**Forestry Department**
**Food and Agriculture Organization of the United Nations**

# GLOBAL FOREST RESOURCES ASSESSMENT

## COUNTRY REPORTS

# GHANA

FRA2005/052
Rome, 2005

## The Forest Resources Assessment Programme

Sustainably managed forests have multiple environmental and socio-economic functions important at the global, national and local scales, and play a vital part in sustainable development. Reliable and up-to-date information on the state of forest resources - not only on area and area change, but also on such variables as growing stock, wood and non-wood products, carbon, protected areas, use of forests for recreation and other services, biological diversity and forests' contribution to national economies - is crucial to support decision-making for policies and programmes in forestry and sustainable development at all levels.

FAO, at the request of its member countries, regularly monitors the world's forests and their management and uses through the Forest Resources Assessment Programme. This country report forms part of the Global Forest Resources Assessment 2005 (FRA 2005), which is the most comprehensive assessment to date. More than 800 people have been involved, including 172 national correspondents and their colleagues, an Advisory Group, international experts, FAO staff, consultants and volunteers. Information has been collated from 229 countries and territories for three points in time: 1990, 2000 and 2005.

The reporting framework for FRA 2005 is based on the thematic elements of sustainable forest management acknowledged in intergovernmental forest-related fora and includes more than 40 variables related to the extent, condition, uses and values of forest resources. More information on the FRA 2005 process and the results - including all the country reports - is available on the FRA 2005 Web site (www.fao.org/forestry/fra2005).

The Global Forest Resources Assessment process is coordinated by the Forestry Department at FAO headquarters in Rome. The contact person for matters related to FRA 2005 is:

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# Contents

# 1 Table T1 – Extent of Forest and Other wooded land

## 1.1 FRA 2005 Categories and definitions

| Category | Definition |
|---|---|
| Forest | Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use. |
| Other wooded land | Land not classified as "Forest", spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5-10 percent, or trees able to reach these thresholds *in situ*; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use. |
| Other land | All land that is not classified as "Forest" or "Other wooded land". |
| Other land with tree cover (Subordinated to "Other land") | Land classified as "Other land", spanning more than 0.5 hectares with a canopy cover of more than 10 percent of trees able to reach a height of 5 meters at maturity. |
| Inland water bodies | Inland water bodies generally include major rivers, lakes and water reservoirs. |

## 1.2 National data

### 1.2.1 Data sources

| References to sources of information | Quality (H/M/L) | Variable(s) | Year(s) | Additional comments | Source |
|---|---|---|---|---|---|
| Reporting Progress, Ghana Forests, Timber Industry Development Board and Forestry Commission, 2002. | M | Forest cover change | 1989 | Provides secondary information on the growing stock and other general information about the forest of Ghana. **Used for reference years 2000.** | 1 |
| Kotey N.A, Francois J., Owusu JGK., Yeboah R., Amanor K.S. and Antwi L. 1998. Falling into place, Ghana, policy that works for forest and people. IIAD. United Kindom. IIAD 1996 | M | Area of forests reserves and off forest reserves | 1996 | | 2 |

### 1.2.2 Classification and definitions

| National class | Definition |
|---|---|
| Forest Reserve (FR) | Forest land within reserves and under protection |
| Off-Forest Reserve (OFR) | Any land area apart from permanent forest reserve in the High forest Zone or Forest lands within the HFZ outside reserves mainly made up of mosaic of agricultural fields, fallow lands, secondary forest patches, etc. |

### 1.2.3 Original data

| Original national data | Area in hectares | |
|---|---|---|
| | **1990** | **1996** |
| Forest reserve | 1 700 000 | 1 634 100 |
| Off-Forest reserve | 5 965 900 | 5 001 385 |
| **Total Forest Cover** | **7 665 900** | 6 635 485 |
| Other land | 15 336 100 | 16 118 515 |
| **Total Land Area** | **23 002 000** | **22 754 000** |

## 1.3 Analysis and processing of national data

### 1.3.1 Calibration

| Years | Actual land Area | UN FAO stats | Calibration factor |
|---|---|---|---|
| 1990 | 23 002 000 | 22 754 000 | 0.989218329 |

| National Classes | Area in hectares | |
|---|---|---|
| | **1989** | **1996** |
| Forest reserve | 1 681 671 | 1 634 100 |
| Off-Forest reserve | 5 901 578 | 5 001 385 |
| **Total Forest Cover** | **7 583 249** | **6 635 485** |
| Other land | 15 170 751 | 16 118 515 |
| **Total Land Area** | **22 754 000** | **22 754 000** |

## 1.4 Reclassification into FRA 2005 classes

| National Classes | Forest | OWL | OL |
|---|---|---|---|
| Forest reserve | 100% | | |
| Off-Forest reserve | 100% | | |
| **Total Forest Cover** | | | |
| Other land | | | 100% |

### 1.4.1 Estimation and forecasting

| FRA 2005 Categories | 1990 | 2000 | 2005 |
|---|---|---|---|
| Forest | 7 447 854 | 6 093 906 | 5 516 932 |
| Other Land | 15 306 146 | 16 660 094 | 17 237 068 |
| Water | 1 100 000 | 1 100 000 | 1 100 000 |
| **Total** | **23 854 000** | **23 854 000** | **23 854 000** |

## 1.5 Data for National reporting table T1

| FRA 2005 Categories | Area (1000 hectares) | | |
|---|---|---|---|
| | **1990** | **2000** | **2005** |
| Forest | 7 448 | 6 094 | 5 517 |
| Other wooded land | 0 | 0 | 0 |

| | | | |
|---|---|---|---|
| Other land | 15 306 | 16 660 | 17 237 |
| ...of which with tree cover [1)] | | | |
| Inland water bodies | 1 100 | 1 100 | 1 100 |
| **TOTAL** | **23 854** | **23 854** | **23 854** |

## 1.6 Comments to National reporting table T1

Total inland water bodies were quoted from the FAO STAT with the assumption that there has not been any change since the year 2000.

