14 Ghana

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14.1 General aspects of forestry in Ghana

Ghana's total land area is estimated at 23.9 million hectares of which 15.7 million ha lie within the savanna zone (SZ) in the north while the remaining 8.2 million ha are within the tropical high forest zone (HFZ) in the south. The savanna zone is characterized by an open canopy of trees and shrubs with a distinct ground layer of grasses (Hall & Swaine 1981). Woodland covers about 9.4 million ha of the savanna zone, producing mainly woodfuel and small amounts of building poles for local use. The main economic activities in that zone include production of livestock and annual crops, such as cereals, root crops and cotton.

The high forest zone, dominated by farmlands and fallows with about 20 % being occupied by forest reserves (Nolan & Ghartey 1992; Hawthorne & Abu-Juam 1995), produces timber to meet the country's demand. A transitional zone that consists of a mixture of dry forest and savanna vegetation occurs between the HFZ and the SZ.

The HFZ comprises nine forest types each having distinct plant associations and characteristic rainfall patterns and soil conditions (Hawthorne 1993). These are the Wet Evergreen, Moist Evergreen, Moist Semi-deciduous South East, Moist Semi-deciduous North West, Dry Semi-deciduous Inner Zone, Dry Semi-deciduous Fire Zone, Upland Evergreen, Southern Marginal and Southern Outlier forest types. In general, these forests are wet in the south west, turning increasingly drier towards the north and east (Treue 2001).

Ghana's deforestation rate is presently estimated at approximately 65,000 ha per year. Much forestland outside the forest reserves (in the so-called off-reserve areas) has been degraded and converted to farmland over the past decades. The current off-reserve forest areas consist of a mosaic of agricultural fields, mostly cocoa and food crop farms, fallow lands, secondary forest patches and trees around settlements (Mayers et al. 1996; Kotey et al. 1998). About 350,000 ha of off-reserve areas are currently available for timber production (Affum-Baffoe 2010). Many timber trees exist in the off-reserve areas and an inventory of this area in 1996, showed a standing tree stock of about 268 million m^3 of timber. Before 2000, at least half of the timber harvested came from off-reserve areas, but this has declined in recent years (Hansen & Treue 2008). Today, the country's forest resources are highly degraded. Wildfires, agriculture and indiscriminate logging (mainly through chainsaw milling) have contributed to this situation.

14.2 Historical developments in forest exploitation

Early commercial exploitation of the natural forest resources dates back to the 15th century. Trade in kola nuts (seeds of *Cola nitida*) within the West African sub-region, and later wild rubber (*Funtumia elastica*) and palm oil (*Elaeis guineensis*) to Europe was reported between the 15th and 18th century (cf. Parren & De Graaf 1995). Quantitative data on exports of these products to Europe between 1911 and 1934 appear in the annual reports of the colonial forestry division (Asamoah-Adam et al. 2006). Timber exploitation, mainly of African mahogany (*Khaya* and *Entandrophragma* spp), started in 1891 when about 3000 m^3 of mahogany were exported (Taylor 1960). The trade has since grown steadily and become an important economic activity. In 2009, the forest sector contributed 4 % to Ghana's Gross Domestic Product (GDP).

Photo 14.1. Forest near Kakum in Ghana. (Photo Tropenbos International)

Forest regulatory mechanisms applied to forest reserves

The main forest regulations applied in Ghana involved the application of minimum felling diameters, felling cycle lengths, and a selected number of stems for allowable cut (selective logging). Other silvicultural interventions, for example tending, were only used on an experimental basis and thus at a small scale. Species were grouped using commercial or silvicultural considerations and on that basis the allowable cut was determined and silvicultural treatments targeted. In addition, forest policy controls (e.g. log export ban, export levy) were introduced to prevent excessive exploitation of some species. These regulations were implemented at the national level (Asamoah-Adam et al. 2006).

