

MANUAL OF PROCEDURES

FOREST RESOURCE MANAGEMENT PLANNING IN THE HFZ

SECTION B - OPERATIONAL PLANNING

GHANA FOREST SERVICE

MARCH 1998

Manual of Procedures - Forest Resource Management Planning in the HFZ

Preface

The Manual of Procedures for Forest Resource Management Planning prescribes the important tasks to be carried out in order to adequately plan for forest resource management in the high forest zone in the interest of the nation and for the benefit of the resource owners.

The planning process can be divided into strategic and operational planning. Strategic planning sets objectives to guide forest resource management in the long term. Operational planning ensures that programmes of operations to achieve strategic objectives are adequately planned and sufficiently resourced. The new planning process will also provide for local consultation in resource management planning. The Manual is produced in two sections:

Section A - Strategic Planning: Prescribes the requirements for strategic planning at national, forest reserve and district levels. Instruction sheets describe the procedures to be undertaken by the Forest Service in ALL high forest zone districts in conjunction with the resource owners and District Assemblies and other interest groups.

Section B - Operational Planning: Prescribes the requirements for planning of forest operations for forest reserves and TUC operations off reserve by the Forest Service in ALL high forest zone districts in order to successfully implement strategic plans.

The Manual has been written to guide forest officers responsible for preparing and implementing forest resource plans but will also be of value to other interest groups outside of the Forest Service particularly the resource owners and District Assemblies.

Forest resource management planning is a core activity at the very heart of our new Forest Service, we expect that the services we provide in this regard will be of the highest standards as set down in this Manual. It is beholding on all officers to be very cognisant with the procedures laid down in this Manual: "ignorance of the law is no excuse for committing an offence."

Procedures documented in this Manual represent the best practice at the time of writing. It is important that individual Instruction Sheets are kept up to date and new Instruction Sheets added as our knowledge improves and techniques are refined.

This Manual replaces all previous guidelines on management plan preparation.

**MANUAL OF PROCEDURES
FOREST RESOURCE MANAGEMENT PLANNING IN THE HFZ
SECTION B - OPERATIONAL PLANNING**

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1. THE PLANNING PROCESS

Manual of Operations Section B - Operational Planning

B1. The Planning Process

Instruction Sheet No. B1.1 Introduction to the Planning Process

1. General

- 1.1 Forest resource management planning takes place in two stages; strategic and operational. Strategic planning sets objectives for forest resource management and prescriptions for achieving those objectives. The time frame for strategic planning is medium to long term. Section A of the MoP prescribes the requirements for strategic planning.
- 1.2 Operational planning follows on from strategic planning, it details the operations and resources required to implement the prescriptions. The time frame for operational planning is short to medium term. Section B of the MoP prescribes the requirements for planning of forest operations to ensure that the strategic resource management plans are successfully implemented.
- 1.3 The MoP is to be used primarily by regional and district staff of the Forest Service to:
 - (a) Operationalise forest reserve management plans.
 - (b) Operationalise any portions of district forestry development plans that the Forest Service has agreed to implement.
 - (c) Plan for administration of timber harvesting in TUC areas outside reserves
- 1.4 The new Forest Service is required to operate in a business like manner on behalf of its clients. The following principles are to be upheld during planning of all forest operations:

Accountability: the Forest Service will have to account to its clients for all retained revenues on reserve and service charges outside reserves. We must therefore be able to justify resources that we intend to use and account for them afterwards

Cost effectiveness: the manager must ensure that all operations are properly costed and that minimum resources needed to complete the operation to the required standard are used. This will include the effective use of contracts to undertake specific tasks, rather than maintaining unnecessarily large labour forces

Quality. The Forest Service has a duty to ensure that its planning and subsequent implementation and monitoring are carried out to the highest professional standards, not only to meet the demands of the land owners, but also to satisfy the international certification requirements for sustainable forest management.

2. Outline of Procedures

- 2.1 The District Forest Officer with assistance from the regional office, will be required to examine the (strategic level) forest reserve management plans for all reserves under his control and to itemise five year targets in terms of protection (length of fire lines to be constructed, fire breaks to be maintained etc.); production (areas to be surveyed and logged, areas to be planted, thinned, harvested etc.); infrastructure (road and track improvement, building and maintenance etc.) and community

development over the next five years. The output from this exercise will be an Operational Planning Annex to each forest reserve management plan.

2.2 The District Forestry Development Plan is a strategic planning document prepared by the District Planning Officer and members of the District Assembly Environmental Committee. Aspects of its preparation have been covered in Section A of this MoP series. It will tend to concentrate on off-reserve forestry activities, though not entirely so and it will be part of an overall district programme covering other sectors such as agriculture, water, mining and wildlife. The inference being that the structure of these particular plans is unlikely to be uniform around the country. However they should all provide a list of targets for a five year period.

2.3 Separate TUC (5 year) Operational Plans will have been produced for both on and off reserve by the contractors which are subject to a standard approval process by the DFO and the RFO as part of the TUC management system (refer MoP Sections C and F in this series)

2.4 Under the programme for commercial plantation development, separate plans may have been drawn up with private sector investors to plant convalescence areas unsuited to natural regeneration on reserve. Again the details of these projects will need to be summarised and those activities that have relevance to the Forest Service in terms of staff inputs need to be listed. Proposals for off-reserve plantation development will feature in the District Forest Development Plan.

2.5 Lastly, for those reserves under threat of fire, the DFO will be required to prepare a fire plan. For many reserves this will be adequately covered in the strategic plan, but there will be critical reserves where the level of interventions are such that a separate programme has to be embarked upon and in such circumstances a five year Fire Plan will have been prepared as a separate step. In such circumstances this plan will also need to be reviewed as part of the process of determining the priorities for the operational plan for the district.

2.6 Programmes for the development of NTFPs will normally be covered adequately within the Operational Planning Annex for on-reserve or within the District Forestry Development Plan for the expansion of marketing opportunities in the district as a whole. Similarly, the programme for floral and fauna biodiversity and watershed protection will be covered within the Forest Reserve Operational Planning Annex, which will summarise any work required to survey, demarcate or monitor the coarse grained protection areas. The identification of the fine-grained protection areas is an activity which is part of the stock survey process (refer MoP Section D).

2.7 The strategic plan may indicate that certain forest reserve operations, for instance boundary maintenance can be undertaken in collaboration with the local communities. Such intentions should have been indicated within the Operational Planning Annex. Separate guidelines are being produced which will further assist staff in operational planning for collaborative resource management.