# 2 Table T2 – Ownership of Forest and Other wooded land

## 2.1 FRA 2005 Categories and definitions

| Category | Definition |
|---|---|
| Private ownership | Land owned by individuals, families, private co-operatives, corporations, industries, religious and educational institutions, pension or investment funds, and other private institutions. |
| Public ownership | Land owned by the State (national, state and regional governments) or government-owned institutions or corporations or other public bodies including cities, municipalities, villages and communes. |
| Other ownership | Land that is not classified either as "Public ownership" or as "Private ownership". |

## 2.2 National data

### 2.2.1 Data sources

### 2.2.2 Classification and definitions

| National class | Definition |
|---|---|
| Communal/Customary Ownership | Land owned by communes under the traditional social system, where all stool/skin lands in practice belong to the paramount chiefs who are traditional heads of paramount stools or skins |
| Public (Government) Ownership | Land belonging to the state, acquired by legislation and vested for the people of Ghana |
| Individual Ownership | Land owned by individuals, purchased from Traditional rulers and government or state |

### 2.2.3 Original data

There is one main type of land ownership in Ghana, which is the communal or customary ownership. Lands in Ghana are owned by traditional rulers and held in trust for them by the state. **Article 267** of the Ghanaian constitution stipulates, "*All stool lands in Ghana shall vest in the appropriate stool on behalf of and in trust for the subjects of the stool, in accordance with the customary law and usage"*. All land is therefore considered to be under public ownership.

## 2.3 Data for National reporting table T2

| FRA 2005 Categories | Area (1000 hectares) | | | |
|---|---|---|---|---|
| | Forest | | Other wooded land | |
| | 1990 | 2000 | 1990 | 2000 |
| Private ownership | | | | |
| Public ownership | 7 448 | 6 094 | | |
| Other ownership | | | | |
| **TOTAL** | | | | |

# 3 Table T3 – Designated function of Forest and Other wooded land

## 3.1 FRA 2005 Categories and definitions

***Types of designation***

| Category | Definition |
|---|---|
| Primary function | A designated function is considered primary when it is significantly more important than other functions. This includes areas that are legally or voluntarily set aside for specific purposes. |
| Total area with function | Total area where a specific function has been designated, regardless whether it is primary or not. |

***Designation categories***

| Category / Designated function | Definition |
|---|---|
| Production | Forest / Other wooded land designated for production and extraction of forest goods, including both wood and non-wood forest products. |
| Protection of soil and water | Forest / Other wooded land designated for protection of soil and water. |
| Conservation of biodiversity | Forest / Other wooded land designated for conservation of biological diversity. |
| Social services | Forest / Other wooded land designated for the provision of social services. |
| Multiple purpose | Forest / Other wooded land designated to any combination of: production of goods, protection of soil and water, conservation of biodiversity and provision of social services and where none of these alone can be considered as being significantly more important than the others. |
| No or unknown function | Forest / Other wooded land for which a specific function has not been designated or where designated function is unknown. |

## 3.2 National data

### 3.2.1 Data sources

| References to sources of information | Quality (H/M/L) | Variable(s) | Year(s) | Additional comments |
|---|---|---|---|---|
| 1.Agyarko. T. Forestry Outlook Study for Africa. Ghana, Ministry of Land and Forestry | M | Forest designation | 1995 | Source of the information is Forest Service Division, 1995 |
| 2. Expert Opinion | L | Reclassification | | |

### 3.2.2 Classification and definitions

| National class | Definition |
|---|---|
| Production Areas | These are areas designated for removal of timber, which usually fall within the High Forest zone. |
| Permanent Protection | These comprise largely hills, swamps and all other protected areas. |
| Conversion Areas | These are degraded areas (Basal Area ≤5m2/ha), within Forest Reserves which require planting or reserved for plantation development. |

| | |
|---|---|
| Convalescence | These are temporary protected areas usually 40 years within timber production areas of natural Forest Reserves with reduced stocking, primarily due to over exploitation and or bush fires but are capable of natural rehabilitation. |

### 3.2.3 Original data

The following data refer to year 1996

| Forest type | Area (ha) | % |
|---|---|---|
| Timber Production Area | 762 400 | 47 |
| Permanent Protection | 352 500 | 22 |
| Convalescence | 122 000 | 7 |
| Conversion | 127 200 | 8 |
| Not inventoried (conversion) | 270 000 | 16 |
| Total Reserve Area | **1 634 100** | **100** |
| Other off-forest reserves (1) | 5 001 385 | |
| ….Of which timber production area (2) | 374 000 | 7 |

Notes :
(1) Other forest reserve area information is from T1
(2) Of which 374000 is timber production area is from Forest Service Division

## 3.3 Reclassification into FRA 2005 classes

| National Class | Production | Protection of soil and water | Conservation of biodiversity | Social | Unknown designation |
|---|---|---|---|---|---|
| Timber Production Area | 100% | | | | |
| Permanent Protection | | 100% | | | |
| Convalescence (2) | | | 35% | 65% | |
| Conversion | 100% | | | | |
| Not inventoried (conversion) | 100% | | | | |
| Other off forest reserves (1) | 7% | | | | 93% |

Notes:
1) 374 000 out of 5 001 385 ha of other off forest reserve area is designated for production.
2) Expert opinion

**Results after reclassification the 1996 data**

| National Classes | Production | Protection of soil and water | Conservation of biodiversity | Social | Unknown designation |
|---|---|---|---|---|---|
| Timber Production Area | 762 400 | | | | |
| Convalescence | 0 | | 42 700 | 79 300 | |
| Permanent Protection | 0 | 352 500 | | | |
| Conversion | 127 200 | | | | |
| Not inventoried (conversion) | 270 000 | | | | |
| Other off forest reserves (1) | 350 097 | | | 0 | 4 651 288 |
| **Total** | **1 509 697** | **352 500** | **42 700** | **79 300** | **4 651 288** |