Minimum felling diameter

The application of felling diameter limits in Ghana commenced with the passing of the Timber Protection Ordinance in 1907. Logging was mainly controlled through application of minimum felling diameters to prevent and protect the felling of immature trees (Taylor 1960). These felling limits were revised in 1910, 1958, 1972, 1989 and 1997 (Ghartey 1992; Ofosu-Asiedu et al. 1997). The minimum felling diameters applied before 1950 were lower than the later limits, possibly because felling and skidding operations during the early period were not mechanized or capable of handling heavy logs. Felling

Photo14.2 Forest in the Goaso region, Ghana. (Photo Tropenbos International)

limits between 50 cm and 110 cm dbh are now used in Ghana for the exploitation of over 60 species from 49 genera (Asamoah-Adam et al. 2006).

Since 1989, minimum felling limits are fixed at a point in the species diameter distributions at which the average national stocking shows a sharp decline (Ghartey 1992). The 1997 revision adopted a diameter range similar to that of 1989, but classified some species into lower or higher limit categories based on additional variables, such as average diameter increments of different dbh classes, ten-year average annual exploited volume, stocking km^{-2} of stems above 40 cm dbh, and prevalence of decay in exploited stems of specific species (Ofosu-Asiedu et al. 1997).

Felling cycle lengths

Two different felling cycle lengths were instituted sequentially between 1960 and 1989 for forest reserve management in Ghana. A felling cycle of 25 years was started in the 1960s, when working plans for some forest reserves were first produced and the respective forests were opened for timber exploitation and silvicultural treatment. In 1972, a management operation, termed "salvage felling", was introduced to remove so-called over-mature trees. It was explained that the then on-going enumeration surveys had shown a preponderance of large diameter trees that were dying and or losing their timber value because of defects. It was believed necessary to remove them through commercial logging before they were lost to natural mortality. Although in other places, salvage felling is done with felling limits that are higher than in normal coupes, in Ghana the same felling limits were applied. Annual log production was increased by opening more areas to harvest, not necessarily by allowing re-entries into previously logged forests. Under this operation, all reserved forests with or without management plans were to be logged within 15 years. The records indicate that the salvage felling, which should have ended in 1987, continued until 1990 in the absence of an alternative yield regulation method. After 1987, salvage felling operations offered an unprecedented chance for second cycle felling in some forest reserves earlier than expected (Boakye-Dapaah 1990). In 1990, a forty year felling cycle was introduced based on the average time of passage estimated for most of the high value species to grow from the next lower diameter class to the exploitable class (Boakye-Dapaah 1990; Asamoah-Adam et al. 2006).

14.3 Productivity, annual allowable cut, silvicultural systems

In Ghana, two broad approaches have been used for determining permissible cut. They are the formula and direct diameter methods. Between 1950 and 1971 three formula methods developed by Jack, Kinloch, and Kandambi, all colonial foresters, were introduced (Anon. 1962). They were all derivatives of the Brandis method (Osmaston 1968) used in the Teak forests of the Far East, and part of the classical European methods

(Brasnett 1953). The Jack, Kinloch and Kandambi formulae determined the permissible cut as the total basal area recruitment for stems above 50 cm dbh (Anon. 1962), but the cut was prescribed in number of stems for each economic species per annual coupe. The yield was selected from stems within the felling diameter classes and usually the bigger stems were chosen first. When the total calculated yield was not obtainable from the available stock of exploitable trees, the deficit could not be taken from the lower diameter class (Asamoah-Adam et al. 2006). Between 1972 and 1989, and alongside the salvage felling regime, only the Minimum Felling Diameter (MFD) was used as the means to determine the permissible cut. By this method all stems of a given species recorded to be above the MFD during a 100 % timber inventory in a compartment were selected for felling (Anon. 1972, Anon. 1995).