2.8 The DFO needs to draw all these plans and proposals together and identify the inputs that the Forest Service will need to provide in order for the various programmes to be kept on target. This is done in the form of a three year rolling plan which itemises those activities that the district forestry staff and work force will need to provide time and physical resources to. Those forestry activities that are being carried out in the district for which the Forest Service does not need to devote specific staff time or labour, and hence funds, need not be included within the rolling plan. The first year of the plan will be completed in the most detail since this is the Annual Programme of Work and should have all labour, subsistence, operational costs and developmental costs itemised. The planning process is illustrated in Figures 1 and 2.

2.9 This MoP does not contain technical recommendations on forest operations. The relevant technical MoP must be consulted to help identify activities to be carried out.

Plantations

- MoP A MoP for Plantations Planning
- MoP B MoP for Nurseries
- MoP C MoP for Plantations Field Operations
- MoP D MoP for Plantation Thinning Operations

High Forest Management

- MoP A Strategic Planning
- MoP C Timber Production (On-reserve)
- MoP D MoP for Stock Survey and Yield Allocation
(also covers fine-grained protection)
- MoP E Harvesting Schedules
- MoP F Timber Production (Off-reserve)

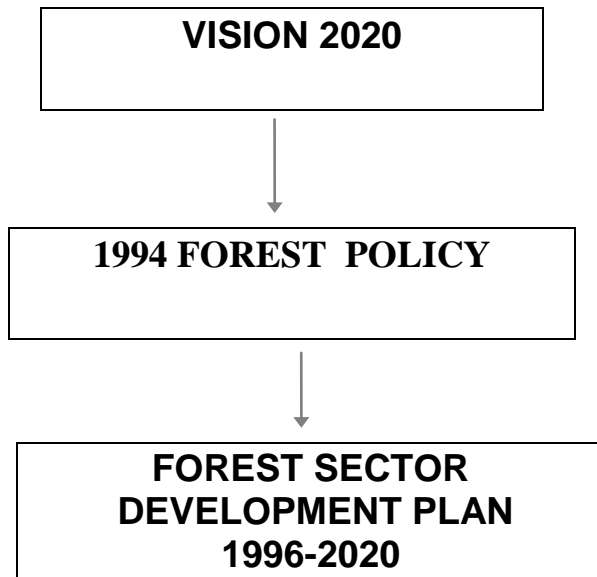
The Logging Manual

Guidelines

- Forest Protection in Ghana (Protection Strategy)
- Fire Control Guidelines,
- Guidelines for Plantation Development
- Collaborative Forest Management Guidelines

Figure 1 The Planning Process

National Planning



Strategic Planning

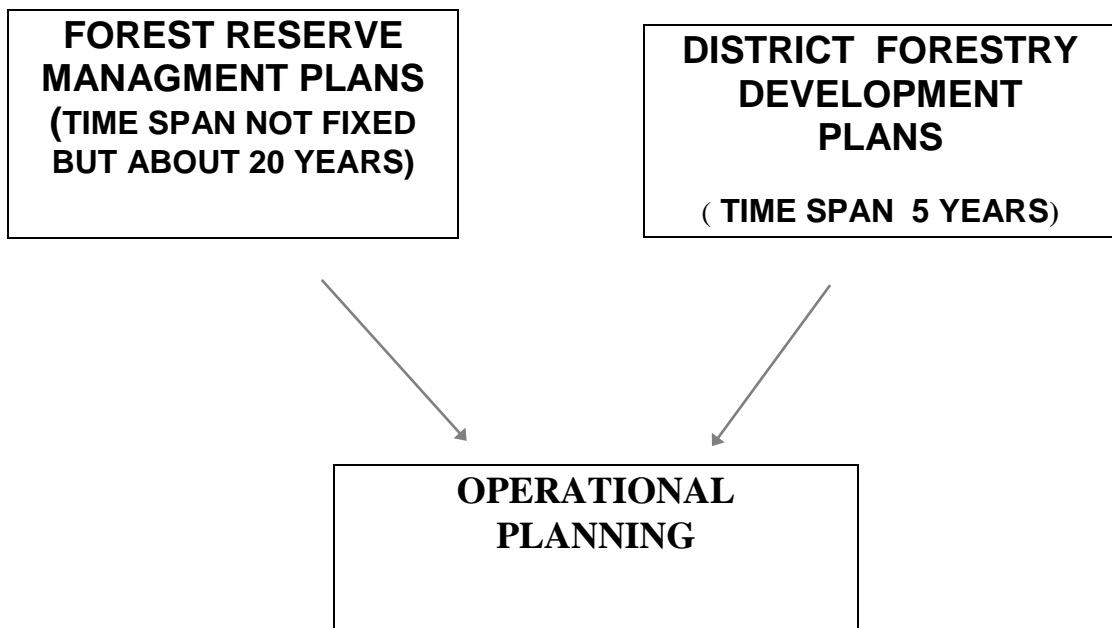
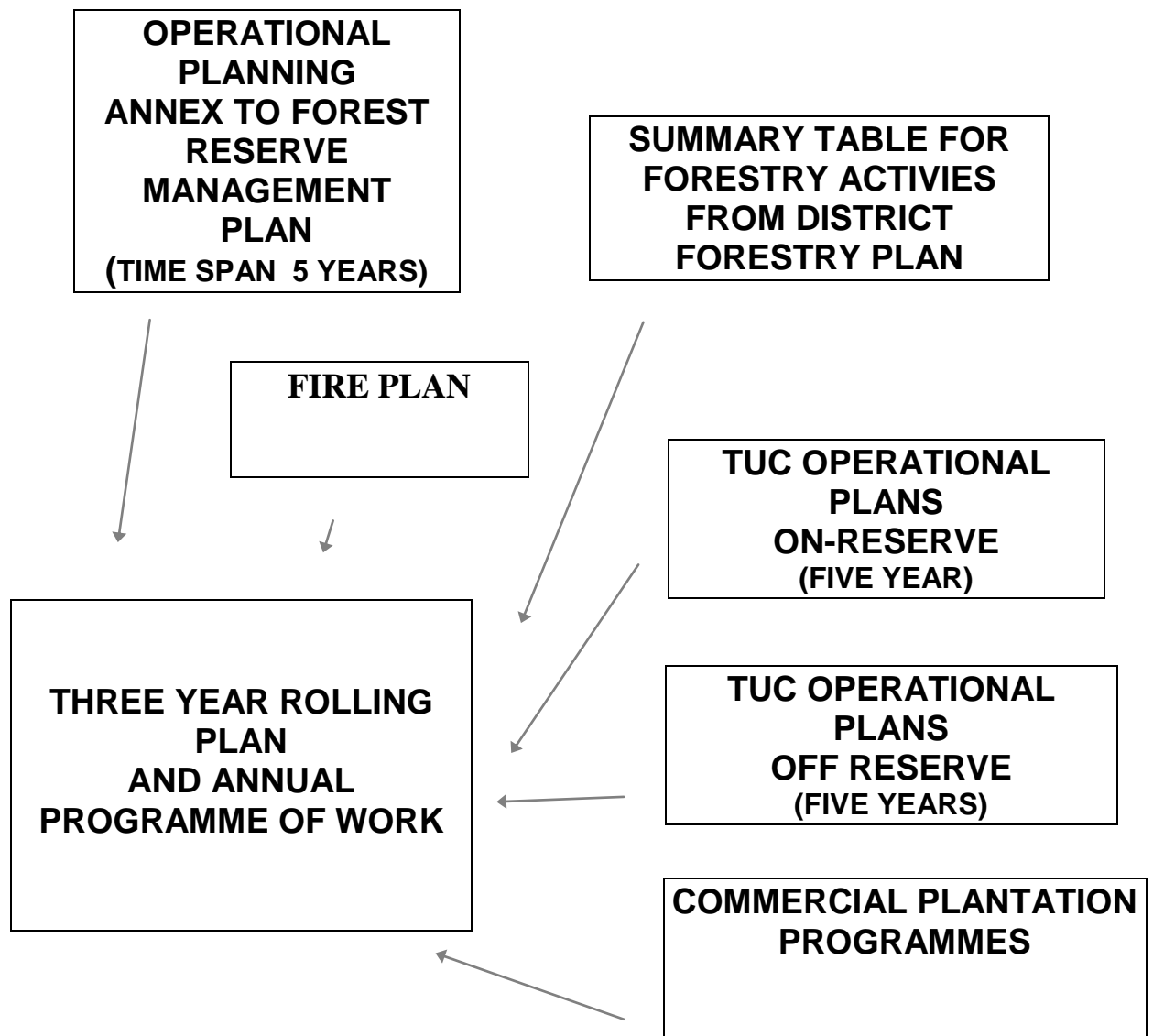


