No.

JAPAN INTERNATIONAL COOPERATION AGENCY
MINISTRY OF LANDS AND FORESTRY, GHANA

THE STUDY
ON
THE RESERVE FOREST MANAGEMENT
IN TRANSITIONAL ZONE
IN
GHANA

FINAL REPORT

OCTOBER, 1999

JAPAN FOREST TECHNICAL ASSOCIATION (JAFTA)

PASCO INTERNATIONAL INC.

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PREFACE

In response to the request from the Government of Republic of Ghana, the Government of Japan decided to conduct the Study on the Reserve Forest Management in Transitional Zone in Ghana and entrusted the study to Japan International Cooperation Agency (JICA).

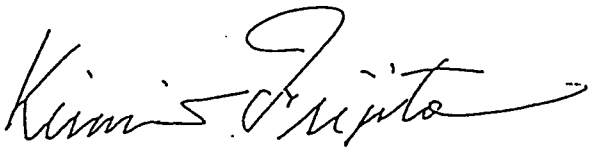
JICA sent to Ghana the study team headed by Mr.Shinji TANABE, Japan Forest Technical Association, six times between October 1997 and August 1999.

The team held discussions with the officials concerned of the Government of Republic of Ghana, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Republic of Ghana for their close cooperation extended to the team.

October, 1999



Kimio Fujita
President
Japan International Cooperation Agency

October 1999

Mr. Kimio FUJITA
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr FUJITA

Letter of Transmittal

It is my pleasure to submit to you the Final Report following the completion of the Study on the Reserve Forest Management in Transitional Zone in Ghana.

The Report compiles the finding of field surveys conducted in the period from October, 1997 to August, 1999 in accordance with the agreement made between the Japan International Cooperation Agency(JICA) and the joint venture [Japan Forest Technical Association and Pasco International INC], the result of the subsequent analysis and the plan formulated.

In the course of the Study, The feasibility study was conducted for the Forest Management Plan targeting five forest reserves in the Transitional Zone. This management plan to be composed of measures to promote forest rehabilitation, fire control and active participation of local people, aims at sustainable forest management and the betterment of local living standard.

I sincerely hope that the Forest Management Plan will be implemented as planned with the concerted efforts of Government of Republic of Ghana and all other organizations concerned to rehabilitate the degraded forest land and to contribute to sustainable forest management of Ghana.

I would like to express my utmost gratitude to JICA, the Ministry of Foreign Affairs and the Ministry of Agriculture, Forestry and Fisheries ,JICA Ghana office, Embassy of Japan, Ministry of Lands and Forestry, Forestry Department and other related organizations for the invaluable advice and assistance given to the Study Team.

I believe that JICA will find the Report useful for the future implementation of the Forest Management Plan

Very truly yours,

田邊眞次

Sinji TANABE
Team Leader
The Study on the Reserve Forest Management
in Transitional Zone in Ghana.

Natural Forest (Tain II F/R)

Degraded Forest after Bush Fire (Nyanponase)

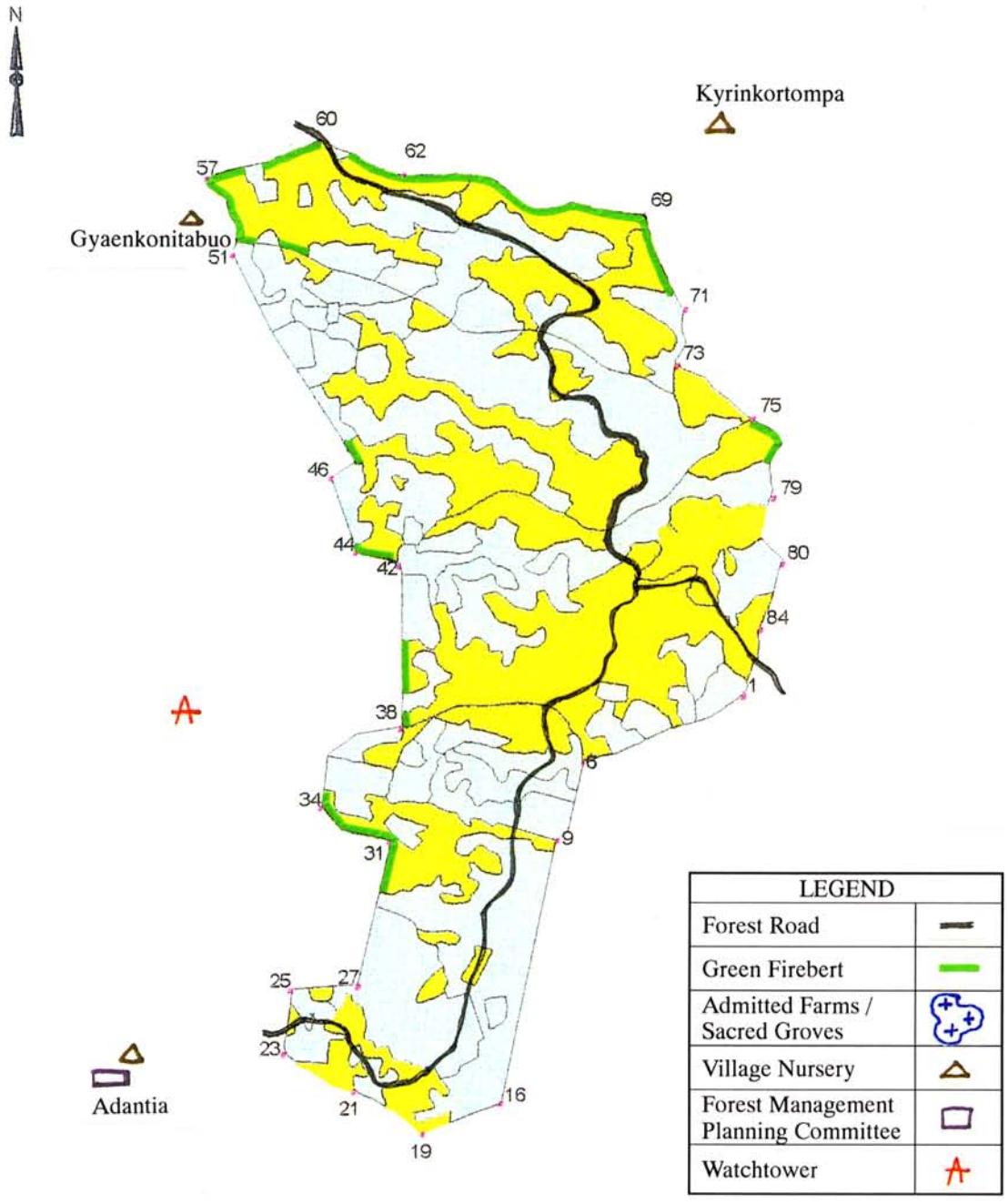
Farmers 'Meeting (Adoe)

Teak Plantation (Bonsuvonberg Farms)

Green Firebelt (Tain II F/R)

Teak Seedling (Sunyani Nursery)

FOREST AREAS AVAILABLE FOR PLANTATION DEVELOPMENT
TAIN I FOREST RESERVE



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\# PILLARS

SUITABLE FOR PLANTATION

OTHER AREAS

SOURCE: JICA MAPS (1998)

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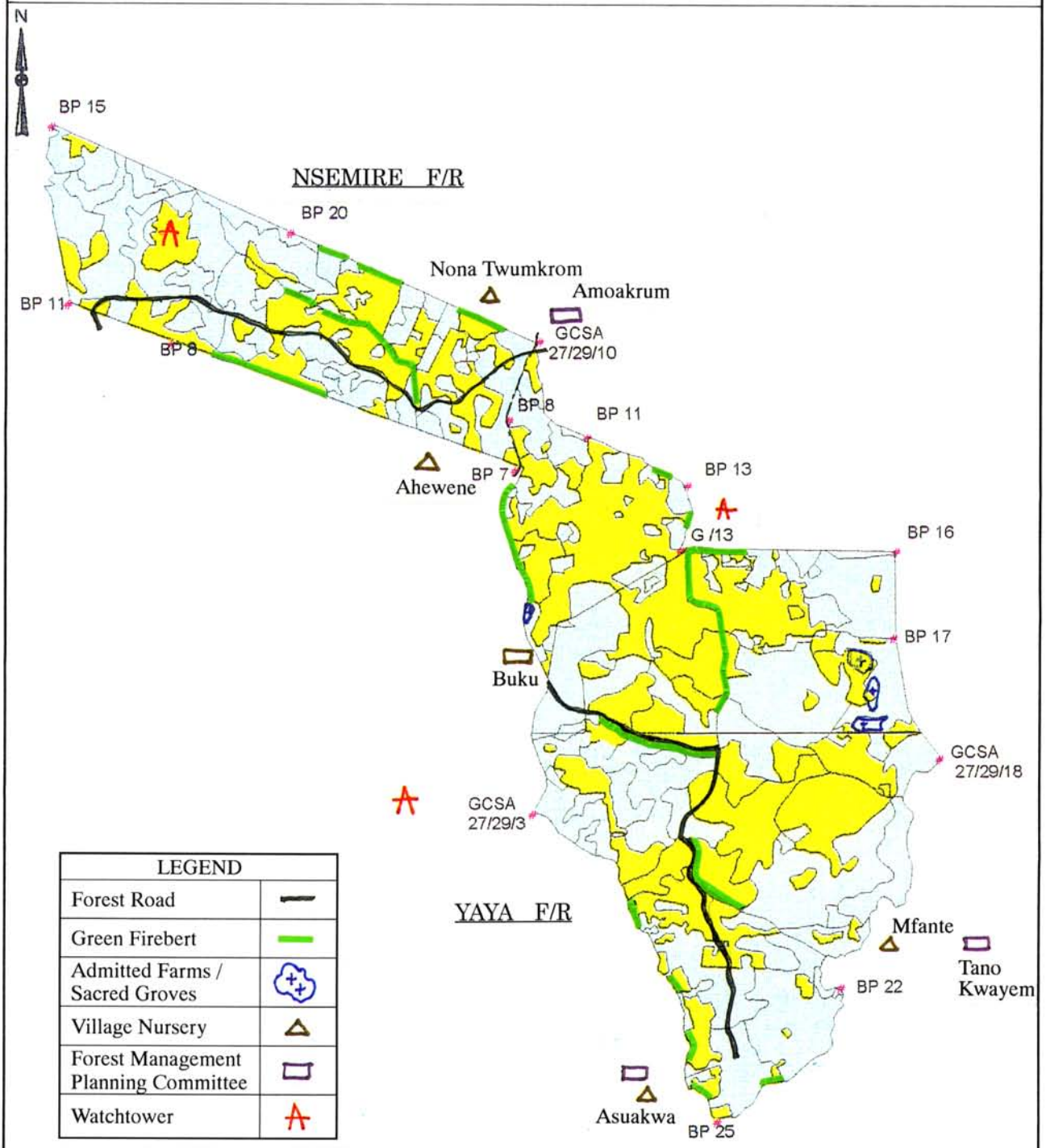
FOREST AREAS AVAILABLE FOR PLANTATION DEVELOPMENT
YAYA AND NSEMRE FOREST RESERVES



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OTHER AREAS

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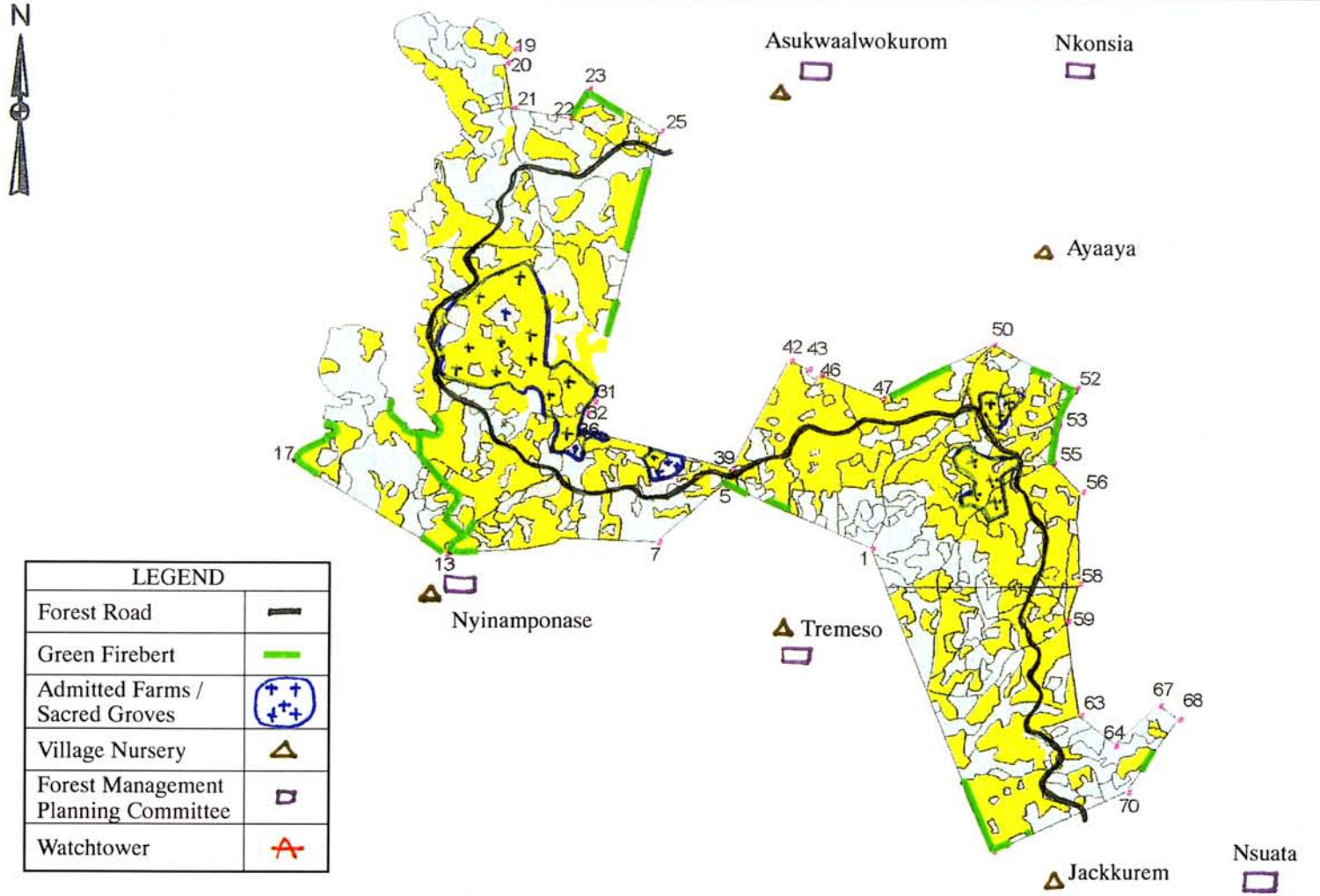
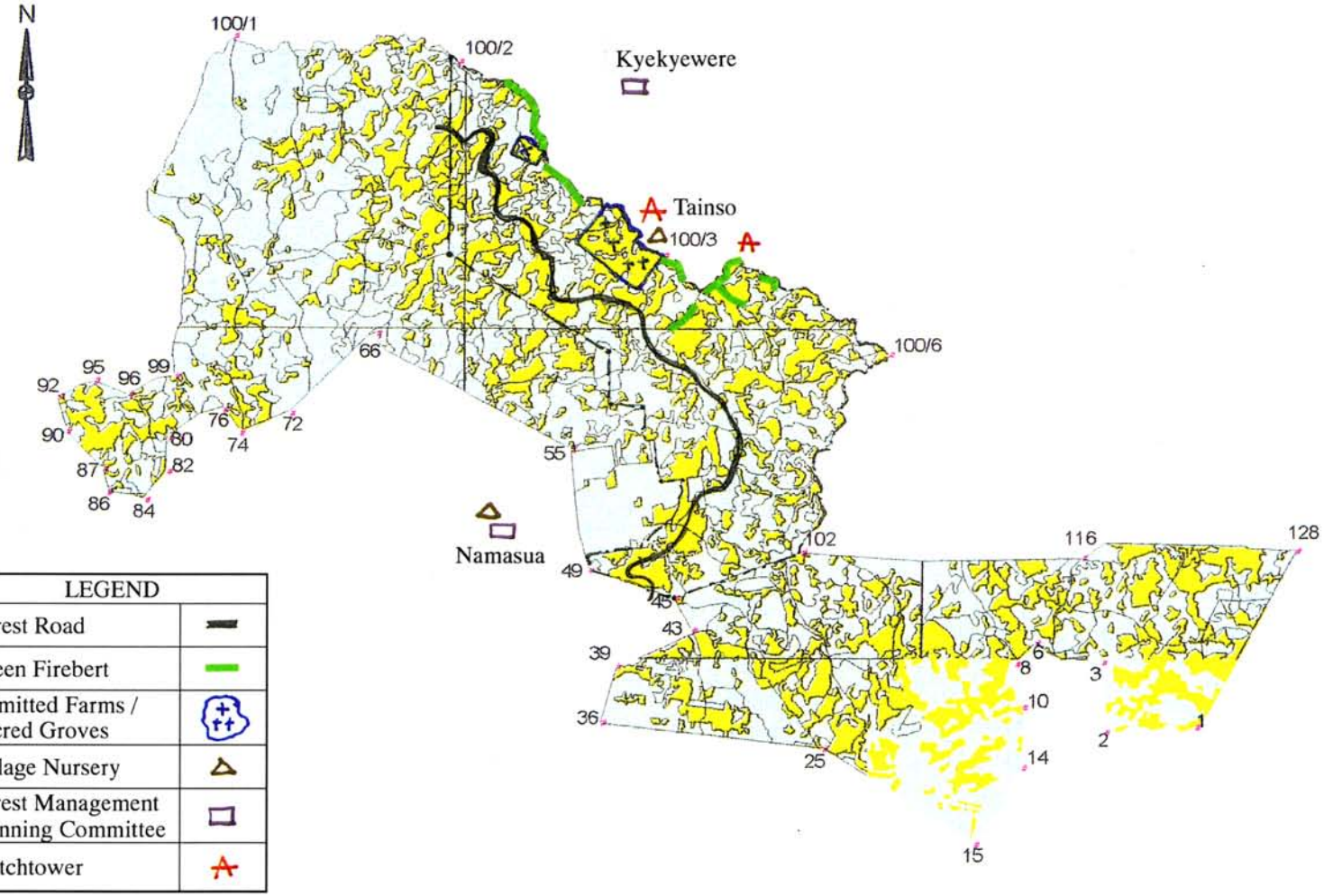
SAWSAW FOREST RESERVE



FOREST AREAS AVAILABLE FOR PLANTATION DEVELOPMENT
TAIN II FOREST RESERVE



LEGEND	
Forest Road	
Green Firebert	
Admitted Farms / Sacred Groves	
Village Nursery	
Forest Management Planning Committee	
Watchtower	

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FOREST AREAS
SUITABLE FOR PLANTATION

SOURCE: JICA MAPS (1998)

Produced by: FIS, FMSC, Kumasi

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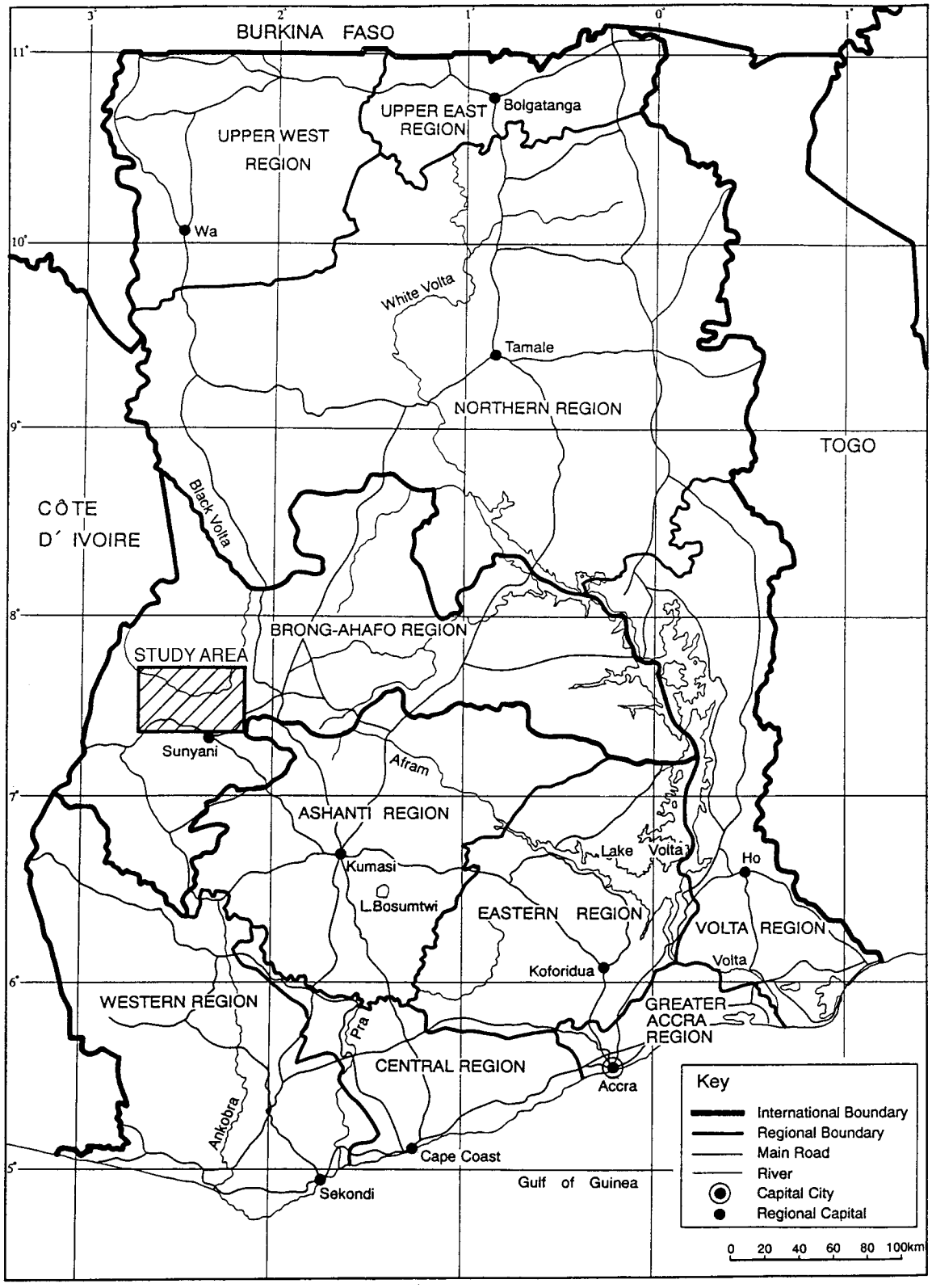
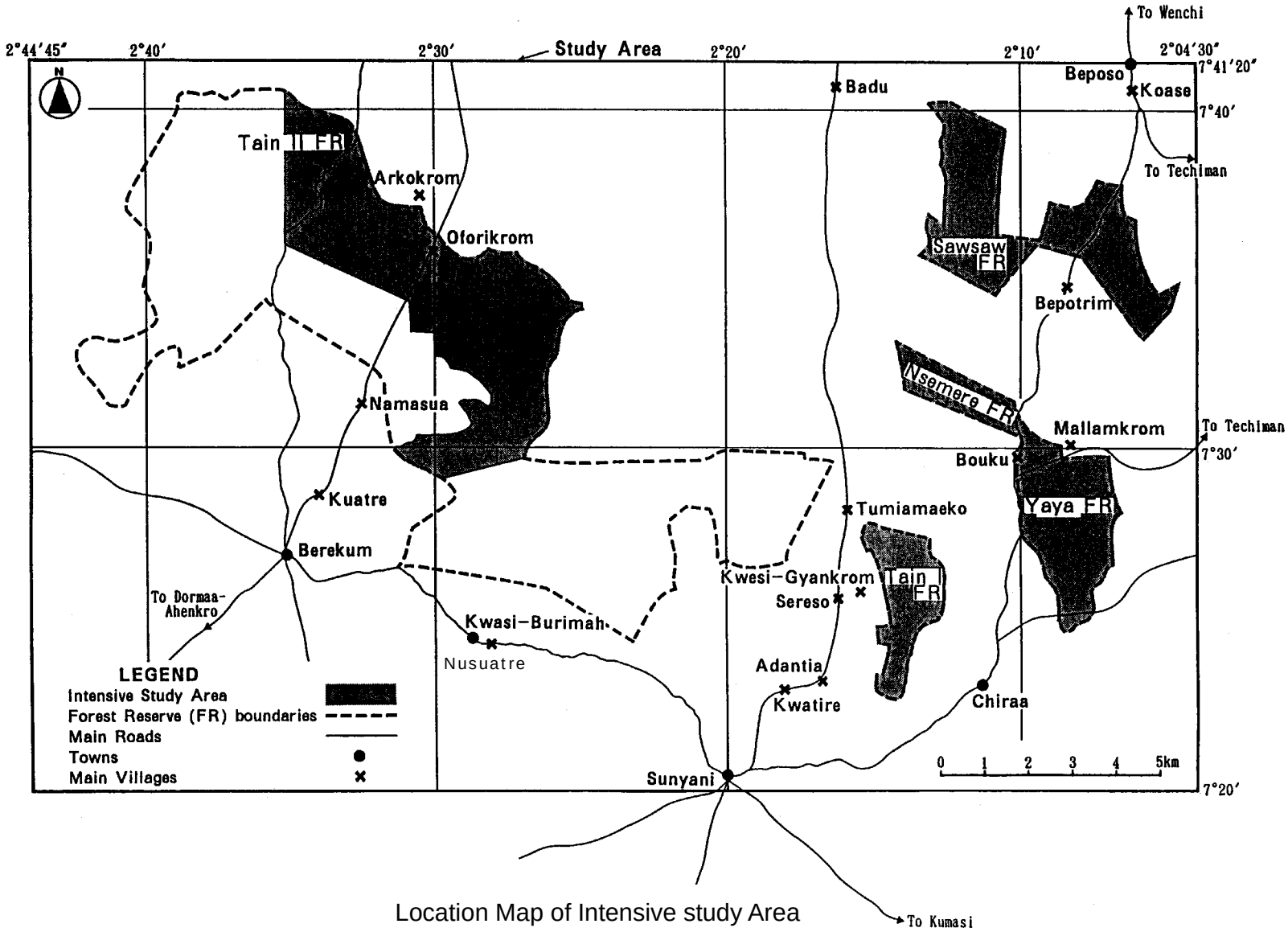


Location Map of Study Area



Location Map of Intensive study Area

GLOSSARY AND ABBREVIATIONS

Abbreviation	English	Remarks
	African oil palm	Elaeis guineensis
	Avocado (pear)	Persea americana
	Bitter yam	Dioscorea dumetorum
	Cacao	Thebroma cacao
	Cassia	Cassia siamea
	Cashew	Anacardium occidentale
	Cassava	Manihot esculenta
C	Cedi (s)	
	Cedro	Cedrela odorata
CCF	Chief Conservator of Forests	
	Chromolaena	Chromolaena odorata
	Citrus fruits/orange	Citrus spp.
	Cocoyam	Colocasia spp./ Xanthosoma spp.
CFMU	Collaborative Forest Management Unit (Planning Branch, FD)	
CSD	Commission on Sustainable Development	
CDC	Commonwealth Development Cooperation	
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora	
DAC	Development Assistance Committee	
DFO	District Forestry Office	
EIA	Environmental Impact Assessment	
EIS	Environmental Impact Statement	
EP	Environmental Permit	
EPA	Environmental Protection Agency	
EPC	Environmental Protection Council	
EU	European Union	
FAO	Food and Agriculture Organization of the United Nations	
FIMP	Forest Inventory and Management Project	
FMU	Forest Management Unit	
FPPP	Forest Plantation Preparation Project	
FORIG	Forest Research Institute (of Ghana)	
FR	Forest Reserve	
FRMP	Forest Resource Management Project	
FSDP	Forest Sector Development Project	
FD	Forestry Department	
FDMP	Forestry Development Master Plan	
FIR	Forestry Inventory Project	
GTZ	German Agency for Technical Cooperation	
	Ground nut	Arachis hypogaea
	Harmattan	North East Trade Wind
HL	Head load	
ha	Hectare	
IEE	Initial Environmental Examination	
JICA	Japan International Cooperation Agency	
	Maize	Zea mays
MEST	Ministry of Environment, Science & Technology	
MOFA	Ministry of Food and Agriculture	

Abbreviation	English	Remarks
MLF	Ministry of Lands and Forestry	
MLGRD	Ministry of Local Government and Rural Development	
M/M	Minutes of Meetings	
NTFPs	Non Timber Forest Products	
NGO	Nongovernmental Organization	
ODA	Overseas Development Administration	
	Ofram	Terminalia superba
	Pepper	Piper nigrum
	Pigeon pea	Cajanus cajan
	Plantain	Musa paradisiac
PE	Potential evapotranspiration	
PWC	Protection Working Circle	
RRA	Rapid Rural Appraisal	
RFO	Regional Forestry Office	
RWC	Research Working Circle	
S/W	Scope of Work for the Study on the Reserve Forest Management in Transitional Zone in Ghana (Accra, 19 March, 1997)	
SWC	Selection Working Circle	
	Sugar apple	Annona (squamosa) spp.
	Teak	Tectona grandis
UST	The University of Science and Technology	
IUCN	The World Conservation Union	
TUC	Timber Utilization Contract	
TDC	Town/Village Development Committee	
UNDP	United Nations Development Programme	
Unesco	United Nations Educational, Scientific and Cultural Organizaion	
	White teak	Gmelia arborea
	Yam	Dioscorea spp.

SUMMARY

SUMMARY

1. Outline of the Study

This Study covers some 300,000 ha in the transitional zone lying in the western part of the Brong-Ahafo Region as the Study Area for the preparation of new land use and vegetation maps. In addition, five forest reserves much degraded totalling some 30,000 ha in the Study Area constitute the Intensive Study Area for which a forest management plan, mainly featuring forest rehabilitation, bushfire prevention/control and the participation of local people, is formulated and a feasibility study on this plan is conducted.

2. Current Conditions of Forests and Forestry in Ghana

2.1 Current Conditions of Forests

The total forest area is 91,747 km^2, accounting for 40.1% of the national land area. Most forests in the Study Area belong to the category of dry semi-deciduous forests. In recent years, forests have been depleting at an annual rate of some 1.3% nationwide. In all, 291 forest reserves (totalling 25,704.06 km^2) have been established across the country. Among them, the forest area (forest reserves) in transitional zone occupies 357,000 ha. In the Brong-Ahafo Region where the Study Area is located, there are 22 forest reserves which cover an area of 2,529.24 km^2.

2.2 Forest and Forestry Policies

Forest management in Ghana commenced with the promulgation of the "Timber Protection Ordinance" in 1907, the establishment of the Forestry Department in 1909 and the promulgation of the so-called Forest Ordinance, the basic law regarding the establishment and protection of forest reserves, in 1927. The problems of an excessive decline of commercial species, forest degradation and forest depletion led to the formulation of the Forests and Wildlife Policy in 1994 and the Forestry Development Master Plan in 1996, clarifying the policy direction for forests and forestry. In recent years, the Timber Resources Management Act was approved by the national assembly in March, 1998.

The reorganization of the Forestry Department as the Forest Service is planned by the end of 1999 as a semi autonomous body to implement efficient as well as effective forestry policies and forest management. The forestry policy in the transitional zone is to promote plantation

through Collaborative Forest Management Programme and bushfire control by people's participation.

2.3 Timber Production

Although the annual allowable harvest is set at 1.2 million m^3, the actual cutting volume has been exceeded since 1990 with a sharp increase of log production in 1993 to earn foreign currency. At present, the timber supply volume for the domestic market is 0.7 million m^3/year which is expected to increase to one million m^3 in 2005, suggesting the growing importance of timber supply by plantations in the coming years. 95% of the fuel consumed in rural areas is provided in the form of fuelwood with an estimated nationwide fuelwood consumption volume of 14 million m^3.

Plantations in Ghana currently cover an area of 72,103 ha which account for a mere 0.8% of the total forest area. Plantations in the Study Area are 20 - 30 years old and are mainly teak plantations.

3. General Conditions of Study Area

3.1 Natural Conditions

The Study Area is located on the Ashanti Highland in the west of the Volta Basin and is dominated by gentle slopes with a flat or undulating surface. Sunyani at the centre of the Study Area has a mean annual temperature of 26.3°C and mean annual rainfall of 1,179 mm (both of these mean values are for a 10 year period). There are two dry seasons, i.e. from November to February and from July to August.

In terms of the vegetation type, the Study Area belongs to the fire zone of the dry semi-deciduous forest zone and indicators of the savanna zone can be found. To be more precise, as such savanna grasses as giant grass (Andropogon spp.) and others indicating the serial phase to savanna are found, the area could become a savanna zone with the frequent occurrence of bushfires.

3.2 Socioeconomic Conditions

There are 31 villages in the Study Area with a total population of some 36,000 as of 1984. Assuming a local population increase rate of 3.3%/year, the present population of the Study Area is estimated to be some 57,000. The ratio of the rural population in the Brong-Ahafo

Region is 73% which is slightly higher than the national average. In all districts, those engaged in agriculture, forestry and stock raising account for a large majority of the working population and a similar picture is believed to exist in the Study Area.

The village structure is made up of matrilineal lineages which act as the basic units. Each matrilineal lineage forms a village community with the ownership of certain land and is called a stool. In fact, each stool has a hierarchical structure and the village stool is situated at the lower end of this hierarchy. Ordinary villages and small settlements lay below the village stool. Stools have land ownership but land and timber resources in areas designated as forest reserves are managed by the Forestry Department instead of the stools. The Forestry Department gives concessions to timber companies. Part of the timber concession fee and rent for the land is distributed to the stools.

3.3 Land Use and Vegetation

The area by land use and vegetation category in the Study Area is shown in Table 1.

Table 1 Area by Land Use and Vegetation Category in Study Area

	Category	Symbol	Area (ha)	Ratio (%)
Forest	Plantations (Man-Made Forests)	MF	6,769	2.3
	Natural Forests	NF	70,747	24.1
	Riparian Forests	RF	2,596	0.9
	Shrub Land	S	15,103	5.2
	Total		95,215	4.8
Non-Forest	Farmland	F1	13,939	4.8
		F2	888	0.3
	Sub-Total		14,827	5.1
	Grassland	G1	15,956	5.4
		G2	109,248	37.3
		G3	49,021	16.7
	Sub-Total		174,225	59.4
	Bare Land/Rocky Land	B	235	0.1
	Villages	V	8,254	2.8
	Water Bodies	W	39	-
	Roads	R	207	0.1
	Total		197,785	67.5
Grand Total			293,000	100.0

3.4 Forests and Forestry

Examination of the degree of forest degradation uses six scoring grades (1 indicates excellent forest conditions and 6 indicates a loss of the forest state with 2 to 5 indicating different grades

of degradation). The Tain II forest reserves (referred below to as FR after its name) has a grade of 4 (mainly degraded) while the other four forest reserves are graded as 5 (very poor). The actual management work of the forest reserves is conducted by a forest officer and technical officers, etc. of each district forestry office.

While teak plantations used to be introduced in forest reserves under the taungya system, this practice was abolished in 1972. Two sawing companies are conducting cutting in the forest reserves and their work is expected to continue until 2001 in the case of one company and 2008 in the case of the other.

The survey on local sawmills and furniture factories in the Study Area found a problem of a declining supply of raw wood and sawn timber in the last 10 years. The survey also found that the sharp price increase of logs and lumber due to the tight supply has severely affected the business management of these factories.

4. Current Conditions of Forests and Site Conditions in Intensive Study Area

4.1 Forests

(1) Land Use and Forest Categories

The Intensive Study Area covers an area of 30,464 ha with plantations, natural forests and grassland accounting for 10.3% (3,138 ha), 42.7% (13,020 ha) and 43.7% (13,317 ha) respectively. Table 2 shows the breakdown of land use by forest reserve.

Table 2 Area by Land Use in Intensive Study Area

(Unit: ha)

		Sawsaw	Nsemere	Yaya	Tain I	Tain II	Total
Plantations		714	147	1,317	551	409	3,138
Natural Forests		2,072	1,136	1,314	1,094	7,404	13,020
Riparian Forests						18	18
Shrub Land		91					91
Farmland	F1	571	52	62		85	770
	F2	2					2
Grassland	G1	435		2		279	716
	G2	2,077	609	1,555	1,153	4,380	9,774
	G3	1,175	67	885	124	576	2,827
Bare Land/Rocky Land		57	5	32			94
Village				8		6	14
Total		7,194	2,016	5,175	2,922	13,157	30,464

For the purpose of natural forest conservation, forests are classified into different types based on the tree height and crown density. 43% (5,647 ha) of natural forests are found to have a crown density of 50% or less, indicating a fairly advanced state of degradation. The regeneration survey found few naturally regenerated juveniles due to the coverage of forest land by Chromolaena spp. and damage due to bushfires.