After the 1989 national forest inventory, another formula method was introduced. This was based on the number of stems above the MFD and the number in the next lower dbh class. It provides for 40 % retention of trees above the MFD in moist and 60 % in dry forest to retain canopy structure, seed production and biodiversity level (Anon. 1995). Currently the formula is given as: $Z = 0.5Y + 0.2X$ (for the moist forest), and $Z = 0.25Y + 0.2X$ (for the dry forest)
where Z = the total permissible number of stems, Y = the number of stems of a given species above the MFD, and X = the number of stems of a given species in the next lower diameter class to the MFD.
The formula is applied at the compartment (128 ha) level and the Y and X estimates are obtained from a 100 % inventory (stock survey) of all timber trees above the X dbh class for each species. Vanclay (1993) indicated that the yield prescribed by this formula, if considered against diameter recruitment and stem mortality over a 40 year felling cycle, can be sustainable only when the ratio of X:Y is 3:1, a situation that is rare in the tropical moist forest. Furthermore, Asamoah-Adam (1999) pointed out that the 40-60 % retention envisaged by the above formula cannot be attained, because the algebraic equation for the retention input is incorrect. For instance, when the value of Y equals X, it means 70 % and 45 % of the mature commercial stems will be cut in a moist or dry forest, and the respective retention will become 30 and 55 % instead of 40 and 60 %, respectively. As the ratio of X to Y increases the retention value diminishes, but that is not what was intended. The continued use of this formula therefore, makes sustained timber production doubtful (Asamoah-Adam et al. 2006).

A timber yield and growth simulation model (GHAFOSIM) was developed by Alder (1990), but has not been used yet to determine the permissible cut at forest reserve level. This is due to the limited number of species for which increment data were available at the time of developing the model. However, it has been used at the planning level to provide estimates of stand mortality and species group time of passage that were used as inputs for the current yield regulation formula (Anon. 1995). The model was also used to determine the national annual allowable cut.

Silvicultural systems
Commercial exploitation of timber in Ghana began in the late 19th century. The rate of extraction even at that time led to the realization of the need to backstop exploitation by a management system that would forestall depletion of commercial stocks. However, this

was not possible without adequate knowledge about the ecology of the natural forest, growth patterns and silvicultural characteristics of the commercial species. Therefore, from about 1946, a series of silvicultural experiments were established to provide the requisite silvicultural insight for promoting natural regeneration and increasing stand productivity.

Photo 14.3. Transport of round wood. (Photo Tropenbos International)

The success of the systems adopted in those days in the silvicultural practice in tropical Asia led to the evolution of several silvicultural systems with many variations in other tropical forests. Noteworthy among the various forms of silviculture in tropical moist forests have been the tropical shelterwood systems and polycyclic systems (Dawkins & Phillip 1998). In Ghana a selection management system, or the modified selection system (MSS), was introduced in 1956. It was fashioned after the Malaysian selective system and included the concept of sustained yield. Although it was not regarded as a silvicultural system, in the absence of adequate information upon which to manage the forest under a silvicultural system, its application was justified as stand improvement (Mooney 1963).

Under the system, all economic trees with dbh > 67 cm were stock mapped along with improvement thinning of smaller trees of economic species (this was referred to as combined operations). Selective felling then followed, with yield regulated by minimum girth limits and a calculated maximum basal area on a 25-year cycle (see Baidoe 1970; Asabre 1987). Between 1958 and 1970, about 259,000 ha of forest have been thus treated. However, unlike the dipterocarp-rich forests of Malaysia and similar to Nigeria, Ghana's forests are characterized by low frequencies of valuable commercial species in the middle size classes. This meant that seed sources of desirable commercial species that were expected to constitute the regenerating crop were limited. Indeed, as noted by Asabre (1987), the modified selection system was a negation of silvicultural principles because exploitation consistently removed the best phenotypes and genotypes. Consequently, the system was abandoned in 1970 and girth increment sample plots were established throughout the high forest zone to provide information on growth and an understanding of the silvicultural measures necessary for satisfactory regeneration of the forest. In the interim, as already mentioned, a salvage felling system was adopted over a 15 year cycle with a view to remove, quickly, all over-mature trees because of the high incidence of decay that stemmed from the yield regulatory measures that had been applied.