Figure 2 Operational Planning



2. METHODOLOGY

Manual of Operations Section B - Operational Planning

B2. Operational Planning Methodology

Instruction Sheet No. B2.1 The Operational Planning Annex

1. Introduction

1.1 This Instruction Sheet provides guidance on the processes required to identify those key activities to be carried out under the Strategic Forest Reserve Management Plan for the next five years.

1.2 For those reserves with no strategic plan fully prepared, it will still be possible to pull together a provisional programme of operations, to be supplemented by information from TUC Operational Plans, Plantation Programmes and a Fire Plan. Assuming the strategic plan is completed within the five years, it would then be necessary to revise the annex accordingly.

1.3 The Annex for the first five years should be completed as part of the preparation of the forest reserve management plan as a natural continuation of the planning process taking advantage of the additional support from the regional planning team that should be available at the time of the strategic planning process.

2. Forest Reserve Operational planning: an overview

2.1 Part II of each forest reserve management plan contains proposals for:

- * management zones for protection objectives
- * management zones for production objectives
- * management for beneficiary objectives

For each management zone the proposals will state:

- * measurable objective [performance standard]
- * management regime
- * management prescriptions
- * rights and responsibilities

For each management zone, a provisional programme of operations should be prepared by the DFO in order to carry out the prescriptions. All the programmes for the reserve are then reviewed by the DFO, prioritised and compiled together along with the appropriate maps to produce a five year operational plan.

2.2 The DFO prepares the provisional programme of operations covering the next 5 years for each management zone using the composite Form OP 1. A target for the end of the five years should be entered for each main activity, entering a zero for those activities regarded as not applicable to the reserve. At this stage operations are not broken down into detail, the emphasis being to get the broad picture. Where the DFO feels confident in entering targets for the intermediate years then this should be done. The last column of Form OP1 (remarks/implementor) can be used to indicate the type of labour to be used (local contract, direct community support -either voluntary or paid, Forest Service workers etc.)

2.4 Ideally, at the stage of preparing the 3 year rolling plan, the district staff will be in possession of not only a current strategic plan for the reserve, but TUC Operational Plans, Commercial Forest Plantation Agreements and an overall Fire Plan for the reserve. That ideal situation may not be in place for some years and the DFO may be faced with putting together a 3 Year Rolling Plan with little supportive documentation. In such circumstances, a best attempt has to be made with the preparation of all these plans put as a top priority for years 1 and 2 and an acceptance that the 3 Year Rolling plan will be heavily modified as additional information becomes available.

3. Structure of the Operation Planning Annex

3.1 The annex is brief and covers the following sections:-

1. Overview of Programmes for Years to

Biodiversity Protection.

Summary of any expansion of areas to be protected in the period by sub zones and any key activities with respect to demarcation or improvement of protection.

Fire Protection

*Main aspects of the fire plan
Area of high fire risk. Existing fire protection measures
Establishment/expansion proposed during period
Patrolling proposed*

Timber Production

*Status of existing TUCs. Proposals for new TUCs
Expected volume production over period*

Plantation Development

*Existing resources to be maintained
Expansion by Forest Service/Taungya under period
Plans for commercial forestry development*

Convalescence Areas

*Changes expected from status quo over the period
Enrichment Planting proposed*

NTFP Production

Any particular developmental proposals

Community Development Aspects

Formation of user groups, community assistance in protection

Infrastructure Developments

*Road /bridge construction by community, forest service or contractor
Buildings proposed*

2. Summary of Main Activities and Targets

Table OP 1 Refer example

3. Indicative Revenue Generation

Summary of Expected Income for years 1-5

Category	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Target 5 years
Timber						
Plantation thinning						
Plantation final fell						
NTFP						
Others						
Total						

4. Comments:

- i. Previous Planning Period - Successes/failures, lessons drawn
- ii Assumptions (does programme require a major increase in investment and operating costs)

Prepared by: Date:
DFO

Approved by: Date:
RFO

..... Date
(for District Assembly)