(2) Current State of Plantations

The subject stands of the survey are all teak plantations with an age ranging from five years old to 29 years old. The growth of the planted teak is not good due to the soil conditions and invasion of bushfire. Some teak stands have reached the cutting age to produce electric poles and saw log. There is every expectation of the demand for teak to produce electric poles under the Rural Electrification Programme.

(3) Current State of Natural Forests

The sample plot survey found 75 species (including exotic species for plantations and unidentified species). The number of species found varies from one site to another, presumably because of the impacts of bushfires and cutting. The undergrowth at many sites is dominated by Chromolaena spp. although the degree of dominance partly depends on the crown density.

(4) Causes of Forest Degradation

The forest reserves are fairly degraded as illustrated by the facts that grassland accounts for more than 30% of the total area of forest reserves and that the inner parts of forests are fairly degraded due to the vigorous growth of undergrowth centering on Chromolaena spp. and stem damage due to bushfires.

The presence of illegal cultivation sites in the forest reserves and the illegal cultivation of maize at cut-over sites are believed to be partially responsible for bushfires during the dry season.

4.2 Soil

The predominant soil types found in the Intensive Study Area are leptosols and cambisols. Of these, dystric cambisols (CMd) offer the highest productivity because of their deep thickness and good water retention. Teak with relatively good form is currently growing on this soil. No significant correlation has been established between the soil factors indicating the site conditions and the site index, suggesting that the growth impediment of low rainfall takes effect prior to

any appearance of significant growth differences due to the soil factors. Excessive cutting and repeated bushfires have made the ground surface bare and high intensity rain easily washes away the top soil, causing sheet erosion of the soil.

5. Socioeconomic Conditions of Intensive Study Area

5.1 General Conditions of Subject Villages

(1) Subject Villages of the Survey

The surveyed village stools belong to the paramount stools of Berekum, Nsuatre and Wenchi. The total population of the 30 villages surveyed is estimated to be some 36,000 with a village population size widely varying from 50 to 12,000.

Local administrative organizations include district assemblies with the authority to formulate and implement village development programmes, unit committees at the village level and village/town development committees which traditionally organize joint work and other activities in villages.

Most of the farmland in the subject villages belongs to indigenous families of the Akan. Share-cropping has been the only realistic and legal way of obtaining farmland for landlles farmers since the suspension of the taungya system.

(2) Agricultural Activities

The predominant farming method is extensive farming using the traditional slash and burn method. Cash crops (maize, etc.) and crops for personal consumption (plantains, etc.) are cultivated locally. Most farmland is small, i.e. 2 ha or less, and the fragmentation of farmland is taking place in accordance with the population increase.

The production cost is predominantly determined by the labour input and rent for the land. The daily wage for an employed farm labourer is 2,000 - 3,000 cedis (US$ 1 = 2,290 cedis) plus a meal (lunch). Income from farming products accounts for 90% of the total household income and maize accounts for some 70% of the income from cash crops. Farming is the joint work of both men and women. While land preparation is conducted by men, planting and weeding, etc. are conducted by women.

5.2 Local People and Forests

(1) Relationship Between Local People and Forests/Forest Resources

Planting under the taungya system in the past mainly failed due to the unfair allocation of land, short period of land use permitted and other reasons. However, because of the shortage of cultivable land and the declined productivity of present farmland, many local people hope for the re-introduction of the taungya system under which the cultivation of relatively fertile land in forest reserves is possible. The present system of non-timber forest products (referred below to as NTFPs) collection is not effectively functioning because of insufficient public relations (PR) of the system by the government and the time-consuming procedure, etc. The tree preference survey found that farmers tend to prefer multi-purpose species which provide various products for personal use as well as external sale, such as food, medicine and building materials.

(2) Bushfires

The causes of bushfires which are recognised by farmers in the Study Area are the deliberate setting of fires by concession holders, extensive nature of slash and burn agriculture and group hunting using fire, etc. Impediment factors/problems for bushfire prevention and control are the poor fire-fighting capability of the village fire volunteer squad (VFVS), poor awareness of the importance of bushfire prevention among ordinary people, declining coercive power of modern laws and customary systems and absence/shortage of fire prevention infrastructure and facilities.

6. Development Needs in Intensive Study Area and Examination of Forest Restoration Measures

6.1 Development Needs

The needs for forest (resources) among industries, local people and the government (Forestry Department) are comprehensively listed below.

① Need for timber resources (sustainable timber production)

② Need of local people for goods and materials related to daily life

③ Need for bushfire prevention

④ Need for a good environment

6.2 Impediment Factors for Forest Restoration

Facing the needs described in 6.1, the Intensive Study Area has sufficient development potential in view of its natural and socioeconomic conditions but the state of forest degradation still remains unrehabilitated. If the degraded stands are left unattended, it will not only be impossible to meet the said needs but may also result in extensive damage to public welfare in the form of environmental destruction, etc., making rapid forest rehabilitation in the Intensive Study Area essential.

The field survey findings, etc. identify the following concrete impediment factors for forest rehabilitation.

(1) Natural conditions : ①The conditions in the Intensive Study Area are not so favourable for forest establishment and the introduction of crops. ②The drought in recent years has made the starting of bushfires easy, posing a great threat to natural forests as well as to plantations.

(2) Socioeconomic conditions : ①The absence of incentives of the taungya system introduced by the Forestry Department. ②Distrust in forest guards ③Insufficient fire-fighting arrangements

(3) The results of interviews at local sawmills : ①Insufficient planting experience ②Unease concerning the market for timber from plantations ③Insufficient budget for bushfire prevention and fire-fighting activities.

6.3 Forest Restoration Measures

Considering the impediment factors described in 6.2, desirable forest rehabilitation measures are listed below which should be implemented while making efforts to ensure their compatibility with existing forest management policies and the future direction for forest management project implementation.

(1) Reforestation Measures

Large-scale reforestation on grassland and other treeless land and sustainable forest resources management in natural forests should be promoted to facilitate both an appropriate response to the timber demand and the conservation of natural forests. Here, an appropriate form of agroforestry (reflecting the strong interest of local people in

farming) and a forest establishment and management system which takes the tree preferences of local people into consideration must be established.

(2) Participation Measures

Village forest management committees should be established to smoothly implement the forest management plan in view of the joint management of forest resources in the Intensive Study Area by the Forestry Department, private companies and local people.

(3) Bushfire Prevention/Control Measures

Bushfires are considered to be the direct as well as largest cause of forest degradation of the forest reserves in question. The introduction of bushfire prevention/control measures is, therefore, essential as a precondition for forest rehabilitation. To be more precise, the establishment of plantations should be promoted on grassland liable to the spread of bushfire during the dry season due to the presence of dried grass, etc. in order to reduce the likelihood of bushfires. Moreover, the participation of local people in forest management, including the taungya system for the establishment of plantations, should be encouraged in view of the effective implementation of bushfire prevention/control measures.

(4) Environmental Conservation Measures

Efforts should be made to conserve natural forests which constitute important habitat for wildlife and to restrict the collection of wild flora and fauna as a conservation measure to prevent a decrease of the populations.

7. Forest Management Plan for Intensive Study Area

7.1 Basic Targets

The basic targets of the forest management plan incorporating the above four types of forest restoration measures are listed below.

① Preservation and increase of timber resources

② Sustainable management of NTFPs and agricultural crops to meet the needs of local people

③ Measures for bushfires

④ Protection of environment

7.2 Basic Items of the Plan

For the implementation of forest management in a concrete manner, land must be properly classified for separate use to meet the need for different forest functions by the nation as well as local areas. The different land use categories in the Intensive Study Area are shown in Table 3.

Table 3 Land Use Categories in Intensive Study Area

Category	Contents	Area (ha)
Reforestation (Plantation) Area	Industrial plantations, green firebreaks and communal woodlots	12,844
Natural Forest Conservation Area	Including natural forests subject to supplementary planting	12,954
Existing Plantation	Cutting and planting by the Forestry Department	3,139
Protection Area	Steep land and precious wildlife areas, etc.	85
Admitted Farmland	Including sacred groves	1,344
Others	Villages (settlements) and rocky land, etc.	98
Total		30,464

Of these categories, basic items of the Plan prepared based on the targets mentioned in 7.1, on Reforestation and Natural Forest Conservation Area which are the positive management areas in the Plan, are summerized as follows in the Table 4.

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I. GENERAL DESCRIPTION OF THE STUDY

I. GENERAL DESCRIPTION OF THE STUDY

I.1 Background of the Study

The territory of Ghana is 23.9 million ha in area, about one-third of which is covered with forests. These forests are comprised of tropical high forests along the Gulf of Guinea in the southwestern part of the country and those in the Savanna Zone and in the Transitional Zone located between the High Forests and the Savanna Zone in the northern part of the country. It is said that in recent years these forests have been lost by 1.3% annually[1] because of timber production, farmland development, fuel wood collection and forest fires.

The forests in the Transitional Zone, not only work as the front to prevent the High Forests from becoming savanna but also function to protect agricultural areas, such as cacao plantations from "harmattan": the hot and dry northeast trade winds that blow from the Sahara from December to February. This zone is one of the important areas in the country where forest resources should be conserved with priority. Nevertheless, the forest degradation in this zone has been reported to be particularly severe because of frequent fires and illegal cutting. Therefore, it is necessary to properly conserve and manage the forests in this zone to restore and maintain their functions.

In Brong-Ahafo Region, forest reserves have been established in the Transitional Zone. Partly due to frequent forest fires, they are becoming savanna more rapidly than before; a sustainable forest management plan needs to be prepared immediately for these forests.

Given the situation, the Government of Ghana has requested the Government of Japan to prepare a forest management plan for reserves in the Transitional Zone (27 Dec., 1995).

In response to the request, Japan delegated the Preparatory (Preliminary) Study Team (7~21 July, 1996) and the Preparatory (S/W discussion) Study Team (9~22 March, 1997). The two teams confirmed the background and other details of the request. Japanese and Ghanaian sides have on the scope and extent of the full-scale study and signed the S/W. (See appendices 1(1), 1(2)①)

I.2 Objectives of the Study

One objective of the Study is to conduct a feasibility study for the forest management plan targeting five forest reserves in the Transitional Zone. This management plan, to be composed of

[1] FAO (1990). Forest Resources Assessment 1990

measures to promote forest rehabilitation, fire control and active participation of local people, aims at sustainable forest management and the betterment of local living standard.

Another objective is to carry out relevant technological transfer to the counterpart personnel through the process of the Study.

I.3 Study Area and Intensive Study Area

① Study Area

An area of approx. 300,000 ha, located in the Transitional Zone in Brong-Ahafo Region in the western part of the country [see Appendix 1, 2 and Map on the top page], has been designated as the Study Area. This Area, lying within the Districts of Berekum, Sunyani and Wenchi, includes five Forest Reserves (approx. 67,000 ha), namely Tain I, Tain II, Sawsaw, Nsemere and Yaya FR.

② Intensive Study Area

Out of the five Forest Reserves (approx. 67,000 ha) within the Study Area, an area of approx. 30,000 ha has been designated as Intensive Study Area.

The Intensive Study Area covers degraded part of Tain II Forest Reserve and the entire other four reserves [see Appendix 1, 2 and Map on the top page].

I.4 Study Components

The Study is divided into two phases: The components of the Study in each phase are as follows (see Fig. I-1).

[Phase I]

The Phase I Survey covers mainly the Study Area including the Intensive Study Area.

① First Field Survey

a) Presentation of / Discussion on Inception Report (IC/R) [See appendices1(2)②]
b) Preparation of Technology Transfer Plan
c) Aerial Photographing (Subcontract)
d) Ground Surveying (Subcontract) to prepare new topographic maps covering the Intensive Study Area
e) Collection of General Data/Information on Natural and Socioeconomic Conditions of the Study Area and the whole country

f) Survey of Land Use and Vegetation
g) Trial Forest Survey
h) Initial Environmental Examination
i) Collection of information on Local Consultants for Socioeconomic Survey
j) Preparation of Field Report I (FL/R (I))

[Phase II]

The Phase II Survey covers mainly the Intensive Study Area and its vicinities to formulate a forest management plan.

① Second Field Survey

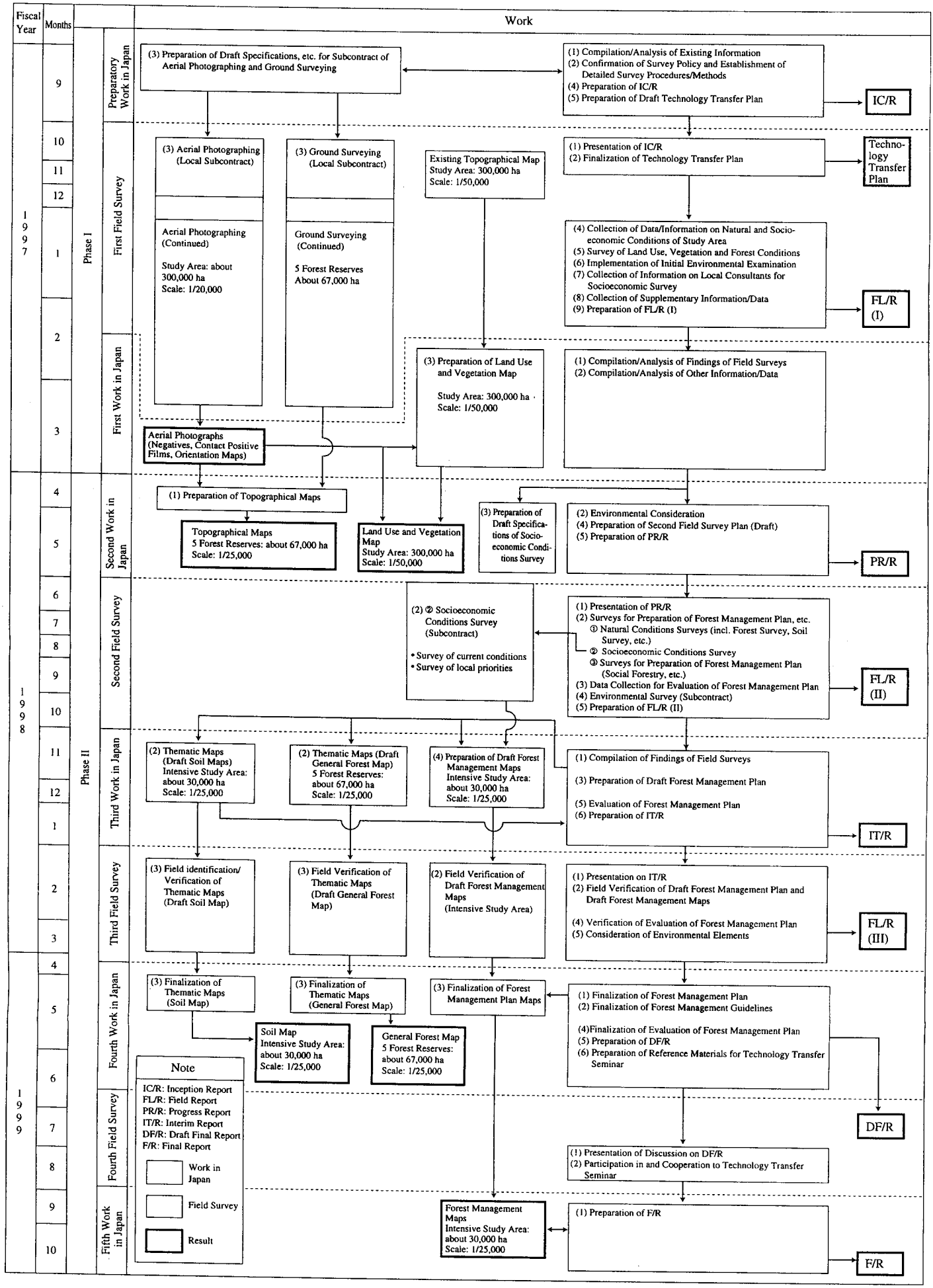
a) Presentation of / Discussion on Progress Report (PR/R) [See appendices1(2)③]
b) Surveys for Preparation of Forest Management Plan and Forest Stand Maps
c) Data Collection for Evaluation of Forest Management Plan
d) Socioeconomic Conditions Survey (Subcontract)
e) Environmental Survey (Subcontract)
f) Preparation of Field Report II (FL/R (II)) [See appendices 3 (2)]

② Third Field Survey

a) Presentation of / Discussion on Interim Report (IT/R)[See appendices 1(2)④]
b) Field Verification of Draft Forest Management Plan and Draft Forest Management Maps
c) Field Verification of Draft Thematic Maps (Soil Maps and Forest Stand Maps)
d) Verification of Evaluation of Draft Forest Management Plan
e) Verification of Consideration of Environmental Elements (for the Draft Forest Management Plan)
f) Preparation of Field Report III [See appendices 3 (3)]

③ Fourth Field Survey

a) Presentation of / Discussion on Draft Final Report (DF/R)[See appendices 1(2)⑤]
b) Participation in and Cooperation to Technology Transfer Seminar



F ig. I-1 Flow Chart of Study on Reserve Forest Management Plan in Transitional Zone in Ghana

II. FORESTS AND FORESTRY IN GHANA

II. FORESTS AND FORESTRY IN GHANA

II.1 Forest Resources

II.1.1 Current Conditions of Forests

The forest area in Ghana is 91,747.83 km^2, accounting for 40.1% of the total national land. Most forests in the Study Area are moist semi-deciduous forests. Among them, the forest area (forest reserves) in the transitional zone occupies 357,000 ha. According to the FAO (1990), the forest ratio declined by annual average of 1.3% in the 10 year period from 1981 to 1990. The rate of deforestation in Brong Ahafo State is shown in Table II-1-1.

Table II-1-1 Net Decrement of Forest in Brong Ahafo State (1981 to 1991)

Categories of Lad Use	1981 to 1984	1985 to 1987	1988 to 1991
Total Area of Artificial Forest (A)	15,600 ha	17,200 ha	18,000 ha
Total Area of Disappeared Forest(B)	69,300 ha	50,900 ha	91,200 ha
Net Reduced Area of Forest(C)	53,700 ha	33,700 ha	73,200 ha
Average Annually Reduced Area of Forest	17,900 ha	16,900 ha	24,400 ha
Annual Decrement in Forest Area	1.65%	1.56%	2.2%

Source: Environmental Condition Survey

Note: C = B - A

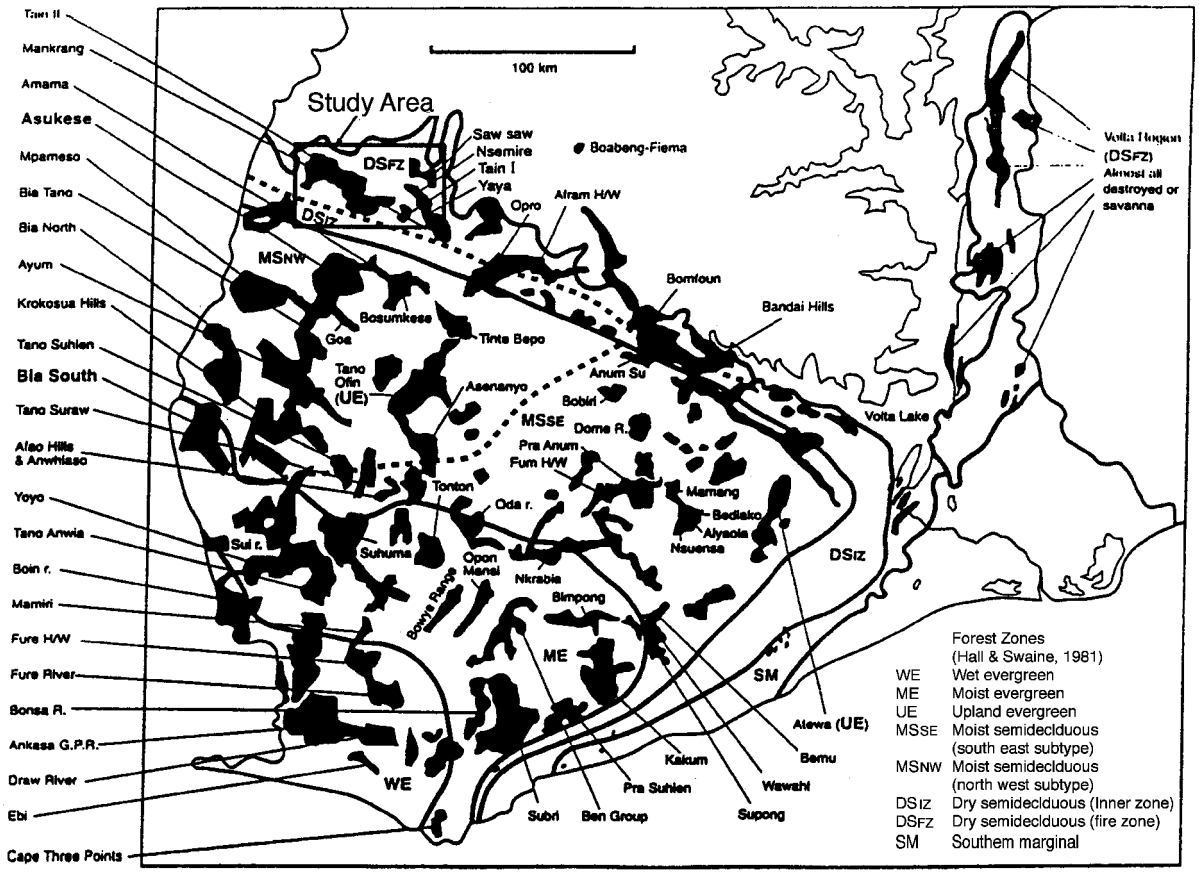
II.1.2 Present Condition of Forest Reserves

(1) Definition of Forest Reserve

The term "forest reserve" is defined by "the Ordinance for the Protection of Forests and for the Constitution and Protection of Forest Reserves 1927 (commonly called the Forests Ordinance)" enforced in 1927. Here, a forest reserve means "an area to be maintained as a forest". It does not necessarily mean a protected forest as the main objective of forest reserve designation is to protect high-volume stands from agricultural development.

(2) Current Distribution

A total of 291 forest reserves have so far been established in Ghana. (See II. III-1-1) In the Brong-Ahafo Region where the Study Area is located, there are 22 forest reserves with a total area of 3,463.37 km^2. (Forest Department Annual Report, 1992).



Source: ODA (1997). Ecology of Forest Trees in Ghana

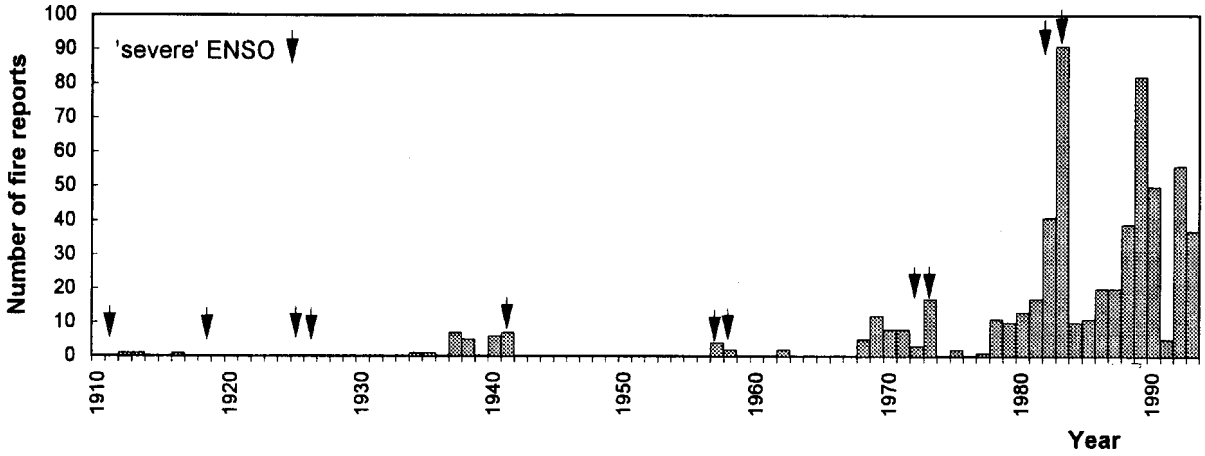
Fig. II-1-1 Forest Zones and Forest Reserves in Ghana

As shown in Fig. III-1-1, the Study Area is located in the north western part of the Fire Zone inside the Dry Semi-deciduous Forest Zone which forms a thin belt between the high forest zone (Moist Semi-deciduous Forest Zone) and savanna zone (Guinea savanna distributed in the sub-Saharan area).

II.1.3 Fires in Forest Reserves

(1) Number of Fire Reports

The number of fire reports in the period from 1910 to 1994 is shown in Fig. II-1-2. 1983 saw the highest number of reports of 90, followed by 1989 (80 reports). The number of fires appears to have been increasing since 1980.

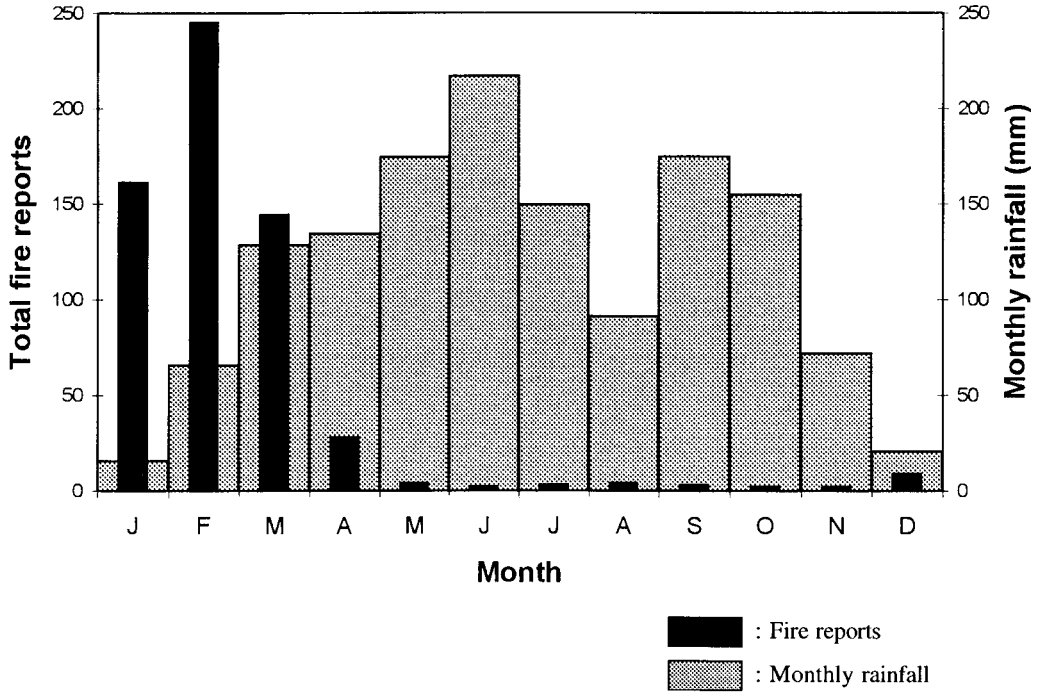


Source : ODA (1997). Forestry Series No. 7. Ecology of Forest Trees in Ghana

Fig. II-1-2 Fire Reports in Forest Reserves: 1910 - 1994

Correlation between the number of bush fires by forest reserve and isohyets shows that large number of bush fires distribute 1,250 - 1,500 mm of isohyets.

According to Fig. II-1-3, fires appear to occur most frequently between December, a month with low rainfall, and February, and considerably decline in April.



Source : ODA (1997). Ecology of Forest Trees in Ghana

Fig. II-1-3 Number of Fires by Month and Monthly Rainfall in Forest Reserves

(2) Fire Prevention and Fire-Fighting Systems

The legal fire prevention and fire-fighting systems in Ghana are stipulated by the Ghana National Fire Service Act (1997) while those regarding bush and forest fires are set forth by the Control and Prevention of Bushfires Law (1990).

II.2 Forestry Policies

II.2.1 Relevant Laws and Regulations

The supreme law in Ghana today is "the Constitution of the Republic of Ghana" which came into force on January 7th, 1993. The Constitution stipulates that the laws of Ghana include, in addition to the Constitution itself, enactments (statute laws), orders, rules and regulations as well as customary laws which are not written laws but which are applicable to specific communities (Article 11 of the Constitution).

The main Acts and Regulations in relation to Forest Management are shown as follows;

- Ordinance for the Protection of Forests and for the Constitution and Protection of Forest Reserves 1927 (commonly called the "Forests Ordinance")
- Forest Protection (Amendment) Law, 1986
- Trees and Timber (Amendment) Law, 1983
- Concessions Act, 1962
- Control and Prevention of Bushfires Law, 1990
- Trees and Timber (Chainsaw Operation) Regulations, 1991
- Forest Fee (Amendment) Regulations, 1993
- Forest Improvement Fund Act, 1960
- The Timber Resources Management Act, 1997

II.2.2 Policies and Main Programs

Forest management in Ghana commenced with cutting restrictions on commercial species with the promulgation of the "Timber Protection Ordinance 1907." The Forestry Department was established in 1909, opening up the age of full-scale forest management. The promulgation of the Ordinance for the Protection and for the Constitution of Forest Reserves (commonly called the

Forests Ordinance) in 1927 commenced the process of establishing and classifying forest reserves throughout Ghana which was largely completed in 1939.

The Forests and Wildlife Policy was announced in November, 1994 as the new basic policy for forests and forestry, replacing the earlier policy introduced in 1948. This new policy spelt out the principles, objectives and strategies. Based on the policy, the Forestry Development Master Plan (1996) was formulated.

The above-said policy, the Master Plan which is deeply related to forestry policy in the transitinal zone, the Collaborative Forest Management Programme which relates to people's participation and the Brong-Ahafo Forest Management Project (1992) which are closely related to the subject forest reserves of the present Study are referred in the sections below.

(1) Forestry Development Master Plan (1996 Draft)

The Forestry Development Master Plan is an action programme of the Forest and Wildlife Policy in the forestry sector. The Master Plan has three phases.

① Development Objectives and Expected Outputs

Programme 1: Sustainable Forest and Savanna Management is most closely related to the forest management in the Study Area and expected outputs of Programme 1 are as follows.

- Harvesting of timber and non-timber products within sustainable levels
- Management of existing forest resources to ensure an increase of the productivity of high forests by at least 40% and also the improvement of the quality, productivity and stability of watersheds
- Increased involvement of individuals and communities in the protection and management of forest resources
- Reduced incidence of bushfires in forest reserves

② Development Activities

The following development activities are planned to achieve these objectives and to produce the expected outputs.

a. Sustainable Forest Management

b. Increased Public Awareness and Involvement

c. Technical Skills for Increased Control of Destructive Land Use Practices

(2) Collaborative Forest Management Programme

Prior to the introduction of the public involvement policy under the Forest and Wildlife Policy which was publicly announced in 1994, the Forestry Department established the Collaborative Forest Management Unit (CFMU) in the Planning Branch in 1992 to commence the Collaborative Forest Management Programme. This programme aims at analysing the possibility of collaboration with local people for high forest management and at developing appropriate management methods.

① Approach to Reforestation Work

Collaborative forest management considers reforestation work to contribute to the promotion of employment of local people, development of local industries and improvement of the local infrastructure as well as services. The following programmes are proposed for local people to participate in reforestation work.

- Bushfire control measures at planted sites, including the creation of green fire belt
- Participation in planting as farming households with a contract for introducing agricultural crops, etc.
- Ownership of planted trees and harvest-sharing in return for tending, maintenance and bushfire prevention work at planted sites
- Use of local people as labour for reforestation work instead of recruiting labour from other areas

② Bushfire Control and Other Protection Measures

The creation of green fire belt and contracts to maintain boundaries, etc. are required for the protection of forests. According to the results of the pilot study, it is possible to assume a reduction of the boundary maintenance cost by two-thirds.

③ Taungya System (Improved Taungya System)

In regard to the introduction of the taungya system which is closely related to planting work, a new type of taungya system (improved taungya system) is proposed to rectify the problems of the conventional taungya system. The key points of the improved taungya system are listed below.

- Change of the subjects of the taungya system from individual persons to communities or groups using the church and other existing organizations
- Establishment of a committee to ensure smooth liaisoning and coordination between the work implementation bodies and the Forestry Department

- Provision of the necessary goods, and technical advice by the Forestry Department to avoid confusion or conflict among farmers in regard to the respective shares of the harvest

④ Non-Timber Forest Products (Referred below as NTFP)

The relevant facts are not sufficiently known regarding the sustainable management of NTFP, making a fact-finding survey essential. The following approaches are proposed for the effective management of NTFP.

- Introduction of NTFP concessions and a system to use borrowed land
- Agreement on harvest control between the Forestry Department and local people
- Raising and planting by user groups

(3) Project Concept Note: Brong-Ahafo Forest Management Project (Forestry Department, Planning Branch, February, 1997)

The Brong-Ahafo Region has inherent, highly noticeable forest and forestry-related problems, including the prevention of bushfires and the control of degraded resources. This project describes its goal and output of the project. The items which are deeply related to the forest management in the Study Area are as follows.

① Provision of Plantation Development Schemes

The new Forestry Service is expected to initiate or subcontract a detailed survey on promising sites for plantation development in forest reserves on behalf of land owners with a view to preparing a plan which should attract prospective investors. However, the direct investment of the private sector in the development of plantations is expected to face problems without the implementation of promotional measures or incentives by the government, etc. because of the long investment recovery period.

② The Framework of the New Collaborative Forest Management Programme

Through a series of training modules, awareness programmes and seminars, the Collaborative Forest Management Program will be introduced at the district level. Workshops on forest reserve planning include subjects related to the restoration of the beneficiary rights of land owning communities and the development of a collaborative management programme, emphasising the production of NTFPs and forest rehabilitation in small areas by means of assisted regeneration and fire control. However, it is expected to be difficult to establish the feasible collaborative forest management without reserving the beneficiary rights of land and creating a new

people's participation system in the forest management through a beneficiary system of land.

③ Establishment of Operational Integrated Bushfire Prevention and Control System

Trial bushfire risk assessment and tactical fire control activities will be conducted by the Planning Branch in all districts of the Brong-Ahafo Region together with the trial preparation and distribution of PR documents for education and awareness improvement purposes. The Forest Service will be required to determine the appropriate width for green fire breaks and the suitable species for forest reserves in the Brong-Ahafo Region in correspondence with the different fire hazard conditions in the region. However, it is expected to be difficult to establish the feasible fire prevention system in the forest management without clarifying the cause of fires.

II.2.3 Administrative Organizations

(1) Ministry of Lands and Forestry

The Ministry of Lands and Forestry is vested with the overall responsibility for the planning, guidance, monitoring and assessment of forest and forestry-related development policies and development programmes. The Ministry of Land and Forestry include the Forestry Department, Wildlife Department, Survey Department, Forest Products Inspection Bureau and Timber Export Development Board.

(2) Forestry Department

Since its establishment in 1909, the Forestry Department has been the sole organization responsible for the development of the forest and forestry sector.

Fig. II-2-1 and Fig. II-2-2 show the organizational structure of the headquarters of the Ministry of Land and Forestry and Regional Forestry Offices/District Forestry Offices respectively.