Enrichment planting techniques were also tried in the 1940s and 1950s mainly in the wet evergreen forest belt to improve the stocking of poorly stocked forest reserves in Ghana. This system involved the planting of two-year-old striplings at 5 m intervals in cleared lines of 1.8 m wide. The lines were 20 m apart and parallel. Tending operations, such as cleaning and further canopy openings, were carried out to enhance the growing conditions of the young trees (see Asabre 1987; Prah 1994). But owing to inadequate knowledge above the extent of canopy manipulations that would ensure success, coupled with high operational costs, the system was discontinued in the early 1960s after about 2500 ha had been planted in two forest reserves.

Silvicultural experiments in Ghana

The major silvicultural systems that were experimented in Bobiri Forest Reserve were the Tropical Shelterwood System (TSS) and its variant the Post-Exploitation System (PES). The Girth Limit selection System (GLS), which remains the main management system in Ghana, was also experimented with but with harvesting followed by limited silvicultural operations to promote regeneration of the commercial crop.

The TSS was applied to over 4800 ha of forest (Osafo 1970) and followed a protocol similar in all respects to the classical TSS as practiced in Nigeria. Climber cutting and over-wood removal through poisoning of large non-economic tree species (dbh > 90 cm) were followed by a series of silvicultural thinning and liberation operations over thirty-six 4-ha blocks in the experimental research area. These were carried out prior to commercial harvesting which took place in about the sixth year after initiation of the interventions. Thinning and liberation involved the removal of unwanted species that competed with the regenerating crop. The schedule of operations that was followed is summarized in Table 14.1.

Table 14.1. Schedule of operations for TSS

Year	Operation
1	demarcation, stock survey, cutting of all large lianas and first canopy opening (medium density)
2	second canopy opening (light density)
3	first cleaning and assessment for regeneration
4	second cleaning
5	third cleaning
6	commercial exploitation
7	climber cutting and tending of coppiced regeneration that followed the exploitation
10	climber cutting
17	thinning and over-wood removal as dictated by the state of regeneration

Thus, canopy opening events were carried out in two stages. There was an initial medium density (2,300 stems ha^{-1}) opening of the canopy by the removal of valueless trees, poles and shrubs with heights up to 6 m and dbh ≤ 10 cm in the first year. This was followed by a light density canopy opening in the second year, cutting all valueless species 9 m in height with low heavy crowns and 28 cm to 48 cm dbh in addition to the poles and shrubs. Subsequent cleanings took place in the third, fourth and fifth years, followed by commercial exploitation in the sixth year. Climber cutting and tending operations on coppiced trees that were damaged by exploitation were carried out in the seventh year and again in the tenth year.

These disturbances resulted in an average basal area reduction from ca. 30 m^2 per 2 ha to 10 – 12 m^2 per 2 ha. Consequently, there was very little shade from the shelterwood which consisted of the tall mature trees with crowns 24 - 30 m above ground, poles with small crowns 12 m high and a sparse scattering of saplings and poles of valuable species with small crowns at lower levels. The greater proportion of each 4-ha block was in full light; and where there was direct overhead cover, there was ample sidelight.

As no direct revenue was expected from TSS until about the sixth year when commercial exploitation was carried out, experiments were also initiated to determine whether sufficient regeneration could be obtained by opening the canopy after exploitation. This also meant that revenue was available in the first year of operations and this system became known as the Post-Exploitation System (PES). In contrast to the TSS, climber cutting, canopy opening and cleaning operations under the PES were carried out after the commercial harvesting.