5. Reporting

- 5.1 The District Forest Officer will be required to report to the RFO and to the clients (i.e. the land owners and District Assembly representatives) on progress being made against the five year operational plan.
- 5.2 The structure of the Annual Report for the forest reserves is discussed in the section on reporting in the MoP Section C, Timber Harvesting on Reserves (refer Instruction Sheet No.C5.1)

**Table OP 1 Forest Reserve Operational Planning
Summary of Main Activities and Targets**

Forest Reserve

Planning Period

Operations	Units	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	5 yr Target	Implementor / Remarks
<u>1 Boundaries</u>								
Boundary maintenance	km							
Re-survey	km							
Pillaring of external boundaries	no.							
Pillaring of internal compartments	no.							
Others								
<u>2 Fire Protection</u>								
Establishment of new fire lines	km							
Maintenance of existing fire lines	km							
Fire-break establishment	km							
Existing fire-break maintenance	km							
Early burning	ha/km*							
Intensive fire patrolling (for fire sensitive areas)	ha/km*							
Demarcation of Fire Protection Block	ha							
Fire tower construction	no.							
Others:								
* delete as appropriate								

Operations	Units	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	5 yr Target	Implementor / Remarks
<u>3. Biodiversity and Site Protection</u> Demarcation of Provenance Protection Areas Demarcation of SBPAs Demarcation of FPAs Other:	 ha/km* ha/km* ha/km*							
<u>4. Timber Production Areas</u> Identification and award of TUC Stock Surveys Monitoring and Supervision of logging Logging Programme (under TUC) Others	 ha ha ha ha							
<u>5. Plantation Production</u> (i) <u>Forest Service Plantations</u> Demarcation of compts Maintenance of existing plantations Thinnings Final Felling New Taungya (not fire-breaks) Enrichment planting	 km ha ha ha ha ha							

Operations	Units	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	5 yr Target	Implementor / Remarks
(ii) Commercial Plantation Site selection demarcation consultation process/feasibility studies Establishment Thinnings Final Felling	ha ha no. ha ha ha							
<u>6. NTFP development</u> Demarcation of NTFP collection areas Surveys of extent and condition of collection areas Regeneration and active management	ha ha ha							
<u>7. Infrastructure</u> Road/track construction (non TUC) Road/track construction (under TUC) Forest Service Buildings - new Others:	km km m2							

Completed by

Designation

Date:

Approved by

Designation

Date:

Manual of Operations Section B - Operational Planning

B2. Operational Planning Methodology Instruction Sheet No. B2.2 Summarising TUC Activities

1. Introduction

1.1 The programme of work to be undertaken as part of the development of the TUCs will be clearly defined in the 5 year Operational Plans produced for the on and off reserve areas. This Instruction Sheet describes the procedures needed to initially summarise those activities that will be required to be undertaken by the Forest Service as part of its responsibilities.

2. Responsibilities of the Forest Service for the TUCs

On-Reserve

Table 2.2.1 Responsibilities of the Forest Service for on-reserve TUCs

Activity	Officers involved	Remarks
1. Preparation Of Management Plans For Each Forest Reserve.	Planning Branch DFO, RFO Community representatives	Basic outline prepared by FMSC with assistance from DFO. Local workshop to fix details and amendments with communities
2. Identification Of TUC Area With Fixing Of Clear Boundaries.	FMSC, DFO and RFO	Critical where TUC area borders protected areas
3. Definition Of Compartments And Scheduling Of Felling	as above	Refer MoP Section E
4. Preparation Of Timber Operation Specifications To Include Preparation Of Social Responsibility Agreements Following Consultation Process.	DFO with support from Regional staff	
5. Award Of Contract agreement of initial TUC Area Plan	Timber Rights Evaluation Committee	TUC Area Plan prepared by contractor as part of evaluation process
6. Pre-Felling Inspection With Contractor	DFO	Refer MoP Section D
7. Stock Survey And Yield Allocation including regular 10% check surveys	DFO/RFO/FMSC	Refer MoP Section D Random check by FMSC
7. Random check surveys	FMSC	New proposal, arising from concern of present standards
8. Approval Of TUC Five year Plans and Compartment Logging Plan and TUC Area Plan (revised)	DFO, RFO	Approval should be made at regional level, but advice of FMSC (and HQ) can be sought.
9. Issue Of Tree Information Forms, checking of Log Information Forms and issue of Log Conveyance Certificates.	DFO	Responsibility for completing the LIFs rest with the contractor
10. Overall Supervision And Monitoring and issue of compartment closure certificates	DFO	RFO to monitor field returns and follow up with field inspections.

2.1 The responsibilities of the Forest Service with respect to on-reserve TUCs are listed in tabular form (Table 2.2.1).

2.2 For those reserve, where the TUCs are still to be identified, the DFO will need to allocate time for checking the state of the forest and for completing discussions with the communities for the preparation of the Timber Operational Specifications (TOS) and the Social Responsibility Agreements (SRA).

2.3 For those reserves where the TUC has been awarded and hence the Timber Operational Plan has been prepared, then the district staff will need to allocate time and physical resources for the stock surveys and the pre-felling inspections that are required (refer MoP D for a technical description of the processes involved).

2.4 At this stage, it is only necessary to list the numbers of those compartments involved for each year, using a simple table similar to the example given below (Table 2.2.2)

Table 2.2.2 Summary of TUC Status and tasks needed for TUCs

Activity	Compartment No.		
	Yr 1	Yr2	Yr3

Activity	Compartment No.		
	Yr 1	Yr2	Yr3
Compts already being logged			
Compts where closure certificate needed			
Compartments for initial selection			
Pre-survey inspection			
Compartment demarcation			
Yield survey, approval of logging plan			
Logging			
Identification of new TUCs			
Preparation of TOS/SRAs			

2.5 Listing the operations that will be required for each TUC provides the DFO with an initial idea of how he will need to organise his time for this activity. The same process should be repeated for off-reserve TUCs.

Off -Reserve

2.6 The responsibilities by the Forest Service for the off-reserve are similar to those already described, except that a yield survey would not be part of normal practice. On the other hand, the preparation of the TOS and SRAs will need to be carried out in greater detail with a more time allocated to consultation.

