and through education and extension programs. Rates of return of rural planting projects based on products alone are about 12-18 percent under Ghanaian conditions. If ecological benefits are added and industrial timbers in the forest zone are salvaged, the rate of return probably would be about 19-25 percent.
Pulp and Paper

73. Pulp and paper prospects for Ghana warrant special comment. Ghana imports paper products valued at about US$2.7 million per year. Even if consumption went up four times to 24,000 tons (the double of FAO's forecast for year 2000) to represent a figure of 2 kg per inhabitant, this would only equal about US$11 million. Investment in a pulp and paper mill in the present situation would yield very low rates of return (5 percent or lower) and would require capital expenditure of US$250 million and upwards. Thus, investing in this sector is clearly less attractive than investing in industrial or rural forestry which is presently not being done adequately because of insufficient financing. A pulp and paper mill would require establishing new plantations (only about 1,000 ha of pulpwood plantations have been established) and should be evaluated on its own merits and not as a venture utilizing an already existing resource.

IV. AN AGENDA FOR PUBLIC POLICY

A. Prospects

74. Forestry makes an important contribution to exports, employment and environmental health. The resource is under pressure, however, and government policy must be directed first toward preserving the existing forest resource and then toward expanding it. Forest management must be strengthened and an effective rural forestry program established. The future of forest industry depends on greater capacity utilization of existing production plants and greater domestic value added. The existing forest policy is very general, and it would be useful to adopt a more specific policy statement which delineates the major strategies that the GOG wants to pursue. In addition to the more general policy statement an action plan should be prepared and could be revised every fifth year or sooner to take into account experience gained and changes in external factors affecting the policy. It is proposed that the MLNR draft such a forestry action plan with other relevant government bodies and that the MLNR employ a highly qualified forest sector specialist so that it would be able to better carry out a current national resource policy formulation and implementation.

- **Recommendation 1.** The GOG should manage its forest resources more effectively and encourage local firms to increase domestic value added. The environmental consequences of deforestation must be recognized and the process reversed. These objectives should be reflected in the government forest policy statement, and a rolling five-year action plan should be developed. MLNR should be strengthened to allow better policy formulation and monitoring to take place.

- **Recommendation 2.** The FC's monitoring of the forestry sector and advising of the PNDC overlap with the functions of the MLNR and
FD, resulting in possible conflicts and duplication. The GOG should review the position of the FC with the view of incorporating it into MLNR to ensure better coordination of forestry and wildlife programs.

- **Recommendation 3.** The FD needs better monitoring by the MLNR, improved fiscal control, and some reorganization with strengthening of line functions. The entire staff strength should be reviewed and staff in inactive or unproductive units reduced (expansion of productive units may subsequently be required).

### B. Role of Government

75. In industrial and informal sector forestry the government should support the long-term health of the sector by maintaining the resource. Forest industries (both industrial and informal sector) should be left to the private sector. The GOG should pursue two core programs: forest management, and rural forestry. These should be supported by improvements in forestry research and education, and by better coordination and policy formulation in the MLNR. At the same time it is important that forest industries and the forest products trade are monitored to regulate level of taxation and to ensure that policies are appropriate. Recommendations concerning the proposed programs and the policies to support them are given in paras 77 to 106.

- **Recommendation 4.** In the short term the government should concentrate on improved forest management and control, and on a rural forestry program (core programs), supported by the rehabilitation of forestry research and improvement of forestry education and training.

- **Recommendation 5.** The government should encourage private sector investments in industrial plantations by providing land and security of tenure. Additional methods and fiscal incentives to stimulate private industrial plantations should be studied and considered. In the longer term establishing government industrial plantations could also increase the resource base if it is determined that additional non-private efforts are warranted.

76. **Population Issues.** Land pressure on the humid forests in the south because of shifting cultivation in agriculture, and in the north because of population numbers exceeding the land's carrying capacity, pose a significant long-term risk for forestry and the environment. An effective program of population management is important.
C. Core Programs

Forest Management (WP VI)

77. The proposed program would have the following components: (a) management of natural forest in the reserves, (b) rehabilitation of forest plantations, and (c) increasing the forest area under sustained yield management.

78. To return to a system in which felling volume is based on volume increment, it is necessary to carry out inventory and management plans for forest reserves. The ODA is presently assisting the GOG in such work and efforts should be expanded to finish within a five-year period. Under the program, upkeep of reserve boundaries and better enforcement of existing regulations would be implemented.