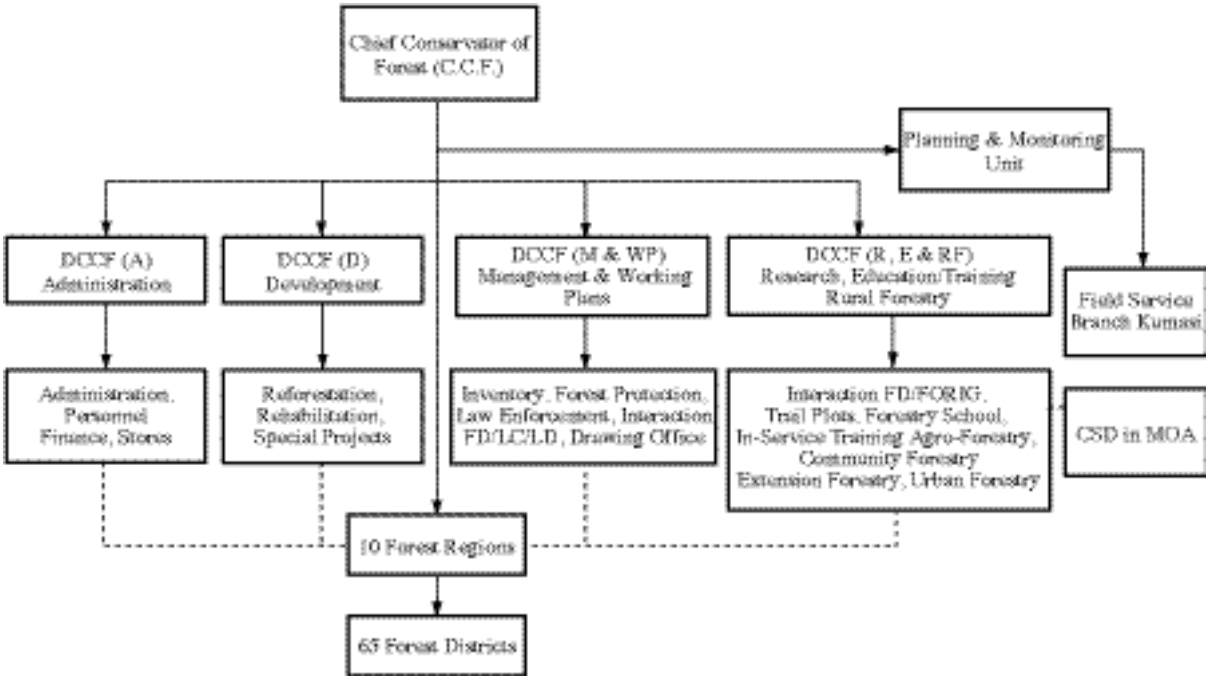


Fig. II-2-1 Organizational Structure of Headquarters of Forestry Department

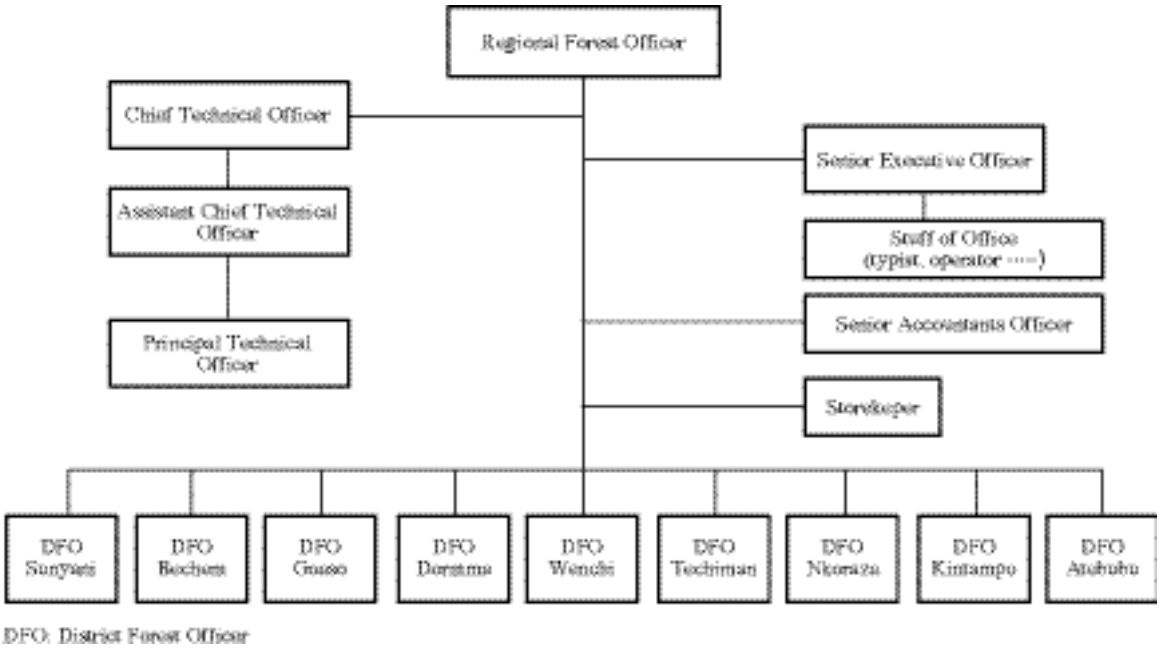


Fig. II-2-2 Organizational Structure of Regional Forestry Office and District Forestry Offices in Brong-Ahafo Region

II.2.4 Forest Plans

(1) Present Plan for Forest Reserves

At present, several forest reserves are combined together to form a single forest management unit (FMU) with a combined area of some 50,000 ha. (If the area of a forest reserve exceeds 50,000 ha, this forest reserve constitutes a FMU). A working plan has been formulated for each FMU and 51 FMUs exist in Ghana.

(2) Proposed Plans

The currently proposed plans based on information obtained from the Planning Branch of the Forestry Department in October, 1997 can be classified as Strategic plans and Operational plans.

① Strategic Plans

Strategic plans consist of the national forestry plan, forest reserve management plans and district forestry development plans.

a) National Forestry Plan

The formulation of a national forestry plan by the Forest Service is legally required under the new Forest Act.[1]

b) Forest Reserve Management Plans

Forest reserve management plans are strategic plans formulated by staff members of the regional and district forest offices. Each plan indicates the general direction for the management of each forest reserve or group of forest reserves forming a forest management unit.

c) District Forestry Development Plans

Each district assembly has established its own environmental committee. The district forestry officer (DFO) which is a standing member of the district environmental (or development) committee, is responsible for matters included in the district forestry development plan in addition to commercial and extension activities in the forestry sector.

[1] A new Forest Act is currently being proposed. Article 1 of this Act stipulates the establishment of the Forest Service.

② Operational Plans

a) Forest Reserve Operational Planning Annex

b) Timber Utilisation Operational Plan[2]

c) Commercial Plantation Plan

d) Three Year Rolling Plan and Annual Programme of Works

II.2.5 Research and Extension Activities

(1) Research

The Forestry Research Institute of Ghana was established in 1963. 45 researchers are currently working in the 7 departments organized by Natural Forest Management Division, Plantation Production Division, Tree Improvement and Seed Technology Division etc.

(2) Education and Training of Forestry Department Staff

As a part of education and training programmes of Forestry Department staff, 14 technicians and five graduates were sent for further study at the University of Science and Technology in Kumasi according to the statistics in 1992. In another case, technical training was provided for some 70 staff members at the School of Forestry in Sunyani.

(3) Extension Activities

Extension activities include those conducted by the Collaborative Forest Management Unit of the Planning Branch, which aim at educating local people. The Agroforestry Division of the Ministry of Food and Agriculture also conducts extension activities.

II.3 Timber Production

II.3.1 Harvest Volume

At present, annual allowable harvest of 1.2 million m^3 (1.1 million m^3 according to the World Bank Forestry Sector Review) is set under the forest management system of the Forestry Department. However as Table II-3-1 shows the harvest volume exceeded 1.2 million m^3 in 1990 and rapidly increased in 1993. This overharvesting forced the Ministry of Lands and Forestry to suspend the export of unprocessed logs in late 1995 and to instruct the Forestry Department to prepare standards to strengthen the harvesting restrictions in forest reserves.

[2] Timber Utilization Contract

Table II-3-1 Changes of Harvest Volume

(Unit: 1,000 m^3)

Year	Inside Forest Reserves	Outside Forest Reserves	Total
1980 - 1984	337	179	516
1985 - 1989	588	343	931
1990	1,056	234	1,290
1991	996	233	1,229
1992	587	731	1,318
1993	266	1,416	1,682
1994	505	1,295	1,800
1995	167	1,027	1,194

Source: MLF (1996). Forestry Development Master Plan Draft, 1996

The cutting regulation for forest reserves revised in 1995 has classified tree species into three groups based on the degree of resource depletion and introduced the allowable harvest for each group.

The Forest Development Master Plan (1996) sets the sustainable and annual allowable harvesting volume in Ghana at some one million m^3, consisting of 500,000 m^3 from forest reserves, in turn composed of the harvesting of 300,000 m^3 of 32 species of the scarlet (already depleted) and red (facing depletion if the present trend continues,which are mainly currently used by the timber industry) groups and 200,000 m^3 of 32 species of the pink (unused and no-risk of depletion) group, and the remaining 500,000 m^3 from forests outside forest reserves and plantations.

II.3.2 Firewood and Charcoal Production

Energy consumption in the form of firewood and charcoal accounts for more than 95% in rural areas and the consequent annual consumption of firewood and charcoal is said to be approximately 14 million m^3 a year. This can be translated to an annual consumption per capita of some 0.83 m^3. According to the World Bank, firewood and charcoal consumption for energy consumption could reach some 20 million m^3 given the present population increase rate.

The annual report of the Forestry Department in 1992 put the firewood and charcoal production volumes at 990,000 m^3 and 560,000 m^3 respectively. The total supply volume of 1.55 million m^3 which is about 10% in calculation in annual wood consumption indicates a serious supply shortage.

II.3.3 Teak Demand

(1) Electrification Programme

The teak production of utility poles in addition to its use as timber is demanded strongly by the National Electrification Programme (NEP) which is currently in progress with a target year of 2020 estimates that the annual demand for utility poles in the year 2020 will be 60,000, totalling 1.2 million poles in the next 20 years. Despite such a strong demand, the domestic production of teak falls short of the demand, making it necessary to rely on imports at present. Although concrete poles are also used, the Ministry of Mines and Energy hopes to switch to teak poles.

(2) Utility Pole Production Companies

Two companies in Ghana produce utility poles.

As the demand for pole materials far exceeds the supply, the supply shortage is filled by imported materials from South Africa.

The main sources or raw materials are plantations in forest reserves. At present, 10 - 20 years old teak is purchased at a cost of 15,000 cedis/tree and is sold in the market at 28,000 cedis/utility pole.

II.3.4 Wood Industry

The forest products industry in Ghana has so far concentrated on the export of wood to earn foreign currency. The Forestry Development Master Plan Draft puts the annual supply of saw timber to the domestic market at 700,000 m^3 which is expected to increase to one million m^3 by 2005 with the domestic economic growth. The importance of plantation timber supply will increase in the future.

(1) Log Production

Log production in Ghana since 1988 is shown in Table II-3-2. It indicates an annual decline of log production for export and the increased production of sawn timber and veneer/plywood. Export of logs has been banned since 1995.

Table II-3-2 Changes of Log Production

(Unit: million m^3)

Item	1988	1989	1990	1991	1992
Logs for Export	0.34	0.20	0.19	0.21	0.18
Supply to Sawmills	0.70	0.69	0.99	0.92	0.99
Supply to Veneer/Plywood Plants	0.05	0.07	0.08	0.05	0.09
Chainsawing	0.05	0.03	0.03	0.02	0.05
Total	1.14	0.99	1.29	1.29	1.31

Source: FD (1992). Forestry Department Ghana Annual Report

Historical changes of the log production in the Brong-Ahafo Region in the past are shown in Table II-3-3. Production has now declined because of the introduction of a log export ban in 1995.

Table II-3-3 Log Production in Brong-Ahafo Region (unit:1,000 m^3)

Year	Production Volume
1981	207
1989	305
1994	402
1995	321

Source: (FPIB): Log Extraction Reports

(2) Sawn Timber Production

As shown in Table II-3-4, sawn timber production for both export and domestic purposes has been increasing annually reaching 0.27 million m^3 for export and 0.3 million m^3 for domestic sale in 1992.

Table II-3-4 Changes of Sawn Timber Production

(Unit: million m^3)

Item	1988	1989	1990	1991	1992
Recorded Exports	0.17	0.15	0.20	0.18	0.23
Domestic Sales	0.11	0.20	0.30	0.35	0.30
Own Use by Mills and Mines	0.03	0.02	0.02	0.02	0.03
Bush/Forest Mills	0.02	0.01	0.01	0.01	0.01
Chainsawing	0.01	0.02	0.02	0.01	0.01
Addition to Stock	0.04	0.02	0.01	0.01	0.01
Total	0.38	0.42	0.57	0.58	0.60

Source: FD (1992). Forestry Department Ghana Annual Report

(3) Veneer/Plywood

Veneer production increased by some 21% in the period from 1991 (21,421 m^3) to 1993 (25,991 m^3).

(4) Other Forest Products

There are local home industries such as the extraction of oil from shea trees (*Butyrospermum parkii, Sapotaceae*), wood carving, charcoal production, palm wine production and basket-work using rattan and cane.

(5) Sawmills, etc.

In Ghana, there are 250 logging companies, 130 sawmills and more than 200 furniture and wood processing companies including veneer/plywood manufacturers according to the annual reports of Forestry Department. These companies employ a total of some 75,000 people.

II.4 Current State of Reforestation

II.4.1 History of Reforestation in Ghana

The first silvicultural activities in Ghana commenced in the Guinea savanna zone in the early 1900's. From 1966 to 1977, planting was conducted at some 40,000 ha of cut-over sites in forest reserves. In subsequent years, however, replanting was conducted only at plantations with a poor performance, because of the financial problems of the government.

The annual report of the Forestry Department in 1992 put the total area of forested sites in Ghana at 72,103 ha, consisting of 71,629 ha of plantations and 473 ha of naturally regenerated sites. This figure accounted for merely 0.8% of Ghana's total forest area and 2.8% of the total area of forest reserves. In the Brong-Ahafo Region, the forested area was put at 19,777 ha, accounting for 4% of the total forest area and 5.7% of the total area of forest reserves in the region.

The main tree species for reforestation are shown as Table II-4-1.

Table II-4-1 Main Species Planted in Ghana

Category	Local Name	Botanical Name
Local Species	Emire Nyankom Dubini	- *Terminalia ivorensis* - *Heritiera utilis* - *Khaya ivorensis*
Exotic Species	teak cedro eucalyptus pine	- *Tectona grandis* - *Cedrela odorata* - *Eucalyptus spp.* - *Pinus spp.*

II.4.2 Reforestation in the Brong-Ahafo Region

The forested area in the Brong-Ahafo Region is approximately 15,000 ha (19,777 ha according to the 1992 forestry statistics), planted some 20 - 30 years ago. The area by species is listed below.

Table II-4-2 Forested Area in Brong-Ahafo Region

Species	Area (ha)	Ratio in Forested Area
Teak (*Tectona grandis*)	10,000	67%
Cedro (*Cedrela odorata*)	3,000	20%
White teak (*Gmelia arborea*)	1,500	10%
Others	500	3%

The royalties and rent for the growing and harvesting of teak in a forest reserve are shown below.

Table II-4-3 Royalties and Rent for Teak in a Forest Reserve

Item	Criteria	Fee
Royalties	DBH: 15 cm : 20 - 30 cm	16,000 cedis/tree 36,000 cedis/tree
Rent		10,000 cedis/ha

Source: FD. Working Plan in Tain II

The common silviculture system in forest reserves has been the taungya system. Fire belts with a width of 20 m are established inside the boundaries of forest reserves to prevent the spread of fires into forest reserves. In these belts, Cassia siamea and other exotic species are planted. Most villages near forest reserves have their own fire-fighting organization.

II.4.3 Existing Plantation Projects

The area of plantations in Ghana is less than 1% of the total forest area as described earlier but small plantations are created by local people to supply charcoal wood and also by private companies in many regions.

① German Agency for Technical Cooperation (GTZ)

The GTZ is implementing forestry projects throughout the Volta Region. The subject area of the latest field survey was southern Volta where community forests are created with a cutting period of 2 - 3 years to produce the charcoal wood required by fishermen.

② VRA (The Volta River Authority)

The VRA by the World Bank etc. has commenced watershed regreening project to improve the environment around Lake Volta with the Forestry Department providing the necessary advice.

③ Pioneer Tobacco Co., Ltd. (PTC)

The PTC produces tobacco in the outskirts of Wenchi, located in the north of the Study Area, and is implementing a teak plantation project to obtain wood for the drying of tobacco. The planting project is characterised by a contract between the PTC and farmers.

④ Bonsu von berg Farms Ltd. (BF)

The BF has a plantation in Somanya in the Eastern Region. This company is a joint venture between a Dutch company and local capital and was established to capitalise on the future

shortage of timber. The BF has established a nursery on the plantation site to supply seedlings not only for its own plantation site but also for people living in adjacent areas.

II.5 Activities of Donors in Forestry Sector

(1) World Bank

① Forest Sector Appraisal

The World Bank sent a joint study mission with FAO to Ghana in 1986 to conduct a forest sector survey. This appraisal promoted active intervention of other donor organizations in the Forest sector. The appraisal results recommended the revision of royalties, rationalisation of the concession system and timber trade policy, supply of firewood and the establishment of a sustainable agricultural system.

② Forest Resource Management Project (FRMP)

This project was implemented from 1989 to 1997, emphasising the sustainable management of industrial plantations and the development of rural forestry in the savanna zone. This project has greatly contributed to forest management in Ghana.

(2) Department for International Development (DFID)

The assistance of the DFID mainly focuses on forest reserve management in the high forest zone.

① Forest Inventory Project (FIR)

The FIR was implemented from 1985 to 1989 in more than half of the forest reserves in the high forest zone so that the Forestry Department could properly assess the sustainable harvesting level in each forest reserve. Valuable information for resources management was obtained.

② Forest Inventory and Management Project (FIMP)

The FIMP was implemented from 1985 to 1995 and was conducted to improve the forest management system and to enhance public awareness of the social aspects of forests.

③ Forest Sector Development Project (FSDP)

This is a technical assistance project aiming at reorganizing the Forestry Department to the Forest Service capable of efficiently and effectively implementing forest policies. The achievements and activities of this project are listed below.

④ Forest Plantation Preparation Project (FPPP)

The FPPP was implemented from 1994 to 1995 and sought not only to achieve economic profits for plantation companies but also to protect areas around natural high forests to a certain extent through the control of bushfires. It was originally planned that the Commonwealth Development Corporation (CDC) would participate in the joint plantation project but this plan was cancelled due to the internal circumstances of the CDC and so on.

(3) United Nations Development Programme (UNDP)

The UNDP has been engaged in forest conservation through energy and agriculture-related projects. In addition, it is implementing the Poverty Reduction Programme, emphasising assistance for NGOs and promoting participatory approaches.

(4) German Agency for Technical Cooperation (GTZ)

The GTZ has been facilitating buffer zone management, village forests development, and community development for forest reserves in the Volta Region for the purposes of forest protection and resources utilisation and management. The project period is from 1995 to 2000.

III. GENERAL CONDITION ON THE STUDY AREA

III. GENERAL CONDITION ON THE STUDY AREA

III.1 Natural Conditions

III.1.1 Climate

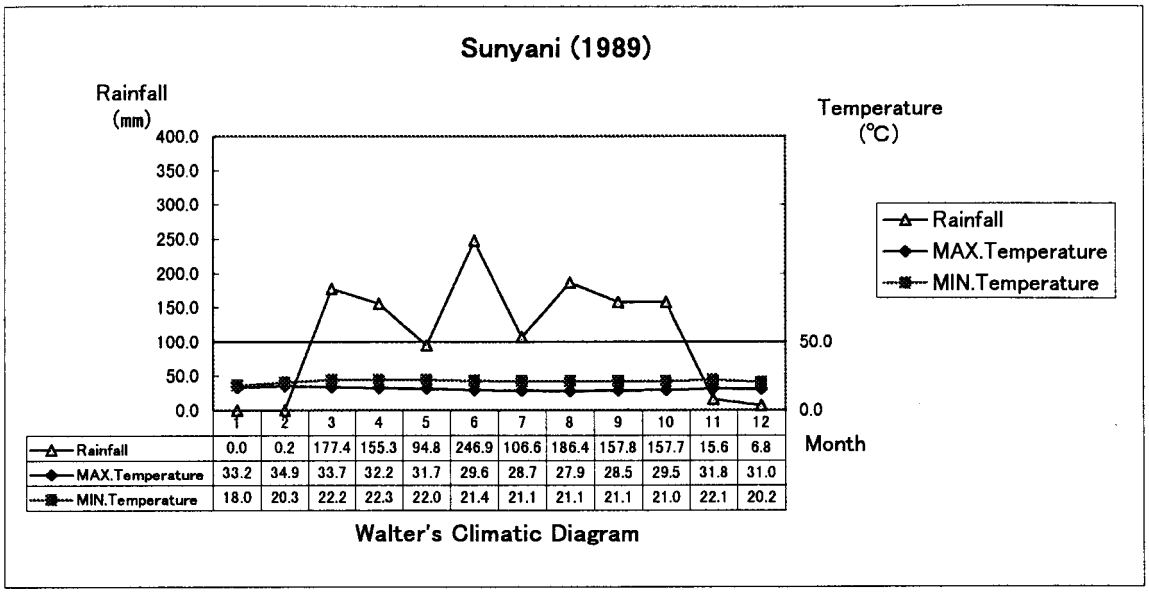
(1) Climate

① Climatic Type

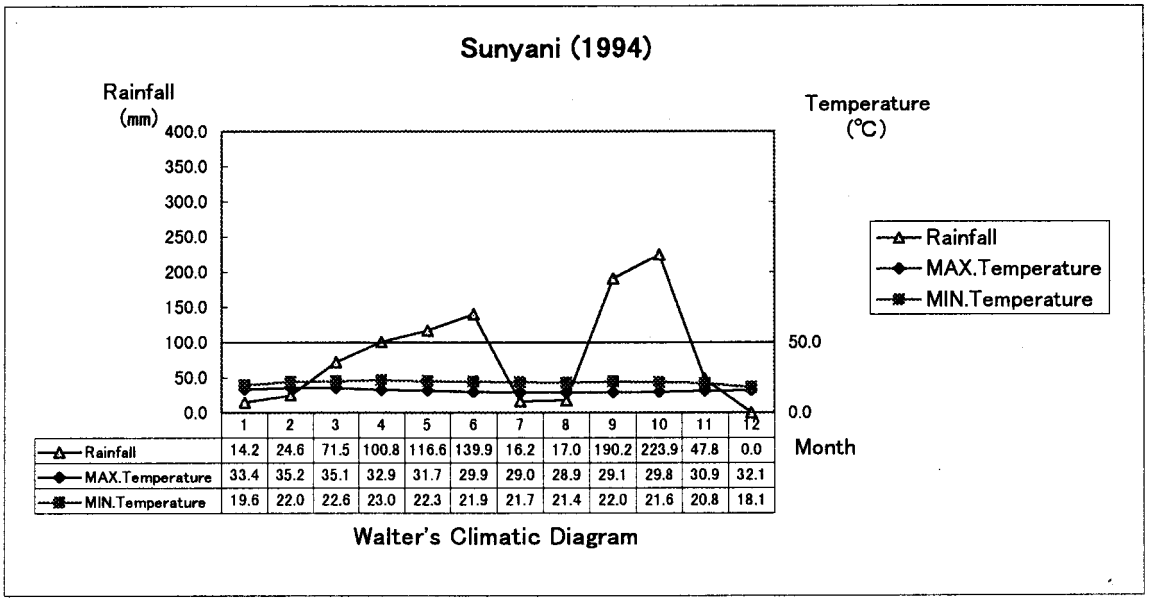
The mean annual temperature at Sunyani is 26.3°C, i.e. the mean value for the above 10 year period; a mean annual maximum temperature of 31.2°C and a mean annual minimum temperature of 21.4°C. The mean monthly minimum temperature is some 19°C or higher every month (mean value for the 10 year period), implying hot or warm weather throughout the year. However, a mean monthly minimum temperature of 17.6°C was recorded in a particular month during this period. The annual rainfall at Sunyani is 1,179 mm (mean value for the 10 year period) but there is a large annual fluctuation between 963 mm and 1,500 mm (see (2) below).

② Dry Season

Based on Walter's climatic diagramme for Sunyani (Fig. III-1-1), within a decade mentioned above the dry season is judged for four months from November to end in February in a wet year (1989). In contrast, the dry year of 1994 saw two dry seasons, i.e. from November to March (duration of five months Minor dry season) and from July to August (duration of two months Major dry season), totalling seven months. The number of months with monthly rainfall of 100 mm or more which makes water shortage in plant bodies less likely is seven months in a wet year and five months in a dry year, suggesting that such water shortage in plant bodies may occur in roughly half of the year.



	1	2	3	4	5	6	7	8	9	10	11	12
Rainfall	0.0	0.2	177.4	155.3	94.8	246.9	106.6	186.4	157.8	157.7	15.6	6.8
MAX.Temperature	33.2	34.9	33.7	32.2	31.7	29.6	28.7	27.9	28.5	29.5	31.8	31.0
MIN.Temperature	18.0	20.3	22.2	22.3	22.0	21.4	21.1	21.1	21.1	21.0	22.1	20.2



	1	2	3	4	5	6	7	8	9	10	11	12
Rainfall	14.2	24.6	71.5	100.8	116.6	139.9	16.2	17.0	190.2	223.9	47.8	0.0
MAX.Temperature	33.4	35.2	35.1	32.9	31.7	29.9	29.0	28.9	29.1	29.8	30.9	32.1
MIN.Temperature	19.6	22.0	22.6	23.0	22.3	21.9	21.7	21.4	22.0	21.6	20.8	18.1

Note: The period in which the rainfall curve is lower than the temperature curve indicates the dry season. Wider spacing between the two curves signifies severe dryness.

Data Source: Regional Meteorological Office, Sunyani (1997): *Climatological Data* (Extract)

Fig. III-1-1 Walter's Climatic Diagramme for the Study Area (Sunyani)

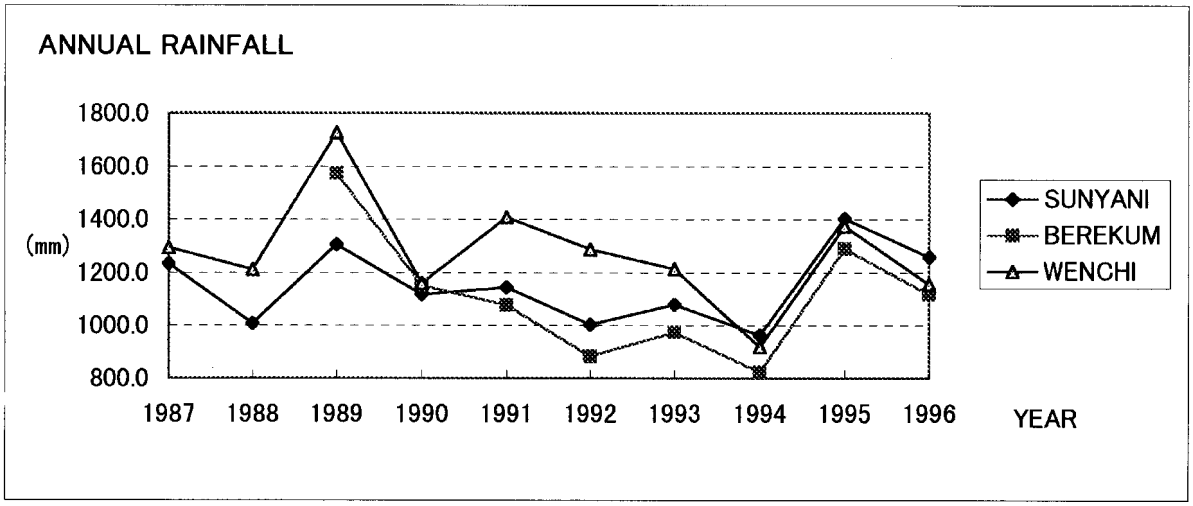
Thornthwite's potential evapotranspiration (PE)[1] in the Study Area is estimated to be 1,200 - 1,500 mm per year based on the mean annual temperature at Sunyani. In the dry season from November to March, the monthly PE value exceeds the monthly rainfall. At Sunyani, it is estimated that excessive evapotranspiration occurs in 4 - 9 months of the year.

[1] Method to estimate the total quantity of evaporation from sufficiently watered vegetation and transpiration from the ground using temperature data.

(2) Rainfall

① Annual Rainfall Fluctuations

Meteorological data observed by three observation stations located in and around the Study Area (for the 10 year period from 1987 to 1996, see Fig. III-1-2) indicate that 1989 was a year of extremely high rainfall while 1994 was a year of extremely low rainfall. Throughout this period, the annual rainfall showed a slightly declining trend. It may be that the Study Area has a characteristic climate of the Sahel[2] where a wet situation and dry situation alternate and that the period in question fell in a minor wet situation.



Data Source: Regional Meteorological Office, Sunyani (1997): *Climatological Data* (Extract)

Fig. III-1-2 Annual Rainfall Fluctuations Observed by Meteorological Stations Located In and Around The Study Area (1987 - 1996)

② Monthly Rainfall Distribution

The monthly rainfall fluctuates throughout the year and no specific distribution pattern can be established. In general, March, April, June, September and October tend to have recorded high monthly rainfall of 100 mm or more in many years in the period observed.

[2] As proposed by Olsson (1985), cited in Douglas L. Johnson & Laurence A. Lewis (1994), *Land Degradation*, Blakwen

③ Daily Rainfall Distribution

The daily rainfall frequency distribution (mean volume between 1987 and 1997) at Sunyani indicates a tendency of five or more days with daily rainfall of less than 10 mm every month except during the main dry season from November to March. Daily rainfall of 60 mm or more is observed at least once every month except in November through January. There are days with daily rainfall of 90 mm or more, particularly in May, July and September. In short, the Study Area is characterised by a strong rainfall intensity. Downpours tend to particularly occur towards the end of the rainy season.

The frequency distribution of rainless days (mean value between 1987 and 1997, see Fig. IV-1-4) indicates a tendency of up to four rainless days a month. During the main dry season, i.e. from November to March, the number of rainless days a month total 20 days or more. There is sometimes no rain at all during the entire month. During the minor dry season from July to August, the duration of continuous rainless days is shortened compared to the main dry season. As downpours are more likely to occur as mentioned earlier, the overall condition of this dry season is a tendency to be milder than the main dry season. During the main dry season, the dry conditions are very severe, suggesting that tree growth is halted. Tree growth may continue during the minor dry season if downpours occur. However, the death of the undergrowth or the occurrence of bushfires is assumed to make the ground liable to soil erosion.

III.1.2 Topography and Geology

(1) Outline of Topography

The Study Area is located on the Ashanti Highland which spreads to the west of the Volta Basin. Gentle slopes generally dominate the area and the ground surface is either flat or undulating. The area can be classified in the category of "Tropisches Ruckenrelief" which is aged peneplain with weak development of the topographical dissection.

(2) Hydrology

The main river in the Study Area is Tain River, a tributary of the Black Volta, which runs from west to east near the northern part of the Study Area and has a width of approximately 10 m. It has a U-shaped cross-section. Both banks are dominated by fine unconsolidated deposits.

(3) Geology

Sandstone said to be distributed in the central part of Ghana was not observed during the field survey which was conducted in 1998, implying that the basement of the Tropisches Ruckenrelief in the Study Area belongs to the West African Craton.[3] The main lithofacies consist of green rock and granite of the Precabrian to the Padeozoic.

III.1.3 Soil

(1) Types and Distribution of Soil

The FAO-Unesco soil map (1974)[4] shows Ferralsols, Cambisols and Leptosols.[5]

(2) Soil Properties

The existing soil map (scale: 1/2,000,000, Draft Soil Classification in Ghana[6]) prepared by the Geological Survey Department and existing soil data[7] suggest the distribution of Forest Ochrosols (in great soil group) in the southern part of the Study Area and Savanna Ochrosols (great soil group) in the northern part of the Study Area.

① Forest Ochrosols (Great Soil Group)

This grouping consists of reddish, brownish and yellow brownish soils with relatively good drainability. The parent materials are weathering products of intermediate to weak acidic rocks or peneplain drifts.

② Savanna Ochrosols (Great Soil Group)

The morphologic features of this grouping are similar to those of Forest Ochrosols great soil grouping. But there is a significance difference in that the top soil of this grouping is not contaminated by humus. Compared to Forest Ochrosols, the distribution area of Savanna Ochrosols is characterised by a low rainfall level, creating unfavourable soil moisture conditions. Accordingly, the level of organic matters and nutrient contents is low.

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3 An area hardly affected by vigorous orogenic movements from the Precambrian to the early Paleozoic.

4 FAO-Unesco (1974). FAO-Unesco *Soil Map of the World* (scale: 1/5,000,000)

5 According to Soil Units in "FAO-Unesco-ISRIC (1988): *FAO-Unesco Soil Map of the World: Revised Legend*"

6 Brammer (1956) System. This system uses category names similar to the USDA Soil Taxonomy. For soil unit judgement purposes, factors which are easily visible are used as in the case of the FAO-Unesco system.

7 H. Brammer. Division of Soil and Land Survey, Department of Agriculture (1958): *Soils of Ghana*

III.1.4 Vegetation

(1) Types of Vegetation

The Study Area belongs to the fire zone of the dry semi-deciduous forest zone.

The Vegetation of Dry Semi-Deciduous Forest Zone belongs to the *Antiaris-Chlorphora* community.[8] Compared to the moist semi-deciduous forest zone showing a high forest type, the tree height in this zone is generally low. Trees belonging to the tree layer have a height of 30 - 45 m although most trees belong to the semi-tree layer or shrub layer (see Fig. III-1-3).

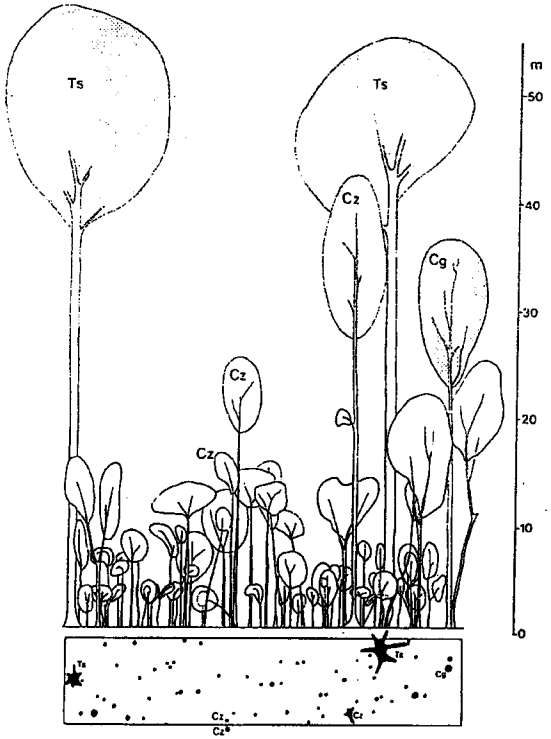
The main indicators are *Cola milleni* of the *Sterculiacea* and *Celtis zeenkeri* (Esakoko) of the *Ulmaceae*.

Compared to the moist semi-deciduous forest zone characterised by the presence of many species, the dry semi-deciduous forest zone is characterised by a high frequency of *Antiaris* spp and *Chlorohora* spp. of the *Moraceae* and also of *Triplochiton scleroxylon* (Wawa) of the *Sterculiacea* which can be said to be an indicator of the dry semi-deciduous forest zone. In addition, *Trichilia prieuriana* (Kakadikuro) of the *Meliaceae* which is also observed in the savanna zone appears in a high density.

The tree density in Forest Fire Damaged Sub-Zone is sparse in this zone and the vegetation structure consists of the semi-tree layer, shrub layer, herbs and climbers. The main indicators are *Afzelia africana* (Papao) of the *Leguminosae* and *Diospyros mespiliformis* (Keke) of the Ebenaceae in the case of woody plants and *Marantaceae* and *Acanthaceae* in the case of herbs.

[8] Based on the classification by Taylor (1959). See Table IV-1-6 for the source.

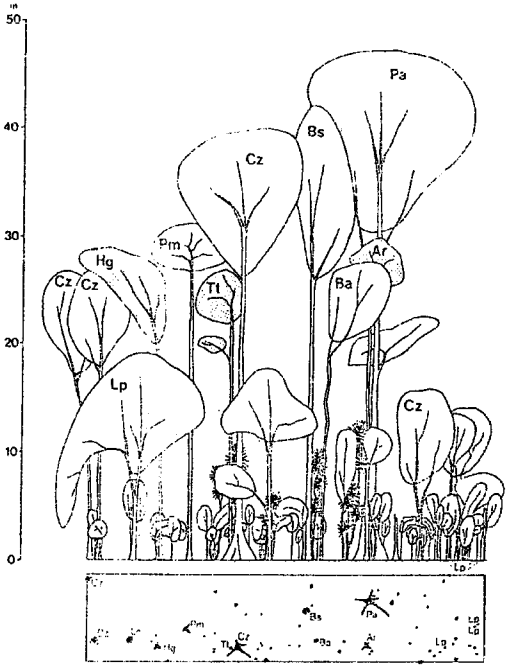
Moist Semi-deciduous forest



Abbreviations: Cg = *Cylicodiscus gabunensis*, Ts = *Triplochiton scleroxylon*, Cz = *Celtis zenkeri*.