Table 2.2.3 Summary of the responsibilities of the Forest Service off-reserve

Activity	Officer involved	Remarks
Check of availability of	Contracts Unit. HQ	1:250,000 scale maps of

unallocated land		unencumbered land made available
Identification of possible TUCs	DFO/RFO	
Consult with District Assemblies	DFO	
Derivation of TOS/SRAs	DFO	Support from regional team
Advertisement	Contracts Unit	Preparation of contract information requires assistance of DFO and regional staff.
Award of contract for TUC	Timber Rights Evaluation Committee	
Evaluation of TUC Coupe Plan and annual plans	DFO/RFO	
Pre-felling inspection and approval	DFO	Pre-felling inspection to include community representatives.
Issue of tree inspection forms and log conveyance forms and checking of log inspection forms	DFO	
Overall supervision and monitoring	DFO	Community encouraged to monitor operations and communicate with district staff when problems arise

2.7 As for the situation on-reserves, the DFO will need to summarise the extent of the major tasks that he will be involved in over the course of the next three years, constructing a table similar to that below (Table 2.2.4).

Table 2.2.4 Summary of operating status and tasks needed for off-reserve TUCs

Activity	Total Area Involved (ha)		
	Yr 1	Yr2	Yr3
Approved and operational annual coupes			
Final Inspection of completed annual coupes, check on TOS/SRAs			
Approval of new annual coupes			
Pre-survey inspection			
Approval, compensation agreed.			
Approval of logging plan			
Logging, TIF/LIFs to be issued			
Approval of new five year coupes			
Preparation of TOS/SRAs			
Identification of new TUC areas.			

Manual of Operations Section B - Operational Planning

B2. Operational Planning Methodology Instruction Sheet No. B2.3 Summarising Plantation Programmes

1. Introduction

1.1 This Instruction Sheet has been written to assist district staff to initially prepare summaries of their work commitments for the coming three years for the development and maintenance of the on-reserve plantations.

1.2 As part of the move towards promoting investment in plantation development by the private sector, plantation development programmes will be initiated for those reserves where there is adequate convalescence forest land to attract long-term investment.

1.3 For those reserves where plantation operations are restricted to the care and maintenance of existing former FD plantations plus small scale taungya development, then the summary sheet Form OP 1 will provide a satisfactory working base for planning the work programme by the Forest Service. However, where the state of the plantation programme within the reserve is such that commercial agreements have already been put into place, then the DFO will obviously need to refer to these agreements, in order to adequately summarise his responsibilities in terms of the district work programme.

1.4 The MoP for Plantations, Section C- Field Operations should be referred to for guidance on both implementing and planning plantation operations. In particular, staff should be aware of the use of Form P33 for summarising labour requirements when preparing the Annual Programme of Works.

2. Responsibilities of the Forest Service for Plantation Activities

2.1 The responsibilities of the Forest Service can be summarised as those below:-

(i) Commercial Programmes

- initial zoning of the reserve and identification of sites
- advertising for investors where necessary
- selection of companies for plantation establishment and maintenance
- overseeing the preparation of the land contract agreements with the land owners
- approving the plantation programmes
- provision of general technical advice as required
- ensuring correct selection of planting stock
- monitoring of general silvicultural standards and fire controls
- collection of any fees agreed and subsequent payment to the landowners
- maintenance of key records and maps

(ii) Maintenance of former FD plantations

- provision of general protection and monitoring

- employment of contract labour for weeding and maintenance of fire breaks
- over-seeing the operation of thinning and felling contracts
- undertake replanting and modest expansion where appropriate
- maintenance of plantation records and maps

2.2 In the case of the commercial plantations, the responsibilities of the district staff are therefore restricted to the identification of the areas suitable for planting, assisting in the preparation of contracts and providing a general monitoring function. Where such a programme is in place or expected to be within the next three years then time will need to be allocated to these tasks, using a summary table similar to that presented in Table 2.3.1 below:-

Table 2.3.1 Summary Table of Tasks related to Commercial Forestry at the District/Regional Level

Activity	Units	Yr 1	Yr 2	Yr 3
Initial screening of sites within the convalescence zone				
Demarcation as required				
Preparation of location maps				
Discussions with land owners on proposals				
Preparation of draft agreements and information package				
Review plantation programme by successful company				
General monitoring of operations				
Collection of fees and maintenance of records				

2.3 The tasks listed above therefore will involve only senior district staff.

2.4 For those reserves where the Forest Service has an appreciable plantation resource to be managed then it will be necessary to examine in more details the operations that will need to be carried out over the next three years. The summary table presented as Form OP 1 not being adequate for this purpose.

2.5 It will be the intention to use contract labour for all production thinning and final felling. The form of contract to be used is specified in MoP Plantations Section C (Form P37). For non-production activities and general maintenance, the DFO will employ labour on a task basis. As for the commercial plantations, the DFO will need to summarise the expected main tasks to be undertaken over the course of the next 3 years (Table 2.3.2)

Table 2.3.2 Summary Table of Tasks related to Plantation Management at the District/Regional Level

Activity	Units	Yr 1	Yr 2	Yr 3
----------	-------	------	------	------

Survey and re-survey of compartments	ha			
Boundary cleaning	km			
Fire break construction	km			
Fire break maintenance	km			
Nursery Establishment	'000.			
Stock production	'000			
Planting	ha			
Beating up	ha			
Weeding 1 year	ha			
Weeding Yr 2	ha			
Weeding Yr 3	ha			
Pre-commercial thinning	ha			
First commercial thinning	ha			
Second thinning	ha			
Third thinning	ha			
Brashing	ha			
Pruning	ha			
Coppicing	ha			
Final felling	ha			

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B2. Operational Planning Methodology Instruction Sheet No. B2.4 Fire Protection Operations

1. Introduction to the Planning of Fire Control Measures

1.1 In the northern sections of the HFZ, fire is the most serious threat to the continued existence of the forest reserves. Since the drought of 1983, large sections of the reserves in the transitional zone have been reduced to open grassland and scrub.

1.2 Forest managers are able to minimise the level of damage that will occur in those reserves under their charge, by directing the resources they have in terms of manpower and equipment, to those areas defined as critical; and by taking practical steps to control the spread of fire through the establishment of fire breaks complemented by early burning.

1.3 Education through public awareness campaigns are also an essential step in the fight against forest fire. First of all, making it clear to forest-using communities of the need for their support in the avoidance of burning at critical times of the year and to request their assistance in the maintenance of reserve boundaries and fire breaks. Formal training of volunteers and fire crews into practical methods of fire control will also pay dividends.

2. Identification of High Risk Areas

2.1 As part of the strategic planning process, it will be possible to assign indicative value scores to the management zones (refer Instruction Sheet A 2.3).