79. Forest plantations (52,000 ha) need to be registered and mapped and rehabilitation programs initiated for weeding, fire protection and thinning. This would require marketing initiatives and close contact with industries for chemical treatment of poles, and the sawing of small dimension logs from thinning.

80. The proposed annual cut of 1.1 million $\text{m}^3$ includes 0.12 million $\text{m}^3$ of sustained felling in a high forest area of 0.3 million ha outside of forest reserves. For environmental reasons and to increase forest production, it is recommended that an attempt be made to bring an area of that size under sustained yield management. The first stage of this pilot program would be to locate the areas of closed forest, using satellite imagery where possible and to make ground reconnaissances. The second stage would be aerial photography. A forest inventory and sociological study of the land tenure system and the people's attitudes toward trees and agriculture would follow. Forest management should be undertaken in close collaboration with the people so that they share in the rewards of forest harvesting and maintain an interest in conserving the forest. The forest management program should be accompanied by the following policy measures.

81. Forest Management: To avoid depletion of the forest until forest management plans can be implemented, Ghana should revert to a 25-year felling cycle, controlling it strictly and also enforcing existing girth limits. To improve the FD's control of concessionaires' operations and to facilitate their own logging plans and marketing strategy, stock mapping should be reintroduced, and the trees enumerated in connection with approval of felling plans. The concessionaires should be obligated to furnish such plans, but the FD or local forestry consultants could prepare them if concessionaires lack the necessary expertise.

82. Concessions: The present concession patchwork should be rationalized. For the purpose of better management, forest reserves would be divided up into concession units of optimally 25,000 ha, taking into account forest reserve size and natural boundaries easily identifiable both
on maps and in the field. Concessions should be no smaller than 10,000 ha. Concession rationalization should begin with concessions in forest reserves because of the benefits to forest management. There are two main options in the method of how to proceed: (a) cancellation of remaining concession tenure by decree followed by reallocation; (b) cancellation of concessions which have been operated in violation of existing regulations combined with cancellation of tenure of other concessions when they expire. The first option would be the easiest to administer. After notifying concessionaires, cancellation would be done sequentially by forest reserve. Upon cancellation these new concession units would be reallocated by auction, providing a fair and impartial vehicle for allocation. Cancellation of the remaining tenure of existing concessions would raise issues of equity since the cutting rights to timber granted by the government have acquired considerable value, as concession fees and royalties have remained static in the face of rapid inflation. These values to concessions have been created by the government by not keeping concession fees and royalties current. But, if concession fees and royalties are raised to better reflect the value of concessions and the timber thereon, then the cancellation of concessions and their reallocation would be less of an equity issue. One way to deal with the issue of unfairness would be to offer compensation to former concession holders and give them a share of the revenues generated from the bids paid for new concessions. This portion could be one-third, one-half, two-thirds or whatever is judged fair. A portion of total revenues generated within a forest reserve from the auctioning of new concessions could be distributed to previous concession holders on a simple per ha basis. Another possible avenue would be to compensate former concession holders by offering them shares in the state owned industries instead of cash compensation. In the second option (b above), mismanaged concessions would be seized by the government. Indications are that more than 50 percent of concessionaires are violating existing regulations. It would therefore be possible to cancel such concession agreements and carry out a reallocation. Although this option may be easier to agree upon from a political point, it has some drawbacks. First of all, there would be numerous arguments from concessionaires trying to justify their cases of violation, secondly as concession agreements range from 10 to 30 years the remaining concessions would expire at different dates and the whole exercise would be drawn out. Because of these disadvantages the Bank would recommend the first option but has understood that the MLNR and FD would prefer to proceed with the second alternative.

83. Forest Fees: To create the revenue base for the GOG to fund the proposed forest management program, a fourfold increase in forest fees is recommended together with a redistribution between area fees and royalties. Area-based fees should be at least 60 percent of total fees. Proposed fees are indicated in para 64. The proposed revision of forest fees will be insufficient, because experience has demonstrated that the fees quickly become outdated. Revising fees requires legislation and PNDC approval and it would be unrealistic to expect such revision to take place frequently enough to reflect changes in prices and exchange rate. Forest fees should therefore be indexed semi-annually. And the revision of the entire fee
system could thus be done less frequently, perhaps every third year. Semi-annual indexing would simply reflect changes in log values in cedi terms estimated both from export log prices and from prices of lumber (export and local) converted to log basis.