The following table of the type of forests designation together with their respective proportion to the total forests area was generated: The respective proportion will be used to generate data for 1990, 2000 and 2005 since, there was only one data set available.

| **FRA 2005 Categories** | **Area** | **Proportion of the total** |
|---|---|---|
| Production | 1 509 697 | 23% |
| Protection of soil and water | 352 500 | 5% |
| Conservation of biodiversity | 42 700 | 1% |
| Social | 79 300 | 1% |
| Unknown or no designation | 4 651 288 | 70% |
| Total | **6 635 485** | **100%** |

## 3.4 Analysis and processing of national data

The area for forests for 1990, 2000 and 2005 are directly taken from T1

| | **Area in hectares** | | |
|---|---|---|---|
| Type | **1990** | **2000** | **2005** |
| Forest | 7447854 | 6093906 | 5516932 |

Applying the above percentages per designation to the total forest areas for each year respectively generate the following table. This table will be used for the final table.

| | **Area in hectares** | | |
|---|---|---|---|
| **National Classes (1)** | **1990** | **2000** | **2005** |
| Production | 1 694 526 | 1 386 478 | 1 255 205 |
| Protection of soil and water (2) | 352 500 | 352 500 | 352 500 |
| Conservation of biodiversity (2) | 42 700 | 42 700 | 42 700 |
| Social | 89 009 | 72 828 | 65 932 |
| Unknown or no designation | 5 269 119 | 4 239 401 | 3 800 594 |
| **Total Forest area** | **7 447 854** | **6 093 906** | **5 516 932** |

Notes:
1).The above table was generated from percentages generated from original data from source 1:
2. Assumption is that the area under protection of soil and water plus the area under conservation of biodiversity will not change.

## 3.5 Data for National reporting table T3

| FRA 2005 Categories / Designated function | Area (1000 hectares) | | | | | |
|---|---|---|---|---|---|---|
| | Primary function | | | Total area with function | | |
| | 1990 | 2000 | 2005 | 1990 | 2000 | 2005 |
| **Forest** | | | | | | |
| Production | 1 694 | 1 386 | 1 255 | 1 694 | 1 386 | 1 255 |
| Protection of soil and water | 353 | 353 | 353 | 353 | 353 | 353 |
| Conservation of biodiversity | 43 | 43 | 43 | 43 | 43 | 43 |
| Social services | 89 | 73 | 66 | 89 | 73 | 66 |
| Multiple purpose | | | | not appl. | not appl. | not appl. |
| No or unknown function | 5 269 | 4 239 | 3 800 | not appl. | not appl. | not appl. |
| **Total - Forest** | **7 448** | **6 094** | **5 517** | **not appl.** | **not appl.** | **not appl.** |
| **Other wooded land** | | | | | | |
| Production | N/A | N/A | N/A | | | |
| Protection of soil and water | N/A | N/A | N/A | | | |
| Conservation of biodiversity | N/A | N/A | N/A | | | |
| Social services | N/A | N/A | N/A | | | |
| Multiple purpose | N/A | N/A | N/A | not appl. | not appl. | not appl. |
| No or unknown function | N/A | N/A | N/A | not appl. | not appl. | not appl. |
| **Total – Other wooded land** | N/A | N/A | N/A | **not appl.** | **not appl.** | **not appl.** |

## 3.6 Comments to National reporting table T3

According to the inventory reports (March 1995) only 15% of the area, which is protected on grounds of genetic diversity, is well stocked and accessible. The rest of the areas are either inaccessible or degraded.

Total area with function was assumed to be the same as the Primary function because there was no area for designated for more than one function.

# 4 Table T4 – Characteristics of Forest and Other wooded land

## 4.1 FRA 2005 Categories and definitions

| Category | Definition |
|---|---|
| Primary | Forest / Other wooded land of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed. |
| Modified natural | Forest / Other wooded land of naturally regenerated native species where there are clearly visible indications of human activities. |
| Semi-natural | Forest / Other wooded land of native species, established through planting, seeding or assisted natural regeneration. |
| Productive plantation | Forest / Other wooded land of introduced species, and in some cases native species, established through planting or seeding mainly for production of wood or non-wood goods. |
| Protective plantation | Forest / Other wooded land of native or introduced species, established through planting or seeding mainly for provision of services. |

## 4.2 National data

No original data is available for this table. Data from table T3 was used as an input to generate data for the final table

## 4.3 Reclassification into FRA 2005 classes

The following areas from table T3 were used as input for the reclassification

| National Classes | Area in hectares | | |
|---|---|---|---|
| Production | 1 644 526 | 1 326 478 | 1 095 205 |
| Protection of soil and water | 352 500 | 352 500 | 352 500 |
| Convalescence+ Unknown Designation | 5 400 828 | 4 354 928 | 3 909 226 |
| Plantations | 50 000 | 60 000 | 160 000 |
| **Total** | **7 447 854** | **6 093 906** | **5 516 932** |

Notes:

1) The area excludes plantations but includes timber production area, conversion area and not inventoried area from forest reserves and the 350 097 area from off forest reserves)
2) Other off forest reserves includes area under conservation of biodiversity, social and unknown designation)

The following reclassification matrix was then applied

| National classes | Primary | Modified natural | Semi-natural | Productive plantation |
|---|---|---|---|---|
| Production area (1) | | 100% | | |
| Protection of soil and Water | 100% | | | |
| Plantation | | | | 100% |
| Convalescence+ Unknown Designation | | 100% | | |

**Notes**

**1.** Reclassification for productive plantation and timber production was done on the bases of an assumption that 20,000 hectares of plantation is established each year from 2000 according to records. Therefore adding 60,000 hectares to (20,000 by 5) gives 160,000 hectares. The rest of the area under timber production is modified forests.