Table 2.4.1 Indicative Value Scores for Fire Protection

Score	Fire Protection Area
1	Areas demarcated for conversion
2	Young plantations and convalescence areas
3	Timber Production Areas, mature plantations
4	Important conservation areas -SPBAs, FPAs
5	Locations close to settlement

This basic zoning can then be linked to an assessment of the fire risk derived from a consideration of the following factors:-

1. **Canopy Closure** - the Forest Condition Index supplemented by observations on grass growth and achempong cover.
2. **Fuel type** - incidence of grass cover, dead and dying tress, presence or absence of recent fires to modify levels of fuel.
3. **Weather** - current rainfall pattern, average wind strength, maximum temperature
4. **Topography** - slope, aspect and elevation will modify the fire risk
5. **Infrastructure** - on the basis of planning blocks of 5 compartments it is possible to score each block for the average crew strength/km², accessibility from the main station, average access time

to a water source and the expected detection time based on the frequency of patrols or coverage by a lookout tower.

2.2 Further guidelines on the process of deriving fire risk values will be produced by FMSC as a separate technical manual - following the completion of current pilot investigations on the most suitable methodology.

2.3 Knowledge of the comparative “value” of areas to be protected coupled with an assessment of their risk to future fire damage will provide the manager for the basis of working out an operational fire plan.

3. Preventive Measures

Green Fire Breaks

3.1 Use has been made of both green (living) fire breaks and cultivated, cleared strips to provide a barrier to the spread of fire. Green fire breaks have certain advantages in that they are cheap to establish and maintain since the approach is normally using local communities to plant the fire breaks under taungya. After establishment, the fire break tends to be self maintaining, except for the possible need for a light early burn of accumulated leaf litter.

Selection of species

3.2 Various tree species have been selected as candidates for green firebreaks. Selection is based on merit of their relative fire tolerance, ability to re-sprout following fire injury, fast growth rate, evergreen foliage, wide crown canopy and low leaf litter production. Below is a list of recommended green firebreak species.

Alsonia boonei [NYAMEDUA]
Albizia adianthifolia [PAMPENA]
Albizia ferruginea [AWIEMFOSAMINA]
Albizia lebbeck [LEBBECK] *Exotic*
Azadirachta indica [NEEM] *Exotic*
Blighia sapida [AKYE]
Cassia siamea [CASSIA] *Exotic*
Cordia millenii/platythyrsa [TWENEBOA]
Dialium guineense [ASENAA]
Erythrophleum saueolens [syn. E. guineense, ODOM]
Ficus spp [AMANGEYEDUA]
Funtumia elastica [FRUNTUM]
Khaya senegalensis [ESRESO MAHOGANY]
Millettia thonningii [MILLETTIA]
Morus mesozygia [WONTON]

Planning Issues

3.3 The local communities will need to be approached to see if they would like to take part in such a programme. At such a meeting it will be necessary to raise the following points:

- The location of a the community nursery to produce enough seedlings to serve their needs. Seedlings raised should include not less than five different species from the recommended green firebreak species. Tree seedlings could be provided to the Forest Service on a contract basis.
- It should be borne in mind that controlled farming in Forest Reserves is not of primary consideration; the tree crop should always have priority over the food crop. Farmers are not allowed to clear more land than is allocated by the Forestry Department. They should be ready to leave the plot by the third/fourth year.

- Farmers shall be entitled to all harvest from their plots for as long as they stay on their farms.
- A management committee shall be formed from among the participants. This would act on behalf of the group by signing an undertaking to abide by all rules and regulations governing the green firebreaks establishment.

Establishment

3.4 For green fire breaks established under the taungya system, the community would undertake clearing of the area. If clearing of an area is done on an individual basis, the area will be divided into plots after demarcation, if done on a communal basis, as should normally be the case, the division into plots will be done after clearing. Clearing must be done thoroughly while leaving all existing trees and poles standing. Burning of slash should be done under the supervision of either members of a village fire volunteer squad, personnel from the Ghana National Fire service or the Forest Service.

3.5 Pegging of the area will be done by the Technical Officer and assisted by the forest guard and representatives from the community. Wooden pegs of not less than two meters long will be provided by the farmers. Spacing of the pegs will be according to the planting design. No planting or sowing of food crops will be permitted until pegging is completed. No permanent food crops are also allowed to be planted on the plots. Cassava may only be allowed under special conditions.

3.6 Current recommendations are for fire breaks of minimum width of 15 m and a maximum width of 40 m. In earlier trials individual plots of 40 x 100 m have proved to be of the right order. Planting distances of 4 x 4 metre have been acceptable, but some modification depending on the habit of the particular species and the expected survival is to be expected.

3.7 All participating communities must establish community nurseries to cater for their needs. The Technical Officer in-charge of the range shall assist the community to choose a suitable site and provide technical support. The farmers collect seeds of the selected plant species, supplemented by quality seed from the Forest Service. An extra 30% of the required planting stock should be made available for beating up.

3.7 Standard nursery equipment and tools would normally be donated or lent to the community by Forestry Service to help in their nursery work. This equipment should be in the custody of the executives of the management committee.

Tending

3.8 Plots will be weeded two to three times every year as required. The farmer must ensure that all dead seedlings are replaced as he weeds. He must also ensure that there is only one seedling per planting hole. After the tree is well established at a height of 5-6 m, it may be beneficial to pollard the stem at a height of around 1.5-2.0 m in order to encourage the development of lateral branches and a wider crown. This will be achieved by cross cutting using a bow saw, not an axe. The cut should be clean without tearing bark from the wood. A useful product from pollarding is fuelwood, leaf mulch and sometimes fodder from some species.

Cleared Fire Breaks

3.9 Standard bare-ground firebreaks and fire traces represent the simplest form of fire control. Where topography allows, the use of farm tractors and disc harrows enable the forest manager to establish and maintain long stretches of fire breaks. In most reserves, however, recourse has to be made to hand preparation and maintenance.. The width of such breaks should be a minimum of 5 m

3.10 Fire tracing is the use of fire to burn off all flammable fuel within a strip of land to mineral soil below along the external boundary; in order to serve as a buffer. The strip should be wide enough to prevent creeping fires from encroaching forest reserves. Fire traces are most effective around

degraded forests especially in the savannah and grassland vegetation zones where crown fires are uncommon. With the exact timing and under strict supervision, fire traces are very effective especially in controlling grassland fires. The recommended width for a fire trace is 10m. This width could, however, be increased especially along slopes, badly degraded forest colonised by elephant grass, acheamong, (*chromolaena odorata*) or where there is considerable fuel load in the surrounding forest that will increase the chances of flying embers in the event of a wildfire. Fires driven by fast moving winds can easily cross such firebreaks so this system may be used only as a temporary measure until green firebreaks are established. For areas earmarked for conversion, green firebreaks establishment will go hand in hand with any reforestation effort or plantation establishment.