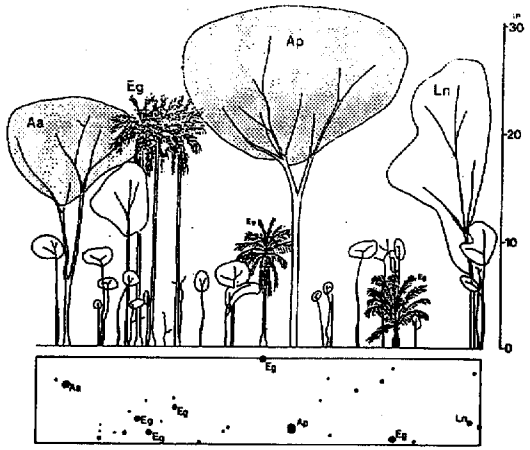
Dry Semi-deciduous forest

Inner Zone subtype



Abbreviations:
Ar = *Aningeria robusta*
Bs = *Blighia sapida*
Cz = *Celtis zenkeri*
Hg = *Holoptelea grandis*
Lp = *Lecaniodiscus punctatus* (source of holotype)
Pa = *Piptadeniastrum africanum*
Pm = *Pterygota macrocarpa*
Tm = *Trilepisium madagascariense*
Tt = *Trichilia tessmannii*
The trees shown with long leaves are *Dracaena arborea*.

Fire Zone subtype



Abbreviations:
Aa = *Afzelia africana*
Ap = *Aubrevillea platycarpa*
Ln = *Lannea nigritana*
Eg = *Elaeis guineensis*

Source: J.B.Hall & M.D.Swaine(1981).Distribution and ecology of vascular plants in a tropical rain forest
Forest vegetation in Ghana

Fig. III-1-3 Examples of Schematic Cross-Section of Vegetation in Dry and Moist Semi-Deciduous Forests

(2) State of Succession

① Example of Succession Due to Fire

According to Taylor (1959)[9], when a high forest is damaged by fire, the type of vegetation changes to become similar to that of the savanna zone[10] (Guinea savanna wood land). During the seral stage from a high forest zone to savanna zone, *Anogeissus leiocarpus* of the *Combretaceae* in particular is believed to regenerate or invade in the early stage.

At the result of the environmental survey conducted in July to September 1998, the presence of indicators of the savanna zone was confirmed. And it did find *Anogeissus leiocarpus* of the *Combretaceae* (which is an indicator of the seral stage due to fire according to Taylor) and *Ceiba pentandra* of the *Bombaceae* (another indicator according to Hall and Swaine). It can be said that there are many relatively recent fire-damaged site in forests and at shrubland in the Study Area as these sites are frequently subject to fire. In particular, the highly noticeable distribution of *Elaeis guineenisis* and *Borassus aethiopium* of the *Palmae*, both of which are fire zone characteristics, along roads in the southern part of the Study Area as well as roads linking the east and central parts of the Study Area appears to indicate that fires frequently occur along these roads.

② Impacts of Exotic Herbs in the Study Area

Chromolaena odorata of the *Compositae*, an exotic herbal species, is widely distributed on farmland and grassland in the Study Area. Hall and Swaine (1981) do not mention any relationship between this particular species and fires.

Chromolaena odorata noticeably prefers light and has strong propagation potential. While it is liable to combustion in the dry season, it is said to easily regenerate after sustaining fire damage. One survey concluded that few buried seeds (i.e. seed banks) of *Chromolaena odorata* were found on the forest floor of a dense forest, (i.e. less degraded forest), but were found on the forest floor of a sparse forest [see Footnote 12)].

[9] See Table IV-1-1 for the source.

[10] Here, savanna means grassland with scattered trees which exists in severe arid areas in the tropics.

III.2 Socioeconomic Conditions

III.2.1 Social Structure in the Study Area

(1) Population

The Study Area is located in the Brong-Ahafo Region, the capital of which is Sunyani, and extends over three districts, i.e. Sunyani, Berekum and Wenchi. The National Census conducted in 1984 puts the total population of the Brong-Ahafo Region at approximately 1.2 million, of Sunyani at some 98,000, of Berekum at some 79,000 and of Wenchi at some 156,000. The size of villages located in the Study Area and registered by the National Census considerably varies from some 9,800 residents in the case of Nsuatre to mere four persons in the case of a small settlement at Antokrom, except for district capitals Sunyani. Based on existing materials and an interview survey conducted locally, the existence of 31 villages (except the capital towns of districts) was confirmed with a total population of approximately 36,000 as of 1984. Assuming that the annual population growth rate in the Region is 3.3%,[11] the present population in the Study Area except the capital towns is estimated to be approximately 57,000.

(2) Local Inhabitants

The indigenous people living in the Study Area belong to the Akan tribe which is divided into such sub-tribes as the Brong and Ashanti. Various dialects of Akan (Twi), which is the mother tongue of 44% of all Ghanaians, are spoken locally.

(3) Immigrants and Seasonal Labourers

Many immigrants from the northern and other parts of the country have settled live in the Study Area. As some of these immigrants have lived in the Study Area over two generations, there are villages where immigrants (and their descendants) outnumber the indigenous people. In addition to permanent settlers, there are also seasonal labourers from outside during the busy agricultural season.

In contrast, outward movement mainly consists of people seeking temporary work. It is reported that the population inflow in the Study Area is larger than the outflow from the Study Area etc.

[11] Bureau of Integrated Rural Development (BIRD), University of Science and Technology, Kumasi (1995)

III.2.2 Production Activities

(1) Working Population

The 1984 National Census puts the ratio of rural population in the Brong-Ahafo Region at 73% which is slightly higher than the national average of 68%. By district, Sunyani, where the regional capital is located, has a high urban population ratio of 68% while Berekum and Wenchi have rural population ratios of some 50% and 84% respectively (see Table III-2-1).

Table III-2-1 Population by Urban & Rural, and by Sex

	Population	Urban (%)	Rural (%)	Male (%)	Female (%)
Total Country	12,296,081	3,934,796 32%	8,361,285 68%	6,063,848 49%	6,232,233 51%
Brong-Ahafo Region	1,206,608	321,106 27%	885,502 73%	613,721 51%	592,887 49%
Sunyani District	98,183	66,583 68%	31,600 32%	49,889 51%	48,294 49%
Berekum District	78,604	38,928 50%	39,676 50%	38,062 48%	40,542 52%
Wenchi District	155,857	25,461 16%	130,396 84%	80,309 52%	75,548 48%

Note : This table was prepared using the data in "Ghana Statistical Service (1984). 1984 Population Census of Ghana".

(2) Agriculture

Farming in the Study Area relies on traditional rain-fed methods and such agricultural inputs as agrochemicals and chemical fertilisers are seldom used. There is a growing land shortage because of the population increase, degradation of land due to forest fires and suspension of the taungya system.

The main farming crops are maize, cassava, plantains (cooking bananas), yams, cocoyams, oil palms, cashews, groundnuts and such vegetables as tomatoes, garden eggs, okra and peppers.

(3) Animal Husbandry and Hunting

Livestock (See Table IV-2-4) raised locally comprises cattle, goats, sheep, pigs and poultry. The operation size significantly varies. Some farmers market almost all of the stock they raise, while others raise only chickens and geese; Other animals are sometimes banned since they often damage crops.

Grasscutters, giant rats and other small animals are hunted. Bushmeat is also sold in the local market, providing a valuable source of income for many farmers.

(4) Forestry and Forest Products

The people of villages located near forest reserves are prohibited from cutting trees for commercial purposes and it is necessary for them to obtain a permit from the Forestry Department in advance to collect forest products such as firewood for their own use to avoid purchasing the wood.

III.2.3 Village Structure

(1) Hierarchical Structure of Stools

The traditional social structure of the Akan is a very complicated hierarchical structure with matrilineal lineage group acting as the basic social unit. These lineage groups form a community in possession of certain land. This community is frequently called "a stool" after the stool (for sitting on) which symbolises the Akan chieftaincy.[12] A community at each level is represented by its traditional head/chief in its superior community.

The largest community is called "a paramount stool" which over-rides divisional (caretaker or territorial) stools at the village level taking charge of the land belonging to a paramount stool. Below divisional stools are ordinary villages and small settlements. A small settlement may consist of a single family or household. The leaders of these communities are called a paramount chief (*Omanhene*) in the case of a paramount stool, a chief (*Ohene*) in the case of a divisional stool and a village headman (*Odikro*) in the case of a village. Paramount chiefs who still live in Kumasi form the Asante Confederacy which is headed by the Asantehene.

[12] By strict definition, the word "stool" is not applicable to any community below a divisional stools. In view of its ambiguous use in reality, however, the word "stool" is used here to signify any community in possession of certain land regardless of its size and hierarchy.

(2) Organization of Stools

① Traditional Organization

Traditional government (Traditional Council / Authority) of the stool consists of the chief and his elders. The chief is not only the political leader of the stool but also the symbol of the culture and identity of the lineage forming the community. A chief of the matrilineal Akan is selected from a specific kindred branch of a given clan and is usually a man.

The traditional council is composed of the queen mother (*Ohemmaa*)[13], deputy chief (*Krontihene*), head of the royal clan (*Abusuapanin*) youth leader (*Gyaasehene*) and the linguist (*Akyeame*), etc. The traditional council is the supreme organization of a stool and is responsible for the general administration of the village. Local people tend to firstly consult the chief or traditional council members rather than a government official when they have a problem. While the chief tends to be seen as a dictator in stool-based society, the consent of the traditional council must be obtained to all his political decisions. Membership of the traditional council is a lifetime tenure in principle.

In the traditional council, the queen mother has a strong say, including a veto, in the selection of a new chief. There are also fetish priests and medicine-men in villages who exert religious and spiritual influence on villagers.

② Modern Organization

In addition to the traditional council, each stool has a town/village development committee, the members of which gather weekly or monthly to discuss issues relating to village development. The committee members are elected at a general meeting of the villagers on the recommendation of the chief. Of the 7 - 15 members, women account for approximately one-third.

III.2.4 Land Tenure

(1) Land Tenure System Based on Modern Law

Article 267 of Ghanaian Constitution stipulates that "All stool lands in Ghana shall be vested in appropriate stool on behalf of, and in trust for the subjects of the stool in accordance with customary law and usage." In practice, all stool lands belong to paramount chiefs who are traditional heads of paramount stools. The Constitution also stipulates the distribution of the profit obtained from stool lands and demands that 10% of the total profit be used for the

[13] The queen mother is often the mother, sister or aunt on the maternal side of the chief.

management of the Office of the Administrator of Stool Land. In regard to the remaining 90%, 55% goes to the District Assembly presiding over the stool land in question, 20% goes to the traditional authority and 25% goes to stools through the traditional authority for the maintenance of each stool in keeping with its status.

According to the Concessions Act of 1962 among stool land, areas designated as forest reserves and timber resources in such reserves are managed by the Forestry Department on behalf of the stools. In accordance with this Act, the Forestry Department transfers concessions to timber producers and receives 70% of the royalties. The remaining 30% of the royalties is divided based on the same distribution ratios of the profit from stool land, i.e. 55% goes to the District Assembly, 20% goes to the traditional authority and 25% goes to divisional stools.

(2) Land Ownership Under Customary Law

The land tenure system of stool land controlled by tradition and customary law is very complicated. According to the concept of the Akan, land is considered in three respects, i.e. (1) the land itself, (2) usufruct or right of occupation of the land and (3) crops and trees growing on the land but separated by the earth itself. The earth itself is not considered a commodity which can be personally owned, bought or sold. Usufruct is the common property of the lineage and is inherited from ancestors. The true land owners are samanfo, ancestral spirits. The land belongs to the chief, but crops and trees grown on the lands are shared between chiefs and farmers by the tenant (share cropping) system referred later.

(3) Inheritance of Land

In the case of the matrilineal Akan, the property of the lineage may be clearly divided into male property and female property which is passed to the successors of the corresponding genders exclusively (Rattray, 1929).[14]

(4) Sharecropping System

While stool land may be sold in other parts of Ghana, this practice is not common in the Study Area. As a result, the most common way for immigrants from outside to obtain farmland is to become sharecroppers. Settled immigrants and seasonal workers obtain sharecropping rights from the chief of a village stool, a family head in possession of land tenure rights and sometimes directly from a paramount chief. A common sharecropping agreement is called either *abunu* or *abusa.* A sharecropper pays half of the harvest to the

[14] Rattray, R.S. (1929) "Ashanti Law and Constitution", Oxford, quoted in Brown C.K. (1996) "Gender Roles in Household Allocation of Resources and Decision-Making in Ghana" in *The Changing Family in Ghana*, Accra

landowner under *abunu* as rent or one-third under *abusa*. The selection of either arrangement usually depends on the purpose of land use.

III.3 Land Use

III.3.1 Forest

① Man-Made Forests (MF)

Man-made forests mainly consist of teak (*Tectona grandis*) and are found in each forest reserve.

② Natural Forests (NF)

Natural forests in forest reserves have many species, of which wawa (*Triplochiton scleroxylon*) and odum (*Milicia excelsa*) enjoy a tree height of 35 m or more, forming the upper-story.

③ Riparian Forests (RF)

These are natural forests which survive along streams outside forest reserves. In some of these forests near settlements, cacao and such fruit trees as orange trees are cultivated.

④ Shrubland (S)

Inside forest reserves, shrubland is observed in former bushfire areas and abandoned shifting cultivation areas. Some shrubland in areas with less bushfire damage appear to be on the path to natural forest restoration.

III.3.2 Non-Forest

① Farmland (F1, F2)

General cultivated area (F1) is popular throughout the Study Area and expanding to the boundary of forest reserves. Oil palm plantations (F2) are dotted along roads. The fact that planting trees is scarcely observed in and around the farms.

② Grassland (G1, G2, G3)

Grassland is classified into three types based on the species and existence of trees.

The first type (G1) where colonies of *Andropogon spp*. and *Panicium spp.* are seen as a result of the savannisation process. The second type (G2) has colonies of such weeds as *Chromolaena odorata*. The third type (G3) where scattered trees are seen.

③ Bare Land and Rocky Land (B)

Sites classified in the category of bare land are treeless land with exposed ground. Few such sites are observed in the Study Area. Rocky land is often observed in the Sawsaw FR, Nsemere FR and Yaya FR and quarries are also found at some places near the land.

④ Villages (V)

A village is formed by a cluster of houses. The surrounding wide area is also classified in this category in the case of such extensive urban areas as Sunyani and Berekum. In contrast, scattered houses in a remote village/hamlets are ignored if the respective dwelling area is smaller than the minimum interpretation unit.

⑤ Water Bodies and Roads (W, R)

The main water bodies are the dam (reservoir) at Berekum, Tain River and other major rivers and river channels with a clearly visible dry riverbed.

The calculated area of each land use and vegetation category in the Study Area is shown in Table III-3-1.

Table III-3-1 Area by Land Use and Vegetation Category in the Study Area

Category	Symbol	Area (ha)	Ratio (%)
Plantation (Man-Made Forest	MF	6,796	2.3
Natural Forest	NF	70,747	24.1
Riparian Forest	RF	2,596	0.9
Shrubland	S	15,103	5.2
Farmland	F1	13,939	4.8
	F2	888	0.3
Grassland	G1	15,956	5.4
	G2	109,248	37.3
	G3	49,021	16.7
Bare Land/Rocky Land	B	235	0.1
Village	V	8,254	2.8
Water Body	W	39	-
Road	R	207	0.1
Total		293,000	100.0

The forest area combining man-made forests, natural forests, riparian forests and shrubland totals 95,215 ha (32.5%) while arable land combining farmland and grassland totals 189,052 ha (64.5%). These figures suggest that the existence of forest reserves ensures a large forest area in the Study Area.

III.4 Forestry

III.4.1 Current Conditions of Forest Reserves

(1) Area and Year of Designation of Forest Reserves

As shown in Table III-4-1, the five forest reserves in the Study area are managed by three district forestry offices under the Brong-Ahafo Regional Forestry Office. Their respective areas are also shown in the same table. The largest forest reserve is the Tain II FR managed by the Dormaa District Forestry Office with an area of 48,267 ha.

Table III-4-1 Area and Year of Designation of Forest Reserves in the Study Area

DFO	Forest Reserve	Area (ha)	Year of Designation
Wenchi	Nsemere	1,813	1939
	Sawsaw	6,288	1939
Sunyani	Tain I	3,056	1932
	Yaya	5,136	1929
Dormaa	Tain II	48,267	1943
Total	-	64,570	-

Source: Based on interviews at the Brong-Ahafo Regional Forestry Office conducted by the JICA Preliminary Study Team

(2) Current Timber Production Activities

The current timber production activities in these forest reserves is shown in Table III-4-2. According to the table, timber production activities are planned to continue up to 2001 by the FWPC (3,056 ha) in the Tain I FR and up to 2008 by the ABTS (10,363 ha). There is one concession holder for each forest reserve except for the Sawsaw FR and Tain II FR.

The first field survey found harvesting in natural forests in the Tain II FR where the term of the concession is still valid.

Table III-4-2 Timber Production Activities in Forest Reserves

Forest Reserve	Concession Holder	Area (ha)	Ending Year	Relevant Stool
Nsemere	Paul K. Sagoe	1,813	1981	Wenchi
Sawsaw	Paul K. Sagoe	3,957	1997	Wenchi
	A.E. Sauod	3,120	1998	Wenchi
Tain I	FWPC	3,056	2001	Dormaa
Yaya	Kwaku Meum	5,126	1995	Wenchi, Dormaa
Tain II	ABTS	10,363	2008	Berekum
	JCM	7,819	1990	Berekum
	JCM	4,662	1990	Berekum
	FWPC	10,360	1997	Nsuatre
	KSBS	5,180	1998	Odumase
	JCM	4,662	1990	Berekum

Source: Based on interviews at the Brong-Ahafo Regional Forestry Office conducted by the JICA Preliminary Study Team.

(3) State of Degradation in Forest Reserves

Signs of forest fires, including scorched stems, absence of seedling growth and the wide distribution of *Chromolaena odorata* which was taller than human height, were found in all of the forest reserves.

The overall scoring result of each forest reserve is shown in Table III-4-3. All forest reserves score 5 (except for the Tain II FR which scores 4), indicating an advanced stage of degradation. The scored state of forest degradation is described in Table III-4-4.

Table III-4-3 State of Forest Degradation in Forest Reserves

Forest Reserve	Year of Designation	Final Record of Cutting	Degree of Degradation (Score)	Points to Note for Protection		
				Sacred Area	Fire Protection Required	Care Required to Protect Remains
Sawsaw	1939	1985	5	Yes	Yes	Yes
Nsemere	1939	1980	5	-	Yes	Yes
Yaya	1930	1991	5	-	Yes	Yes
Tain I	1932	1991	5	-	Yes	Yes
Tain II	1934	1991	4	-	Yes	-

Source: See Table IV-4-3

Table III-4-4 State of Forest Degradation

Score	State of Forest	Description
1	Excellent	Rate of disturbance by fires and human activities (cutting and farming) is 2% or less; excellent crown; well-developed virgin forest or secondary forest
2	Good	Rate of disturbance is 10% or less with limited damage by cutting; virtually non-existent bushfire damage
3	Slightly degraded	Clearly disturbed but good stands remain in patches; upto 25% of trees are damaged with minor signs of natural regeneration; upto 50% of the crown is destroyed
4	Mostly degraded	25 - 50% of trees are damaged; resulting in unproductive stands; 75% of the crown is destroyed
5	Very poor	More than 50% of trees are damaged with no signs of natural regeneration; strong presence of *Chromolaena odorata*; more than 75% of the crown is destroyed
6	No significant forest left	Forest has been destroyed by savannisation, plantation or farm land development; forest survival rate is 2% or less; trees are scattered or observed in small number along rivers

Source: W.D. Hawthorn & M. Abu Juan (1995), Forest Protection in Ghana: IUCN/ODA/FD

In addition to the above forest degradation score, the Forestry Department defines degradation as a crown density of 50% or lower and has two categories of degradation, i.e. a crown density of 20% to 50% and a crown density of less than 20%. As these categories roughly correspond to Score 4 and Score 5 in Table III-4-4, it can be said that the forests in the study area has been degraded from the standpoint of a crown density.

(4) Current Conditions of Forest Reserve Management

① Management System

The actual management work in forest reserves is conducted by technical officers, forest guards and workers under the supervision of the forest officer of each district forestry office. A technical officer is assigned to each forest reserve.

② Basic Matters of Forest Management Plan

Of the items referred to in the working plan, the main items requiring careful consideration in connection with the formulation of the Forest Management Plan are described below.

a. Local People has the following right; collection of dead trees and snails, fishing and hunting rights, admitted farm and timber rights.

b. The term of concession is set at 25 years.

c. The treatment of forests is selective cutting. The subject trees are those which are classified in Tree Group I with a minimum DBH of 50 cm.

d. Monitoring is conducted every five years in cooperation with Forest Research Institute.

e. The Working Plan has a life of 20 years and reviewed after 10 years. The change of the contents of the plan is to conducted through consultation between Planning Branch and Regional Forestry Office

f. The felling cycle is 40 years with natural regeneration. The optimum size of a concession is 80 - 125 km^2.

g. Firebreaks with a width 20 m, accompanied by 20 m wide planting belts on both sides. The maintenance of these firebreak is entrusted to local people. The yard stick for the overall size of firebreaks is 2% of the area of a SWC.

h. In principle, forest roads are planned along compartment boundaries and meet forest reserve boundaries. The general standards for forest road width are 20 m for trunk forest roads, 15 m for branch forest roads and 10 m for spur roads.

III.4.2 Agroforestry

A case survey was conducted to examine the feasibility of introducing agroforestry in forest reserves in view of the importance of agroforestry to encourage the participation of local people in the Forest Management Plan.

(1) Taungya System

All of the farming households surveyed are engaged in agroforestry based on the taungya system. While the planting distance differs depending on whether teak or cassia is planted, the cultivated agricultural products do not greatly vary from one household to another. A typical planting plan and cross-section are shown below. (see Fig. III-4-1, Fig. III-4-2)

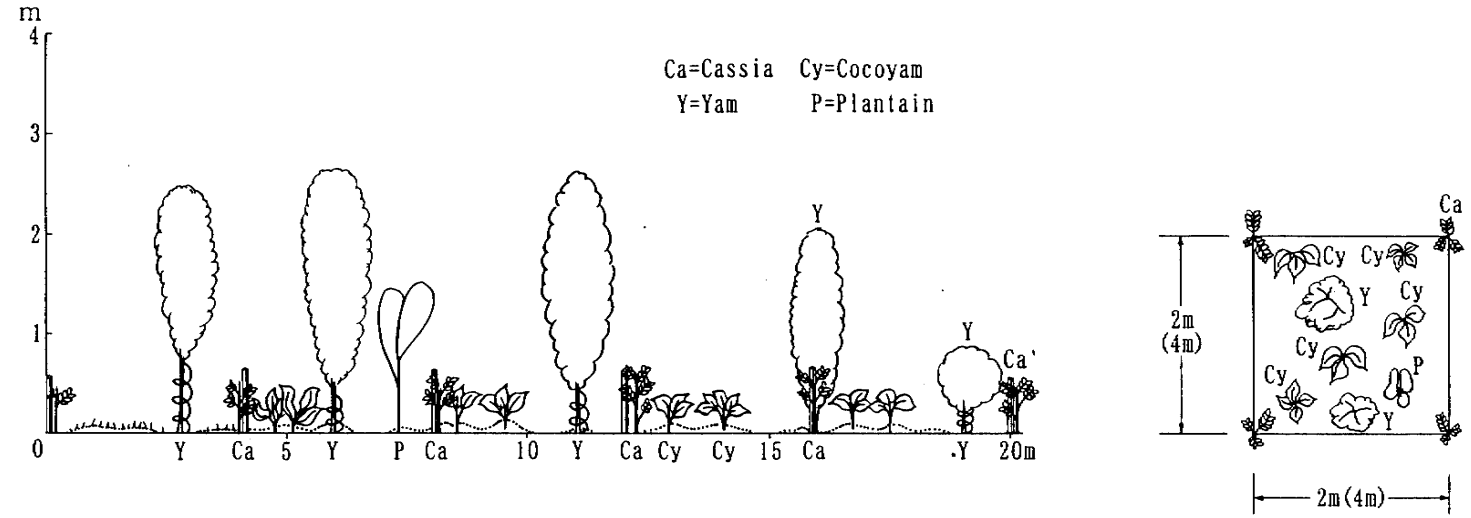


Fig .III-4-1 Example of Agroforestry (in Green Firebett)

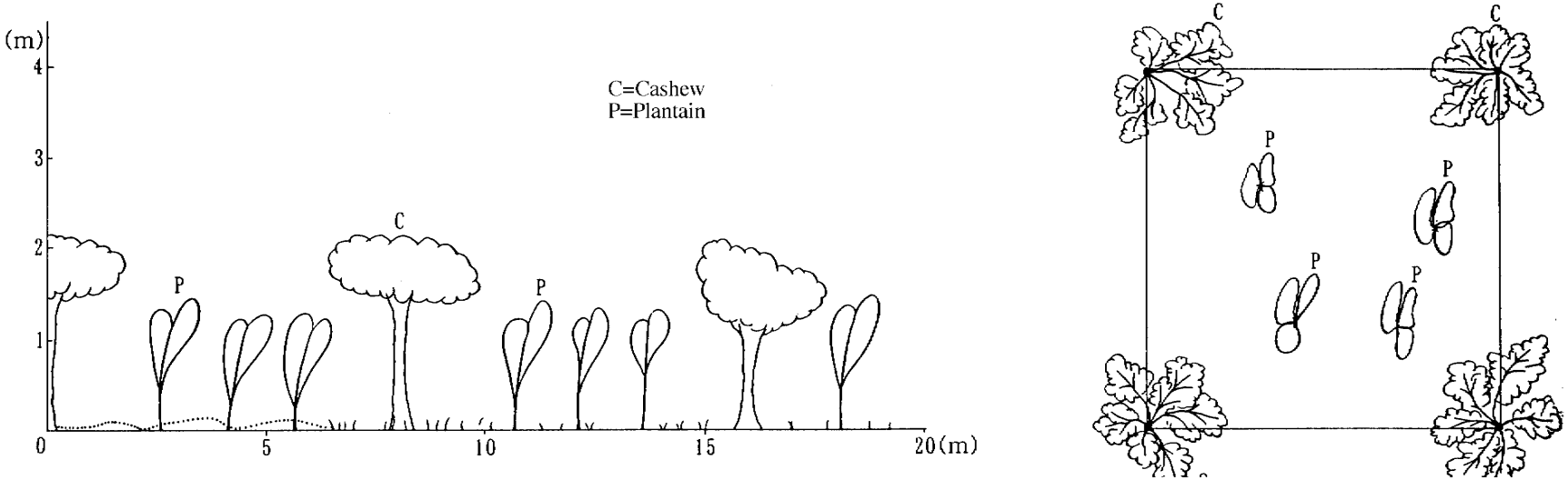


Fig. III-4-2 Example of Agroforestry (Combination of Cashew and Crops)

The growth of cultivated crops is favourable in the first year, the higher tree height of cassia in the second year and thereafter is said to shade the crops. In fact, some of the planted trees have already been cut at the surveyed sites, reflecting this problem. (See Table III-4-6)

The cultivation period of agricultural products found by the survey is 1 - 2 years in the case of the planted trees being teak and 7 - 8 years in the case of cashew.

Table III-4-5 Example of Cultivation System

Teak plantation (Ataniata)	Cashew plantation (Ataniata)
1 year Teak + Cassava + Plantain	1 year Cashew + Cassava + Plantain
2 years Teak	2 years Cashew + Cassava + Plantain
3 years Teak	3 years Cashew + Plantain
4 years Teak	4 years Cashew
5 years Teak	5 years Cashew
6 years Teak	6 years Cashew + Cassava

(2) Management

① Personal Management

While the entrepreneurial farm and large-scale farming households have proved capable of conducting diverse farming activities, including agriculture, without outside assistance, medium-scale farming households appear to have become involved in agroforestry due to an active drive by the administration and/or due to NGO assistance at the time.

② Organizational Management

Green firebelt development projects are conducted by the forestry office to maintain forest reserve boundaries and to prevent the spread of bushfires in forest reserves and involve local people in the vicinity of forest reserves. The projects started with extension work by district forestry office staff to organize taungya groups and the projects actually commence with the allocation of land. As each taungya group is reorganized every year, however, there is no continuity of the organized activities and all aspects of the practical work are left to the participating individuals after the allocation of land. As a result, some farming households in the neighbourhood of the surveyed households have already abandoned farming in forests, threatening the maintenance of the green firebelt function in some areas. This fact implies the difficulty

of organizing farmers anew. According to agricultural office staff at Wenchi and others involved in the GTZ project at Sunyani, the continual management of farmers' groups is difficult in some places.

③ Markets

The entrepreneurial farm and large-scale farming households sell their products in overseas markets as well as the market in Accra and appear to have their own channels of obtaining relevant information. In the case of medium-scale farming households, the local markets at Sunyani and Kumasi appear to be the main destinations for their products.

III.4.3 Nursery Practices

(1) Current Conditions of Nurseries

Each district forestry office in the Study Area has its own nursery. The nursery of the Sunyani district forestry office is the largest and is located on the campus of a forestry school run by the Forestry Department. The seedlings produced so far are said to have been distributed to forest reserves, the private sector and local people. The size of this nursery is approximately 2 ha and it is complete with nursery beds, a water tank and soil yard, etc. Teak is the predominant species although the nursing of Gmelina and other species is also conducted on a minor scale.

(2) Characteristics of Nursery Practices

The characteristics of the current nursery practices are outlined below based on the findings of interviews at the Sunyani district forestry office.

① Seeds

While it is easy to obtain seeds of teak (*Tectona grandis*), cedro (*Cedrela odorata*), cassia (*Cassia siamea*) and Eucalyptus spp., it is difficult to obtain seeds of gmelina (*Gmelina arborea*), mahogany (*Khaya spp*.) and Blighia spp. as shown in Table III-4-6.

Table III-4-6 Seed Collection

Tree Species	Collection		Difficullty		Number of Seed (per 500 gram)
	Place	Method of Collection	Yes	No	
Tectona grandis	Mantukuwa	Climbing		v	140
Gmelina arborea	Forestry school	Under trees	v		70
Cedrela odorata	Bibiani	Climbing		v	210
Cassia siamea	Forestry school	-		v	1,800
Eucalyptus spp.	Winneba	Climbing		v	uncoutable
Khaya spp.	Forestry school	Under trees	v		250
Blighia spp.	Sunyani	Climbing/under trees	v		70

The germination ratio of all species of 70 - 90% is high as shown in Table III-4-8. The seed treatment to encourage germination is relatively simple although the actual method varies from one species to another. The storage of seeds for six months or upto two years is possible except for the seeds of Blighia spp.

Table III-4-7 Germination Rate and Treatment

Tree Species	Germination rate (%)	Treatment			Storage			
		Yes	No	Method	Yes	No	How long	Method
Tectona grandis	80	v		soaking/burning	v		over 1 year	Peeting and put in a sack
Gmelina arborea	90		v	boiling/soaking/ burning	v		6 months	Remove freshy part of fruit
Cedrela odorata	70	v			v		8 months	Put in sack
Cassia siamea	90	v		soaking	v		over 1 year	Put them in air tight container
Eucalyptus spp.	70	-			v		two years	put in plastic bag
Khaya spp.	80	v		soaking	v		one year	air tight container
Blighia spp.	90	v				v	-	-

② Nursery method

Transplanting is conducted using bare roots, potted seedlings (using plastic bags) or stumps as shown in Table III-4-9. The mortality rate after transplanting varies from 10% to 40% depending on the species.

Table III-4-8 Nursery Method

Tree Species	Bare root	Plastic bag	Stump	Mortality (%)	Raising period
Tectona grandis	v	V	v	30	3 months - 1 year
Gmelina arborea	v		v	10	4 - 6 months
Cedrela odorata	v		v	10	4 - 6 months
Cassia siamea	v	V		20	3 - 8 months
Eucalyptus spp.		V	v	30	6 - 12 months
Khaya spp.		V	v	40	after one year
Blighia spp.		V	v	40	3 - 6 months

Watering is conducted twice a day for all species and the weeding frequency varies from one species to another as shown in Table III-4-10. Shading is required for teak, cassia and mahogany while pest control measures are required for teak (termites), gmelina (termites) and cassia (green caterpillars).

Table III-4-9 Maintenance Method of Seedling

Tree Species	Watering	Weeding	Shading		insect/measure	
	Times/day	times	yes	no	Name	Countermeasure
Tectona grandis	2	5	v		Termite	Chemical control
Gmelina arborea	2	3		v	Termite	Chemical control
Cedrela odorata	2	5		v	-	-
Cassia siamea	2	3	v		caterpillar	Chemical control
Eucalyptus spp.	2	1		v		
Khaya spp.	2	3	v			Swollen under leave
Blighia spp.	2	3		v		

III.4.4 Utilization of Firewood

The firewood consumption, collection distance and head load, etc. were surveyed in order to examine the feasibility of the establishment of forests with a view to facilitating the participation of local people and determining the locations of such forests under the Forest Management Plan.

(1) Firewood Consumption

While the average firewood consumption is one head load of firewood every 2.4 days, the duration of firewood consumption varies from one area to another and also from one person to another.

By purpose of firewood utilization, 65% is for domestic consumption, 21% for commercial use and 14% for both (see Fig. IV-4-2).

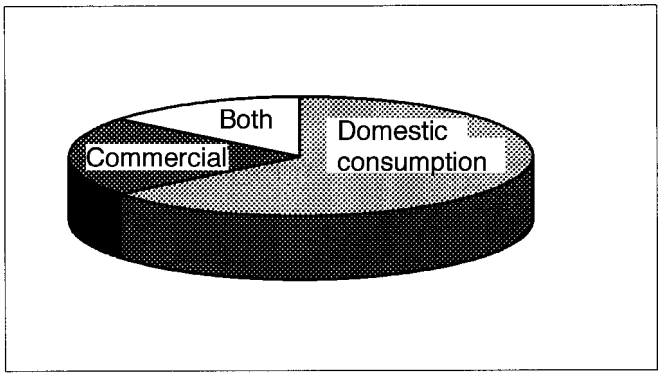


Fig. III-4-3 Proportion of Firewood Consumption

The mean weight and mean volume per head load are 27.3 kg and 0.1385 m^3 respectively.

(2) Species for Firewood

Twenty-four species are locally used as shown in Table III-4-10. The combination of species used as firewood differs from one area to another.

Table III-4-10 The List of Tree Species for Firewood

Tree species Local Name (Scientific Name)	Sunyani-Chirra-Wenchi	Sunyani-Berkum	Sunyani-Adantia-Badu	Remarks[2)]
Wawa (Triplochiton scleroxylon)	1	1		○● (222)
Ofram (Terminalia superba)	1	1		● (213)
Onyina (Ceiba pentandra)	1	1		○● (49)
Kyenkyen (Antiaris toxicaria)	1	1		○● (23)
Teak (Tectona grandis)	1			○● (205)
Pepea (Margaritaria discoidea)			1	○ (148)
Pepaa	1	2		
Kontokuno	1	1		
Moto (Monodora spp.?)	1			
Nwoo	1			
Kane (Anogeissus leiocarpus)	1	1		○● (19)
Krahyere	1			
Domene (Ficus spp.)			2	○ (112)
Adoma (Ficus sur)		2	1	(113)
Okure (Bosqueia angolensis)			1	(38)
Nyankyerene (Ficus exasperata)		2	1	○ (111)
Okro (Albizia-zigia)			3	(11)
Repa		1		
Albizia (Albizia spp.)			1	○ (10)
Pampena (Coryranthe pachyceras)		2	2	○ (77)
Esa (Celtis mildbraedii)		1		○● (50)
Akye (Blighia sapida)		1		○● (31)

Note 1) Number shows respose numbers
2) ○: tree species which surveyed
●: Tree preference survey result
( ) Plant No.

(3) Firewood Supply Shortage

28% of the respondents stated that the firewood supply is sufficient while 72% stated that the firewood supply is insufficient. The ratio of people pointing out a supply shortage was low along the Sunyani-Wenchi route but high along the other two routes.

① The reasons cited for the sufficient firewood supply are as follows.

- The collection of firewood in forest reserves is permitted, although it takes time to get permission.
- Waste wood from sawmills is used as firewood for the moment.

② The reasons cited for the insufficient firewood supply are as follows.

- Felling activities and repeated bushfires have turned forests into grassland with a decline of the number of trees to produce firewood.
- Shortening of the fallow period in the off-reserves due to the increase of the population has made natural regeneration difficult.