84. Funding: Program funding tends to constrain the achievement of forestry sector targets in many countries. Timely release is as important as the total magnitude of funding. How forest fees are shared is a political decision but clear guidelines are necessary. The GOG should review the present sharing of forest revenue, and also examine whether proportions that are kept at the local level are used to enhance the community's interest in maintaining the forest. The Forestry Improvement Fund should be maintained. With proposed increased revenues, the silvicultural fees (which are paid into the fund) would equal about $207 million, 20 percent of the proposed expanded FD budget (Appendix 2).

- Recommendation 6. The inventory of forest resources in forest reserves and plantations should be completed. A special effort should be made to identify remaining virgin forests, and conserve them for preservation of genetic resources.
- Recommendation 7. The government should enforce an annual cut of 1.1 million m$^3$ and implement a policy of effective sustained yield management.
- Recommendation 8. Ghana should return to a 25-year felling cycle.
- Recommendation 9. In order to encourage efficient resource use, Ghana should reallocate concessions.
- Recommendation 10. Forest fees should be increased fourfold and area based fees be at least 60% of total. Fees should be indexed every six months.
- Recommendation 11. The government should fund the FD timely and adequately. It should review the present sharing of forest fees and ensure that adequate proportions collected by the government be allocated to forest management programs. Funds retained at local level should be used for community development.

Rural Forestry (WP VII)

85. Rural forestry requires much coordination because of the various agencies involved. The principal agencies are the FD, LD, MOA, MRD and the Energy Board under the Ministry of Fuel and Power. A lead agency and a national agroforestry coordinator should be nominated. The coordinator would be supported by a silviculturist and an extension and training coordinator; both should be senior experts in their field with experience in similar posts. The silviculturist would be responsible for setting up demonstrations, advising FD regional and district staff responsible for FD nurseries, and for monitoring and evaluating the results. The extension and training coordinator would direct the preparation of extension
materials, and would coordinate the extension and training program. As agroforesters graduate from IRNR and SFS, the FD would gradually appoint regional and district agroforestry staff.

86. The rural forestry program would have the following components: (a) studies of local customs of land and tree tenure and attitudes of the rural population towards tree planting, (b) project related training, (c) agroforestry extension, (d) nursery rehabilitation, (e) establishment of demonstration plots in agroforestry, and (f) monitoring and evaluation.

87. The program should conduct a survey using sociologists from the universities in Ghana. The study should focus on local customs of land and tree tenure and the opinion of farm families concerning agricultural improvement, present and future supplies of forest produce for domestic use and for export, the effectiveness of government agencies in the area, and any other factors that might affect the rural forestry program.

88. Presently the MOA extension staff and most FD staff do not have any educational background in agroforestry. Therefore, such staff should be trained in agroforestry and extension. The extension and training coordinator would initiate training of instructors for such courses which could be held at the SFS and at the four agricultural colleges.

89. Extension would be carried out at various levels. The media would broadcast an educational program on the value of trees, how to protect and regenerate them and on control of bush fires. At the district level, extension would primarily be administered by the MOA extension staff who after training would be equipped with extension materials including agroforestry. FD regional and district staff would work closely with the MOA extension personnel and would provide extension lectures to schools, church groups, social clubs etc.

90. Government nurseries would gradually be rehabilitated and if necessary new ones constructed to meet the rural population's demand for seedlings. The production of highly-demanded fruit trees, trees for fuelwood, poles and timber would be emphasized. The regional agroforestry officers would be responsible for the operation of the nurseries.

91. The silviculturist would select at least six sites for demonstration plots. The demonstrations would show how trees can be integrated into a more stable agricultural cropping system, involving longer use of the same land area while minimizing the decline in soil fertility. Each demonstration should consist of four adjacent treatments: (i) the agricultural cropping system which is traditional in the areas; (ii) the traditional cropping system plus intercalated fruit and pole trees; (iii) IITA-type alley-cropping with single row hedges and 4-5m alleys for traditional crops; and (iv) complex multi-story mixed cropping farm (WP VII).
92. Farmer response and the survival of trees planted as well as success of nursery programs and demonstrations should be monitored on a systematic basis.