**Results after reclassification**

| FRA 2005 Categories | Area in hectares | | |
|---|---|---|---|
| | **1990** | **2000** | **2005** |
| Primary | 352 500 | 352 500 | 352 500 |
| Modified natural | 7 045 354 | 5 681 406 | 5 004 432 |
| Semi-natural | | | |
| Productive plantation | 50 000 | 60 000 | 160 000 |
| Protective plantation | | | |
| **Total** | **7 447 854** | **6 093 906** | **5 516 932** |

## 4.4 Data for National reporting table T4

| FRA 2005 Categories | Area (1000 hectares) | | | | | |
|---|---|---|---|---|---|---|
| | Forest | | | Other wooded land | | |
| | **1990** | **2000** | **2005** | **1990** | **2000** | **2005** |
| Primary | 353 | 353 | 353 | | | |
| Modified natural | 7 045 | 5 681 | 5 004 | | | |
| Semi-natural | | | | | | |
| Productive plantation | 50 | 60 | 160 | | | |
| Protective plantation | | | | | | |
| **TOTAL** | **7 448** | **6 094** | **5 517** | | | |

# 5 Table T5 – Growing stock

## 5.1 FRA 2005 Categories and definitions

| Category | Definition |
|---|---|
| Growing stock | Volume over bark of all living trees more than X cm in diameter at breast height (or above buttress if these are higher). Includes the stem from ground level or stump height up to a top diameter of Y cm, and may also include branches to a minimum diameter of W cm. |
| Commercial growing stock | The part of the growing stock of species that are considered as commercial or potentially commercial under current market conditions, and with a diameter at breast height of Z cm or more. |

## 5.2 National data

### 5.2.1 Data sources

| References to sources of information | Quality (H/M/L) | Variable(s) | Year(s) | Additional comments |
|---|---|---|---|---|
| **Baytas A, Rezvani F,** Forest Resource Accounting in Ghana, 1970-1987., Centre for Economic Research on Africa. School of Business, Montclair State University. Upper Montclair, New Jersey | M | Volume/ha | 1980 | |

### 5.2.2 Classification and definitions

| Classification | Definition |
|---|---|
| Closed Productive Forests | Managed or logged forests are those that have some control of use such as harvesting regulations and/or silvicultural treatments |
| Unproductive forest | Refers to those forests used for protection (watershed management or soil stabilisation) or conservation in national parks |
| Open forest | Mixed forest or grassland with at least 10% tree cover and a continuous grass layer |
| Plantations | Refers to forests stands artificially established for harvest. |

### 5.2.3 Original data

Original Data (Source above, data year 1980)

| National Classes | Area | Growing Stock | Growing Stock |
|---|---|---|---|
| | 1000 ha | 1000 m3 | m3/ha |
| Closed productive forest | 1 167 | 161 046 | 138.0 |
| Unproductive forest | 551 | 64 464 | 117.0 |
| Open forests | 6 975 | 195 300 | 28.0 |
| Plantations | 75 | 7 500 | 100.0 |
| **TOTAL** | **8 768** | **428 310** | **48.8** |

**Areas from table T3 was used as an input to the estimations for this table**

| | Area (hectares) | | |
|---|---|---|---|
| **National Classes** | **1990** | **2000** | **2005** |
| Timber Production Area | 1 694 526 | 1 386 478 | 1 255 205 |
| Permanent Protection area | 352 500 | 352 500 | 352 500 |
| Open Forests | 5 400 828 | 4 354 928 | 3 909 226 |
| **Total Forest** | **7 447 854** | **6 093 906** | **5 516 932** |

**Assumptions:**
1) Production area from forests reserves + Plantations + production area from the off forests reserve areas = = Closed productive forests
2). Protection of soil and Water = Unproductive forests
3).Other off forest reserves = Open forests

## 5.3 Analysis and processing of national data

### 5.3.1 Estimation and forecasting

As no other information is available, It is assumed that volume per ha did not change from 1980 to 2005.

Applying the above forest areas from table T3 and multiplying these with the respective volume per hectare for each reporting year gives:

| | | Growing stock (1000 m3) | | |
|---|---|---|---|---|
| | m3/ha | 1990 | 2000 | 2005 |
| Closed productive forest | 136 | 230 456 | 188 561 | 170 708 |
| Unproductive forests | 117 | 41 243 | 41 243 | 41 243 |
| Open forests | 28 | 151 223 | 121 938 | 109 458 |
| **Total** | | **422 921** | **351 741** | **321 409** |

Note: The figure 136 m3/ha is a weighted average for Close productive forest and Plantations

Commercial growing stock is estimated as the growing stock in closed productive forests.

## 5.4 Data for National reporting table T5

| FRA 2005 Categories | Volume (million cubic meters over bark) | | | | | |
|---|---|---|---|---|---|---|
| | Forest | | | Other wooded land | | |
| | **1990** | **2000** | **2005** | **1990** | **2000** | **2005** |
| Growing stock | **423** | **352** | **321** | | | |
| Commercial growing stock | 230 | 189 | 171 | | | |

| Specification of country threshold values | Unit | Value | Complementary information |
|---|---|---|---|
| 1. Minimum diameter at breast height of trees included in Growing stock (X) | cm | 10 | |
| 2. Minimum diameter at the top end of stem (Y) for calculation of Growing stock | cm | 5 | |
| 3. Minimum diameter of branches included in Growing stock (W) | cm | ID | |
| 4. Minimum diameter at breast height of trees in Commercial growing stock (Z) | cm | 30 | |
| 5. Volume refers to "Above ground" (AG) or "Above stump" (AS) | AG / AS | AG | |
| 6. Have any of the above thresholds (points 1 to 4) changed since 1990 | Yes/No | NO | |
| 7. If yes, then attach a separate note giving details of the change | Attachment | | |

# 6 Table T6 – Biomass stock

## 6.1 FRA 2005 Categories and definitions

| Category | Definition |
|---|---|
| Above-ground biomass | All living biomass above the soil including stem, stump, branches, bark, seeds, and foliage. |
| Below-ground biomass | All living biomass of live roots. Fine roots of less than 2mm diameter are excluded because these often cannot be distinguished empirically from soil organic matter or litter. |
| Dead wood biomass | All non-living woody biomass not contained either in the litter, standing, lying on the ground, or in the soil. Dead wood includes wood lying on the surface, dead roots, and stumps larger than or equal to 10 cm in diameter or any other diameter used by the country. |

## 6.2 National data

### 6.2.1 Original data

Since no original data exist, data from table T5 is used as input for the estimation of biomass stock.