(4) Firewood Collection

1) Firewood Collection Areas and Time

As shown in Fig. III-4-4, the most frequently used area for firewood collection is farmland, accounting for 60% of all firewood collection areas, followed by forests outside forest reserves (19%), sawmills, forest reserves and savannised grassland(21%)

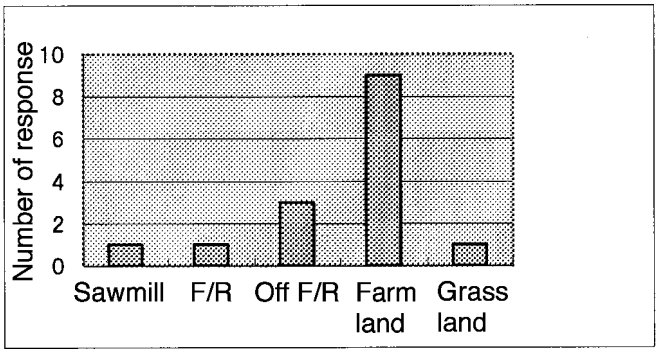


Fig. III-4-4 Firewood Collection Areas

The average collection frequency is 3.7 times a week. The most frequent answer is twice a week (four respondents), followed by three times a week and seven times a week (three respondents each), five times a week (two respondents) and four times a week (one respondent) (see Fig. IV-4-5).

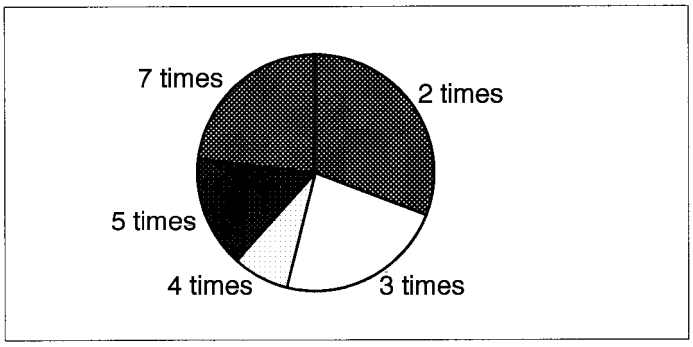


Fig. III-4-5 Collection Frequency

The average collection distance per one way trip is 2.3 miles. The most frequent distance is 1 - 2 miles (six respondents), followed by 3 - 4 miles (three respondents), more than four miles (three respondents) and less than one mile (two respondents) (see Fig. III-4-6).

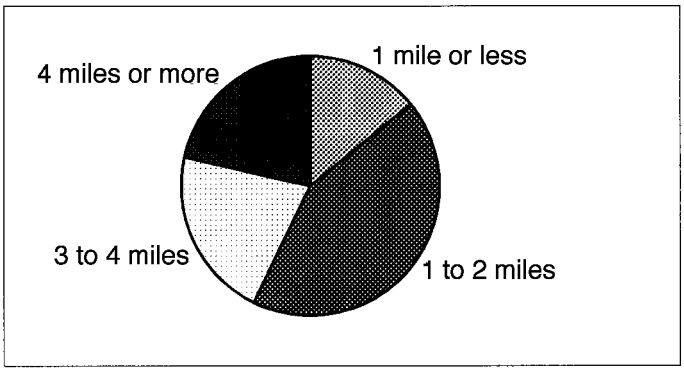


Fig. III-4-6 Collection Distance

Collection frequency decreases as consumption duration becomes longer. Also regarding collection distance and frequency, the frequency varies even at the same distance.

III-4-5 Intentions of Local People Involved in Forestry

(1) Sawmills

Sawmills whose business is related to the Intensive Study Area were surveyed in terms of their planting experience, intentions and hopes vis-a-vis forests and forestry, etc.

① Planting Experience

The general tendency is for larger sawmills to have more planting experience.

The actual planting area of those sawmills with planting experience varies from 20 ha to 230 ha and the planting sites are land owned by the stool outside forest reserves. Teak is the main planting species although wawa (*Triplochiton scleroxylon*) and Ceiba (*Ceiba pentandra*) are also planted.

② Intention of Planting

The interest in planting, preferred species and use of the planted trees by sawmills are summarised in Table III-4-11.

Table III-4-11 Intention of Sawmills in Planting

Interest in Planting	Preferred Species	Use of Planted Trees
- Some sawmilla are interested while others are not - Some will conduct planting if sufficiently large land is available - Some are concerned in regard to bushfires - The problems associated with land tenure must be solved	Odum (*Melicia excelsa*) Emire (*Terminalia ivorensis*) Ofram (*Terminalia superba*) Teak (*Tectona grandis*) Ceiba (*Ceiba pentandra*)	- Supply to own sawmill - Use as furniture and roofing materials - Certain facilities (production line for small and middle size logs and kiln drying facilities are required for the planning of exports

The preferred species are teak and such local species as odum and wawa. Careful examination of the species to be planted is required, taking such needs of sawmills into consideration.

③ Management

There are two types of the management for planting, i.e. independent management and joint management, as outlined in Table III-4-12.

Table III-4-12 Difference Management Preferences of Sawmills

Independent Management	Joint Management
- Avoidance of problems at the time of profit allocation - Management of planting sites by means of payment to district forestry office staff	- Cooperation with local people in regard to planting in the case of small sawmills - Joint planting with local people with the provision of labour by local people and the financial assistance of the government.

④ Needs Vis-a-Vis Forestry Department

The needs of sawmills vis-a-vis the Forestry Department are summarised in Table III-4-13.

Table III-4-13 Needs of Sawmills Vis-a-Vis Forestry Department

Large Sawmills	Small Sawmills
- Encouragement for planting - Provision of education for local people as regards bushfire prevention with financial assistance - Introduction of cultivation sites in green firebreaks, backed by encouragement for the planting of cassia, etc. - Examination of a suitable land acquisition method for planting (relaxation of the present regulations) - Free provision of land in forest reserves for planting - Improved share of felled trees (for example, 80% for those planting trees) - Mechanisation and technical development of planting work	- Financial assistance (credit shortage) - Priority emphasis on the production of sawn logs for the domestic market rather than the export market - Strengthening of education and patrols (by soldiers, etc.) for bushfire prevention - Introduction of small sawing machinery - Promotion of the use of silviculture funds - Supply of seedlings for planting

⑤ Others

One of the problems faced by the surveyed sawmills and furniture factories in the Study Area is a decline of the log and sawn timber supply during the last 10 years. The steep increases of the log and sawn timber prices due to the wood supply shortage have also considerably affected factory management.

The wood supply shortage is assumed to have been caused by bushfires, illegal cutting by chainsaw operators and preference for timber export in addition to the general depletion of wood resources due to excessive felling. The remedial measures suggested by the surveyed factories include the strict enforcement of felling control, purchase from the wood market, restrictions on the felling of small diameter trees, law enforcement vis-a-vis chainsaw operators, changed emphasis on local development instead of timber export, effective use of funding for silviculture and active planting.

The wood supplied to sawmills and furniture factories currently comes from concession holders, sawmills (which are also concession holders in many cases) and chainsaw operators regardless of whether or not the wood comes from a forest reserve. Hardly any controls exist in regard to the wood price and stock level. The survey found that one solution to the problem of a supply shortage is the purchase of logs/timber in the wood market. This shows that the wood market, designed to ensure a stable supply of logs at a steady price through the dissemination of adequate information, is not functioning properly, presenting a major problem for the implementation of the Forest Management Plan in the coming years.

(2) Furniture Factories (Carpenters)

As in the case of sawmills, the planting experience, intentions and hopes vis-a-vis forests and forestry, etc. of eight factories of furniture (carpenters) located in Sunyani were surveyed.

① Planting Experience

None of the factories listed have any experience of planting.

② Intention of Planting

Although none of the factories have any experience of planting, all of the factories have intention of planting provided that they can obtain the necessary land and financial assistance. (see Table III-4-14)

Table III-4-14 Interest of Woodworking Factories of Furniture in Planting

Interest	Species	Use
Provision of land: interested Financial assistance from government: interested	kwaso, wawa (*Triplochiton scleroxylon*), oprono (*Mansonia spp.*), mahogany (Khaya spp.), teak (*Tectona grandis*), sapele, cedar, mahogany (*Khaya spp.*) , hyedua (*Daniella ogea*), odum (*Milicia excelsa*), baku (*Tieghemella heckelii*), ofram (*Terminalia superba*)	External sales and furniture

③ Management

Only large factories are willing to conduct independent planting while most factories opt for joint planting. (see Table III-4-15)

Table III-4-15 Different Planting Preferences of Factory of Furniture

Size of Factory	Preferred Type of Planting	Description
Large	Independent planting Joint planting	- Independent planting forestalls the problem of profit allocation - Assistance in terms of labour and finance may be possible for joint planting
Middle	Joint Planting	- Assistance in terms of labour and finance may be possible for joint planting
Small	Joint Planting	- Assistance in terms of labour and finance may be possible for joint planting - Independent planting is difficult due to insufficient own funds

④ Needs Vis-a-Vis Forestry Department

The needs of factories of furniture vis-a-vis the Forestry Department are summarised in Table III-4-16.

Table III-4-16 Needs of Factories of Furniture Vis-a-Vis Forestry Department

Factory Size	Description of Needs
Large	- Guarantee of felling permits - Adequate as well as effective monitoring of felling permits - Provision of long-term credit and guarantee - Secured supply of timber - Law enforcement vis-a-vis illegal felling - Use of alternative building materials (steel, etc.)
Medium	- Log export control - Granting of concessions directly to factories - Introduction of bushfire prevention measures - Education of local people
Small	- Development of processing technologies by the government - Financial assistance - Law enforcement vis-a-vis illegal felling - Implementation of educational programme for bushfire prevention - Secured supply of timber within the locality

(3) District Forestry Offices

The district forestry officers of the three district forestry offices controlling the subject forest reserves of the Forest Management Plan were interviewed in regard to their intentions vis-a-vis silviculture projects for forest restoration.

① Planting Species

The planting species and planting method of man-made forests are summarised in Table IV-4-17.

Table III-4-17 Summary of Man-Made Forest Development by District Forestry Office

DFO	Planted Species	Current Planting Method
Wenchi	cedrela (*Cedrela odorata*) teak (*Tectona grandis*)	The taungya system had already ended
Sunyani	cassia (*Cassia siamea*) teak (*Tectona grandis*)	- Planting at poorly performing plantations - The taungya system was introduced to obtain the crop yield
Domma	cedrela (*Cedrela odorata*) ceiba (*Ceiba pentandra*)	- The taungya system has been introduced

② Opinion on Participation by Local People

The opinions of the district forestry offices in regard to the participation of local people in forest restoration are summarised in Table III-4-18.

Table III-4-18 Opinions of District Forestry Offices on Participation of Local People

DFO	Problem(s)	Measure(s) to Solve Problem(s)
Wenchi	- Because of inability to conduct planting, the assistance of NGOs and others	- While outside assistance is required to commence a project, a system should be established which will makes farmers conduct their own planting in the future
Sunyani	- Unclear planting sites for local people in some cases with less information - Small allocation of arable land to farmers	- Implementation of active extension work in regard to planting - Ensuring a proper understanding of the contract terms - Consideration of possible leasing of arable land to farmers at the time of planting
Doma	- Failure to implement planting projects because of a land ownership problem despite interest in planting on the part of local people	- Introduction of a new profit-sharing system while respecting the traditional land ownership system

③ Opinion on Introduction of Private Sector Investment

Recent years have seen a rising movement for forest restoration by means of attracting private sector investment. One major factor behind this movement is the planned replacement of the Forestry Department by the Forest Service as part of the administrative reform of the central government. The opinions of the district forestry offices on private sector investment are summarised in Table III-4-19.

Table III-4-19 Opinions of District Forestry Offices on Private Sector Investment

DFO	Situation and Comments
Wenchi	- The office is optimistic in regard to the implications of the entry of private companies to the silviculture business - A sawmill located near the Sawsaw FR has shown interest in planting
Sunyani	- Clarification of the benefits is required to promote planting by the private sector - The possible share allocation may be 60% for the private sector, 20% for the government, 10% for the stool(s) and 10% for others
Doma	- It is important to demonstrate successful cases to local people - Consultative meetings for investment and participation involving the three parties, i.e. the Forestry Department, landowner(s) and the private sector, are essential

III.4.6 Extension Activities of NGO

NGOs have recently commenced forestry extension, forest conservation and local development projects. According to the Planning Branch, the following NGOs are active in and around the Study Area. (See Table III-4-20)

Table III-4-20 NGOs Operating around the Study Area

Name of NGO	Activity
GACON	- Protection of sacred sites - Environmental education (Sunyani)
Green Earth Organization	- Protection of sacred sites - Environmental education campaign
Friends of the Earth	- Environmental policy campaign - Planting in communities - Research (Sunyani)
ASWIF	- Tree planting - Watershed management (nationwide)
COFOSODE	- Tree planting
CEDEP	- Local development - Preparation of educational programmes - Consultancy service (Kumasi)
EPA	- Tree planting - Agroforestry (nationwide)
ISODEC	- Local development
31st Dec. Women's Movement	- Tree planting (Sunyani)
Technoserve	- Processing of agricultural products - Export promotion of NTFPs (Kumasi)

Note : GACON Ghana Association for Consultation of Nature
ASWIF Association of Women In Forestry
CEDEP Center for Development of People
EPA Environmental Protection Association

Source: Interviews at Planning Branch. Place names in brackets indicate respective areas of activity.

IV. PRESENT CONDITIONS OF FORESTS IN THE INTENSIVE STUDY AREA

IV. PRESENT CONDITIONS OF FORESTS IN THE INTENSIVE STUDY AREA

IV.1 Forests

IV.1.1 Land Use and Forest Type[1]

(1) Land Use by Forest Reserves

Land use in the Intensive Study Area by forest reserves is shown in the Table IV-1-1. The table shows 16,267 has (53%) of forests and 14,197 ha (47%) of non-forest.

Table IV-1-1 Land Use Area in the Intensive Styudy Area

(Unit: ha)

		Saw Saw	Nsemire	Yaya	Tain I	Tain II	Total
Man-made forest		714	147	1,317	551	409	3,138
Natural forest		2,072	1,136	1,314	1,094	7,404	13,020
Riparion forest						18	18
Shrub land		91					91
Farm land	F1	571	52	62		85	770
	F2	2					2
Grass land	G1	435		2		279	716
	G2	2,077	609	1,555	1,153	4,380	9,774
	G3	1,175	67	885	124	576	2,827
Bare land / Rocky land		57	5	32			94
Village				8		6	14
Total		7,194	2,016	5,175	2,922	13,157	30,464

(2) Forest Type, Area and Volume by Forest Reserve[2]

Forest type in the Intensive Study Area is as follows. (See Table Ⅳ-1-2) Area and Volume of each forest reserve in the Intensive Study Area are shown in the Tables IV-1-3 and IV-1-4.

[1] The Standard for land use and forest type were discussed with F.D.

[2] Based on survey results of pantation and natural forests, the forest inventory register book was prepared.

Table Ⅳ-1-2 Forest Type Interpretation Criteria

Tree height class		Crown density class	
Range	Symbol	Range	Symbol
12 m and less	H1	20% and less	D1
13 - 20 m	H2	21% - 50%	D2
21 - 30 m	H3	51% - 75%	D3
31 m and more	H4	76% and more	D4

IV.1.2 Present Condition of Man-Made Forests (Teak Forests)

The sample plot survey results for man-made forests are shown in Table IV-1-5.

(1) Age, Tree Numbers, etc.

All of the surveyed man-made forests are teak forests of 5 - 29 years of age. In the Sawsaw FR, many of the stands are young with an age of up to 10 years. However, the surveyed man-made forests are generally 20 years old or more. The number of standing trees per ha considerably varies from 20 to 570. The plot with the lowest density is Plot 12 in the Tain I FR while the plot with the highest density is Plot 27 in the Tain II FR.

The mean tree height of each plot in older stands of 10 years or more of age substantially varies from 8.6 m to 17.3 m.

Average volume per ha of each plot varies from 4.4 ~ 156.5 m^3. This variation seems to be affected by the number of standing trees and the extent of thining.

Table IV-1-3 Forest Type Area in the Intensive Study Area

(Unit: ha)

Forest type	Saw saw			Nsemire			Yaya			Tain I			Tain II			Total		
	MF	NF	Other	MF	NF	Other	MF	NF	Other	MF	NF	Other	MF	NF	Other	MF	NF	Other
H1D1	8						2			16						26		
H1D2	43			15						37			12			107		
H1D3	137			5			7			31						180		
H1D4	251						56			7			15	40		329	40	
H2D1	10	307			63		32	5		31	62		6	322		79	759	
H2D2	50	251		37	168		146	37		24	20		145	312		402	788	
H2D3	109	145		54	5		397	16		131	110		26	264		717	540	
H2D4	106	72		36	13		323			274			163	246		902	331	
H3D1		32			147			69			19			530			797	
H3D2		494			188		80	746			157			1,718		80	3,303	
H3D3		771			416		274	299			726			2,667		274	4,879	
H3D4					136								42	402		42	538	
H4D1																		
H4D2													4					
H4D3								142						921			1,063	
H4D4																		
Other			4,408			733			2,544			1,277			5,326			14,288
S. Total	714	2,072	4,408	147	1,136	733	1,317	1,314	2,544	551	1,094	1,277	409	7,422	5,326	3,138	13,038	14,288
G. Total	7,194			2,016			5,175			2,922			13,157			30,464		

Note) MF: Man-made forest, NF: Natural forest, Other: Non-forest. The items of forest type is as follows.

Table IV-1-4 Forest Type Volume in the Intensive Study Area

(Unit: m^3)

Forest type	Saw saw			Nsemire			Yaya			Tain I			Tain II			Total		
	MF	NF	Other	MF	NF	Other	MF	NF	Other	MF	NF	Other	MF	NF	Other	MF	NF	Other
H1D1																		
H1D2				255						270			180			705		
H1D3	460			175			140			460						1,235		
H1D4	8,280						1,915			385			525			11,105		
H2D1	350	4,605			945		1,120	75		465	930		210	4,830		2,145	11,385	
H2D2	3,290	20,080		2,590	13,440		7,940	2,960		1,035	1,600		8,235	24,960		23,090	63,040	
H2D3	8,380	21,750		4,860	750		34,720	2,400		10,145	16,500		2,100	39,600		60,205	81,000	
H2D4	13,085	15,480		3,240	2,795		32,165			24,085			16,995	52,890		89,570	71,165	
H3D1		480			2,205			1,035			285			7,950			11,955	
H3D2		39,520			15,040		8,400	59,680			12,560			137,440		8,400	264,240	
H3D3		115,650			62,400		34,250	44,850			108,900			400,050		34,250	731,850	
H3D4					29,240								5,880	86,430		5,880	115,670	
H4D1																		
H4D2																		
H4D3								21,300						138,150			159,450	
H4D4																		
Other																		
S. Total	33,845	217,565		11,120	126,815		120,650	132,300		36,845	140,775		34,125	892,300		236,585	1,509,755	
G. Total	251,410			137,935			252,950			177,620			926,425			1,746,340		

Note) MF: Man-made forest, NF: Natural forest, Other: Non-forest

Table IV-1-5 Summary on the Results of Sample Plot Surveys in Man-made Forest

No.	Plot No.	Forest type	Photo-interpretation results H (m)	R (%)	Forest Reserve		Age (years)	Inventory results Planted trees Species	Numbers of trees/ha Total	20=<D<34	35=<	Subtotal (20=<D)	Average DBH (cm)	Total height (m) [All]	[Upper]	Total D2 (m^2/ha)	Volume (m^3/ha)	Quality class of Planted trees(%) Fire-damaged	Forked	Coppiced	Health	Site index Index 1)	Tree height of 20 years 2)
1	10	H2D2	18	50	Nsemire	*	25	Teak	240	20	30	50	15	9.0	16.2	9.6720	54.2	100	13	46	0	V	15.03
2	19	H1D3	10	60	Sawsaw	*	6	Teak	310	0	0	0	9	6.7	8.5	2.6840	8.7	100	42	13	0	V	13.62
3	17	H1D4	10	90	Sawsaw	*	9	Teak	510	0	0	0	11	6.7	10.0	6.8160	25.5	98	51	6	2	V	13.49
4	18	H1D4	10	90	Sawsaw	*	9	Teak	560	40	0	40	12	7.1	10.1	9.1560	34.2	100	71	4	0	V	13.62
5	20	H1D4	10	80	Sawsaw	*	5	Teak	550	0	0	0	10	8.2	10.1	5.6200	21.5	100	20	16	0	V	17.57
6	14	H2D3	18	60	Sawsaw	*	26	Teak	370	90	0	90	13	10.0	17.4	9.4200	57.7	96	35	59	5	V	15.94
7	15	H2D4	20	90	Sawsaw	*	26	Teak	350	220	30	250	23	14.5	20.6	22.7800	156.5	97	51	20	3	V	18.87
8	16	H2D4	16	80	Sawsaw	*	26	Teak	450	60	30	90	13	9.3	17.0	11.7440	70.2	100	33	47	0	V	15.57
9	12	H1D1	11	20	Tain I	*	25	Teak	20	0	10	10	21	9.5	9.5	1.3320	4.4	100	0	0	0	V	8.82
10	11	H2D2	17	50	Tain I	*	25	Teak	180	80	20	100	23	13.4	17.6	11.5360	68.4	94	50	0	6	V	16.33
11	27	H1D4	12	80	Tain II		29	Teak	570	80	10	90	11	8.6	14.4	10.6880	55.3	2	0	37	63	V	12.74
12	22	H2D3	18	70	Tain II	*	24	Teak	230	160	50	210	29	17.3	19.4	22.0600	141.2	4	4	9	83	V	18.25
13	26	H2D3	17	70	Tain II		27	Teak	190	100	20	120	23	13.4	16.5	10.8480	60.8	0	0	26	74	V	14.93
14	28	H2D3	16	70	Tain II		24	Teak	200	110	10	120	23	14.3	18.0	11.4520	69.6	65	15	75	0	V	16.93
15	29	H2D3	16	60	Tain II		26	Teak	370	60	10	70	13	9.2	20.0	0.8296	58.1	100	0	0	0	V	18.32
16	23	H3D3	22	70	Tain II	*	24	Teak	240	130	40	170	24	17.3	22.7	15.8120	119.3	0	0	25	75	IV	21.35
17	5	H2D2	16	50	Yaya	*	24	Teak	210	80	20	100	20	11.1	16.0	11.5160	62.8	52	38	19	10	V	15.05
18	2	H2D3	17	60	Yaya		24	Teak	250	100	30	100	20	12.5	19.0	14.3000	91.5	76	8	40	16	V	17.87
19	3	H2D3	17	70	Yaya		25	Teak	230	90	50	140	24	13.8	18.5	17.2840	106.5	83	30	57	0	V	17.17
20	1	H2D4	17	80	Yaya		24	Teak	330	170	40	210	23	13.5	19.5	21.7480	142.2	88	27	30	3	V	18.34
21	4	H3D3	20	60	Yaya		29	Teak	390	70	20	90	15	10.8	20.2	12.1960	85.0	79	23	28	5	V	17.87
22	6	H3D3	21	70	Yaya		27	Teak	400	130	40	170	17	12.0	22.2	16.6120	125.2	95	55	10	0	IV	20.09
23	7	H3D3	21	60	Yaya		27	Teak	400	110	10	120	14	12.0	21.2	11.1850	81.6	98	35	35	0	IV	19.19

Notes 1) Estimated by "Site indices-Teak(Planning Branch, FD; 1993)"

2) Estimated by the equation(Plannning Branch,FD;1993): Ln S = Ln H + 3.073 * (A^-0.21)-0.533

S : the mean height of the upper-story trees ata a stand age of 20 years

H: mean height of upper-story trees of the stand

A: stand age

(2) Damages and Tree Form by Bush Fire

In terms of bushfire damage at the sample plots, four out of 23 plots have suffered damage of 10% or less while the remaining plots have suffered damage of 50% or more.

Poorly formed or forked trees account for more than 70% of all trees at some plots while the corresponding ratio is almost zero at other plots. Forked trees, i.e. trees with poor form, are assumed to be the result of vigorous sprouting which is a characteristic of teak coupled with the loss of shoots due to bushfires. Other possible factors are dormancy or die-back of the shoots due to water stress for the growth of teak, and damage due to diseases and pests. This poor tree form may well pose a problem for the future production of pole materials.

IV.1.3 Natural Forests

The sample plot survey results for natural forests are shown in Table IV-1-6.

(1) Species Found

22 - 33 tree species were found in each plot by the sample plot survey, totalling 75 species of which 61 were identified, excluding such exotic species as teak, cedrela and cassia used for plantations (Table IV-1-7).

(2) Number of Standing Trees, etc.

The number of standing trees per ha of each plot varies from 39 to 329. Meanwhile, the mean dbh of each plot varies from 20 cm to 32 cm.

Table IV-1-6 Summary on the Results of Sample Plot Surveys in Natural Forests

No.	Plot No.	Forest type	Photo-interpretation results		Forest Reserve	Inventory results Standing trees					FIP class of standing trees					Potential usage class			
			H (m)	R (%)		No. of species /ha	No. of trees/ha	Average DBH(cm)	Basal area (m^2/ha) 1)	Volume (m^3/ha) 1)	Class	% of no. of trees	Basal area (m^2/ha) 1)	Volume (m^3/ha) 1)	(%)	Class	% of no. of trees	Basal area (m^2/ha) 1)	Volume (m^3/ha) 1)
1	21	NFH3D2	25	40	Sawsaw	22	91	30	9.1906	71.07	I	64	5.4699	49.09	69	Construction wood	47	6.8479	58.94
											II	24	3.1027	18.83	26	Firewood/ charcoals	95	8.7502	67.24
											III	12	0.6180	3.15	4	Medicine	24	4.2524	33.90
																Others	3	0.0654	0.00
2	9	NFH3D3	28	60	Nsemire	25	133	28	12.2101	106.86	I	60	8.7292	89.08	83	Construction wood	38	5.9311	56.83
											II	23	1.5609	8.55	8	Firewood/ charcoals	78	11.0364	99.69
											III	50	1.9200	9.23	9	Medicine	32	3.2946	25.24
																Others	18	0.7324	3.04
3	13	NFH3D4	28	80	Tain I	27	221	29	24.8163	265.77	I	32	19.7162	245.13	92	Construction wood	30	17.6213	220.61
											II	52	4.4465	19.12	7	Firewood/ charcoals	91	24.4966	265.01
											III	16	0.6536	1.52	1	Medicine	21	14.3515	184.70
																Others	9	0.3197	0.76
4	24	NFH3D3	28	70	Tain II	33	329	20	16.4204	118.13	I	48	10.6296	93.01	79	Construction wood	60	10.0148	76.31
											II	22	2.8499	13.76	12	Firewood/ charcoals	55	15.6321	115.29
											III	29	2.9409	11.36	10	Medicine	9	4.2159	41.62
																Others	1	2.0800	2.08
5	25	NFH3D1	25	20	Tain II	10	39	32	4.8804	43.09	I	38	2.5630	27.29	63	Construction wood	33	3.6697	33.54
											II	28	1.9170	14.28	33	Firewood/ charcoals	58	4.8616	43.09
											III	33	0.4004	1.52	4	Medicine	8	1.3731	10.47
																Others	2	0.0188	0.00

Note 1) Values on the stem parts for commercial timbers caluculated by "Summary table of size class sampling errors for Tain Trubutaries II FR cited in Forest Inventory Method(Planning Branch, FD)

Table IV-1-7 Major Characteristics on the Tree Species Found in the Forest Inventory Plots (1/2)

Tree code	Species name				FIP class	Indicator	Existence of trees		Usage class	Summarized local people's use Major use(>=10% total scores;the top 10 species from the Tree Preference Scorings)					
	Scientific name	Local name	English name	Family		(Rare: *) (Exotic: e)	(DBH>=5cm) MF	(Plot nio.) NF		Commercial timber	Construction wood	Furniture	Firewood	Fruits	Medicine
01(69)	Cedrela odorata	Cedrel(l)a	Cedar, Spanish cedar	Meliaceae	III	-(e)	all	24	1	○					
02	Tectona grandis	Teak	Teak	Verbenaceae	-	-(e)	all		-	○	○	○	○		○
03	Cassia (Senna) siamea	Cassia	Bombay black wood	Leguminosae	-	-(e)			-	○	○	○	○		○
1	Afzelia africana	Papao	Doussie	Leguminosae	I	D (FZ)		13,21	1,2	○	○	○	○		○
2	Albizia adianthifolia	Pampena	-	Leguminosae	I	-		24,25	1,2						
2-1(68)	Albizia ferruginea	Awiemfosamina	Aviemfo-samina	Leguminosae	I	-		24	1,2	○	○	○	○		○
3	Albizia spp.	-	-	Leguminosae	-	-	26		-						
4	Alstonia boonei	Sinuro	Sindru, Ahun	Apocynaceae	I	-			2,3						
5	Anogeissus leiocarpus	Kane	-	Combretaceae	III	-	1	21,24	2						
6	Antiaris toxicaria	Kyenkyen	Upas tree, Sack tree	Moraceae	I	-		9,13,21,24,25	1,2	○	○	○			
7	Antrocaryon micaster	Aprocuma/Aprokuma	-	Anacardiaceae	I	-		13	2						
8	Blighia sapida	Akye	Akee	Sapindaceae	II	-		13,21,24,25	1,2,3						
9	Blighia spp.	Akye-kokor	-	Sapindaceae	II	-		24	1						
10	Bombax (brevicuspe) spp.	Onyinakoben	-	Bombaceae	I	-		24	1,3						
11	Bussea occidentalis	Kotoprepre	-	Leguminosae	II	-		9	2						
12	Ceiba pentandra	Onyina	White silk-cotton tree	Bombaceae	I	-	8,23	9,13,21,24,25	1,2,3	○	○	○	○	○	
13	Celtis mildbraedii	Esa	-	Ulmaceae	I	M		9,13,21,24,25	2	○	○		○		
14	Celtis wightii	Pre(m)presa/Esafufuo	-	Ulmaceae	II	-		24	1,2						
15	Celtis zenkeri	Esa- kokor/Esakoko	-	Ulmaceae	I	D		24	1,2						
16	Chrysophyllum albidum	Akasaa	African star apple, White star apple	Sapotaceae	I	-		9	3						
17	Chrysophyllum perpulchrum	Atabena	-	Sapotaceae	II	-		9	2,3						
18	Chrysophyllum spp.	Akasa(a)/Akasoa	-	Sapotaceae	I	-		9,21	1,2,3	○	○	○	○	○	
19	Cola caricifolia	Ananseaya	-	Sterculiaceae	III	-	26,29	24,25	2	○	○	○			
20	Cola gigantea	Watapuo	-	Sterculiaceae	II	D(FZ)	4,6,23	9,13,21	2						
21	Cola lateritia	Wabre/Watapuobere	-	Sterculiaceae	III	-		9	3						
22	Cordia millenii	Tweneboa(-mini)	-	Boraginaceae	I	-		24	2						
23	Corynanthe pachyceras	Pamprana/Pampenama	-	Rubiaceae	II	-		24	2						
24	Cylicodiscus gabunensis	Denya(o)	Okan	Leguminosae	I	-		9	1,3						
25	Diospyros gabunensis	Kusibere/Kusibiri	-	Ebenaceae	III	-		21	2						
26	Discoglypremna caloneura	Fetefre	-	Euphorbiaceae	III	-		13,21	2						
27	Drypetes chevalieri	Katerica/Katrika-akoa	-	Euphorbiaceae	III	-		24	2						
28	Entandrophragma angolense	Edinam	Gebur-nohor	Meliaceae	I	-		9	1,2,3						
29	Entandrophragma candollei	Penkwa-akua/Penkwa-akoa	Akowaa, Omu	Meliaceae	I	-(*)		9,21	1,3						
30	Ficus exasperata	Nyankyerene	-	Moraceae	III	-		13,25	2						
31	Ficus spp.	Domene	-	Moraceae	III	-	15,26	13	2						
32	Holarrhena floribunda	Sese	Large neem	Apocynaceae	III	-		13,21	2,3			○	○		○
33	Holoptelea spp.	-	-	Ulmaceae	-	-	29		-						
34	Hunteria picralima	Ka(t)wane/Ka(t)wene	-	Apocynaceae	III	-		24	1,2						
35	Khaya anthotheca	Krumben	White mahogany,Ahafo	Meliaceae	I	M(NW)		13	1,2,3	○	○	○	○		○
36	Khaya spp.	Mahogany	-	Meliaceae	-	-			-						
37	Lannea welwitschii	Kumanini	Kumenini	Anacardiaceae	II	-		13	2						
38	Mansonia (altissima) spp.	Oprono	Aprono, Ofun	Sterculiaceae	I	-		9,24,25	1,2	○	○	○	○		
39	Margaritaria discoidea	Pepea	-	Euphorbiaceae	II	-		13	2						
40	Milicia excelsa	Odum	-	Moraceae	I	-		9,13,21,25	1,2	○	○	○	○	○	○
41	Morus mesozygia	Wonton	-	Moraceae	II	-		9,13,21,24	1,2,3						

Table IV-1-7 Major Characteristics on the Tree Species Found in the Forest Inventory Plots (2/2)

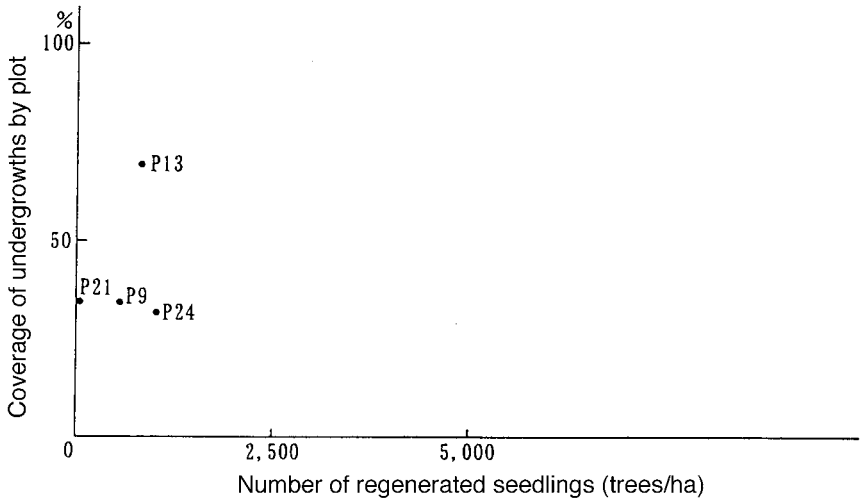
Tree code	Species name				FIP class	Indicator	Existence of trees		Usage class	Summarized local people's use Major use(>=10% total scores;the top 10 species from the Tree Preference Scorings)					
	Scientific name	Local name	English name	Family		(Rare: *) (Exotic: e)	(DBH>=5cm) MF	(Plot nio.) NF		Commercial timber	Construction wood	Furniture	Firewood	Fruits	Medicine
42	Nesogordonia papaverifera	Danta	-	Annonaceae	I	M		9,13,21,24	1,2,3						
43	Parkia spp.	-	-	Leguminosae	-	-	20		-						
44	Pericopsis elata	Kokrodua	Afrormosia	Leguminosae	I	-(*)		24	1		○	○	○		
45	Piptadeniastrum africanum	Dahoma	Dahoma,Dabema	Leguminosae	I	-		13,21	1,2						
46	Pseudospondias microcarpa	(A)Katowani/(A)Katawani	-	Annonaceae	II	-		9	2						
47	Pterygota macrocarpa	Kyereya/Kyereye	Awari,Kefe	Sterculiaceae	I	-		13,21	1,2						
48	Ricinodendron heudelotii	Wama	Wama	Euphorbiaceae	II	-		9,13,21,25	1,2,3						
49	Spathodea campanulata	(A)Kuakuo- Ni(n)suo	African tulip tree	Bignoriaceae	III	-		9,13	2,3						
50	Sterculia oblonga	Ohaa	Pangao	Sterculiaceae	II	-		13,25	1,2,3						
51	Sterculia rhinopetala	Wawabima	Brown sterculia	Sterculiaceae	I	-		9	1,2						
52	Sterculia spp.	-	-	Sterculiaceae	-	-	8,11		-						
53	Sterculia tragacantha	Sofo	-	Sterculiaceae	II	D (FZ)	2	13,21,24,25	1,2						
54	Terminalia spp.	-	-	Combretaceae	-	-	18		-	○	○	○	○		○
55	Tetrapleura tetraptera	Prekese	-	Leguminosae	III	-		24	-						
56	Trichilia monadelpha	Tanuro	-	Meliaceae	III	-		9,24	2,3						
57	Trichilia prieuriana	Kakadukrom/Kakadik(u)ro	-	Meliaceae	II	-		9,24,25	1,2						
58	Triplochiton scleroxylon	Wawa	Samba, Obechi	Sterculiaceae	I	D		9,13,21,24,25	1,2	○	○	○	○	○	
59	Zanthoxylum gilletii	Okuo	-	Rutaceae	III	-		13	2						
60	-	Akomaba/Akumaba	-	-	-	-		24	1,2						
61	-	Ayefroanato	-	-	-	-	2	24	2						
62	-	Komaba	-	-	-	-		24,25	2	24	2				
63	-	Offter	-	-	-	-		24	2	24	2				
64	-	Tri	-	-	-	-	27,29	-	-						
65	-	-	Other	-	-	-	-		-						
66	-	-	Unknown	-	-	-	-		-						
67	-	Kotowebema	-	-	-	-	-	24	2,3						
70	Mallotus oppositifolis	Anyanyanforowa		Euphorbiaceae	-	-	-		-						
71	-	Srajwa	-	-	-	-	-		-						
72	-	Morinda	-	-	-	-	-		-						
73	-	Kule	-	-	-	-	-		-						
74	-	Astowia	-	-	-	-	-		-						

Note: Usage Class 1.Construction 2.Fuelwood 3. Medicine

The mean total basal-area per ha of each plot varies from 4.8 m² to 24.8 m² and the volume per ha varies from 43 m³ to 265 m³. As far as the proportions of the FIP classes are concerned, FIP Class I shows the highest proportion at every plot except for Plot 13 in the Tain I FR. The restoration of these stands to highly stocked stands is feasible in the future if the regeneration and growth of FIP Class I species are assisted by appropriate forest management measures, including the removal of Chromolaena odorata and the prevention of bushfires.