93. Although the program would be national in character and make available seedlings and a framework of extension in all districts, there would be more intensive programs in areas where the rural forestry is most needed and farmer response, therefore, probably the greatest. Areas of intensive development would include the Upper Eastern Region and isolated areas in the eastern part of Northern Region where there are fuelwood shortages and the beginning of desertification. Other areas of special interest are forest reserves with problems of encroachment and areas that are earmarked for reservation under the forest management program. It is a long-term program and its size is limited mainly by the institutional capacity which favors gradual development in line with increasing farmer response. Program costs are estimated at $222 million annually in excess of the FD operational budget (Appendix 2) and would cover vehicles, technical assistance and incremental recurrent costs. It is estimated that over a five year period the program would be able to rehabilitate/construct 50 nurseries to produce 12.5 million seedlings annually. Assuming a 50 percent survival rate and the planting of 25 trees per ha this would affect a land area of 250,000 ha annually. The mean annual increment from 6 million single trees is an estimated 50,000 m³ annually. This would be in addition to natural regeneration from seeds and suckers which would be the main source of tree establishment. The rural forestry program should be accompanied by the following policies.

94. **Land Tenure:** The user rights to trees vary with local customs. The GOG should promote a policy of giving usufruct rights to trees to the farmer cultivating the land or to local communities when the land is not under cultivation. In the high forest areas, the use of commercial timber trees is regulated through concession agreements. With the proposed increases in concession leases, concessionaires may rid themselves of those parts of their concessions that produce little or no timber. Areas outside forest reserves will, therefore, increasingly be excluded from concession agreements. The GOG would then have the opportunity of extending tree tenure rights to the farmer or local communities and would form a better basis for the proposed rural forestry program.

95. **Fuelwood Tax:** The FD should set tax rates on fuelwood and charcoal and authorize and assist local producer communities to charge fuelwood dealers such fees. Part of these charges should be spent by the local communities on community development including tree planting.

96. **Regulations on Fire:** By better range management and bush burning practices, the number of fires and the damage caused by individual fires can be reduced. In unfarmed savanna areas, it would often be an advantage to introduce early burning (November-December), carried out before the vegetation gets too dry (January-February). Early burning is already carried out in forest reserves by the FD in the Northern and Upper Regions.
The GOG should promote the elaboration of fire regulations at regional and district levels.

- **Recommendation 12.** In order to establish an effective rural forestry program, MOA extension officers should be trained in agroforestry and agroforestry should be included in the extension package.

- **Recommendation 13.** The FD should carry out a study of land tenure and tribal rights toward forest resources and revenues.

- **Recommendation 14.** The government should implement a fuelwood tax, to be collected through local community associations.

- **Recommendation 15.** Fire regulations should be worked out at the local level and endorsed by the government.

### D. Associated Programs

97. Improved performance in forestry research and education would support the proposed core programs. An increased effort in national parks and wildlife conservation is recommended as part of the improved resource management.

**Forestry Education** (WP XII)

98. The rehabilitation of FD and its success in the management of forest resources will depend primarily on the adequate provision of well-educated, trained and motivated staff. GOG attention should thus be focused on the teaching staff and budgets of educational institutions.

99. At present agricultural staff do not receive training in agroforestry. The newly created small agroforestry unit in the MOA could play an important role by introducing agroforestry into the agricultural education at both university and technical level and in the development of appropriate syllabi.

100. The SFS has a direct role to play in arranging for training courses under the proposed forestry programs and provision for technical assistance and necessary equipment is included in FD's budget under the core program.

101. The B.Sc. course at IRNR would benefit from an additional year with more forestry specialization. The IRNR has plans to introduce an agroforestry option parallel to the more traditional forestry course. The possibility of specializing during an additional year should be considered instead. In the diploma course, rural sociology and extension work are absent and should be included. A business management course should perhaps be included in both B.Sc. and diploma courses. The introduction of new M.Sc. level courses at the moment should be given less priority than the improvement of the current M.Sc. and diploma courses. Upgrading the IRNR
with additional senior staff, vehicles, teaching materials and technical assistance (WP XII) would add ₤27.2 million to annual costs of operating the IRNR (Appendix 3).