An assessment of results showed at that time, that regeneration under the PES consisted largely of those species that were left after exploitation, notably the so-called class II species that were of lesser economic importance. Regeneration of the valuable economic (class I) species was poor because most of the mother trees had been removed during the harvest. On account of the poor results obtained at that time, and given that the costs of operation were similar between the TSS and PES, the latter was discontinued.

The main objective of the experiments on the GLS was to obtain information on the effect of exploitation preceded by climber cutting and followed by the treatment of felling gaps by cutting up branches of felled trees and pilling the slash in gaps. In addition, improvement cleanings were carried out entailing the cutting of all non-valuable trees and shrubs in the dense lower story. Short, thick-boled species with characteristic large crowns and which attained the lower middle story when mature (e.g. *Carapa procera*, *Trichilia prieuriana*, *Trichilla manadelpa*, *Panda oleosa* and *Myrianthus* spp) were cut. The purpose was to attract new regeneration following commercial exploitation, and to improve the existing crop by encouraging saplings, poles and middle size classes of valuable and non-valuable upper canopy species. Saplings of non-valuable trees that normally attain the upper middle and dominant canopies were not cut, as the intention was to remove them, to the extent possible, in the improvement thinning that would be carried out ten years later. The timing of operation under the GLS can be summarized as shown in Table 14.2.

Table 14.2. Schedule of operations for GLS

Year	Operation
0	stock survey and yield prescription as per Working Plan, principally under the Brandis yield control system with a 10-year felling cycle
1	climber cutting and commercial exploitation
2-5	post-exploitation treatment of felling gaps by climber cutting and cutting up broken crowns and pilling the slash in small piles to create openings for crowns
10	improvement thinning

Essentially, therefore, the various interventions resulted in differences in the structure of forest in the treated stands, with a tendency towards a more or less uniform structure in TSS and PES relative to the GLS forest. On the whole, however, trees in the treated stands had more light relative to unlogged forest, although many trees had poor crowns, probably as a result of previous suppression, including the effect of climbers.

At present, forest management is based on a polycyclic system that involves mainly the harvesting of commercial species using a minimum felling diameter limit, felling cycle lengths, and a selected number of stems as the allowable cut. This diameter limit selection system is being used on a 40-year felling cycle. This is supposed to result in less damage to the residual forest and ensure sufficient regeneration. However, the current practice is such that selection harvesting removes only the most highly valued species and often does not provide appropriate conditions for their regeneration.

14.4 Main issues restricting sustainable forest management

Overexploitation and illegal logging

The excessive harvesting of timber far exceeding the annual allowable cut (AAC) is an important single factor contributing to deforestation and forest degradation in Ghana. In recent times, logging activity has been intensified more in the semi-deciduous zones than in the evergreen forest due to greater densities of desirable timber species. Illegal logging activities are having a serious toll on the timber resource base in Ghana. A major problem associated with the excessive logging is the insufficient attention given to logging practices. In most cases, no proper management procedures are followed during these logging operations.

The current AAC for timber is 2 million m^3 but this amount has been exceeded by total actual harvest for over a decade. Until 2004 the AAC was 1 million m^3. However, in 1999 the total timber harvest was estimated to be about 3.7 million m^3, which was almost four times the AAC set at that time (Birikorang 2001). According to the AAC estimates, approximately 25 % of the 1996 recorded timber extraction represents an over-exploitation, predominantly of valuable timber (the so-called scarlet star) species. The current AAC of 2 million m^3 consists of 1.5 million m^3 and 0.5 million m^3 from the off-reserves and forest reserves, respectively. The off-reserve AAC was set high due to the desire to salvage timber trees before they are lost to the widespread illegal exploitation and conversion of forest to agriculture and other land-uses like mining. Even so, the current total timber harvest, estimated at 3.3 to 3.7 million m^3 (Hansen & Treue 2008), exceeds the current AAC. The challenge now is to protect over-exploited species against the demand pressure through control-of-supply measures; to create a sustained production of timber from off-reserves; and to divert demand away from over-exploited and over-utilised species and towards under-utilised species (Treue 2001).