The potential use ratio of the surveyed species by plot is 58 - 95% for fuelwood (firewood and charcoal), 30 - 60% for building timber and 9 - 32% for medicinal use. (See Table Ⅳ-1-6)

The relationship in the natural forests between the undergrowth and the number of seedlings is shown in Fig. IV-1-1.



Note: Coverage of undergrowths by plot: Mean values of all the coverage values observed in each plot

Fig. IV-1-1 Relationship between Number of Regenerated Seedlings and Undergrowths in the Natural Forests

In natural forests, the number or proportion of short seedlings is fairly small, suggesting that successful regeneration is difficult naturally unless the situation changes.

IV-1-4 Preparation of Aerial Photograph-Based Stand Volume Table

(1) Preparation of Volume Table

① Man-made Forests

In order to estimate the growing stock per ha in man-made forests, a simple aerial photograph-based stand volume table was prepared based on the regression calculation using the sample plot survey results.

② Natural Forests

In the case of natural forests, the linear regression equation involving the crown density height and volume per ha established by the sample plot survey was used to estimate the growing stock.

③ Volume Table

The volumes per ha calculated by the above regression equations were classified with a unit of 5 m^3. The resulting aerial photograph-based stand volume table is shown in Table Ⅳ-1-8.

Table IV-1-8 Aerial Photograph-Based Stand Volume Table

(Man-made forest) (Unit: m^3/ha)

		Crown density class (X2)			
		1	2	3	4
Mean tree height (m) (x 1)	8	–	–	–	20
	10	–	–	20	35
	12	–	15	35	55
	14	15	35	55	70
	16	35	50	70	90
	18	50	70	90	105
	20	70	85	105	125
	22	85	105	125	140
	24	105	120	140	160
	26	120	140	160	175
	28	140	160	175	195
	30	155	175	195	210

(Natural forest) (Unit: m^3/ha)

	Crown density class (X2)			
	1	2	3	4
Mean tree height (m)	15	80	150	215

(2) Estimation of Number of Trees (Man-Made-Forests)

The calculated number of trees per ha was classified with a unit of 50 trees as shown in Table IV-1-9.

Table IV-1-9 Stand Density Estimation (Tree/ha) for Existing Plantation

		Crown density class (X1)			
		1	2	3	4
Stand age (x 2)	4	100	250	350	500
	6	100	250	350	500
	8	100	200	350	500
	10	100	200	350	500
	12	50	200	350	500
	14	50	200	350	450
	16	50	200	350	450
	18	50	200	350	450
	20	50	200	300	450
	22	50	200	300	450
	24	50	200	300	450
	26	50	150	300	450
	28	50	150	300	450
	30	–	150	300	450
	32	–	150	300	450
	34	–	150	300	400
	36	–	150	300	400

(3) Estimation of Basal-Area

The basal-area of man-made forests was estimated by substituting the number of trees per ha established by the regression equation using the sample plot survey results and the tree height value established by the aerial photograph interpretation with N and H in the following equation ($G = 0.006042 \times H^{1.733} \times N^{0.459}$).

In the case of natural forests, the basal-area was established as shown in Table Ⅳ-1-10 by the regression calculation using the plotless sampling survey results.

Table IV-1-10 Basal Area Estimation for Natural Forests

(m^2/ha)

		Crown density class			
		1	2	3	4
Mean tree height class	1	3	8	13	18
	2	5	10	15	20
	3	8	13	18	23
	4	10	15	20	25

IV.1.5 Analysis of Current Forest Conditions Related to Forest Management

(1) State of Forest Degradation

The ratios of the forest (man-made and natural forests) area and grassland area by forest reserve are shown in Table Ⅳ-1-11.

Table IV-1-11 Ratios of Forest Area and Grassland Area by Forest Reserve

(Unit: %)

FR	Forests	Grasslands	The other	Total
Sawsaw	38	51	11	100
Nsemire	63	33	4	100
Yaya	50	47	3	100
Tain I	56	44	0	100
Tain II	67	32	1	100
Total	62	36	2	100

The above table shows that grassland accounts for more than 30% of the forest reserve area. If grassland is assumed to be an indicator of forest degradation, the Sawsaw FR with a grassland area of 51% is the most severely degraded. As already mentioned in the section describing the sample plot survey, fairly degraded areas due to the propagation of such undergrowth as Chromolaena odorata and damage of the tree trunk by bushfires, etc. are found in many forests. Taking this into consideration, it is not an exaggeration to say that the entire forest reserves are, in general, degraded.

(2) Illegal Farming in Forests

The area of admitted farms in each forest reserve is shown in Table Ⅳ-1-12.

Table IV-1-12 Area of Admitted Farms by Forest Reserve

FR	Area of admitted farms (ha)
Sawsaw	702
Nsemire	0
Yaya	54
Tain I	0
Tain II	1,574
Total	2,330

Farming in forest reserves is prohibited except by legally admitted farms. The Tain II FR has the largest area of admitted farms. While the area of admitted farms is small in other forest reserves, maize is cultivated illegally at felled forests and is assumed to be one cause of bushfires during the dry season.

(3) Problems of Teak Silviculture

The lowest site index for teak in the Intensive Study Area is estimated to be an index of V class.[3] The current situation suggests that although teak can grow in the area, the area is not best suited to the growth of teak. While the flowering of teak is said to generally commence at around an age of 10 years, the early flowering at an age of 2 - 3 years observed in the Study Area and other places appears to indicate both severe site conditions for the growth of teak in the Intensive Study Area and bad genetic characteristics.

(4) Silviculture Using Indigenous Species

The sample plot survey confirmed the existence of some 60 species, including such main species as wawa, odum and papao. Although the number of individuals has declined due to felling, these species can grow at suitable sites.

(5) Zoning Based on Basal-Area

The total basal-area was estimated using the plotless survey results for natural forests. Table V-1-14 shows the estimated basal-area by forest management category used for zoning of forest reserves of the Forestry Department.

For all forest reserves, the total area of the conversion forest less than 5m^2 is 799 ha (7%), the total area of the convalescence forest (between 6 and 15 m^2) is 5,428 ha (41%) and the total area of the timber production forest zone (more than 16 is m^2)6,811 ha (52%).

Table IV-1-13 Area of the Natural Forests by Total Basal Area

(Unit: ha)

Total basal area (m^2/ha)	Sawsaw	Nsemire	Yaya	Tain I	Tain II	Total
5 m^2 and less	307	63	5	62	362	799
6 - 15 m^2	922	508	868	306	2,824	5,428
16 m^2 and more	843	565	441	726	4,236	6,811
Total	2,072	1,136	1,314	1,094	7,422	13,038

[3] The Survey results apply to the site index of Planning Branch, FD.

IV.2 Soil

IV.2.1 Soil Properties and Distribution

The properties and distribution of the soil in the Intensive Study Area is summarised below and a schematic drawing of the distribution of various soil types is shown in Fig. Ⅳ-2-1.

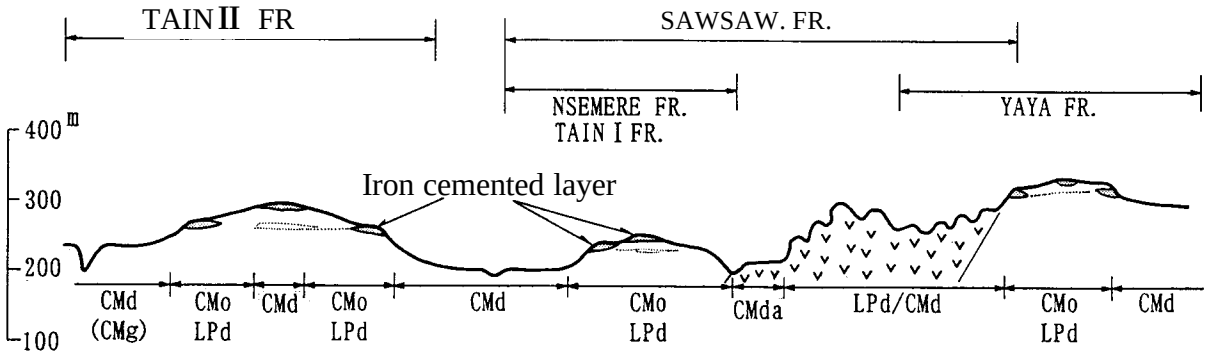


Fig. IV-2-1 Schematic Diagram on Soil Distribution

(1) Leptosols (LP)

① Dystric Leptosols (LPd)

Dystric Leptosols are a type of soil of which the depth is restricted to less than 30 cm by an iron cemented layer or bedrock of granite, etc. or which contains little fine earth because of the outcropping of an accumulation layer of ironstone or quartz gravel with a surface enriched by iron.

This soil is considered to have been left over from the erosion of the topsoil and is widely distributed on isolated monadrocks, narrow ridgelines, areas around exposed rocks, the summit of hills or platform and the surface of convex sections rising above flatland, etc.

② Lithic Leptosols (LPq)

Shallow soil of which the depth is restricted to less than 10 cm by either an iron cemented layer or continuous hard bedrock is classified as Lithic Leptosols. Lithic Leptosols in the Intensive Study Area are distributed in a continuous or mosaic manner together with Dystric Leptosols in areas around the outcrops of bedrock or

the iron cemented layer. Given their sporadic distribution with limited coverage, they are included in Dystric Leptosols as in the case of outcrop sites.

(2) Cambisols (CM)

① Ferralic Cambisols (CMo)

Strongly reddish soil with an iron cemented layer, ironstone layer or layer with a large quantity of pisolitic ironstone or iron-enriched quartz gravel in 30 - 50 cm below the surface is classified as Ferralic Cambisols in this survey. The development of the structure is weak and the lower horizons have a minor clay skin. The drainage is good.

This soil is assumed to be formed by the topsoil erosion of old soil or the deposition of new parent materials above the eroded surface. It is observed at gentle hills, tableland and hillsides which are not heavily eroded.

② Dystric Cambisols (CMd)

Reddish-to-yellowish soil which has neither an iron cemented layer nor an accumulated ironstone layer within 50 cm of the ground surface and which does not show the bedrock formation within 30 cm of the surface horizon is classified as Dystric Cambisols in this survey. The structural development is weak and the lower horizons have a clay skin. The minor downward movement of clay is observed but there is no typical clay illuvial layer. The lower horizons are relatively firm and the water retention is believed to be better than that of the Ferralic Cambisols described above.

③ Areni-Dystric Cambisols (CMda)

Of the Dystric Cambisols described above, those with a coarse sandy texture upto a deeper horizon and of which the B horizon is brown soil are sub-classified as Areni-Dystric Cambisols.

This type of soil is believed to be the product of the supply of less weathered, young parent materials with a loss of only clay grains.

④ Gleyic Cambisols (CMg)

Soil showing gleyic properties within 100 cm of the soil surface due to the influence of groundwater is classified as Gleyic Cambisols.

IV.2.2 Judgement of Site Environment for Silviculture

(1) Dystric Leptosols (LPd) and Lithic Leptosols (LPq)

As these types of soil are classified by either a high gravel content or very shallow soil horizon, the rooting volume and water retention, both of which are essential for plant growth, are very small, making them less useful for both forestry and agricultural purposes. As tree roots can penetrate cracks in the bedrock and spaces between fragmented rocks, stones and gravel, trees can survive. Even mechanical plantation is possible though normal growth cannot be anticipated. In the case of agricultural products, these types of soil can only be used for maize and red peppers, etc. which can withstand a shallow soil depth. Many sites of these soil types are currently treeless.

(2) Ferralic Cambisols (CMo)

Compared to Leptosols, Ferralic Cambisols have a larger rooting volume and water retention, making the establishment of tree plantations or the cultivation of agricultural products possible. Even mechanized plantation is difficult when large ironstones are found on the ground surface or in the soil. Sites of this soil type are currently used for natural forests, teak plantations, maize fields and cassava fields, etc.

(3) Dystric Cambisols (CMd)

Among the soil types observed in the Intensive Study Area, Dystric Cambisols are believed to offer the highest productivity because of their thickness and good water retention. Sites of this soil type are currently used for natural forests, teak plantations and farmland and teak trees with relatively good form grow on this soil. Among agricultural products, it is believed that oil palms, coffee and cacao, etc. can be cultivated in addition to maize and pulses although cultivation is dependent on the rainfall level.

(4) Areni-Dystric Cambisols (CMda)

Compared to Dystric Cambisols, this type of soil has a lower productivity due to its poorer water retention and nutritional conditions although manual planting is possible.

(5) Gleyic Cambisols (CMg)

As groundwater logging seasonally occurs, resulting in an excessive water environment, the productivity is rather poor.

IV.2.3 Evaluation of Correlation Between Site Index and Site Environment

The soil in the Intensive Study Area now have hardly any organic matters and easily weatherable minerals, becoming soil with extremely low natural fertility. The high drainage level also means that the moisture content usable by plants is low despite the texture. The present soil, therefore, lacks promise in terms of land productivity.

For the purposes of evaluation of site environment, the correlation between such soil factors as the soil type, effective soil depth, pH, hardness, gravel content, texture and altitude and the estimated height of trees at an age of 20 years as well as the existence rate of poorly formed trees (forked trees) was analysed (see Figs. **IV**-2-2 and **IV**-2-3).

However, no significant correlation was established between the factors indicating the site environment and the estimated height of 20 year old trees indicating the site quality or site index. The most important reason, however, is the growth impediment caused by low rainfall prior to the emergence of the negative impacts of soil factors on tree growth. While Teak primarily prefers sites with an affluent water supply, its strong resistance to a dry climate with a dry season of 4 - 6 months makes it possible for teak to grow in the Intensive Study Area. This fact suggests that protecting vegetation strips in the land preparation to keep soil and water conditions of planting sites favorable.

IV.2.4 Soil Erosion

Most soil profiles in the Intensive Study Area are more sandy near the surface with a higher clay content in the lower horizons. The absence of a clear clay illuvial horizon suggests that clay grains have not only moved downwards but also that a large quantity of clay grains have been lost.

Felling activities and repeated bushfires greatly affect the surface erosion of soil. The high intensity of rain in the Intensive Study Area is evidenced by the ground surface of forests where ground vegetation is absent. To be more precise, gravel, dead branches and dead stems are seen to be detached from the ground surface as they are supported by columnar mud and their occurrence has no connection with the slope direction.

Moreover, bushfires burn organic materials which should be returned to soil, adversely affecting the soil productivity. Given the naturally slow decomposition of fallen teak leaves, their loss due to bushfires means that no organic materials remain to be recycled. As the recycle of such organic matter as fallen leaves and branches is important for not only

agroforestry but also for the growth of teak, surface erosion caused by repeated bushfires must be avoided.

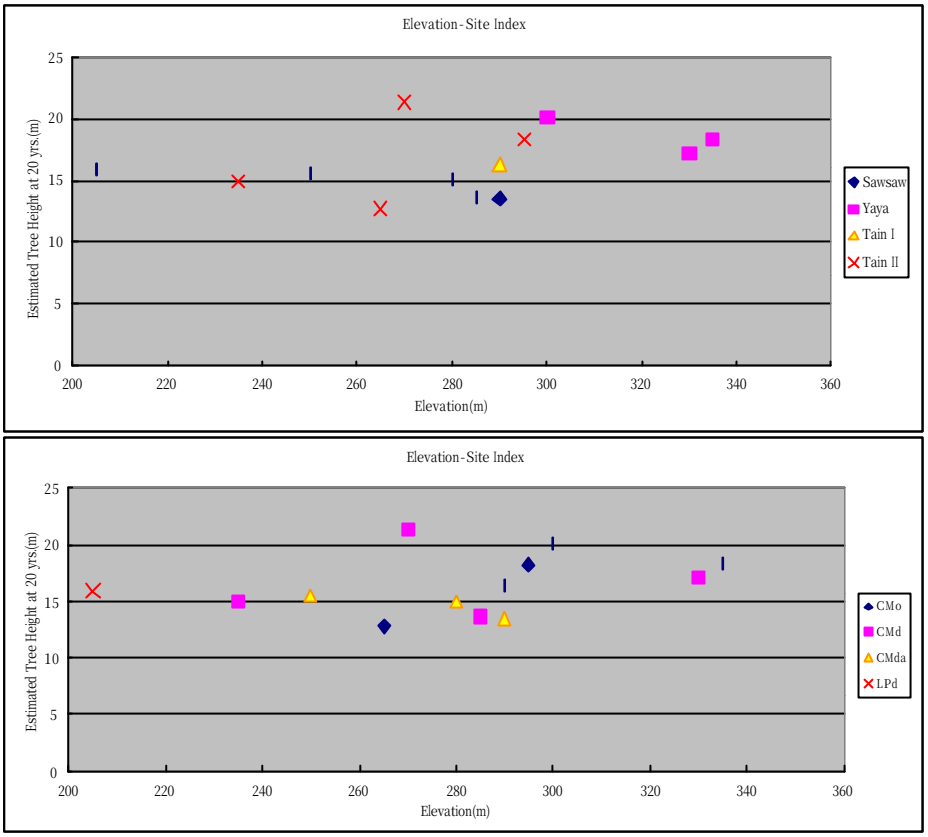


Fig. IV-2-2 Correlation Among Soil Type, Elevation and Tree Height

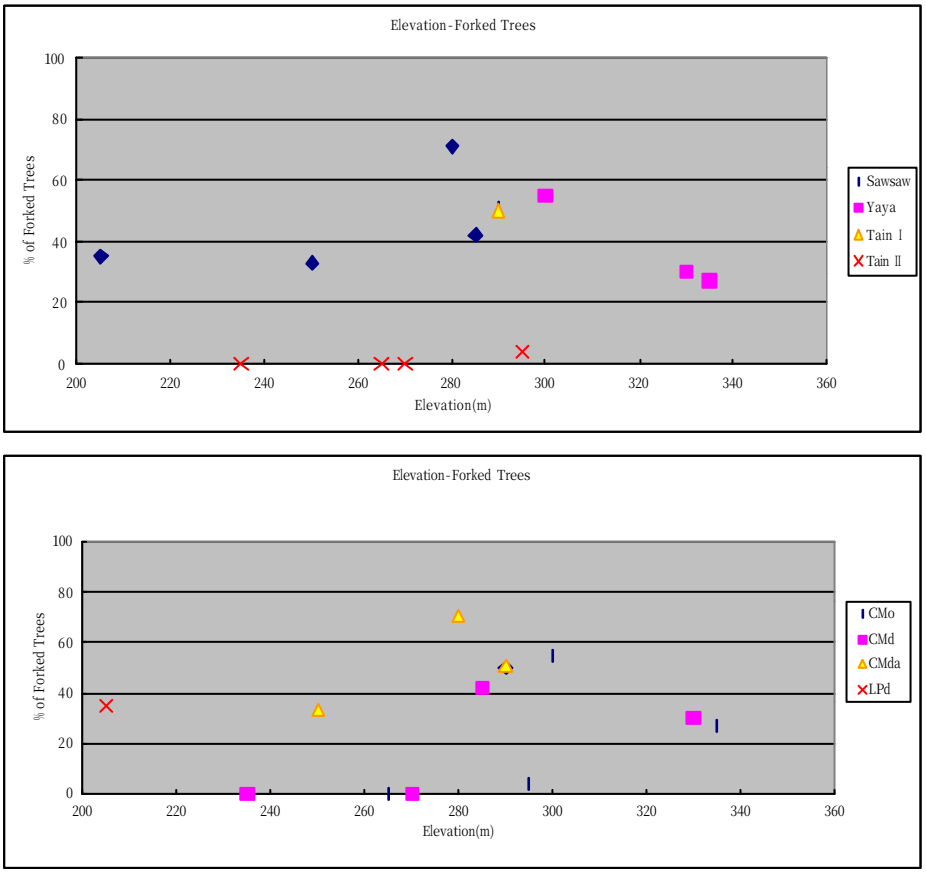


Fig. IV-2-3 Correlation Among Soil Type, Elevation and Forked Trees

V. SOCIOECONOMIC AND CULTURAL CONDITIONS AROUND THE INTENSIVE STUDY AREA

V. SOCIOECONOMIC AND CULTURAL CONDITIONS AROUND THE INTENSIVE STUDY AREA[1]

V.1 The Outline of Subject Villages

The outline of the subject villages and the number of the sample village are shown in Table V-1-1.

V.1.1 Characteristics of Subject Villages and Households

(1) Social Structure and History of Villages

The social structure of the subject villages is based on the stool system, the traditional social system, as already described in Chapter III.2.3. Village stools in the Study Area belong to the paramount stool of Berekum, Nsuatre, Odumasi or Wenchi.

Many of the subject villages were established more than 100 years ago (see BIRD, 1998b for further village history details) and are assumed to have been established by people moving into the area from southern Ghana or other places for farming and/or hunting purposes.

The primary social unit of the Akan is the extended family. The social unit below this is a household which may be comprised of more than 10 members.

[1] This chapter was summarized by base-line survey, RRA survey, FGD and Forest Management Seminar in Socioeconomic and cultural survey. This survey was subcontracted to the University of Science and Technology (UST) and the Bureau of Integrated Rural Development (BIRD) in Kumasi.

Table V-1-1 Outline of Subject Villages and Number of Samples

	Village	Nearest FR	District Forestry Office	District	Paramount Stool	Estimated Population (Interviews in 1998)	Population*	No. of Samples	Educational Facilities	Medical Facilities	Water Supply (Borehole)
1	Pruso	Tain II	Dormaa	Berekum	Berekum	200	-	10	-	-	O
2	Kotaa *			Berekum	Berekum	2,000	726	16	P + J	-	-
3	Fatentaa			Berekum	Berekum	2,000	-	10	P + J	-	O
4	Abisease			Berekum	Berekum	500	902	18	P + J	O	O
5	Twebabi			Berekum	Berekum	550	-	10	P + J	-	O
6	Amanfoso			Sunyani	Nsuatre	150	-	10	P	-	O
7	Asantekrom			Jaman	Seikwa	500	22	10	P + J	-	O
8	Kyekyawere			Wenchi		1,500	-	16	P + J	-	O
9	Tainso			Wenchi		500	-	10	P	O	O
10	Mantukwa			Sunyani	Odumasi	500	-	10	-	-	O
11	Adoa *			Sunyani	Odumasi	105	-	15	P	-	O
12	Abronye	Tain I	Sunyani	Sunyani	Dormaa	250	261	15	P	-	O
13	Kwatire			Sunyani	Odumasi	4,500	-	20	P + J	O	O
14	Twumasikrom*			Sunyani		50	-	10	-	-	-
15	Kofitwumkrom*			Wenchi	Wenchi	250	-	10	P	-	O
16	Ayibge	Yaya	Wenchi	Wenchi	Wenchi	600	619	16	-	-	-
17	Chiraa			Sunyani	Dormaa	12,000	9,569	25	P + J + S	O	O
18	Mangoase			Wenchi		700	164	10	-	-	-
19	Bohomoden			Techiman		350	-	10	P	-	-
20	Mfante			Offinso	Offinso	450	-	10	-	-	-
21	Asuokwa*			Sunyani	Dormaa	1,700	80	16	P	-	O
22	Tromeso	Sawsaw	Wenchi	Wenchi	Wenchi	1,500	1,114	20	P + J + S	-	O
23	Bepotrim			Wenchi	Wenchi	500	234	15	P	-	O
24	Ayaayo			Wenchi	Wenchi	150	76	10	P	-	-
25	Nyampease*			Wenchi	Wenchi	1,700	410	16	P	-	O
26	Boasu			Wenchi	Wenchi	500	-	10	P + J	-	O
27	Amoakrom	Nsemere	Wenchi	Wenchi	Wenchi	1,000	-	10	P	-	-
28	Mensakrom			Wenchi	Wenchi	200	-	16	-	-	-
29	Ahwene			Wenchi	Wenchi	800	-	16	P	-	-
30	Pepewase			Sunyani	Osumasi	200	-	10	-	-	-
					Total	35,905		400			

* Subject villages of the RRA

** Ghana Statistical Service (1984), 1984 Population Census of Ghana

Source: Various field data

(2) Demographic Data

The total population of the 30 subject villages is estimated to be approximately 36,000.

① Immigrants

The immigrants found in the Study Area have mostly lived locally for 10 - 30 years or even more and many were born in the area. Those immigrating from other regions to the area within the last 10 years account for 27% of all respondents.[2] (Table V-1-2)

The population increase due to the arrival of immigrants is said to have increased the pressure on farmland in the Study Area, making the adoption of a more sustainable farming method desirable.

Table V-1-2 Origins of Respondents

Origin	Number of Respondents	Ratio (%)
Same District	223	55.75
Same Region	68	17.00
Outside the Region	109	27.25
Total	400	100.00

Source: BIRD (1998a)

② Age Groups and Gender Ratio

As shown in the Table V-1-3, 52% of the respondents are younger than 45 years of age. The average age is 35/36 years and is slightly higher in urbanised areas, such as Chiraa, than rural areas. More than half of the household heads are aged between 30 and 44 years.

Table V-1-3 Age Groups of Respondents

Origin	Number of Respondents	Ratio (%)
60 years or More	90	22.50
45 - 59	101	25.25
Upto 44	209	52.25
Total	400	100.00

Source: BIRD (1998a)

[2] The term "immigrant" in this Report refers to those who have lived locally for more than 10 years who are much assimilated to the host community. Seasonal workers who temporarily reside locally to earn farming wages are, therefore, not considered to be immigrants.

③ Household Size

A household has approximately six members in such large towns as Chiraa and Kwatiri, whereas six to nine members in ordinary villages are the most, occupying 47% (the average household sizes in Brong-Ahafo and Accra are 5.3 members and four members respectively .

Table V-1-4 Household Size

Number of Household Members	Number of Respondents	Ratio (%)
10 or More	42	12.80
6 - 9	156	47.70
3 - 5	117	35.80
3 or Less	12	3.70
Total	327	100.00

Source: BIRD (1998a)

Some 32.5% of the households surveyed this time are headed by women (national average: 30%).

④ Educational Standard

The educational standard of the respondents is shown in Table V-1-5. While those who have received primary education (primary school and/or junior secondary school) comprise the majority, those with no formal education at all account for as much as 32%. Only some 11% have attended senior secondary school or higher, mainly because of the poor family background and lack of a local senior secondary school.[3]

Table V-1-5 Educational Status of Respondents Frequency

Education Status	Number of Respondents	Ratio (%)
No Education	129	32.30
Primary School/JSS/MSLC	218	54.50
SSS/Technical College	46	11.50
University	7	1.70
Total	400	100.00

Source: BIRD (1998a)

[3] Of the 30 villages surveyed, only Chiraa and Tromeso have a senior secondary school.

⑤ Employment Situation

Most people of working age in the Study Area are engaged in agriculture as stated earlier and 91.25% (365 out of 400) of the respondents, as shown in Table V-1-6 indicate that agriculture (including stock raising and forestry) is the main source of income. The remaining 8.75% are engaged in services, manufacturing and commerce, etc. with farming providing a side income.

Table V-1-6 Occupational Distribution of Respondents

Occupation	Frequency	Ratio (%)
Agriculture	365	91.25
Services	15	3.75
Manufacturing	10	2.50
Commerce	7	1.75
Unemployed	3	0.75
Total	400	100.00

Source: BIRD (1998a)

(3) Local Life and Social Customs

In all of the surveyed villages, there are one or two days a week which are called taboo days (mainly Tuesday, Friday and/or Saturday). It is prohibited to go to a forest, farmland or river on a taboo day. Taboo days currently function as days for communal work, visits to relatives and friends, funerals, completion of left-over household work and leisure.

(4) Gender Roles

① Division of Work Between Men and Women

Farming is joint work for men and women. While such hard work as land preparation (including felling and the removal of trees and shrubs) is mainly conducted by men, planting, weeding, harvesting and transportation of the harvest[4] are more often conducted by women than men. The division of work between men and women in the same household is shown in Fig. V-1-1.

[4] The harvest is mainly transported in small quantities using head baskets. The burden of this work on women increases in accordance with the distance of the farmland from the village.

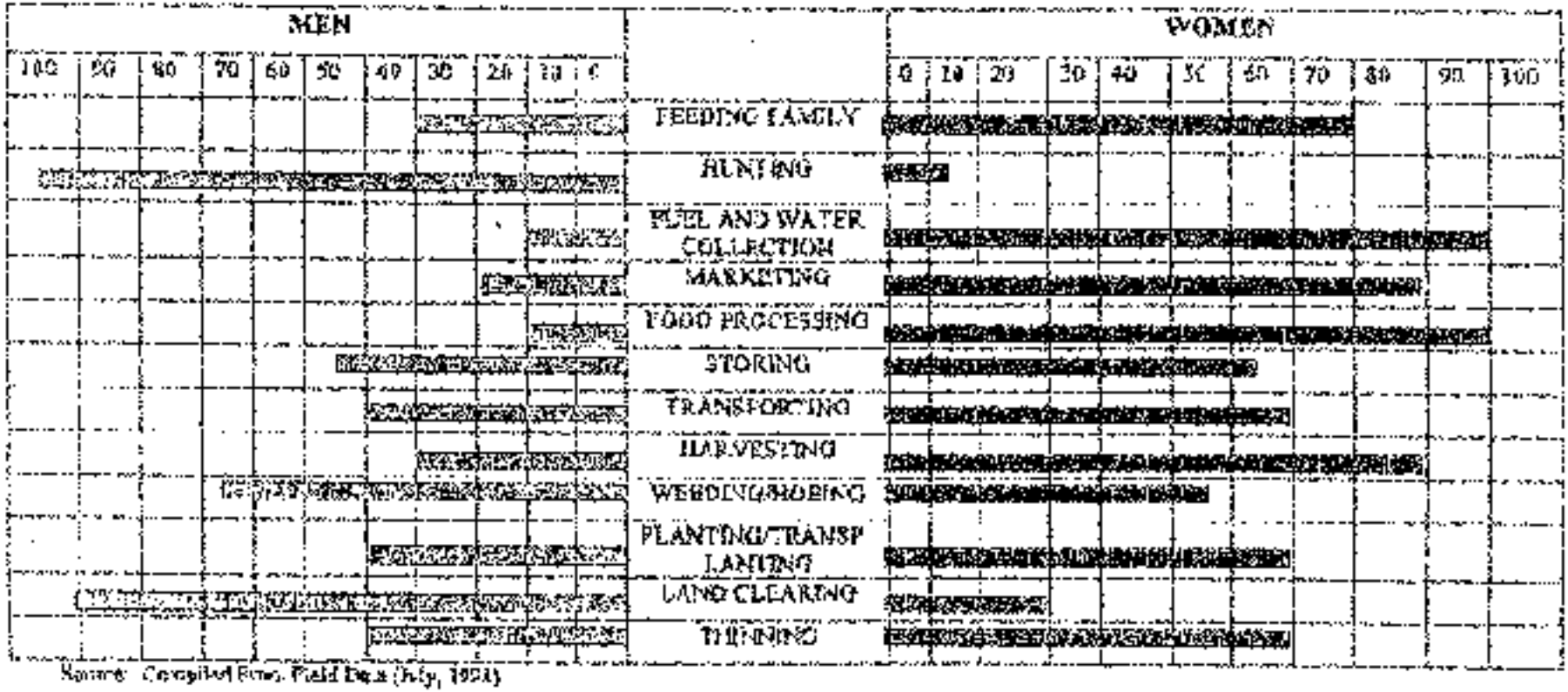


Fig. V-1-1 Division of Work between Men and Women

② Daily Working Hours

Fig. V-1-2 shows the general daily schedules of men and women of farming households based on the findings of the interview survey.

In short, women work longer hours than men because of their responsibility for childcare, housework, firewood collection and water fetching in addition to farming.

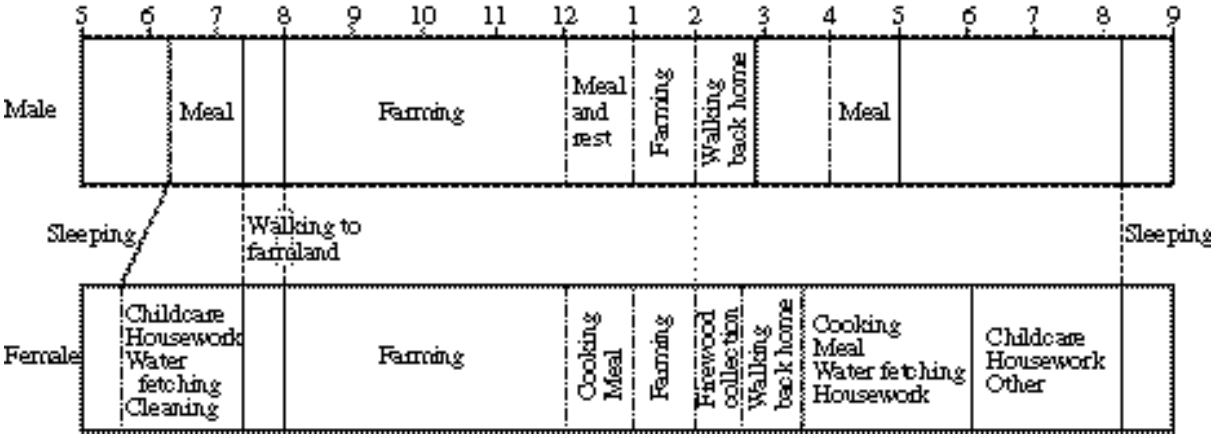


Fig. V-1-2 Example of Daily Schedules of Men and Women

(5) Land Tenure and Land Use

① Current State of Land Tenure in Subject Villages

Most farmland in the subject villages belongs to indigenous families of the Akan. Although the chief (Ohene) or village head (Odikro) acts as the landowner (or person responsible for land management),[5] the real land tenure belongs to "families". Land which does not belong to a specific family or lineage is directly controlled by the chief or village head as stool land.

Some half (52%) of the farmland in the subject villages has been established as a result of the division of "family land". Share-cropping farmland is the second largest category, accounting for approximately 13%, followed by inherited land (approximately 11%) and rented land (approximately 10%).

[5] As described in **III**.2.4, there is no general concept of "land ownership" among the Akan people, particularly those living in rural areas. It can be said that the paramount chief, the most influential person under the stool system, is the landowner or manager of the land but this is quite different from the concept of land ownership in modern society.

One of the problems originating from the traditional land tenure system is the fragmentation of farmland due to the treatment of land as the common property of a stool or family, making silviculture and the rational management of farming difficult to pursue.

② Land Use in Subject Villages

The land use around the subject villages is classified as forests (including forest reserves), farmland (including fallow land) and dwelling sites (settlement sites). It is often the case that the use of land is decided without any long-term planning.

V.1.2 Infrastructure

The present state of infrastructure (schools, medical facilities and water supply facilities) in the subject villages is shown in Table V-1-1, illustrating the general lack of basic infrastructure in these villages.

(1) Dwellings

Most houses in more rural areas have a thatched roof using palm leaves and/or spear grass, etc. and walls made of earth or small tree branches. These building materials can be easily obtained from nearby grassland or forest land and are popularly used because of their low cost.

(2) Transport/Transportation Facilities

While regional capital Sunyani and villages are connected to a principal city of the district by paved trunk roads, the feeder roads to most villages and hamlets are unpaved and are extremely difficult for vehicle traffic to use.