- Recommendation 16. Agroforestry instruction should be given in connection with all forestry and agricultural education.

- Recommendation 17. It is recommended that the IRNR be fully integrated with the UST.

Forestry Research (WP XI)

102. The proposed rehabilitation of the FPRI should begin with a review of the entire institution, its work program and staff strength. Existing research data should be examined, extracted and recorded in a format that allows for rapid retrieval of research results. Based on the information gained from such an exercise, it would be possible to identify: (a) areas of research completed, (b) investigations partially completed or requiring an extension of study for completion, and (c) important areas of research not yet covered by any investigation. A revised work program should be drawn up based on identified needs in the forestry and forest products sectors. Priority should be given to experimental work of direct assistance to the FD core programs. In connection with such revision, the relevance of existing field stations should be examined. The three year program would cost ₤21 million, and would cover technical assistance (4 man months) for a review of the research program and essential equipment and materials.

103. The redirection of priorities and modest improvements in facilities mentioned above are essential for making the FPRI operational. Further expansion should depend on the success of the core programs and availability of funding. An agroforestry research program in conjunction with the rural forestry program would be useful. Such a program would focus on developing techniques to arrest soil decline using intercropping with element accumulating species, crop residue mulches, cover crops etc. The cost of the proposed program (WP VIII) would be ₤76 million (Appendix 3).

- Recommendation 18. The government should review the work program and institutional aspects of the FPRI and carry out a rehabilitation to make the institute operational.

Wildlife (WP X)

104. A program to rehabilitate the GWD and fund major wildlife programs (WP X) has been drawn up, and includes: (a) improving the logistics of GWD, (b) technical assistance and training, (c) rehabilitating the Mole and Digya National Parks, (d) a game production program, and (e) a conservation education program. The program should provide technical assistance and training to strengthen the GWD and provide material and equipment. The five-year program was estimated to cost US$2.9 million, most of which would be foreign costs. The program would add an additional
J88 million annually to the GWD's budget. The Government should consider requesting outside assistance for its conservation efforts.

- **Recommendation 19.** Because of the importance of wildlife in Ghana, the GWD should always be consulted in connection with projects affecting large-scale land use.

- **Recommendation 20.** Game licenses and park entrance fees should be raised to reflect inflation and change in cedi values.

E. **Forest Industry (WP VIII)**

105. The Ghana timber industry has demonstrated considerable survivability during the country's economic crisis. The industry is now in the process of rehabilitation and the government should continue its policy of allowing the sector to function freely within the framework of forest regulations, taxes and foreign exchange regulations. The GOG should pursue its plans of getting the private sector involved in the state-owned companies. This could be achieved by equity participation, leasing agreements, and management agreements. The first two methods are recommended, and leasing arrangements leading to a gradual participation in equity would also be possible. Management agreements tend to be less effective because of the managing company's lack of financial involvement. Investment in a pulp and paper mill is clearly less attractive than investing in forest resource programs but initiatives should be left open for the private sector. The Government should prepare a strategy for how to avoid future government investment in forest industries and for obtaining private participation in existing state owned industries.

106. How to keep the industrial wood harvest within the prescribed allowable cut is a major issue. The proposed increase in forest fees would have a positive impact on the wood industry by encouraging a higher wood recovery from the trees felled, thereby reducing waste. It should force the most inefficient mills out of business and stimulate investment in replacement equipment that can achieve higher rates of recovery, as well as investments in equipment creating value added such as drying kilns, treatment plants and wood working machinery. In addition to higher fees, better forest regulations and control, it may be helpful to control annual felling volume by regulating log exports and the capacity in primary processing. It is too early in the rehabilitation process to propose further restrictions on log exports. Log exports should, however, be monitored closely and if wood processing in Ghana continues to expand and be economical, the government should either extend the existing log export ban to cover remaining species or replace the export ban by heavy taxes on roundwood exports graduated by tree species. An additional way to control roundwood consumption would be to register and license all primary processing plants, and to not allow further capacity expansion (but replacement only).

107. Statistical data on log production, exports and product manufacture are insufficient, and it is recommended that the FPIB require
companies to report production and that such reports be monitored closely. While the FPIB should be responsible for obtaining data on production, the FD would continue assessing royalties by stump counts which is an integral part of forest management and control of concession operations.

- **Recommendation 21.** The government should seek private sector participation in forest industries and refrain from investing in pulp and paper industry.