Fortunately, the latter option actually exists in Ghana. The substantial resource within the forest reserves of under-utilized species forms a security of raw material supply and a marketing challenge for the timber industry. The over-exploitation of certain species within forest reserves forms a management challenge to the Forestry Commission, which should set things straight in the long-term interest of the nation including the timber industry (Treue 2001).

In line with the above, a drastic reduction of logging activities would be needed. This is difficult to realize, since many interests are at stake and so far there is lack of political will to take such drastic steps. Given the fact that the condition of many production forests is poor or confined to slopes with an incline of over 30 %, an AAC of less than 1 million m^3 might be nearer to reality. The increase of the AAC from 1 million m^3 to 2 million m^3 in 2004 under current forest conditions underscores the lack of political and administrative will to take drastic steps to reduce logging activities. In addition, financial returns of the forest sector are not sufficiently redirected to this sector for a financially sound implementation and execution of the forest policy. This shows an unsustainable situation in sustainable forest management in Ghana.

Closely related to the problem of over-exploitation is the widespread illegal harvesting of timber. This hampers any strategies seeking to reduce over-exploitation, forest degradation and deforestation and to ensure sustainable forest management. Illegal logging in Ghana accounts for over 50 % of total timber harvest. Such illegal activities result in huge damage to the environment and to the forest resources and negatively affect the local communities who depend on forests for their livelihood. It also deprives the government of revenues.

According to Birikorang (2001), out of about 3.7 million m^3 of timber harvested from the forest in 1999, illegal harvesting and chainsaw lumbering accounted for 1.5 million m^3. No proper management procedures are followed and negative environmental consequences often result from the operations of these illegal timber operators, who most often harvest timber from areas reserved for biodiversity and other environmental purposes.

Attempts at using legislative instruments to outlaw chainsaw operations as a regulatory measure failed to control the situation. This is because of the inadequate capacity of the forestry sector to enforce the legislations and corruption within the sector and law enforcement agencies being very high. Another major reason is the inadequate response of policy to satisfy the domestic demand for timber. Since 2005, various strategies are being implemented to mobilize chainsaw operators into alternative productive ventures, such as forest plantation thinning and coppice management, forest boundary demarcation and clearing, assisting timber companies in timber harvesting operations and recovery of timber off-cuts in the forests.

The forestry sector is further pursuing appropriate measures to ensure that adequate quantities of mill-sawn lumber and other wood products are available to meet the needs of the domestic market. Among these measures are policies to compel sawmills to sell to the domestic market and setting up of mobile mills in strategic locations for the production of lumber to feed various localities. These measures have so far not been successful. The sector is also exploring the feasibility of charging chainsaw operators all the statutory fees and charges for the grant of access to the resource to fell and crosscut trees just as the legitimate logging and saw milling companies. Meanwhile, debates and stakeholder consultations are ongoing to come out with appropriate control measures and policy options (e.g. see Marfo 2010).

Export as the driving force for timber harvest

The general trend during the period 1986-96 has been increasing export revenue and an increasing volume of processed wood exports. Harvest for export has played a significant role in this respect. During the period 1986-96, the export harvest made up 60-94 % of the total recorded timber extraction. Hence harvest for export has in the past been the dominant driving force behind timber exploitation in Ghana. This estimated percentage of the harvest for export out of the total recorded extraction depends entirely on the assumed recovery rates and the reliability of the data. However, the recovery rates used here are probably on the high side and the official timber extraction data most probably under-estimates the actual harvest by at least 10 %. As a matter of fact, there are no indications of significant discrepancies between the official data on export volumes and actual export volumes during the period 1986-96 (Treue 2001).