The following conversion factors were applied:

| National Classes | Stem vol. m3/ha | Density ton/m3 | Stem wood ton/ha | BEF | R/S ratio | D/L ratio |
|---|---|---|---|---|---|---|
| Timber Production Area | 136 | 0.58 | 78.88 | 2.73 | 0.24 | 0.14 |
| Permanent Protection area | 117 | 0.58 | 67.86 | 2.94 | 0.24 | 0.14 |
| Open Forests | 28 | 0.58 | 16.24 | 6.07 | 0.48 | 0.14 |

Notes:
1. BEF calculated using formula from FAO Forestry Paper 134
2. Wood density: Average for Africa (FAO Forestry Paper 134)
3. R/S ratio: Appendix 5 of Guidelines
4. D/L ratio: Appendix 5 of Guidelines

The following table is obtained from T5:

| National classes | Area (hectares) 1990 | 2000 | 2005 |
|---|---|---|---|
| Timber Production Area | 1 694 526 | 1 386 478 | 1 255 205 |
| Permanent Protection area | 352 500 | 352 500 | 352 500 |
| Open Forests | 5 400 828 | 4 354 928 | 3 909 226 |
| **Total Forest** | **7 447 854** | **6 093 906** | **5 516 932** |

## 6.3 Analysis and processing of national data

The following procedure was applied for biomass estimation:

(1) Multiplying area of respective national classes by stem wood by biomass expansion factor= Above ground biomass
(2) Multiplying above ground biomass by Root-shoot ratio= below ground biomass
(3) Multiplying living biomass by 0.14 = dead wood biomass

| | Biomass (million tonnes) | | |
|---|---|---|---|
| **Timber Production Area** | **1990** | **2000** | **2005** |
| Aboveground biomass | 364.9 | 298.6 | 270.3 |
| Belowground biomass | 87.6 | 71.7 | 64.9 |
| **Living Biomass** | **452.5** | **370.2** | **335.2** |
| Dead wood biomass | 63.3 | 51.8 | 46.9 |
| **Total Biomass** | **515.8** | **422.1** | **382.1** |
| **Permanent Protection area** | | | |
| Aboveground biomass | 70.3 | 70.3 | 70.3 |
| Belowground biomass | 16.9 | 16.9 | 16.9 |
| **Living Biomass** | **87.2** | **87.2** | **87.2** |
| Dead wood biomass | 12.2 | 12.2 | 12.2 |
| **Total Biomass** | **99.4** | **99.4** | **99.4** |
| **Open forest** | | | |
| Aboveground biomass | 532.4 | 429.3 | 385.4 |
| Belowground biomass | 255.6 | 206.1 | 185.0 |
| **Living Biomass** | **787.9** | **635.4** | **570.3** |
| Dead wood biomass | 110.3 | 88.9 | 79.8 |
| **Total Biomass** | **898.3** | **724.3** | **650.2** |

Summing the three different classes generates the final Table:

## 6.4 Data for National reporting table T6

| FRA 2005 Categories | Biomass (million metric tonnes oven-dry weight) | | | | | |
|---|---|---|---|---|---|---|
| | Forest | | | Other wooded land | | |
| | 1990 | 2000 | 2005 | 1990 | 2000 | 2005 |
| Above-ground biomass | 967.6 | 798.2 | 726.0 | | | |
| Below-ground biomass | 360.0 | 294.6 | 266.7 | | | |
| Total living biomass | 1327.6 | 1092.8 | 992.7 | | | |
| Dead wood biomass | 185.9 | 153.0 | 139.0 | | | |
| **TOTAL** | **1513.5** | **1245.8** | **1131.7** | | | |

# 7 Table T7 – Carbon stock

## 7.1 FRA 2005 Categories and definitions

| Category | Definition |
|---|---|
| Carbon in above-ground biomass | Carbon in all living biomass above the soil including stem stump branches bark seeds and foliage. |
| Carbon in below-ground biomass | Carbon in all living biomass of live roots. Fine roots of less than 2 mm diameter are excluded because these often cannot be distinguished empirically from soil organic matter or litter. |
| Carbon in dead wood biomass | Carbon in all non-living woody biomass not contained in the litter either standing lying on the ground or in the soil. Dead wood includes wood lying on the surface dead roots and stumps larger than or equal to 10 cm in diameter or any other diameter used by the country. |
| Carbon in litter | Carbon in all non-living biomass with a diameter less than a minimum diameter chose by the country for lying dead (for example 10 cm) in various states of decomposition above the mineral or organic soil. This includes the litter fumic and humic layers. |
| Soil carbon | Organic carbon in mineral and organic soils (including peat) to a specified depth chosen by the country and applied consistently through the time series. |

## 7.2 National data

Since no national data exist, data from table T6 is used as input for the estimation of carbon stock.