- **Recommendation 22.** The government should support the rehabilitation of existing private sector firms.

- **Recommendation 23.** Statistical monitoring of the industry should be strengthened.
Figure 1 - Organization Chart of Government Institutions with Forestry, Forest Industries, Game and Wildlife Responsibilities

PROVISIONAL NATIONAL DEFENSE COUNCIL

MINISTRY OF AGRICULTURE
- NATIONAL AGROFORESTRY COMMITTEE

MINISTRY OF LOCAL GOVERNMENT
- ENVIRONMENTAL COUNCIL

MINISTRY OF LANDS AND NATURAL RESOURCES
- LANDS DEPARTMENT
- DEPARTMENT OF GAME AND WILDLIFE
- FORESTRY DEPARTMENT
- FOREST PRODUCTS INSPECTION BUREAU
- TIMBER EXPORT DEVELOPMENT BOARD

FORESTRY COMMISSION
- FOREST PRODUCTS RESEARCH INSTITUTE

LANDS COMMISSION
- INSTITUTE OF RENEWABLE NATURAL RESOURCES
### Cost of Proposed Core Programs

#### The Forestry Department

<table>
<thead>
<tr>
<th>Program</th>
<th>Local Costs (Million Cedis)</th>
<th>Foreign Costs (Million US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forest Management Program</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(industrial/forest)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicles and equipment</td>
<td>4.7</td>
<td>1.2</td>
</tr>
<tr>
<td>Technical assistance</td>
<td>-</td>
<td>0.5</td>
</tr>
<tr>
<td>Recurrent costs</td>
<td>57.4</td>
<td>0.3</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td><strong>62.1</strong></td>
<td><strong>2.0</strong></td>
</tr>
<tr>
<td><strong>Rural Forestry Program</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicles</td>
<td>9.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Equipment and materials</td>
<td>7.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Upgrading and nurseries and</td>
<td>24.2</td>
<td>0.2</td>
</tr>
<tr>
<td>construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical assistance</td>
<td>-</td>
<td>0.3</td>
</tr>
<tr>
<td>Recurrent costs</td>
<td>30.2</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td><strong>71.1</strong></td>
<td><strong>1.0</strong></td>
</tr>
<tr>
<td><strong>Sunyani Forestry School</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicles and equipment</td>
<td>0.5</td>
<td>0.1</td>
</tr>
<tr>
<td>Technical assistance</td>
<td>-</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td><strong>0.5</strong></td>
<td><strong>0.2</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>523.7</strong></td>
<td><strong>3.2</strong></td>
</tr>
</tbody>
</table>

Total budget expressed in cedis: 1,006.9

---

1/ Estimated necessary annual budget based on 1986 budget, actual allocations and 1986 salary increases.
GHANA
FORESTRY SECTOR REVIEW

Cost of Supplementary Programs

IRNR

<table>
<thead>
<tr>
<th>Description</th>
<th>Cedis</th>
<th>US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual level of expenditure 1/</td>
<td>8.9</td>
<td>0.23</td>
</tr>
<tr>
<td>Filling of vacant posts</td>
<td>3.6</td>
<td>0.09</td>
</tr>
<tr>
<td>Other additional required facilities and equipment US$290,000 in total</td>
<td>12.5</td>
<td>0.12</td>
</tr>
<tr>
<td>through a five year period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical assistance requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Working Paper XII 120 man-months through a five year period)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>Total budget in cedis:</td>
<td>39.7</td>
<td></td>
</tr>
</tbody>
</table>

FPRI

<table>
<thead>
<tr>
<th>Description</th>
<th>Cedis</th>
<th>US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent budget requirement</td>
<td>75.0</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicles and equipment (WP XI)</td>
<td>1.5</td>
<td>0.11</td>
</tr>
<tr>
<td>Technical assistance and training</td>
<td>-</td>
<td>0.02</td>
</tr>
<tr>
<td>Sub-total</td>
<td>1.5</td>
<td>0.13</td>
</tr>
<tr>
<td>Agroforestry Research Project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicles and equipment</td>
<td>3.0</td>
<td>0.18</td>
</tr>
<tr>
<td>Technical assistance and training</td>
<td>-</td>
<td>0.16</td>
</tr>
<tr>
<td>Recurrent costs</td>
<td>11.4</td>
<td>0.07</td>
</tr>
<tr>
<td>Sub-total</td>
<td>14.4</td>
<td>0.41</td>
</tr>
<tr>
<td>Total</td>
<td>90.9</td>
<td>0.54</td>
</tr>
<tr>
<td>Budget in cedis:</td>
<td>172.44</td>
<td></td>
</tr>
</tbody>
</table>