(3) Educational Facilities

The subject villages have only a limited number of schools and most children have to travel outside their village to attend senior secondary school or higher. The interview survey results suggest a shortage of educational equipment as well as teaching materials, including textbooks. Teachers are often unqualified.

(4) Energy

Among the subject villages, only the central towns of a district and those along a trunk road, such as Chiraa, enjoy electricity supply. Most of the surveyed households (approximately 95% - 100%), therefore, almost entirely rely on firewood as the household fuel for cooking and other purposes. Kerosene and candles are occasionally used for lighting purposes.

(5) Water Supply and Sewerage Systems

As in the case of electricity supply, piped water supply is only available in large towns. Although many villages have a borehole(s), the water supply is inadequate, making it necessary for villagers to use water from shallow wells, reservoirs, rivers and fountains.

(6) Financial Services

Local financial services are provided by such financial institutions as banks and such informal providers as middlemen. While banking facilities are provided by commercial banks in the district capitals and by the rural bank at Chiraa, small-scale farmers rarely take advantage of these facilities.[6]

(7) Medical and Public Health Facilities

While modern medical facilities are in place at Sunyani and other district capitals, they do not necessarily provide sufficient medical services because of the shortage of manpower and equipment.

There are no adequate drainage facilities in the subject villages and the toilets in particular are said to be the Achilles heel of village hygiene.

V.1.3 Agriculture

(1) Agricultural Activities

① Farming Methods and Main Products

The predominant farming method is extensive farming using the traditional slash and burn technique. Even though such different methods as shifting cultivation, crop rotation, intercropping, mixed cultivation and traditional agroforestry[7] are also used, the slash and burn technique has long been established as the preparation of farmland can be conducted with a small labour input.

Every year, farmers decide the cultivation site, area and proportions of different crops based on the perceived land productivity and need for different crops for own consumption and cash income. Cacao, taro and plantain are often cultivated at relatively

[6] According to a farmer in Adantia, farmers used to be able to borrow money from public financial institutions but at present can only borrow from middlemen. Even though a loan from a middleman imposes unfavourable conditions on farmers, there is no other means of quickly obtaining cash.

[7] This involves the mixed cultivation of such farming crops as plantain, maize and taro with such tree crops as oil palm, orange, cacao, avocado and mango. Stock raising may also be conducted.

fertile land while maize and cassava tend to be grown at land of intermediate or poor productivity.

The fallow period to restore land productivity has been reduced to two years in many villages at present. At some villages, there is no scope for a fallow period because of the acute shortage of arable land, in turn caused by a significant population increase. Consequently, the land productivity has been constantly declining, leading to complaints by many farmers that the farming productivity has considerably worsened.

There is still ample room for an increase of productivity outside forest reserves by means of the efficient use of resources, improved farming methods and investment in soil improvement, etc. in order to reduce the pressure to invade forest areas.

② Size of Farmland

The size of the farmland possessed by the surveyed households is shown in Table V-1-7. Most farmland is small and 43% of the surveyed households have only up to some 2 ha (five acres) of farmland. As this land is usually divided among household members, the farmland size per person is much smaller, accelerating the shortage of farmland with an increase of the population.

Table V-1-7 Size of Farmland in Possession

Size of Farmland	Number of Respondents	Ratio (%)
Less than 1 acre	13	3.98
1 - 2 acres	40	12.23
2 - 3 acres	37	11.32
3 - 5 acres	49	14.98
5 acres or more	188	57.49
Total	327*	100.00

* Excludes key informants
Source: BIRD (1998a)

③ Farming Schedule

One example of the annual farming schedule of a farming household in the subject farmer is shown in Fig. V-1-3. Although the annual farming schedule is naturally affected by the weather conditions (particularly rainfall) of a specific year, the busy season in the Study Area generally lasts from mid-March or April to November when the harvesting work is more or less completed. Double cropping is conducted in the case of some crops using the minor rainy season.

Land preparation work is conducted between January and March. This work includes the cutting of trees, bushes and grass, burning and levelling (and furrowing, etc.) While farming is conducted by both men and women, such heavy work as levelling is mainly conducted by men.

Farming is less intense from December to February of the following year and some men leave their village to work outside depending on the availability of jobs[8] during this period.

④ Processing and Marketing of Agricultural Products

Agricultural and forest products are sometimes sold after simple processing. Women can often be observed selling such processed foods as *gari*,[9] *kenkey*[10] and palm oil in villages or along roads. Men occasionally produce palm wine for their own use or cash income. The processing technologies are generally limited, making it difficult to produce added value.

Farming households have to sell their crops at a time when the price are low immediately after harvesting because they lack the skills required for the processing and storage of the harvested crops. Agrochemicals are not used to preserve the harvested crops and the loss after harvesting is said to be as high as 20 to 30 %.

8 Some men work as miners in the western regions.

9 Dried and powdered cassava.

10 Ground and then steamed maize.

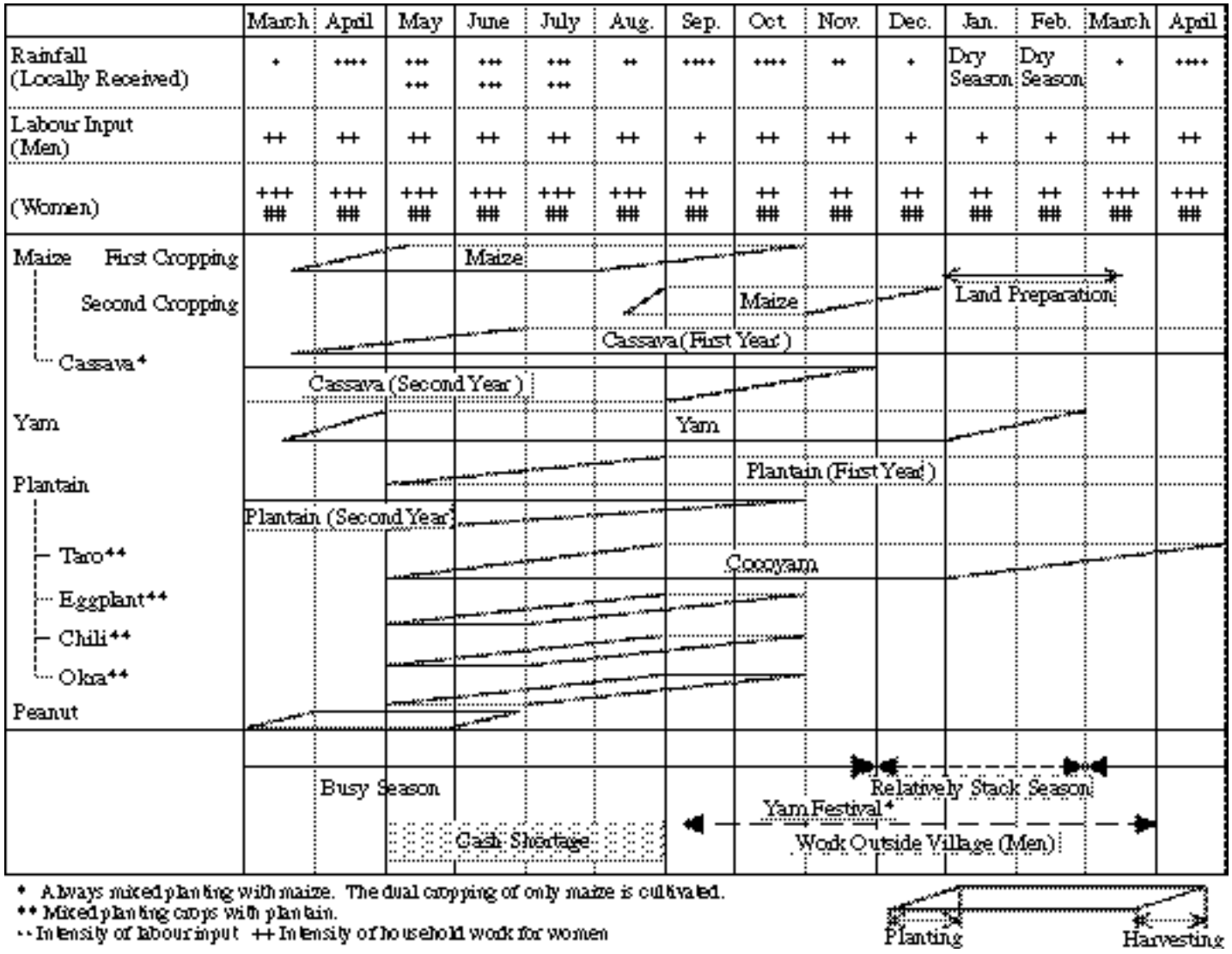


Fig. V-1-3 Farming and Labour Input Calendar (Based on Interview Survey Results)

Farming households in the Study Area have to sell their crops at a time when the prices are low immediately after harvesting because they lack the skills required for the processing and storage of the harvested crops. Agrochemicals are not used to preserve the harvested crops and the loss after harvesting is said to be as high as 20% - 30%.

(2) Economy of Farming Households

① Input (Production Cost)

As farming in the Study Area is the extensive type of farming, the production cost is predominantly determined by the labour input. While the resources of farming households consist of land and labour, the latter is usually abundant within the same household.

The generally high unemployment rate makes waged labourers available throughout the year.

② Income of Farming Households

The main income sources for an average surveyed household are shown in Fig. V-1-4. The largest proportion (some 71%) of income comes from farm produce, followed by transportation/commerce (marketing of products) at 16%. As most people living in the Study Area, except those in Chiraa and other urban areas, have few employment opportunities other than farming, income from farm produce is likely to account for more than 90% of the total income. Maize accounts for some 70% of the income from cash crops and cassava, vegetables and other agricultural crops account for the remaining 30%.

In response to the general question regarding household income as shown in the Table V-1-8, some 3% of the respondents state that their annual income exceeds 10 million cedis while approximately half of the respondents fall in the income bracket of 1 - 4 million cedis a year (approximately 430 - 1,700 US dollars). The average income per capita in the Sunyani District in 1995 was approximately 1.09 million cedis (approximately US$ 150 based on the exchange rate at the time). However, this figure does not necessarily indicate a higher income than average once price increases are taken into consideration.

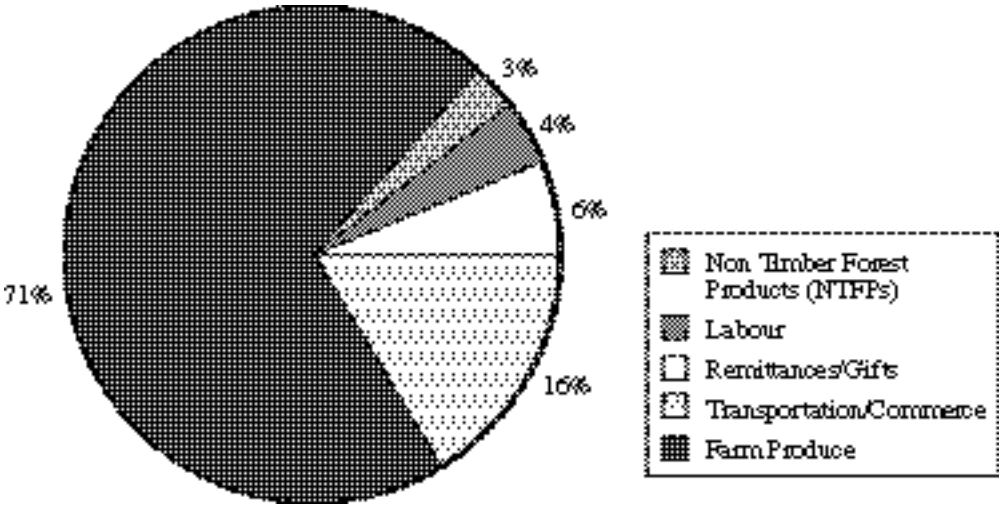


Fig. V-1-4 Major Sources of Household Income

Table V-1-8 Annual Household Income of Respondents

Annual Income ('000 cedis)	Number of Respondents	Ratio (%)
10,000 or More	10	3.05
4,000 - 9,990	46	14.06
1,000 - 3,990	163	49.84
500 - 999	63	19.26
100 - 499	40	12.23
Less than 100	5	1.56
Total	327	100.00

Source: BIRD (1998a)

③ Expenditure of Farming Households

Some 60% of the respondents spend 1 - 4 million cedis for household items while 36% (117 respondents) spend between half and one million cedis a year.

V.1.4 Factors Impeding Village Development in Study Area

The factors impeding the general development of villages in the Study Area are summarised in Table V-1-9.

Table V-1-9 Impediment Factors of Village Development

Physical Factors	- Slow development of transport/transportation facilities (difficult transportation of agricultural and the high transportation cost inhibits the producer price, resulting in a lower profit rate for farming households) - Shortage of irrigation and domestic water supply facilities - Shortage of adequate storage facilities for agricultural products
Economic Factors	- Immature local market: the difficulty of distributing farm products reduces the producer prices - Insufficient micro-financial services: the procedures of such formal financial institutions as banks are too complicated for small-scale farmers and share-croppers; informal money lenders (middlemen, etc.) impose high interest rates
Social Factors	- Poverty: results in the lack of a long-term perspective and willingness to invest on the part of farming households - Land tenure system: prevents investment in land and the cultivation of perennial crops; loans using land as collateral cannot be made; the fragmentation of farmland has resulted in an inefficient farming method - High illiteracy rate (low educational standard): makes it difficult for farmers to learn modern farming methods and new techniques
Institutional and Organizational Factors	- The insufficient agricultural extension services make it difficult for farmers to improve their farming methods; insufficient experience and skills in regard to tree planting

V.2 Local People and Forests

V.2.1 Relationship Between Local People and Forests/Forest Resources

(1) Collection of NTFPs

① Importance of NTFPs

Local people in have long been dependent on forest resources as they collect various NTFPs to support their lives. Table V-2-1 lists the main NTFPs used by local people by the purpose of use.

Table V-2-1 Main NTFPs and Others Used by Local People

Purpose of Use	Main NTFPs and others
Food	Snails, bushmeat, mushrooms, cashew nuts and fruit (mangos papayas, oranges and avocados)
Medicine	Leaves and bark of odum, teak and mango, etc.
Construction	Pillars and roofing materials and ropes to secure roofs and hedges
Agriculture	Honey crops for bees, sticks (climbing plants) and animal fodder
Household Articles/Small Tools	Chewing sticks (toothbrushes), mortars and pestles, handicrafts (baskets, etc.) and wrapping leaves (for food)
Fuel	Fuelwood (charcoal is mainly sold outside)

Local people traditionally collect various herbs, leaves, roots and fruits, etc. for medical treatment purposes. Table V-2-2 gives some examples of the medicinal plants found in the forest reserves.

Table V-2-2 Some Common Medicinal Plants in the Forest Reserves

Botanical Name	Akan Name	Parts Used	Medicinal Purpose
Albizia ferruginea	Awiemfo samina	leaves and bark	stomach-ache, dysentery, fever and syphillis
Entandrophragma	Adinam	bark	stomach ulcer
Ficus asperifolia	Nyankyerene	roots, latex and leaves	boils, tarantula spider bite, whitlow
Funtunia elastica	Funtum	bark and roots	piles, frequent stools in children, chest pains
Ricinodendron heudeloti	Warna	bark	intestinal inflammation and rheumatism
Spathodea campanula	Akuakuanisuo	bark	delayed walking in children and limb fracture
Terminalia superba	Ofram	bark	rheumatism
Tetrapleura tetraptera	Prekese	bark and fruit	dysentery, spice for food
Trichilia heudelotti	Tannuro	bark	internal inflammation, sores, loss of appetite, stomach-ache and ulcers
Xylopia aethiopia	Hwentea	fruit, bark and roots	ingredient in medicines, bodily pains, dysentery and intestinal worms
Aframonoum laurentii	Sensam	stem	soft foreheads in babies and eye problems

Source: Compiled from field data (1998)

Although NTFPs assist local life in many ways, the quantities of NTFPs have been declining in recent years along with the degradation of forests and their collection is becoming increasingly difficult.

② Problems of NTFPs Collection

The present forest policy permits the free access of local people to NTFPs in forest reserves for their own use only. In reality, however, most people are unaware of their right.[11] While it is compulsory to obtain a permit by payment of a certain fee to the district forestry office responsible for a particular forest reserve. [12]For the collection of NTFPs for marketing purposes, this system is not functioning effectively. All of the above appear to

[11] Through the FGD, a gap was clearly found between the current policy regarding people's rights and the awareness of such rights among local people.

[12] The permission of the chief is also required in some villages.

make farmers prefer illegal collection. The forest guards responsible for law enforcement cannot do their job properly because of the large tracts of forest reserves. As a result, forest resources are treated as open access resources without anyone being responsible for their management.

Efficient forest management must start with the reform of the existing NTFP collection permit system to make the procedure both fair and transparent and the establishment of the clear picture of forest resources utilization by local people.

(2) Planting Activities

① Planting Under Taungya System

The main reasons for the failure of the taungya system, as pointed out by local people during the field survey, are listed below.

- The planted species were unsuitable for the needs of local people (farmers did not generally prefer teak).
- The procedure for allocating taungya land was neither fair nor transparent from the viewpoint of local people.
- The allocated land was often unsuitable for the planting of teak.
- The timing of taungya land allocation was inappropriate for farmers in view of their farming schedule.
- The main incentive of the taungya system for farmers was access to new arable land. However, the limited cultivation period (approximately three years) made the land use rights unstable.
- When the initial cultivation period expired, the farmers were not given the right to use the planted trees and/or share the profit of them. Consequently, there was no incentive for them to protect and manage the trees from the long-term perspective.
- The Forestry Department was unable to monitor all of the land. There were many cases where no staff member of the Forestry Department visited the land after its initial allocation on the map.

On the other hand, the survey shows that there is an increasing desire among local people for the re-introduction of the taungya system which will allow the cultivation of relatively fertile land in forest reserves.

② Planting Experience Other Than Taungya System

The interview survey on the willingness to participate in and experience of tree planting among local people found uniform interest in planting among the respondents. Local people generally respond favourably to any approach as long as they will be allowed to use parts of forest reserves as farmland. Farmers with previous experience of planting were mainly those who planted teak under the taungya system.

Public relations activities and the provision of education and training for local people through seminars and workshops will be required to encourage local people who lack planting experience to commence planting activities.

(3) Customary Conservation Sites

There is also land which is customarily used and conserved by local people in forest reserves. This land includes sacred sites/groves (Nananom Mpow) linked to taboos and the graveyards of ancestors, both of which are traditionally preserved, riparian forests and land conserved as water source conservation forests. This land must be taken into careful consideration at the forest management plan formulation stage.

V.2.2 Local People and Administration / Activities of Forestry Department

(1) Local People and Forestry Department

Although the land ownership of forest reserves belongs to the stool as described in III.2.4, local people do not have the opportunity to express their opinions on important decisions related to the disposal and management of forest resources. Even though they have the right to collect NTFPs for their own use, the reality is that they are not properly informed of this right.

① Policy Change in Forestry Department

The Forestry Department changed its policy and introduced the new Forest and Wildlife Policy in 1994, emphasising forest management with the cooperation of local people. Nevertheless, the Forestry Department still does not have a section responsible for (i) close contact with local people through the provision of extension and other services, (ii) the promotion of its policies and silviculture and (iii) technical guidance to facilitate planting and other activities. At present, technical officers and forest guards of the district forestry officers are ones to have the most opportunities for direct contact with local people but they have not yet been properly notified of the change of the basic principle of the Forestry Department to emphasise the participation of local people.

② Necessity of Collaboration with Villages

The staffing strength of the Forestry Department will be halved in the future following its reorganization as the Forest Service. The efficient management of the vast forest reserves located in remote areas by a limited number of staff members will require the collaborative activities to neighbouring communities.[13]

In order for the idea of local people's participation to be developed into actual planting, however, many things are necessary, including (i) improvement of the relationship between the Forestry Department and local people, (ii) change of the awareness of local people, (iii) change of the behavioural pattern from the collection to production of forest products and (iv) technical guidance, diffusion of information and training to achieve these improvements/changes. On its own part, the Forestry Department must make efforts to properly notify its staff of policy changes, re-educate them in regard to desirable ways of implementing participatory forest management and provide radical education and training in order to prevent corruption and boost the morale of its staff.

(2) Local People, Concession Holders

According to the interview survey results, many villagers living near forest reserves have a strong feeling of ill will towards concession holders approved by the Forestry Department and chainsaw operators who conduct illegal felling in the belief that these companies and chainsaw operators are responsible for forest degradation and the outbreak of bushfires.

During the PRA survey, people in several villages situated near forest reserves expressed their hope to be given the power to monitor the activities of concession holders and chainsaw operators as the current monitoring of these activities by the Forestry Department is ineffective. It was also suggested that the permit contents should be made open to local people and that local people should have the right to veto the contents of a permit which are believed to have an adverse impact on local life.

V.2.3 Local People and Trees

Tree preference survey was conducted for male and female groups, to identify those trees popularly used by local people living near forest reserves and the species which they would prefer to plant in the future. Tables V-2-3 shows the highly ranked species based on this scoring and ranking exercise.

[13] In a pilot scheme of the CFMU, weeding and the removal of leaves in green firebreaks has been entrusted to local people, resulting in more efficient work (in terms of cost and time). This is an ideal method of creating employment opportunities during a period of high unemployment, i.e. during the slack farming season.

Table V-2-3 Tree Preference Survey Results (Ranking)

Village Name	Sex	1	2	3	4	5
Adantia	Male	Teak	Cacao	Mahogany	Cashew	-
	Female	Oil Palm	Cashew	Teak	Cacao	-
Oforikrom	Male	Teak	Odum	Oprono	Mango	Wawa
	Female	Odum	Oprono	Baku	Oil Palm	Teak
Namasua	Male	Odum	Teak	Oil Palm	Mango	Cedrela
	Female	Teak	Odum	Cola	Oil Palm	Papao
Bouku	Male	Teak	Cassia	Mahogany	Papao	-
	Female	Cacao	Coffee	Orange	Mahogany	Odum
Kwesi-Gyaukrom	Male	Oil Palm	Teak	Cassia	Orange	Cashew
	Female	Oil Palm	Orange	Teak	Sheabutter	Cola
General Evaluation	Male	Teak	Odum	Oil Palm	Mahogany	Mango
	Female	Oil Palm	Teak	Odum	Orange	Mango

* The general evaluation ranking is based on the total scores of individual species in order of preference (four points for the most preferred species and one point for the least preferred species).

Farmers prefer multi-purpose species which provide various products both for personal use and for sales, such as food, medicine, building materials and handicraft materials, etc. This preference appears to be particularly strong among the surveyed women.

Another emphasised function of these species is the environmental conservation function, including the prevention of soil erosion, conservation of water sources, improvement of soil productivity, protection of houses and crops from strong wind and provision of shade. Table V-2-4 shows the main purposes of use of those species of which the preference was found to be high among local people by the survey.

Table V-2-4 Possible Use of High Scoring Species Based on Local People's Preferences

	Species	Fast Growth	Use
1	Odum	No	Medicine (bark for measles and high blood pressure); firewood; furniture materials; mortar; building materials; mushroom culture; bushfire control; soil and water conservation; soil improvement; windbreaking; shading
2	Teak	Yes	Roofing materials (leaves); medicine (leaves for malaria); furniture materials; utility poles; firewood; windbreaking; soil and water conservation (deep root system); shading
3	Oil Palm	Yes	Baskets; brooms; mats; roofing materials (leaves); building materials; liquor (palm wine; aperitifs); medicine (roots); palm oil; kernel oil; soap; mushroom culture; fuelwood; windbreaking; soil and water conservation; shading
4	Mango	Yes	Food (fruit); medicine (bark for fever); fuelwood; furniture materials; bushfire control; soil and water conservation; soil improvement; windbreaking; shading
5	Papao	Yes	Firewood; mortar; building timber; furniture materials; medicine (bark); soil and water conservation; soil improvement; bushfire control
6	Cassia	Yes	Medicine (bark); windbreaking; commercial timber; furniture materials; fuelwood (particularly charcoal); bushfire control; shading
7	Orange	Yes	Food (fruit); medicine (leaves and seeds); chewing sticks; fuelwood; bushfire control; soil and water conservation; soil improvement; shading
8	Mahogany	No	Firewood; building materials; furniture materials; medicine (bark); soil and water conservation; soil improvement; bushfire control
9	Oprono	Yes	Building materials; furniture materials; commercial timber; firewood; soil and water conservation; soil improvement
10	Ofram	Yes	Building materials; furniture materials; firewood, soil and water conservation; soil improvement; windbreaking; shading
11	Wawa	Yes	Building materials; furniture materials; soil improvement; windbreaking; firewood; soil and water conservation; handicraft materials
12	Avocado	Yes	Food (fruit); fuelwood; medicine; soil and water conservation; soil improvement; shading
13	Cashew	Yes	Fruit (nuts, oil and wine); windbreaking; soil and water conservation; shading; bushfire control

(1) Teak

Teak is highly valued in terms of both its rank and score, mainly because of the overwhelming experience of planting teak under the taungya system among the respondents who have little experience of planting other species.

The true reason why teak is highly ranked is that land in forest reserves could be used for the cultivation of agricultural crops together with the planting of teak and it may be fair to say that farmers in general are not particularly interested in the planting of teak.

When the creation of teak forests through the re-introduction of the taungya system is intended, the establishment of a new system, share cropping right to directly benefit the farmers providing labour for planting and tending will be necessary together with the existing royalty system.[14]

(2) Fruit Trees

Fruit trees are generally welcomed by farmers as they are fast growing and have a wide range of uses. Particularly popular among local people in the Study Area are mango, orange and avocado as well as such plantation crops as cashew, cacao and coffee, etc. for cash income. Large-scale plantations of mango, orange and avocado, etc. for commercial purposes do not appear to be the case in the Study Area which is dominated by small-scale farmers and share-croppers. The fruit produced locally is mainly consumed at home and the surplus is sold as and when it occurs.

Cashew nuts are thought to be a promising cash crop in and around the Study Area and may be exported in the future if the quality is good enough.

Mango, orange, cashew and avocado, etc. are all fast-growing, multi-purpose evergreen species and their assumed fire control function should be actively exploited by their use as planting species for green firebreaks.

(3) Oil Palm

Oil palm is associated with fuelwood for domestic use, medicine, building materials (roofing materials), furniture materials and various tools. It is also used to produce palm oil extracted from the pulp, kernel oil (raw material for soap), palm wine made from the sap and fruit and a local brew. As oil palm cannot be used as timber nor function as a fire control species, however, its planting in forest reserves is not within the present scope.

(4) Fuelwood Trees

Particularly preferred are those species which are light and produce little smoke so that undesirable odour does not spoil the cooked food. One respondent put the firewood consumption at 2 - 3 headloads per week for a family of 6 - 7 people[15] while the RRA survey put the daily firewood consumption at 2 - 2.5 kg (14 - 25 kg/person/week).

As the surveyed villages are located near a forest area, they are said to have relatively rich firewood resources compared to urban areas.

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[14] It may be appropriate to maintain the royalty system in order to avoid social conflicts.

[15] While the actual weight of a headload varies, some data put it at an average of 27.3 kg.

Under these circumstances, fuelwood trade hardly exists in villages near forest reserves.[16] Nevertheless, it is almost certain that a fuelwood shortage will occur in villages in a forest area in the future if the firewood consumption continues at the present rate.

V.2.4 Local People and Bushfires

(1) Recognition of Causes of Bushfires

The main causes of the degradation of the forest reserves which constitute the Intensive Study Area are said to be excessive felling for timber (including illegal felling), bushfires and forest clearance to create farmland. Of these, damage due to bushfires is particularly devastating and, according to local people, the scale of bushfire damage has been noticeably increasing in the last 20 years (BIRD, 1998a).

As a result, the following causes of bushfires were identified by the local participants of this analysis.

- Deliberate setting of fires by concession holders and others (to obtain a permit to fell the damaged trees)
- Extensive nature of slash and burn agriculture (shifting cultivation)
- Group hunting using fires
- Production of palm wine in forests
- Failure to extinguish cigarettes
- Climatic conditions (lasting and frequent droughts and decline of rainfall, etc.)

Once a bushfire starts, people in the area are preoccupied with the need to prevent its spread to their farmland or settlement and have no motivation to take a personal risk in trying to protect forest reserves from which they do not directly benefit.

(2) Current State of Damage to Local Life

People living next to forests are arguably the worst victims of bushfires, including the loss of crops, domestic animals, houses and even human lives in some cases. Moreover, the decrease of NTFPs, including medicinal herbs, only found in forests and bushmeat has further aggravated the poverty of self-sufficient farmers whose lives depend on forest resources. Thus, the most damaged by bushfire are the people living near the forest reserves.

[16] People in relatively large villages/towns located far from a forest reserve often buy fuelwood. The price is said to be approximately 1,000 cedis/headload (Bouku).

(3) Existing Bushfire Control Measures of Local People and Their Problems

The surveyed villages commonly have their own village fire volunteer squad (VFVS). These VFVSs contribute to bushfire prevention and control. The expected role and activities of the VFVS appear to slightly vary from one village to another. In short, the activities of the VFVS are classified as bushfire prevention activities and actual fire-fighting and extension-control activities.

① Bushfire Prevention Activities

- to prevent the spread of bushfires or burning by means of the planting of evergreen species, cutting of grasses in settlements and at farmland boundaries and the removal of leaves
- Supervision of burning on privately owned farmland

② Fire-Fighting and Extension Control Activities

Once a bushfire occurs, the members of the VFVS, the chief and members of the traditional authority lead the fire control and extinguishing activities. In one village, there is an arrangement that the villagers and people of neighbouring villages are mobilised to establish a system to commence fire-fighting activities before the next morning when the wind starts to blow if a bushfire starts in the evening.

(4) Impediment Factors for Bushfire Prevention and Control and Associated Problems

① Lack of Fire Prevention Infrastructure and Facilities

Farmers use such simple tools as hatchets, hoes and buckets, etc. for fire prevention and fire-fighting activities and do not have fire-resistant clothing and boots to protect themselves. Villages do not have a watch-tower and no facilities, such as a radio system or bicycles, etc. which are available for quick communication.

② Attitude of Ordinary People To Bushfire Prevention

Among local people whose direct benefits from forest reserves are very limited, there is a lack of motivation in regard to the conservation of forest reserves through bushfire prevention and control.

③ Declining Coercive Power of Modern Laws and Customary Systems

While the Control and Prevention of Bushfires Law (1979) is the principal law in Ghana related to bushfires, the surveyed villages have established their own rules for bushfire prevention (for example, prohibition of the use of fire during the dry season as described

earlier). However, the reality is that these laws and customary regulations are not properly observed.

V.3 Participation of Local People in Forest Management

V.3.1 Silviculture by Taungya System

(1) Restriction of Contracted Farmers (Conclusion of Contract in Writing)

A written agreement should, therefore, be made to clarify the project contributors, i.e. beneficiaries, when re-introducing the taungya system in order to eradicate such concern on the part of farmers to prevent any conflicts in the future.

(2) Allocation of Land to Farmers' Groups (Introduction of Joint Responsibility Agreement)

It is deemed appropriate for the planned forest management plan for the transitional zone to combine allocation to farmers' groups which has the advantage of easy monitoring and evaluation of the activities of these groups through the introduction of joint responsibility and allocation to individual farmers to stimulate the sentiment of competition between individuals.

Moreover, the maximum cultivation period must be determined before allocating land to farmers.

(3) Establishment of Profit-Sharing Rights

As part of incentive for farmers in addition to wage money, profit-sharing rights over mature stands can be given to farmers contributing planting and tending activities.

The introduction of a profit-sharing system is welcomed by farmers as it would secure a source of income (labour saving) in the future when they are no longer able to work (BIRD, 1998c). From the viewpoint of the Forestry Department and investors, such a system can reduce the cost of silviculture, particularly the initial investment cost, and also has the substantial advantage that part of the operational risk of silviculture in the future will be shared by the contracted farmers.

V.3.2 Management of Natural Forests

(1) NTFP Management

Facilitation of the use of NTFPs for domestic use by guaranteeing the right of local people to collect them and also by means of entrusting the management of NTFPs to local people because of the following reasons in the conservation and management of natural forests.

- Restoration of the traditional rights of local people to use forest resources in forest reserves
- General improvement of local living standard through the increase use of forest resources (improved income, improved food supply and satisfaction of the subsistence needs for medicinal herbs and other forest products)
- Raising awareness among local people of the importance of forest resources and the significance of their long-term conservation by the sustainable management of NTFPs
- Improvement of the partly antagonistic relationship between local people and the Forestry Department in order to establish a constructive relationship to achieve the efficient as well as effective management of forest resources

(2) Admitted Farms, Customary Conservation Areas and Sacred Sites

The handling of admitted farms which existed prior to the establishment of forest reserves, riparian forests and water sources customarily used and conserved by local people and sacred groves for traditional worship and the graveyards of ancestors, etc. will be left to local people as has been the case so far.

V.3.3 Consideration of People's Needs in Terms of Timing of Planting and Geographical Scope of Work

(1) Timing of Participation

The busy farming season in the Study Area generally lasts from April to November with a high level of rainfall as described in V.2.1. Therefore, the period from December to February, i.e. the dry season, constitutes the slack season during which the unemployment rate increases among wage labourers and young people who cannot find suitable employment even though many men leave their villages to seek temporary work. It should, therefore, be possible to conduct land preparation for planting sites, seedling production, pruning of planted trees, weeding and removal of combustibles.

(2) Walking Distance

According to one farmer, a walking distance of one hour is the geographical limit for efficient farming and tree tending work by local farmers. Any work involving the use of farming tools and transportation of the harvest may prove quite difficult without any means of transport if the distance exceeds 3 km.

V.3.4 Examination on Village Organization to Enhance Participation

All villages in the Intensive Study Area have various socioeconomic sub-groups with loose links and each plays various roles and interact each other. To promote the participation of local people and efficient forest management in forest reserves, the establishment of a village organization is necessary which will be responsible for (i) facilitating a cooperative relationship between contracted farmers and also between the holders of various rights, (ii) conveying various information, (iii) extending knowledge and skills, (iv) controlling illegal or undesirable activities and (v) negotiating with external organizations, including the Forestry Department, on behalf of the village population.

(1) Component of Organization

During the FGM, an immigrant group in Asuokuwa proposed the establishment of the Forest Management and Planning Committee (FMPC) for the purposes of issuing NTFP collection permits and conducting forest management as an example of a village organization. A similar opinion was expressed by people in other villages. In short, members of the FMPC will consist of representatives of various groups, including the chief, queen mother, taungya leader, leader of the Fire Squad, chairman of the Unit Committee and the leader of immigrants. A staff member (technical officer) of the area's district forestry office will also be a member.

(2) Contents of Activities

① Issue and Control of NTFP Collection Permits and Reporting to Forestry Department

The primary objective of the establishment of the FMPC is the decentralisation of the power to issue NTFP collection permits and to control NTFP collection activities at the village level.

② Conveyance of Information to and Education of Local People

The FMPC will convey notices from the Forestry Department and other administrative organizations to local member.

③ Coordination with Forestry Department and Other External Organizations

The FMPC will negotiate with external organizations, such as the Forestry Department and private companies, on behalf of the village. Its work will include (i) coordination between villagers in regard to their rights and obligations concerning forest resources, (ii) coordination with the Forestry Department on the allocation of taungya land, green fire belts, community woodlots and nursery sites in forest reserves and (iii) negotiation on behalf of villagers with powerful bodies with a vested interest, such as concession holders.

④ Monitoring of Illegal Activities

The FMPC will establish village task force(s), the members of which will patrol forest reserves to monitor whether or not villagers or outsiders are illegally using the forest resources in forest reserves and the like.

V.3.5 Impediment Factors and Problems of Participation and Improvement Measures (External Impediment Factors)

For the smooth implementation of the Forest Management Plan to successfully achieve its targets, external conditions which are beyond the control of the plan must be satisfied. These include the cooperation of non-forestry organizations, physical conditions, social conditions, economic conditions, policy conditions, financial resources and labour supply. Here, the external impediment factors which are believed to have a serious impact on plan implementation, especially on those components related to people's participation, are identified and analysed.