## 7.3 Analysis and processing of national data

The default conversion factor of 50% was used to convert from biomass to carbon.

| FRA 2005 categories | Carbon in Million tons | | |
|---|---|---|---|
| | 1990 | 2000 | 2005 |
| Carbon Aboveground biomass | 483.8 | 399.1 | 363.0 |
| Carbon in Belowground biomass | 180.0 | 147.3 | 133.4 |
| Carbon in Total living biomass | 663.8 | 546.4 | 496.4 |
| Carbon in Dead wood biomass | 92.9 | 76.5 | 69.5 |
| **Total biomass** | 756.8 | 622.9 | 565.8 |

## 7.4 Data for National reporting table T7

| FRA 2005 Categories | Carbon (Million metric tonnes) | | | | | |
|---|---|---|---|---|---|---|
| | Forest | | | Other wooded land | | |
| | 1990 | 2000 | 2005 | 1990 | 2000 | 2005 |
| Carbon in above-ground biomass | 483.8 | 399.1 | 363.0 | | | |
| Carbon in below-ground biomass | 180.0 | 147.3 | 133.4 | | | |
| **Sub-total: Carbon in living biomass** | 663.8 | 546.4 | 496.4 | | | |
| Carbon in dead wood | 92.9 | 76.5 | 69.5 | | | |
| Carbon in litter | | | | | | |
| **Sub-total: Carbon in dead wood and litter** | | | | | | |
| **Soil carbon to a depth of __ cm** | | | | | | |
| **TOTAL CARBON** | **756.8** | **622.9** | **565.8** | | | |

# 8 Table T8 – Disturbances affecting health and vitality

No information has been found to support estimates of disturbances.

# 9 Table T9 – Diversity of tree species

## 9.1 FRA 2005 Categories and definitions

| Category | Definition |
|---|---|
| Number of native tree species | The total number of native tree species that have been identified within the country. |
| Number of critically endangered tree species | The number of native tree species that are classified as "Critically endangered" in the IUCN red list. |
| Number of endangered tree species | The number of native tree species that are classified as "Endangered" in the IUCN red list. |
| Number of vulnerable tree species | The number of native tree species that are classified as "Vulnerable" in the IUCN red list. |

## 9.2 National data

### 9.2.1 Data sources

| References to sources of information | Quality (H/M/L) | Variable(s) | Year(s) | Additional comments |
|---|---|---|---|---|
| 1.Field guide to the forest trees of Ghana Hawthorne W. 1990 | M | Growing stock | 1989 | Provides secondary information on tree species in Ghana and their identification |
| 2.Forest protection in Ghana with particular reference to vegetation and plant species Hawthorne W. D and Abu-Juam Gland and Cambridge IUCN 1995 | M | Growing stock | 1993 | Provides secondary information on the vegetation and plant species in Ghana |
| 3.http://www.fao.org/forestry | M | Growing stock | 1994 | Provides information on red list tree species |

### 9.2.2 Original data

| FRA 2005 Categories | Number of species (year 2000) |
|---|---|
| Native tree species (1) | 680 |
| Critically endangered tree species (2) | 3 |
| Endangered tree species(2) | 19 |
| Vulnerable tree species(2) | 94 |

Notes:
(1): Source 1
2) Source 2 and 3

## 9.3 Data for National reporting table T9

| **FRA 2005 Categories** | **Number of species (year 2000)** |
|---|---|
| Native tree species | 680 |
| Critically endangered tree species | 3 |
| Endangered tree species | 19 |
| Vulnerable tree species | 94 |

Note: Refer to appendix 1 for list of species.

# 10 Table T10 – Growing stock composition

## 10.1 FRA 2005 Categories and definitions

List of species names (scientific and common names) of the ten most common species.

## 10.2 National data

### 10.2.1 Data sources

| References to sources of information | Quality (H/M/L) | Variable(s) | Year(s) | Additional comments |
|---|---|---|---|---|
| Resource Management Support Centre Mensuration and Inventory Unit Kumasi Report of Multi Resource Inventory | M | Growing stock | 1990 and 2001 | |

### 10.2.2 Original data

## 10.3 Analysis and processing of national data

## 10.4 Data for National reporting table T10

| FRA 2005 Categories / Species name (Scientific name and common name) | Growing Stock in Forests in millions cubic meters | |
|---|---|---|
| | 1990 | 2000 |
| *Triplochiton scelroxylon*/ WAWA | 15.94 | 18.35 |
| *Celtis mildbraedii*/ESA | | 17.73 |
| *Piptadeniastrum africanum*/DAHOMA | 7.73 | 7.21 |
| *Ceiba pentandra*/ONYINA | 10.27 | 6.37 |
| *Terminalia superba*/OFRAM | 5.95 | 5.17 |
| *Celtis zenkeri*/ESAKOKO | 10.12 | 5.03 |
| *Petersianthus macrocarpus*/ESIA | 6.85 | 4.77 |
| *Nesogordonia papaverifera*/DANTA | 5.21 | 4.15 |
| *Psycanthus angolensis*/OTIE | 5.79 | 4.12 |
| *Antiaris toxicaria*/KYENKYEN | 9.17 | 3.85 |
| *Total* | 77.03 | 76.75 |
| *Remainder* | **346** | **275** |
| **TOTAL** | **423** | **352** |

## 10.5 Comments to National reporting table T10

Most of the common names of tree species were not known so local names were used in place.