1/ Taking into account 1986 salary increases.
BURKINA FASO

UPPER WEST REGION

UPPER EAST REGION

GHANA

VEGETATION ZONES

- Reserved Forest
- Unreserved Closed Forest
- Rain Forest
- Transition Zone
- Moist Semi-Deciduous Forest
- Celtis-Triplochiton Association
- Anthon Chlorophora Association
- Guinean Savannah Woodland
- Sudan Savannah Woodland
- Thicket and Grassland
- Strand and Mangrove

NORTHERN REGION

Antananrivo

CÔTE D'IVOIRE

BRONG-AHAFO REGION

ASHANTI REGION

WESTERN REGION

GENERAL REGION

TOGO
BURKINA FASO

UPPER EAST
Bolgatanga
REGION

UPPER WEST
REGION

NORTHERN REGIOn

CÔTE D'IVOIRE

BAMPOI

BRONG-AHAFO
REGION

ASHANTI

WESTERN
REGION

CENTRAL
REGION

TOGO

Ghana

River Basins
And Climatic Zones

Rivers

River Basin Boundaries

Tributary Basin Boundaries

Climatic Zones:

1. Southern Savannah Zone
2. Transition Zone
3. Northern Savannah Zone
4. Southwestern High Rainfall Zone

- Region Boundaries
- International Boundaries

This map has been prepared by The World Bank's staff exclusively for the convenience of the reader and is not intended for the internal use of The World Bank and the International Finance Corporation. The depictions used and the boundaries shown on the map do not imply, on the part of The World Bank and the International Finance Corporation, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.
BURKINA FASO
NORTHERN REGION
BRONG-AHAFO REGION
ASHANTI
STERN
CENTRAL REGION
GHANA GEOLOGY
RECENT: Unconsolidated sand, clay, and gravel
ERTERIARY: Red continental deposits, mainly limonitic sand, sandy clay, and gravel
EOCENE & CRESCENT: Marine series of shale, sandstone, limestone
SEKONDIAN & ACCRAIAN (Devonian): Sandstone, grit, conglomerate, shale, and mudstone
VOLTAIAN (Paleozoic): Quartzite, shale, arkose, mudstone
BUEM FORMATION (Upper Pre-Cambrian): Sandstone, arkose, lava
TOGO SERIES: Quartzite, shale, phyllite
TARKWAIAN: Quartzite, phyllite, grit, conglomerate
UPPER BIRRIMIAN: Metamorphosed lava and pyroclastic rocks
LOWER BIRRIMIAN (Middle Pre-Cambrian): Phyllite, schist, tuff, and graywacke
DAHOMEYAN (Lower Pre-Cambrian): Acids and basic gneiss and schists
BASIC INTRUSIVES: Gabbro, dolerite, epidiorite
GRANITIC (Middle Pre-Cambrian): Granite and granodiorite
Region Boundaries
International Boundaries

This map has been prepared by The World Bank's staff exclusively for the convenience of the reader and is exclusively for the internal use of The World Bank and the International Finance Corporation. The omissions and the terms shown on this map do not affect the legal status of any territory or any endorsement or acceptance of such boundaries.
GHANA
EROSION HAZARD

- Land area where the predominant erosion hazard is slight to moderate sheet erosion
- Land area where the predominant erosion hazard is a combination of moderate to severe sheet and gully erosion but more of the latter
- Land area where the predominant erosion hazard is with moderate to very severe sheet and gully erosion but more of the former

* Land area where the predominant erosion hazard is with slight to very slight sheet erosion

Region Boundaries
International Boundaries

This map has been prepared by The World Bank’s staff exclusively for the convenience of the readers and is exclusive for the internal use of The World Bank and the International Finance Corporation. The denominations used and the boundaries shown on this map do not imply, on the part of The World Bank and the International Finance Corporation, any judgment on the legal status of any territory or any endorsement or assurance of such boundaries.