Photo 14.4. Chainsaw milling is an important activity in Ghanaian forestry. (Photo G. Ametsitsi)

Low forest taxes & fees regime

Forest revenue is generated mainly through royalties, rental fees and silvicultural charges. From the economic point of view, often in the timber industry, a substantial residual economic value remains (before tax) after accounting for production costs and imputing sufficient profit to sustain the enterprise over the long term. This residual value or stumpage value in reference to the value of the standing timber is the maximum price a logger would be willing to pay to the government under competitive conditions. Meanwhile, the government practices discretionary allocation of timber resources and is known to have the lowest rent collection record in West Africa (Birikorang & Rhein 2005). Between 2000 and 2003, the government captured less than half of the revenue accrued to it.

The Ghanaian forest authorities have frequently established inappropriate forest revenue systems in which timber royalties do not cover the cost of managing the forest. The forest fees do not cover the full economic cost, neither does it cover full operating cost. Until recently, timber royalties were charged per tree and value was estimated at less than 2 % free on board (fob) price per m^3 of round log multiplied by the average tree volume of the species at the minimum felling diameter. Additionally, inefficiencies in the system have resulted in non-payment of stumpage fees by timber operators. It has been estimated that non-payment of stumpage fees covers 600,000-700,000 m^3 per year. Such a system is inefficient as a mechanism for recovering stumpage value, thus promoting wastage both in the forests and at the mills.

An analysis of the forest fees in Ghana shows that forest fees have been too low in absolute terms to protect the resource or slow down exploitation. The system resulted in an inadequate market-incentive differentiation between species, thus leading to over-exploitation of highly desirable timber species and under-exploitation of abundant but less-desirable species.

Weak institutional structures

The failure of the Forest Authorities to adequately control and manage the forest sustainably has resulted in large-scale encroachment on the forest reserves. Weak administrative machinery to monitor and patrol the forest is also the underlying factor for increasing bush fire in the forest areas. The weak administrative machinery may also be the result of inadequate funding for the operations of the forest authorities.

The weak administrative machinery is often a measure of the gap between projected revenues and what is actually collected, or the ability to generate enough revenue to cover the cost of operation. The income generating ability of the Forest Authorities determines the efficiency in managing the forest. Until 1998, the FSD was able to collect less than 60 % of its potential revenue due to be collected. The Service was therefore unable to cover the full cost of forest management. It could not acquire the basic equipment needed for forest management and monitoring. This gave rise to widespread illegal timber operations across the country. The illegal operators became very sophisticated and, in their illegal operations, could outwit the Forest Authorities.

Over-capacity and inefficiencies of the timber industry

Ghana is among the countries in West Africa having a well-developed sawmilling industry and the export of timber has been a key activity in the country. The Ghanaian timber industry is made up of 130 wood-processing units and about 200 other enterprises focus on furniture production. There are over 41,000 small-scale carpenters registered with the Association of Small Scale Carpenters. The small-scale carpenters represent the largest group of end-users. They require about 219,000 m^3 of sawn timber annually. This represents about 72 % of the total domestic timber requirement for the entire country (Agyarko 2000).

The timber industry is characterized by an over-capacity of out-dated and inefficient mills. It was reported that new factories were installed in the late 1990s and early 2000s to bring the processing capacity to about 5.2 million m^3, which is far in excess of the annual allowable cut of 2 million m^3 (Agyeman et al. 2003). The increase in mill capacity is attributed largely to the availability of relatively cheap raw material. Worsening the situation is the fact that the industry is operating at a low recovery rate (20-40 %) due to the inefficiency of the mills.

The timber industry is seriously distressed due to unavailability of trees for felling and growing demand for timber. Consequently, a major problem facing the timber industry is the large unutilized capacity of out-dated machinery and low rates of recovery. The timber industry requires significant restructuring and a reduction in the milling capacity to fully support the achievement of sustainable forest management. Increasing demand for timber has resulted in a decreasing resource base and affected the quality of the forests. The current extraction rates are unsustainable either in the long-term or short-term.

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