# 11 Table T11 – Wood removal

## 11.1 FRA 2005 Categories and definitions

| Category | Definition |
|---|---|
| Industrial wood removal | The wood removed (volume of roundwood over bark) for production of goods and services other than energy production (woodfuel). |
| Woodfuel removal | The wood removed for energy production purposes regardless whether for industrial commercial or domestic use. |

## 11.2 National data

### 11.2.1 Data sources

| References to sources of information | Quality (H/M/L) | Variable(s) | Year(s) | Additional comments |
|---|---|---|---|---|
| 1. Resource Management Support Centre Production Unit Timber Information Forms Annual report | M | National log production in volumes | 1988-2003 | National production statistics of wood removal based on the Annual Allowable Cut (AAC)<br><br>Source only provides information on production for forest |
| 2. Year book of forest product | | Fuelwood | 1988 to 2002 | |

### 11.2.2 Classification and definitions

| National class | Definition |
|---|---|
| Forest Reserve (FR) | Forest land within reserves and under protection |
| Off-Forest Reserve (OFR) | Forestland outside reserves mainly made up of mosaic of agricultural fields fallow lands secondary forest patches and settlements. |

### 11.2.3 Original data

**Table of Industrial Roundwood and Wood Fuel removed from the forests**

| Year | Volume of Industrial Wood removal over bark in cubic meters (1) | Volume of wood fuel under bark in cubic metres (2) | Volume of wood fuel over bark in cubic meters (3) |
|---|---|---|---|
| 1988 | 1 400 000 | 12 750 000 | 14 662 500 |
| 1989 | 990 000 | 12 870 000 | 14 800 500 |
| 1990 | 1 289 023 | 12 870 000 | 14 800 500 |
| 1991 | 1 229 430 | 11 000 000 | 12 650 000 |
| 1992 | 1 318 406 | 15 000 000 | 17 250 000 |
| 1993 | 966 757 | 18 100 000 | 20 815 000 |
| 1994 | 1 681 872 | 20 678 000 | 23 779 700 |
| 1995 | 1 194 416 | 20 678 000 | 23 779 700 |
| 1996 | 1 166 407 | 20 678 000 | 23 779 700 |
| 1997 | 1 202 889 | 20 678 000 | 23 779 700 |
| 1998 | 1 400 822 | 20 678 000 | 23 779 700 |
| 1999 | 1 102 203 | 20 678 000 | 23 779 700 |
| 2000 | 981 883 | 20 678 000 | 23 779 700 |
| 2001 | 1 245 536 | 20 678 000 | 23 779 700 |
| 2002 | 1 364 392 | 20 678 000 | 23 779 700 |

Notes:
1).Source**:** Country data source 1.
2).Source: FAO yearbook of forest products (source 2)
3) Conversion factor used to convert to over bark =1.15

## 11.3 Analysis and processing of national data

| | 5 year Average 1988-1992 | 5 year Average 1993-1997 | 5 year Average 1998-2002 |
|---|---|---|---|
| **Year** | **1990** | **1995** | **2000** |
| Industrial Roundwood | 1 245 372 | 1 242 468 | 1 218 968 |
| Wood Fuel | 14 832 700 | 23 186 760 | 23 779 700 |
| **Total** | **16 078 072** | **24 429 228** | **24 998 668** |

### 11.3.1 Estimation and forecasting

Data for 2005 was estimated by linear extrapolation of the data in the table above. The extrapolation resulted in the following table that then was used to generate the final table

| | Volume over bark in $m^3$ | | |
|---|---|---|---|
| **FRA 2005 Categories** | **1990** | **2000** | **2005** |
| Industrial Roundwood | 1 245 372 | 1 218 968 | 1 205 765 |
| Wood Fuel | 14 832 700 | 23 779 700 | 28 253 200 |
| **Total** | **16 078 072** | **24 998 668** | **29 458 965** |

## 11.4 Data for National reporting table T11

| FRA 2005 Categories | Volume in 1000 cubic meters of roundwood over bark | | | | | |
|---|---|---|---|---|---|---|
| | Forest | | | Other wooded land | | |
| | 1990 | 2000 | 2005 | 1990 | 2000 | 2005 |
| Industrial roundwood | 1 245 | 1 219 | 1 206 | | | |
| Woodfuel | 14 833 | 23 780 | 28 253 | | | |
| **TOTAL for Country** | **16 078** | **24 999** | **29 459** | | | |

## 11.5 Comments to National reporting table T11

Industrial round wood is extracted from the production areas, which comprises the area under Forest reserves and the 370 000 production area under Off-Forest reserve.

# 12 Table T12 – Value of wood removal

## 12.1 FRA 2005 Categories and definitions

| Category | Definition |
|---|---|
| Value of industrial wood removal | Value of the wood removed for production of goods and services other than energy production (woodfuel). |
| Value of woodfuel removal | Value of the wood removed for energy production purposes regardless whether for industrial commercial or domestic use. |

## 12.2 National data

### 12.2.1 Data sources

Stumpage fees from Forestry Commission

### 12.2.2 Classification and definitions

### 12.2.3 Original data

There was no original data for this table. An average stumpage fee for year 2000 in USD was calculated from the stumpage price in Cedi and the exchange rate for year 2000. It was then assumed that the stumpage fee in USD has remained the same for 1990, 2000 and 2005.

| FRA 2005 Category | Average Stumpage Price | | Exchange rate |
|---|---|---|---|
| | Cedis | US$ | 2000 |
| Industrial Roundwood | 41 806 | 5.931911 | 1US$=7047.65 Cedi |

## 12.3 Analysis and processing of national data

To get the unit value of the removal at the border of the forest, an average logging cost of $US20.00 was added to the stumpage price. The unit value will then be US$25.93. Multiplying the volume of the industrial round wood removal for 1990, 2000 and 2005 respectively ( from T11) by the average unit value provides the following table:

| | Value in US$ | | | |
|---|---|---|---|---|
| FRA 2005 Category | 1990 | 2000 | 2005 | Unit value in US$ |
| Industrial round wood | 32 292 491 | 31 607 829 | 31 265 498 | 25.93 |

## 12.4 Data for National reporting table T12

| FRA 2005 Categories | Value of roundwood removal (1000 USD) | | | | | |
|---|---|---|---|---|---|---|
| | Forest | | | Other wooded land | | |
| | 1990 | 2000 | 2005 | 1990 | 2000 | 2005 |
| Industrial roundwood | 32 292 | 31 608 | 31 265 | | | |
| Woodfuel | NDA | NDA | NDA | | | |
| **TOTAL for Country** | | | | | | |

## 12.5 Comments to National reporting table T12

The value of roundwood for 1990 is an estimate because during this period industries were paying for roundwood in the form of 'Royalties'. This "royalties" system was used when the industry pays for a concession and the amount shared between the then Forestry Department and the stool owners who are the customary owners of the land at a rate of 70 and 30 percent respectively). This system was then abolished for the stumpage system in 1999 with the backing of the LI 649 where value is given to tree before felling.