① Institutional Impediment Factors

- Inadequate capability of administrative organizations (including human resources, financial resources, technical skills and managerial capability)
- Absence or insufficiency of extension services
- Weak cooperation between organizations and rampant sectionalism

② Natural Conditions and Physical Impediment Factors

- Worsening natural conditions, including frequent, long-lasting droughts due to declined rainfall
- Frequent bushfires

③ Social and Cultural Impediment Factors

- Willingness and interest of farmers in planting, weak economic incentives

- Collapse of the traditional sense of values regarding resources conservation among local people
- Population increase

④ Economic Impediment Factors

- Absence of micro-finance services for small-scale farmers
- Prevailing Poverty (encouraging encroachment into forest reserves, and excessive collection of resources and population increase)

⑤ Administrative Impediment Factors

- Inconsistent prosecution of violators of the forest laws
- Royalty system from which local people do not benefit
- Lack of policies to assist local people in forestry and other activities

⑥ Intrinsic Impediment Factor

- Long growth time of trees (it is difficult for poor farmers to adopt a long-term perspective)

VI. DEVELOPMENT NEEDS AND MEASURES FOR FOREST RESTORATION IN THE INTENSIVE STUDY AREAS

VI. DEVELOPMENT NEEDS AND EXAMINATION OF THE MEASURES FOR FOREST RESTORATION IN THE INTENSIVE STUDY AREAS

VI.1 Forest Degradation and Study for Forest Restoration in the Intensive Study Areas

The state of degradation in the forest reserves, using 6 scoring grades prepared by Forestry Department(See Fig**III**-4-4), based on the artificial disturbance and crown density of the subject forest, belongs from 4(indicates mostly degraded) to 5(indicates very poor). The forest reserves are considered to be entirely degraded in spite of keeping the state of forest, because of sparse trees, conversion into grassland and decrease of soil productivity.

In this connection, the survey of this time showed that the areas of 23,271 ha (about 36 %), out of total forest reserve areas of 65,918 ha, have been converted into grassland covered with Chromohena, etc. Of the natural forests, the forest stands less than 50% in crown density have occupied 43% of them.

Following factors are considered as causes of the forest degradation in the forest reserves.

① Degradation caused by daily life activities of local people (production and reproduction activities)

- Destruction of forests caused by conventional farming system, shifting cultivation and illegal farming
- Bushfire caused by group hunting and production of palm wine
- Destruction of forests caused by illegal logging, collection of fuelwood and illegal intrusion into the forest reserves

② Degradation caused by poor management practice for forest resources

- Destruction of forests caused by overlogging, illegal logging and the like

③ Degradation caused by bushfire brought about secondarily by the above mentioned activities of ① and ②

The circumstances mentioned above are assumed to emerge from failures and/or lack in liaison on the forest reserve matters among the Forestry Department, private sectors and local villagers.

There are actual needs for forest resources on the part of industries, local people and the government. Meanwhile, the continuous neglect of these degraded forests will not only result in failure to meet such needs but could also seriously damage public welfare through environmental destruction and others.

Therefore, in order to meet those needs, this chapter will draw up the measures for restoring the degraded forests which should be the basis of preparation of the forest management plan through the following process (see Fig. VI-1-1). In this case, it is necessary to make the measures for forest restoration more practical, grasping the needs for the forests in the Intensive Study Area, based on the impeding factors against reforestation and potentiality in the field, and intending the adaptability to the present policy and the direction of project implementation for forest resource management.

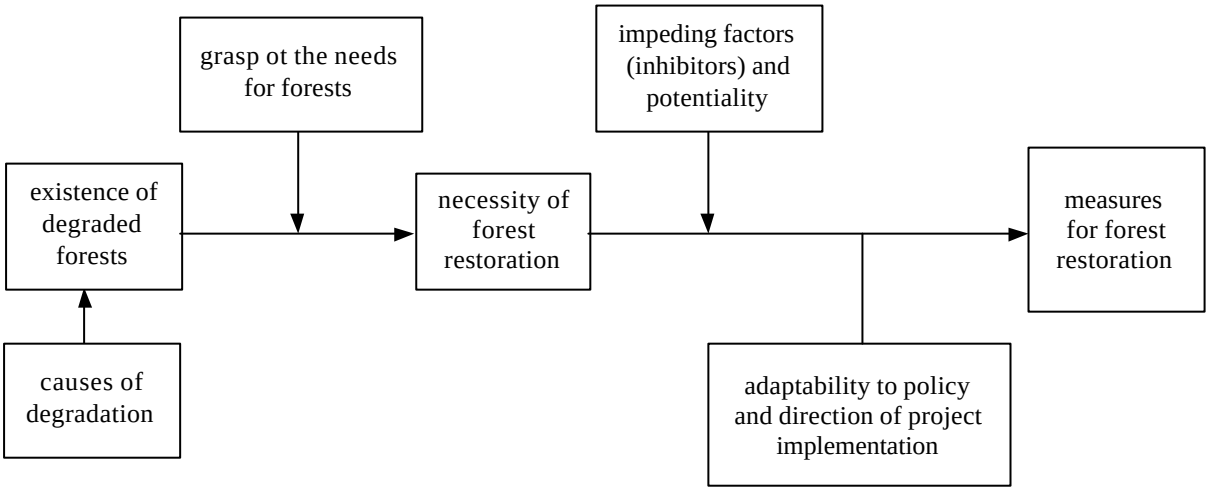

Fig. VI-1-1 Process of Examination for Forest Restoration

VI.2 Development Needs in the Intensive Study Areas

First of all, it is necessary that the development needs existing in the local residents in the surrounding areas of the forest and in the industries, and the intention of the Forestry Department towards the Forest Reserves should be held in order to restore degraded forests and contribute to local communities by conserving forest resources.

The needs for the forest in the study areas by each sector level are discussed as following.

VI.2.1 Industries

The population in Ghana is assumed to increase up to 34 million by 2020, boosting the demands for forestry products including timber with an approximate annual increment of 200.000 m^3 by 2003, while the lack of timber supply appears to raise the prices with the basis of 0.5 to 1 % in a year.[1]

(1) The Needs at the Central Level

The Executive Secretary of GTMO, the Ghana Timber Millers Organization, mentioned his opinion in the interview during the study, that he too took the demand of development of plantation (especially, that for teak) seriously as a timber processor. He concluded that the government should take initiative for that, by presenting concrete reforestation program, etc.

According to the report[2] on timber industries, efforts have been made to attract overseas investment for the development of plantations for commercial use and although Ghana has the annual goal to establish plantation area of 10,000 ha,[3] it is said to be achieved up to 3,000 ha only in a year due to the lack of funds etc.

Thus, there is a strong need for plantation establishment, considering the price rise together with the shortage of timber supply, the recognition of the necessity for reforestation by the timber industry and non-realized reforestation plan regardless of it.

On the other hand, only 40 tree species out of 680 indigenous ones in the Ghanaian forest are utilized for timber production, and so it is considered to make efforts to expand the utilization range of tree species in the demands for domestic use as well as in exporting. The need for utilization of less-used tree species is arising.

(2) The Need for the Electrification Expansion Program

The electrification/communication expansion program, currently being planned, also appears to provide appropriate market, which absorbs timbers for electric poles harvested in existing and/or future teak plantation. In short, as the local electrification program proceeds, domestic sales volume of teak electric poles will increase and the commercial plantations will be the source of its supply.

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1 TEDB (1997). Ghana Hardwoods, Trade and Industry Directory

2 Same as above

3 Forestry Development Master Plan (1996-2020)

(3) The Needs at the Sawmills

The survey on sawmills, etc. in the Study Area found a declined in the supply of sawn logs and other materials due to depleted wood resources, caused by excessive felling, frequent bushfires and too much emphasis on timber exports, leading to a call by sawmills, etc. for the strict enforcement of felling control. The survey on the needs of sawmills vis-a-vis the Forestry Department also found that sawmills hope for the government's encouragement of planting and the priority distribution of sawn logs to the domestic market.

VI.2.2 Local Residents

(1) The Needs for Fuelwood

The target villages are located in the proximity of forest areas, materials for fuel are relatively abundant in comparison with urban areas. Although, gradually, the location for firewood collection is getting father, increasing the physical burden and time-consumed for the labor, the complaints which claim difficulties for living due to shortage of firewood are seldom heard in the socio-economic survey.

However, if the firewood consumption continues on the current basis, there will be sure to be a shortage even in the villages in the forest areas.

Another survey (See **II**-3-2) estimated that the annual fuelwood consumption volume is approximately 14 million m^3. The supply volume is some 10% of the consumption volume, illustrating the very serious nationwide shortage of fuelwood.

(2) Needs for NTFPs (for domestic and commercial use) and Multi-purpose Tree Species

Many of NTFPs products, i.e. plants for food and drugs, bushmeat and housing materials, etc. are consumed in villages. Aside from cheap cost, they are essential for daily life and traditions of the villagers. In addition, the multi-purposed tree species are widely exploited, providing food like fruits, animal fodder (leaves) and poles and posts for housing (timber), etc. As mentioned above, the needs for NTFPs are high among local people.

(3) Needs for Agricultural Products (for domestic and commercial use)

The degradation in productivity of farmland (land fertility) can be attributed to demands in food production to support population growth and/or cutting down of duration in fallow practice of farmland outside the forest reserves. Consequently, villagers are interested in farm production on the forest reserve in which the state of forest is maintained with relatively high land fertility.

(4) Needs for Good Environment

As clearly shown by the findings of the tree preference survey, local people recognise the importance of forests and the positive effects of trees on the environment. To be more precise, they are well aware of the fact that forests play a crucial role in the preservation of the living environment and its functions, including the protection of agricultural crops from the harmattan, maintenance of the agricultural productivity through preservation of the soil fertility of farmland, conservation of animals for hunting (bushmeat) and useful plants and maintenance of the water flow of rivers.

Given the present situation where the public benefit functions of forests are not fully performed due to the occurrence of surface soil erosion (gullies, etc.), distribution of low productivity soil, decline of the numbers of animals for hunting and useful plants and decrease of the river water flow during the dry seasons as indicated by the findings of the natural conditions survey and others, the need of local people for a better environment is likely to steadily increase in the coming years.

(5) Needs for Forest Management

The results of the focus group meetings and forest management seminar indicate various needs of local people, i.e. (i) creation of green firebreaks to prevent bushfires, provision of fire-fighting equipment and establishment of fire-fighting teams, (ii) provision of education and training on techniques regarding forest conservation, fostering of seedlings and planting and (iii) forest management methods (revival of the taungya system, fostering of multi-purpose species and substantial transfer of NTFPs control rights to local people).

VI.2.3 Forestry Department

(1) The Intention of Forestry Department

Currently, the Forestry Department is on the way to carry on what is called privatization, i.e. rationalization of its functions (transition from organization of 4,500 personnel to 2,500, etc.), devolvement of its competence to private sectors, simplification of bureaucratic procedures and improvement of credibility, etc., which is on the way of reorganization from FD to Forest Service. It is also making effort to introduce vitalization of private sectors into the development of forests, as well.

When interviewed on the desirable way to conduct forest restoration in the Intensive Study Area, senior members of the Forestry Department gave priority to the establishment of timber

production forests through investment by private companies and listed possible investors in the Intensive Study Area in the following order of preference.

① Private companies in Ghana

② Foreign companies in the form of joint ventures, etc.

③ Public organizations (such as the Forest Service to be newly established and others) using grant aid, etc.

The expected roles of the Forestry Department include the enforcement of regulations/rules, monitoring, mediation of disputes, technical guidance, guarantee for investment safety and public education on bushfires.

Meanwhile, in connection with attracting private investment, the advantages of planting for all those involved in planting must be clarified through good communication and improvement of their understanding using past successful examples.

They also referred to the possibility of industrial plantation pilot project to be implemented by the Forest Service that will be financed by soft loan.

In the case of the Planning Branch, private bodies interested in planting in forest reserves were invited to a meeting to express their opinions and interviews were conducted on the planting capacity of each body in terms of land size.[4]

(2) The Intention of District Forestry Office

Staff members of the district forestry offices who implement the practical daily management of forest reserves are responsible for execution of the policies of the Forestry Department in the field and also for direct monitoring of the actions of private companies and local people in forests. Consequently, their needs are naturally related to forest management, not regarding as mere labourers

To be more precise, incentives for farmers to be continuously involved in plantation work should be created from the viewpoints of preventing bushfires, providing after-care for the planted trees and conserving plantations. The creation of the effective incentives for farmers is, therefore, considered necessary for forest officers to promote the participation of local people in forest management.

[4] This meeting took place in February, 1999 with the participation of 30 bodies (private companies, associations and villages, etc.)

The development needs and intentions of each sector above-mentioned are summarized into four categories as follows. These needs are the basis for studying the establishment of the measures for forest restoration.

① Needs for timber resources

- natural timber and plantation timber (sustainable timber production)

② Needs for the goods and materials related to local people's life

- production growth of crops, NTFPs, poles and posts and fuel-wood, etc.

③ Needs for the prevention of bushfire

- establishment of fire-fighting system for plantation trees, etc.

④ Needs for good environment quality

- prevention of soil erosion, wind (harmattan) damage and protection of water source (streams, etc.)

VI.3 The Inhibitors against Reforestation and the Potentiality

There seems to be enough potentiality that forests with various economic and public functions will grow, since following conditions already exist.

① Forest with the function of wood production and such public functions as water conservation and wind protection, can exist and grow fully, because the Intensive Study Area belongs to the moist dry-deciduous forest zone.

② Forest reserves are the area classified as permanent forest in the national land use and there is no room for changing the forests into other land uses such as agriculture etc.

③ There are remarkable numbers of large and small sawmills in the neighborhood of the Intensive Study Area and the area is located comparatively near (around 100km) Kumasi, the center of timber industry and markets in Ghana.

And also there exists enough accessibility to these markets since infrastructure such as roads (national roads etc.) has been improved for timber transportation.

④ Plenty of labour power are necessary for the establishment of the forests in the Intensive Study Area and it is possible to secure low-cost labour power from the nearby regional capital Sunyani or other towns.

Although the Intensive Study Area has basically these potentialies, it has also the inhibitors against forest establishments and the like.

The potentiality can be vitalized by taking the measures to overcome such inhibitors.

Impeding factors (inhibitors) regarding forest establishment, etc. in the Intensive Study Area are shown in Table VI-3-1. They are summerized as follows.

① As indicated by the findings of the forest survey as well as the soil survey, the natural conditions of the Intensive Study Area are not particularly favourable for forest establishment and the cultivation of agricultural crops. In addition, the drought in recent years has made it easier for bushfires to occur, posing a great threat to natural forests and plantations alike.

② From the viewpoint of the socioeconomic conditions, forest development is hampered by a lack of incentives for the taungya system, mistrust in forest guards and inadequacy of the fire-fighting system.

③ Moreover, as disclosed through interviews with people involved in the local timber industry, further problems are caused by the lack of planting experience, uncertainty surrounding the market for timber produced by plantations and insufficient budget to fight bushfires.

Table VI-3-1 Inhibitors against Reforestation etc. from the Viewpoint of Natural and Socio-economic Condition in the Intensive Study Area

	Reforestation	Agricultural Production	Conservation of Environment
Natural conditions	①Development of artificial forest • low site index (teak) • More than 80 % of the artificial forestry was damaged by bushfires. • Not proper water environment for teak growing. • Less precipitation • Loss of young tree due to bushfire. • Strong wind • Inferior genetics of teak • Development of surface soil erosion ②Conservation of natural forest • Loss of young trees by bushfire • Not many mother tree • Difficulties in supplementary planting for thickly grown Chromohena • Development of surface soil erosion	①Adverse effects on farmland due to cutting and degradation of forest ②Erosion of surface soil due to bushfires ③ Frequent and extended droughts, reduction in precipitation ④Bad soil condition	①Neighboring location to the area of frequent bushfire outbreaks ②Soil erosion ③ Reduction of water conservation function due to decrease of ground covering plants
Socio-economic conditions	①Lack of industrial and life infrastructures, i.e. transport system and water supply system, etc. ② Underdeveloped distribution system, i.e. lack of local timber markets and small-scale financial service, etc. ③ Poor social conditions, i.e. poverty, unstable land tenure system and high illiteracy, etc ④Lack of forestry extension service/intention to plant trees ⑤Poor resource management for the forest reserves ⑥ Difficulties in participation of local residents in the development, i.e. lack of policies to support them, etc. ⑦Collapse of traditional sense of value for forest conservation ⑧ Impact on forests by extensive agriculture	① As left ② As left ③ As left ④ Insufficient agricultural extension services and unimproved farming methods ⑤Extensive farming using slash and burn method ⑥Shortage and fragmented ownership of farmland ⑦Decline of land productivity due to shortened fallow period and continuous cultivation ⑧Difficulty of organizing farmers and promoting joint work	①Invasion of farming into the forest reserves ②Inappropriate farming system ③Uncontrolled bushfires
Forestry/forest products industries	①Lack of experience on forestation in small scale timber processors ②Enormous costs for countermeasures to control bushfire if held without support ③Enormous cost of raising tree seedlings if done without support ④ Shortage of fund in small scale timber processors ⑤ Reduction in profitability due to share and land rent ⑥Lack of experience in forestation on timber processors ⑦Lack of technological development to manufacture the saw for small diameter tree (for artificial forest) ⑧ Underdeveloped kiln drying technologies (to the products for	① Stamping down and damaging farmland by concessionaires	① Degradation of forest by concessionaires or chaionsawers ②Overlogging

	domestic market)		

VI.4 Present and Future Direction in Forest Resource Management and the Project Implementation

VI.4.1 Direction in Present Policy

The Forestry Development Master Plan (prepared in 1996), spells out the intended policies and actions for Ghana's forest sector and points out that the annual yield constantly exceeds the allowable quantity because of inadequate control and speculative as well as illegal felling (2.2.2 of the Plan). According to interviews held at the Forestry Department, the utilisable timber resources will largely be depleted in the next 15 years if the current level of cutting is allowed to continue. Accordingly, the annual yield must be reduced from the viewpoint of sustainable management, meaning that the permitted cutting volume must be reduced.

Meanwhile, the domestic timber demand is expected to increase due to the anticipated population increase in the future and it is believed that this increased demand must be met by increased timber production through the establishment of new plantations.

The Forest Development Master Plan believes that 32% of the forest reserves have been degraded and plans to boost the timber production to meet the future demand by means of restoring the productivity through the prohibition of cutting in 122,000 ha of natural forests and the conversion of 397,000 ha into timber plantations (2.2.1 of the Plan). The Master Plan hopes for the participation of Ghanaian people, i.e. the private sector, in the necessary investment for the establishment of plantations (2.6.1 of the Plan). The "Brong-Ahafo Forest Management Project"[5] prepared by the Planning Branch also calls for private sector investment in forest establishment in the Study Area.

Although the management of forest reserves has so far excessively focused on timber production, a new policy has been put forward by the Forestry Department which calls for the active achievement of environmental protection, timber production and benefits for local people under sustainable management.[6]

Meanwhile, the Collaborative Forest Management Plan urges the active participation of local people in forest management while emphasising that the basis of forest management lies with a balance between development and conservation.

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[5] "Brong-Ahafo Forest Management Project" submitted by the Forestry Department to the Ministry of Land and Forestry on 26th February, 1997

[6] Manual of Procedure: Forest Resources Management, Planning in the HFZ, Section A

Furthermore, the Master Plan referred to above lists the prevention of bushfires in forest reserves as one of the main objectives of the sustainable forest management programme in the first phase of the Plan.

VI.4.2 Future Direction for Forest Management Project Implementation Under World Bank Aid Programmes

World Bank aid programmes appear to have been involved in forest and forestry policies in Ghana in a fairly comprehensive manner as witnessed by the Forest Sector Evaluation Programme[7] which is said to have played a leading role in the full-scale assistance of foreign donors for the forest and forestry sector in Ghana and the Forest Resources Management Programme (FRMP)[8] which has greatly contributed to forest resources management in Ghana. Here, the future direction for the implementation of projects related to forest resources management is examined by reviewing the Natural Resources Management Programme (NRMP)[9] assisted by the World Bank and scheduled to commence in 1999.

The objectives of the NRMP are the protection/rehabilitation and sustainable management of national land, forests and biological resources as well as the contribution to the increased income of rural villages in possession of these resources through the realization of the objectives.

(1) High Forest Resources Management: Component 1

① Promotion of Investment in Plantation Establishment

As Ghana is considered to provide an attractive prospect for investment in plantations because of its climatic conditions, easy access to domestic as well as European timber markets, low cost labour and existence of FRs for wide-area planting, the NRMP plans the introduction of appropriate policies to promote the development of plantations by private sector funding in order to utilise such favourable conditions. This should constitute the backbone for assistance for the intended inducement of private companies to participate in the present plan. The following items referred to in this component are particularly relevant.

a. Easy procedure for the allocation or possession of forest land in FRs to facilitate the planting activities of the private sector

b. Establishment of a Plantation Development Fund to facilitate investment in plantations

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7 Conducted in 1986 by a joint team, resulting in revision of the concession fee and others

8 Implemented from 1989 to 1997

9 Scheduled to be implemented from 1999 to 2004 at a total cost of US$ 90 million (funded by the IDA, GEF and the UK, etc.)

c. Establishment of a seed bank to overcome the shortage of planting materials and to establish a private sector seed distribution system

d. Support for the technical training of those involved by means of the preparation of manuals and other means

② Collaborative Forest Management

During the Phase I period of the NRMP, it is planned to commence a pilot collaborative forest management project in 12 FRs. These projects will have the objective of improving general forest management and will provide the opportunity for practical experience through a new approach designed to promote effective collaboration projects between the new Forest Service and local villages. As such, these projects could be used for various programmes under the Plan to promote the participation of local people.

③ Establishment of Central Bushfire Detection System and Implementation of Green Firebreak Programme in Five FRs

This system and programme could be used for the establishment of the green firebelt zones and the implementation of bushfire control measures under the Plan.

(2) Biodiversity Conservation: Component 5

This component funded by the GEF involves the identification as well as documentation of priority areas to be excluded from future cutting in high forests, the implementation of village-based management to protect the identified areas and the provision of financial support for an alternative livelihood programme for affected villages in view of the global importance of biodiversity conservation. In addition, the monitoring and evaluation of biological and social indices related to the alternative livelihood programme will be conducted.

This component is related to the protection/conservation of wildlife in remaining natural forests under the Plan.

(3) Wildlife Resources Management: Component 3

This component envisages the re-organization of the Wildlife Department (WD) to improve its management ability and to promote the economic as well as social sustainability of the wildlife management programme. In addition, it aims at improving the ability of implementing collaborative projects with such partners as local villages, private companies and NGOs.

It is hoped that this component will be used to improve NTFP management under the Plan.

As the above analysis clearly indicates, the following needs are referred to by both the current policy (**VI**-4-1) and future projects.

① Implementation of silviculture projects involving the private sector

② Participation by local people in forest management and silviculture projects

③ Bushfire control measures

④ Environmental conservation

VI.5 Measures for Forest Restoration

VI.5.1 Basic Idea

The basic principles for the appropriate implementation of forest rehabilitation are described below, taking into consideration the causes of forest degradation, development needs of the forests in question, impediment factors to forest establishment in the Intensive Study Area and direction for future policies and project implementation, all of which are discussed in the earlier sections.

① From the viewpoint of land use, forest reserves are, in principle, sites where forests are permanently preserved. The forests in the forest reserves in question are designated timber production forests. As examined earlier, the forest reserves have already degraded because of the inadequate management of forest reserves despite the existing need for timber resources. Therefore, in order to meet timber demand and to promote natural forest conservation, the forest establishment in the tree-less lands like grass land and sustainable forest resource management of natural forests are urgently required (forest establishment measures).

② While forest establishment is necessary as described in above, local people need to obtain goods and materials from forest reserves to support their daily lives. As a result, the lives of local people (productive and reproductive activities) are a cause of forest degradation. In order to rectify this situation, it is necessary to employ participatory forest management as a means of forest establishment (participatory measures).

③ Bushfires are assumed to be the most direct and largest factor in regard to the forest degradation of forest reserves in question, making the introduction of bushfire prevention and control measures essential as a precondition for forest establishment (bushfire control measures).

④ Finally, as the preservation and enhancement of a good environment are necessary, environmental issues must be taken into proper consideration in forest establishment efforts. (environmental conservation measures).

Thus, based on above basic idea it is required in this forest management plan to design the four measures as shown in the Fig. VI-5-1. In other words, basic implementation plan is here prepared, focusing on these four measures.

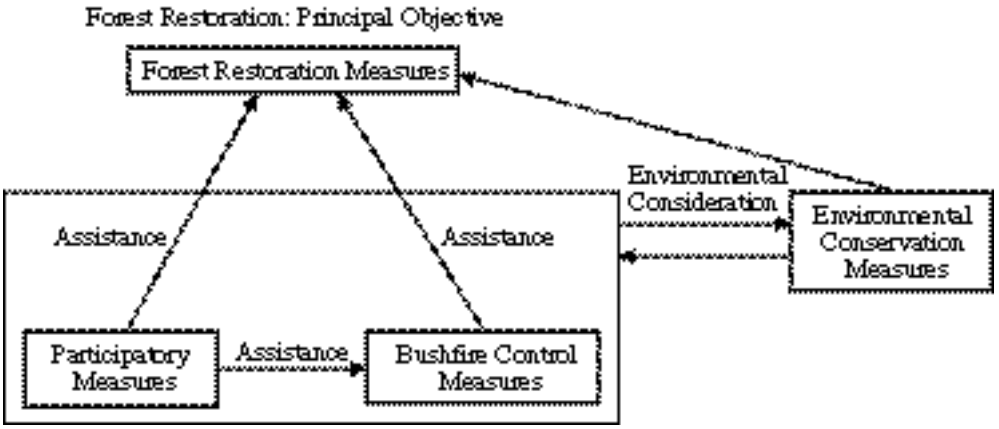

Fig. VI-5-1 Mutual Relationship Between Four Types of Measures[10]

[10] It is impossible to prevent forest fire and to establish forests without people's participation and cooperation, and bushfire control measures is indispensable for forest establishment. Moreover, in adopting these three measures, consideration to environment i.e. environmental conservation is necessary. With all the measures implemented comprehensively, restoration of forests and sustainable forest management, the ultimate goal, will be attained.

VI.5.2 The Measures for the Establishment of Forests

Improvement of the timber resources will be achieved by means of (i) the conversion of large areas of grassland liable to the spread of bushfire among degraded stands in the FRs to plantations and (ii) the efficient restoration and subsequent conservation of natural forests by means of supplementary planting at open sites.

(1) Establishment of Plantations

Forests will be actively established through the creation of newly planted plantations on grassland and other treeless land. As described earlier, while industrial[11] plantations assume that private sector investment will play a central role in plantation establishment in view of the government policy of attracting and encouraging private sector investment and a large project scale, etc., special attention should be paid to the participation of local people and the prevention of bushfires together with the creation of green firebreaks and communal woodlots.

① Industrial Plantations

- Purpose

Plantations (mixed with local species) will be established mainly at the large areas of grassland offering the prospect of high efficiency from the business point of view by the private sector (timber industry) to produce the trees for sawn timber, electric poles etc. while paying attention to the need for the participation of local people.

In this forest management plan, initial investment will cost highly since reforestation must be carried out urgently in the large tract of grassland. So, as it is necessary for the investment capital to be returned as soon as possible from the viewpoint of private companies, cutting period must not be extended more than final cutting age and consequently the size of cutting area shall be the same as planting size in the Plan.

However, in the case of first generation plantations, the planting species for which a stable supply of seedlings is available and for which there is an established world market, resulting in reliable income generation, is appropriate as the initial cost such as that of forest road is high.

[11] Industrial plantation is defined here as "Cultivation of forest resources through sustainable development and utilization of them, regardless of project implementation body". Namely, it aims at improving forest resources by reforestation and meeting demand for timber. And also an appropriate land use plan and a forest management plan can be implemented by continuous investment brought about by profit produced from the forest resource management, so that they could be sustainably utilized.

Taungya method is adopted within the activity range of farmers in the industrial plantation area.

- Incentives

Investment in silviculture usually means the fixing of capital for a long period of time. If the annual profit rate is lower than that of other industries, the provision of soft loans may well be required to facilitate investment in silviculture activities. However, there is no long-term, low interest loan programme designed to serve specific purposes, such as forest establishment, in Ghana at present.[12] The introduction of soft loans by the Plantation Development Fund (see VI.4.2-(1)-①-b) and/or other funding sources specialising in assisting plantation establishment will be necessary in the coming years with a view to encouraging private sector investment.

As land ownership inside FRs is believed to have been stable for a long period of time unlike off-FRs, the conditions for the involvement of private companies are advantageous.

Moreover, the provision of grant aid, etc. will also be required for the establishment of nurseries to ensure a stable supply of high quality, standardised seedlings in the required quantity for large-scale silviculture projects as a precondition for such projects. The availability of seedlings should constitute an incentive for the participation of private companies.

- Project Implementation System

While the private sector will play a central role in forest establishment, the work will also involve landowners (stools, etc.), nearby residents (including people's organizations), villages and other local public bodies (including local assemblies) and the Forestry Department. The types of contracts/agreements for profit-sharing and land allocation, etc. between interested parties will be major issues in the future and will also constitute the key to successful forest establishment. The adjustment between those parties must be done by establishing Forest Management Center referring to in the following chapter. The use of universities, NGOs and R & D institutions, etc. as intermediate bodies to organize/coordinate interest parties may be a good idea for smooth project implementation.

[12] Project Appraisal Document, p. 38 (World Bank: Report No. 17679)

② Establishment of Community Woodlots

Small areas of grassland which are scattered in natural forests indicating low profitability from a business point of view will be subject to planting by neighbouring communities for forest rehabilitation purposes, i.e. establishment of woodlots. The forest resources required by local people will be enhanced at these sites through the establishment of plantations (woodlots) with a view to facilitating the function of FRs of contributing to the maintenance and improvement of local life.

Local species which are appropriate vis-a-vis the needs of local people (fuelwood species and multi-purpose species but not fruit trees) will be planted at these woodlots which will also act as an ecological buffer zone (maximum area per site: 40 - 50 ha) for extensive industrial plantations.

③ Establishment of Green Firebelts

Another type of plantation (green firebelts) will be established on grassland along the FR boundaries (inside FRs) and block boundaries to prevent the spread of bushfires. These green firebelts will support crop production, which is a major need of local people, and will assist the function of FRs of contributing to an improved standard of living for local people through enhancement of the forest resources required by local people.

(2) Forest Conservation

While supplementary planting will be conducted at open sites in degraded natural forests, no cutting will be conducted in natural forests during the plan period (except for the cutting of trees damaged by bushfire, etc.) This supplementary planting will mainly be conducted by the Forestry Department. As supplementary planting will require rather complicated skills in regard to the selection of suitable species, soil scarification of the ground surface and planting (including large seedlings, entrusting of the work to private companies and local people from the beginning will be problematic. The training of local people for involvement in planting under the supervision of foresters is, therefore, desirable as this will constitute the creation of employment opportunities for local people. Meanwhile, natural forests will also be conserved through the appropriate management of NTFPs.

VI.5.3 The Measures for Promoting Participation of Local People

The establishment of various types of plantations is expected to support crop production, which is the main need of local people, and to enhance the forest resources required by local people so that

the perceived contribution of FRs to the maintenance and improvement of local life will stimulate forest rehabilitation.

For this purpose, it will be necessary to establish a Forest Management Planning Committee[13] to increase the practical feasibility of the forest management plan and to facilitate the comprehensive management of forest resources in the Intensive Study Area by the Forestry Department, private companies and local people. At the same time, the introduction of a collaborative forest management agreement[14] should be considered to ensure smooth project implementation.

The range of activities of local residents must be fully considered in promoting people's participation in the following measures for the establishment of forests.

① Participation of the Local People in the Development of Industrial Plantation

After planting, local villagers can continue cultivation of farm products by Taungya System for 4 years. Even after completion of the system, their participation in the development can be promoted in such forms as surveillance of the plantation by them for protection of tree, etc. Allotment of taungya land and Profit-sharing right for planted trees will be established.

② Participation of the Local Residents in the Development of Green Firebelts

Green firebelts will mainly be established by existing or newly created groups of local people. As incentives for participating local people, the ownership of crops as well as planted trees and the right to use the fruit of planted trees and planted trees to produce firewood, etc. will be guaranteed. Bearing in mind that the primary purpose of green firebreaks is the prevention of bushfires, any improvement of the incentives for local people must be conducted in line with this purpose as much as possible. The possible interested parties to the relevant contracts/agreements include local public bodies and the Forestry Department in addition to local people.

For the green firebelts, selected tree species with fire-resistant characters i.e. evergreen tree, etc should be planted, while they meet the needs for local community people (fruit tree may be available). Local people can practice agroforestry by intercropping or undercropping in the area.

[13] The participants of the forest management seminar (held in March, 1999) agreed to the establishment of such a committee.

[14] The Logging Manual makes it compulsory for concession holders and landowners (village stools, etc.) to conclude a social responsibility agreement (SRA) regarding the management of forests subject to cutting.

③ Participation of Local Residents in the Development of Community Woodlot

The establishment of community woodlots will mainly be conducted by village communities. While the possible interested parties may be the same as those for green firebelts, there may be less incentive for local people because of the prohibition of the cultivation of either crops or fruit trees. As the planned communal woodlots will be established in natural forests or plantations in the FRs, arrangements must be made to deal with their impacts on the surrounding area from the viewpoints of forest technology as well as forest management (boundary preservation and bushfire prevention, etc.)

For the development of community woodlot, the trees such as multipurpose tree, and tree for fuelwood/charcoal and fodder, etc. meeting the needs which are considered to be high in future or potential demand for the local residents should be planted. However, agroforestry practice should not be permitted in the forest.

This approach will make it possible to promote the participation of the people who are not interested in above agroforestry measures of (1) or (2).

④ Participation of Local Residents in Extraction of the NFTPs Leading to Conservation of Natural Forests

The following measures designed to facilitate the participation of local people in the collection and management of NTFPs will be introduced to prevent the degradation of natural forests, etc., to conserve wildlife and also to support the role of local people of conserving natural forests through the sustainable use of NTFPs in correspondence with the needs of local people.

The procedures for the extraction of the NFTPs in natural forests should be disseminated and simplified while promoting autonomous conservation of the products by the local villagers. This approach also improve people's concern in forest fire and resource management by promoting the participation of the people not interested in above (1) - (3) measures.

VI.5.4 Measures for Bushfire Control

Bushfire control shall be carried out by establishing cooperation system among local residents, private companies and the Forestry Department through setting up of information and monitoring system such as people’s participation in reforestation, building of watching towers and the like.

To be more precise, the following measures will be introduced.

(1) Establishment of Green Firebelt

In order to prevent fire intrusion spread into the forest reserves from outside and to seize the expansion of fires originated in the reserves, green firebelts will be established along boundaries for the forest reserves and block boundaries respectively (at the reserve boundaries with outside, the belt should be developed inside the reserve). In the green fire belts, planting of evergreen tree species as well as clearing of combustible deposited materials on the ground in dry season, should be practiced together with agroforestry.

(2) Establishment of Fire Control Infrastructures

Forest roads and their width (15 m for feeder roads and 10 m for spur roads) should effectively act as fire belts and watchtowers for fire surveillance should be built in the vicinity of the villages neighboring the forest reserves.

(3) Vitalization of village fire brigades and education/training for conscious-raising activities for the villagers to prevent bushfires and to improve the capabilities of existing communal fire control organization, should be implemented.

(4) Surveillance for Fire Control in the Industrial Plantation

The surveillance should be practised in the industrial plantation by participating local residents during and after the Taungya period based on the agreement among the companies, the village organization and the Forestry Department (as coordinator). The monitoring system, meaning the establishment of the cooperation among Forestry Department, Forest Management Planning Committee, Village Fire Squad etc., must be strengthened.

VI.5.5 Measures for Environmental Protection

While attempting to conserve natural forests which are important habitat for wildlife, the conservation of wildlife itself will also be attempted by means of reducing the collection/hunting of wildlife which results in a population decline. To be more precise, the following measures will be introduced.

(1) Conservation of Natural Forests

Logging in natural forests should be prohibited for the project period. Supplementary planting should be applied to the open stands (gaps).

(2) Development of Artificial Forest by Mixed Planting

In Establishing plantation for timber for industrial use, development of large scale of pure teak planting should be avoided by employing mix planting of local species.

(3) Implementation Measures for Bushfire Control

In respect to environmental viewpoint, as the study areas are neighboring to the areas in which bushfires frequently occurred, implementation of fire control in the study area would result in environmental protection.

(4) Consideration of Wildlife (flora and fauna)

According to the results of the environmental survey conducted in this study, habitats of rare flora and fauna are found in the study areas. Consideration of them inclusive of some protection measures should be done for them.

In the industrial plantation, the planting of diverse species to establish the next generation of plantations at cut-over sites of original plantations must be considered in order to avoid a decline of the productivity by the repeated planting of the same species and to make forests fulfill multiple functions, including the assurance of biological stability and timber production.

Sustainable forest management in subsequent years will be possible once the required capital investment has been made through the successful management of first generation plantations.