3.11 The District Forestry Officer or his representative demarcates of fire prone areas along forest reserves that need fire tracing. A band of forest of width 10m is demarcated along the external boundary of the reserve. This should be done just before the onset of the fire season. All flammable material is gathered within this area to ensure a total burn out. Fire traces have to be placed where topography will not affect their potential for stopping fire. A rule of thumb to remember for fire tracing across slopes is that the steeper the slope, the wider the fire traces needs to be. The larger fallen logs, which lie across fire traces or which are in the path of construction, will have to be removed. Appropriate time to carry out the burn should be early mornings or late evenings of a sunny day when fuel moisture content is very minimal to ensure a complete burn out. It is also important to avoid constructing fire traces on windy or turbulent days.

Early Burning

3.12 This is a method of fuel management where an area is burnt under controlled conditions in order to reduce the fuel available for late burns when conditions are more favourable for wildfires and the fire intensity is that much worse. Early burning should be carried out between September and November when there is still an appreciable fuel moisture to allow for a complete burn yet not too dry to risk the fire escalating into protected areas. This will also reduce the fire intensity so that the impact on juveniles and soil microbes will be minimal. This is very feasible in the savannah vegetation zones and grassland areas within the savannah-forest transition zones. Since this operation could cover very extensive areas, a one week warning and education should be given to people for them to harvest or remove all their property from surrounding farms which are likely to be affected by the burn.

3.13 To effectively use fire as a fuel management tool, the right type of equipment and personnel must be employed to be able to achieve the specific objective. Personnel from the Forest Service with training in fire management are required to supervise all early burning activities. At the community level, personnel from Ghana National Fire Service, Village Fire Volunteer Squad or the Ministry of Food and Agriculture with the requisite training can supervise early burning in other protected areas off-reserves. The following basic equipment is required to effectively carry out early burning at any level: Protective clothing, shovels, mattocks, cutlasses, drip torch and hand pumps.

Fire Patrols

3.14 During the critical months, regular fire patrols need to be maintained. Depending on the terrain, one patrol guard or volunteer should be able to keep control of 1 - 4 km. This task is one which should be more and more undertaken by village fire workers operating on a volunteer or partly paid basis.

3.15 Basic training in fire suppression and local fire organisation will be a standard requirement for all Forest Service field staff and the DFO and his technical staff will need to develop an integrated network of volunteer fire watchers to supplement their FS staff.

4. Operational Planning for Fire Control

4.1 In order to plan for the use of labour and resources for fire control, the manager needs to be aware of the timing of the main operations. Table 2.4.2 below provides an indication.

Table 2.4.2 Calendar of Fire Control Activities

Task	J	F	M	A	M	J	J	A	S	O	N	D
1. Early burning									█	█		
2. Fire Tracing												
Identification of areas									█	█		
Clearing traces											█	█
Conducting the burn	█	█										
3. Green fire breaks												
Nursery Establishment				█	█	█						
Demarcation of plots				█	█	█						
Clearing of plots				█	█	█						
Pegging					█	█						
Planting					█	█						
Weeding						█	█	█				
Pollarding					█							
4. Fire breaks												
Identification						█	█					
Line Clearing								█	█	█	█	
5. Patrolling	█	█	█	█	█							

Manual of Operations Section B - Operational Planning

B2. Operational Planning Methodology Instruction Sheet No. B2.5 Preparation of the 3 Year Rolling Plan

1. Introduction to the Three Year Rolling Plan

1.1 The forest reserve management plans, the TUC Operational Plans and any other forestry activities specified in the District Forestry Development Plan will need to be distilled into a costed action plan for the more immediate future. It is recommended that district and regional staff now adopt a three year planning period as standard procedure (though should all of the above plans conveniently start and end in the same year, five years hence, the DFO might wish to extend his rolling plan for the full five year period). But for the coming three years at least, the main operational tasks to be undertaken are listed and prioritised.

1.2 For the first 12 months the programme must be set out in detail and this becomes the Annual Programme of Works (APW). The three year rolling plan therefore provides a detailed 12 month programme with a more flexible programme for the remaining two years. Toward the end of the current operational year, the plan is extended by a further year and the detailed programme for the next APW is worked out taking into account the actual achievements to date and the level of resources that are expected to be available. The APW should be designed to be as realistic as possible, not too optimistic in terms of the budget required but it should ensure that, as much as possible, all the high priority tasks are included.

1.3 The basis of good operational planning is the use of work-breakdown structures - essentially breaking down tasks into a series of activities or work elements which can be closely defined in terms of the inputs required and the responsibilities of particular individuals in carrying out these activities. The degree to which tasks can be broken down into work elements will vary, with minimal breakdown being possible or relevant for those tasks that have been identified to be undertaken in Year 3. For those tasks to be undertaken in the coming year i.e. within the framework of the APW, then a complete listing of all work elements is required to enable full costings to be prepared.

1.4 The three year plan will be composed of a series of separate components:-

1. For years 1, 2 and 3 a list of tasks , priority rating and indicative time frame
2. Outline costs for years 2 and 3

1.5 The Annual Plan of Works covering year 1 only will further have:-

1. List of tasks, broken down into activities or work elements, plus a time frame for each activity
2. Gantt chart for Task./activities plus responsibility chart
3. Detailed breakdown of labour and material inputs.- costs for year 1

2. Process of Preparing the 3 year Rolling Plan

2.1 In order to prepare the district three year rolling plan, the DFO will need to assemble the following material :-

- (i). The five year operational annex from each of the forest reserve plans supported if necessary by a separate fire plan
- (ii). All current TUC 5 year Operational Plans for on-reserve TUCs
- (iii). All current TUC 5 year Operational Plans for all off-reserve TUCs.
- (iv). Commercial Forestry Programmes
- (v). The current District Forestry Development Plan

2.2 From these plans, the DFO will be able to extract those main activities that need to be carried out within each of the next three years, using the summary tables indicated in Instruction Sheets B2.1 B2.2, B2.3, B2.4 in the case of (i)-(iv) listed above. For the District Forestry Development Plan, the DFO should carefully identify all activities not already covered under the programmes for the TUCs or the forest reserves and give a rough breakdown of the inputs required. Such activities are likely to include extension activities, participation in soil amelioration projects, community forestry projects, commercial plantation programmes and support to cross-sectoral activities.