At present the commercial production and marketing of fuel wood is virtually uncontrolled and unplanned hence data on wood fuel extraction is not available.

# 13 Table T13 – Non-wood forest product removal

No information available to support estimates for this table

# 14 Table T14 – Value of non-wood forest product removal

No information available to support estimates for this table

# 15 Table T15 – Employment in forestry

Forestry Department now Forestry Commission was set up in 1909. Forestry industry directly employs 70000 people equivalent to some 250000 in the form of workers and their families, which is about 0.38% of total country population. The Forestry commission now has a staff population of 4000. Many more are indirectly dependent for example those who supply goods and services. According to the information obtained from FAO industrial forestry employment, an estimated 10 000 persons were employed in forestry, logging and related services in 1990 as opposed to 6 500 in 2000 ("Trends and current status of the contribution of the forest sector to national economies" (FAO, 2003))

However, this information has not been considered sufficient to provide estimates for this table.

# Appendix 1

**Critically Endangered**

| Scientific Name | Common Name |
|---|---|
| *Aubregrinia taiensis* | |
| *Salacia fibrisepala* | |
| *Talbotiella gentii* | |

## Endangered

| Scientific Name | Common Name |
|---|---|
| *Chrysophllum azagnieanum* | |
| *Cola boxiana* | |
| *Dactyladenia hirsute* | |
| *Dalbergia setifera* | |
| *Hemandradenia cevalieri* | |
| *Hunteria ghanensis* | |
| *Hyenostegia gracilipes* | |
| *Lecaniodiscus punctatus* | |
| *Monocyclanthus vignei* | |
| *Neolemonniera clitandrifolia* | |
| *Pericopsis elata* | African teak |
| *Placodiscus attenuatus* | |
| *Placodiscus pseudostipularis* | |
| *Pleleopsis habeensis* | |
| *Pyrenacantha cordicula* | |
| *Sericanthe toupeton* | |
| *Swartzia fistuloides* | |
| *Tieghmella heckelii* | Cherry mahogany |
| *Vepris heterophylla* | |

## Vulnerable

| Scientific Name | Common Name |
|---|---|
| Afrostyrax lepidophyllus | |
| Afzelia Africana | |
| Albizia ferruginea | |
| Allexis cauliflora | |
| Amanoa bracteosa | |
| Amanoa strobilacea | |
| Anopyxis klaineana | |
| Anthonotha vignei | |
| Antrocaryon micraster | |
| Berlinia occidentalis | |
| Cassipourea hiotou | |
| Citropsis gabunensis | |
| Coffea togoensis | |
| Cola reticulate | |
| Cola umbratilis | |
| Copaifera salikounda | |
| Cordia platythyrsa | |
| Craibia atlantica | |
| Croton aubrevillei | |
| Cryptosepalum tetraphyllum | |
| Cussonia bancoensis | |

| | |
|---|---|
| Dactyladenia dinklagei | |
| Deinbollia molliuscula | |
| Dienbollia saligna | |
| Dennettia tripetala | |
| Desmostachys vogelii | |
| Diospyros barteri | |
| Drypetes afzelii | |
| Drypetes pellegrinii | |
| Drypetes singroboensis | |
| Encephalartos barteri | West African cycad |
| Entandrophragma angolense | |
| Entandrophragma candollei | |
| Entandrophragma cylindricum | |
| Entandrophragma utile | |
| Eribroma oblongam | Yellow Sterculia |
| Garcinia afzelii | |
| Garcinia epunctata | |
| Garcinia kola | |
| Gilbertiodendron bilineatum | |
| Gilbertiodendron splendidum | |
| Gluema ivorensis | |
| Guarea cedrata | |
| Guarea thompsonii | |
| Guibourtia ehie | |
| Hallea ledermannii | |
| Hallea stipulosa | |
| Heritiera utilis | |
| Hymenostegia aubrevillei | |
| Isolona deightonii | |
| Khaya anthotheca | African mahogany |
| Khaya grandifoliola | African mahogany |
| Khaya ivorensis | African mahogany |
| Khaya senegalensis | |
| Lophira alata | |
| Lovoa trichilioides | |
| Milicia regia | |
| Millettia warneckei | |
| Nauclea diderrichii | |
| Neostenanthera hamata | |
| Nesogordonia papaverifera | |
| Nothospondias staudtii | |
| Ouratea amplectens | |
| Pavetta lasioclada | |
| Pavetta mollissima | |
| Phyllanthus profusus | |
| Pierreodendron kerstingii | |
| Piptostigma fugax | |
| Placodiscus bancoensis | |
| Placodiscus boya | |
| Placodiscus bracteosus | |
| Placodiscus oblongifolius | |
| Pseudagrostistachys Africana | |
| Pterygota bequaertii | |
| Pterygota macrocarpa | |
| Rhodognaphalon breviscupe | |
| Robynsia glabrata | |
| Sapiumaubrevillei | |
| Schumanniophyton problematicum | |

| | |
|---|---|
| Spathandra barteri | |
| Synsepalum aubrevillei | |
| Tapura ivorensis | |
| Terminalia ivorensis | |
| Trichilia ornithothera | |
| Trichoscypha albiflora | |
| Trichoscypha atropurpurea | |
| Trichoscypha beguei | |
| Trichoscypha cavalliensis | |
| Turraeanthus africanus | |
| Uvariodendron occidentale | |
| Vitellaria paradoxa | Shea butter tree |
| Warneckea memecyloides | |
| Xylopia elliotii | |
| Zanthoxylum chevalieri | |