2.3 Form OP 2, should be used to arrange the work programme. This provides a framework of all the principal tasks needed to be completed over the next three years. Form OP 3 is used to provide indicative budgets for years 2 and 3 of the rolling plan. Finally, the costed work programme for the first year (the APW) is worked out making use of Form OP 4

Completion of Form OP 2

2.4 The main components of the form are indicated below, but you are referred to the worked example at the end of this section for assistance.

Table 2.5.1 Form OP 2 - Three Year Work Programme

Task	Units	Yr 1 Quantity	Yr 1 Priority	Yr 1 Target	Yr 2 Quantity	Yr 2 Priority	Yr 3 Quantity	Yr 3 Priority

2.5 The example provided indicates the type of tasks and activities to be entered. An attempt should also be made to put a priority to these tasks and set a target completion date for those activities in year 1. For many tasks, there will be a seasonality which needs to be respected, fire lines need to be clean before end of the year and the on-set of the dry season; planting stock needs to be ready for the field at the start of the rains and so forth. The priority system used is not important, it is simply to provide a degree of rationale if resources do not allow all tasks to be completed by the target date; but a suggested system would be:-

- 1 High Priority task, this task must be carried out within the year and, if possible, within one month of the target date.
- 2. Medium Priority task. Should be completed within the year and, if possible within 3 months of the target date.
- 3. Low priority task. Should be completed within the year, with slippage minimised.
- 4 Task could be allowed to run-over to the following year if necessary.

Completion of Form OP 3

2.6 The next stage is to attach some more detail in terms of costs to the activities to be undertaken in years 2 and 3. The work under year 1, will be linked to the APW and is separately considered.

Table 2.5.2 Form OP 3 Year 2 and Year 3 Outline Costs

Tasks	Yr 2 labour input (md)	Yr 2 Cost '000 cedis	Yr 3 labour input (md)	Yr 3 Cost '000 cedis

2.7 Calculation of the costs of the labour require the use of standard work outputs modified by local knowledge of specific conditions (refer Table 2.7). RFOs should compile their own standards based on the averages of actual achievements over the past 10 years. Staff should made use of Form P33 in MoP for Plantations Section C for summarising labour inputs.

Table 2.5.3 Standard working rates for some forestry operations

Operation	Unit	Quantity
Demarcation, pillaring and surveying	man-days/km	15
Line cutting	man-days/km	1
Line clearing (2 m width)	man-days/km	9
Pillaring only	man-days/km	2.5
Line survey	man-days/km	2.5
Compartment demarcation	man-days/km	15
Fire protection	man-days/ha	2
Stock survey	man-days/ha	2.5

2.8 After compiling the labour costs, additional details of the proposed budget could be added including such items as:-

- Assumed subsistence requirements for staff
- Vehicle operation costs of existing fleet
- Vehicle hire
- Maintenance of buildings and plant
- Construction works

Manual of Operations Section B - Operational Planning

B2. Operational Planning Methodology

Instruction Sheet No. B2.6 Preparation of the Annual Programme of Works

1. Introduction

1.1 The previous instruction sheet has detailed the processes necessary for preparing the three year rolling plan and has provided guidance how the work programme for years 2 and 3 can be completed. This present instruction sheet is concerned with the next and final stage, the preparation of the Annual Programme of Works (APW).

1.2 The APW should detail all activities that the district office intends to be concerned with over the course of the year. At the minimum level, it must provide a listing of all activities where labour (either permanent or contract) is to be employed, together with a listing of all building material, office material, nursery material, vehicle operation, etc., so that the operational budget for the district can be drawn up. Ideally, it should also include an assessment of how staff time is to be used, their responsibilities over the year and an indication of the how tasks are going to be slotted into the 12 month period.

2. Preparation of the APW

2.1 The preparation of the APW will go through the following stages:-

1. Preparation of the tables indicated in the previous instruction sheets (Forms OP 1, 2 and 3)
2. Preparation of the Work-Breakdown Structure (Form OP 4)
3. Preparation of time charts - Gantt charts (Form OP 5)
4. Cost break down for the APW. (Form OP 6)

Work Breakdown Structure

2.2 The earlier tables will not have gone into too much detail concerning a particular task, but in order to put reliable costings to a particular task to be done, it is necessary to consider the individual activities that make up the task. For example the task of constructing a new access track to a forest post will in Forms OP 1 -3 have been most likely have been considered as just that one single, overall activity and it will have been roughly costed on the basis of the average cost of putting in a 1 km of track, But in fact this particular task is made of several distinctive activities such as:-

- a) determination of a suitable alignment on the map
- b) pegging out alignment in the forest
- c) clearing undergrowth and tree felling
- d) hiring dozer if necessary
- e) contracting supply of ballast for wet areas
- f) etc.

2.3 Obviously the degree of detail that each task is broken down into will vary depending on the complexity of the particular task, for many i.e. second weeding of teak, no further breakdown of the task is required, since it can be costed and timed well enough as a single activity. The Form OP 4 can be used for this stage, reference should be made to the worked example at the end of this section.

Table 2.6.1 Form OP 4 Work Break Down Structure

Task /Activities	Units	Quantity	Priority	Target Date
Task 1				
Activity 1.1				
1.2				
1.3				
Task 2				
Activity 2.1				

Preparation of Time Charts or Gantt Charts

2.4 It will assist overall organisation of the work programme if the DFO marks out the proposed start and end date of each main task /activity, to check that there will not be a conflict of resource needs in terms of allocating supervisory staff , labour and vehicles. As an additional modification to the Gantt Chart is to consider those staff to be allocated to supervising the job, thereby building up a work programme for the district staff.

2.5 The Gantt Chart is just a very simple time chart, as indicated in the worked example at the end of this section. The format used is provided as Form OP 5.

Table 2.6.2 Form OP 5 Time and Responsibility Chart

Task	1	2	3	4	5	6	7	8	9	10	11	12	Responsible staff	Others
Task 1														
Task 2														
Task 3														

Cost break-down

2.6 The final step is to determine the cost of each activity in terms of labour, incremental staff costs and materials. Form OP 6 provides the framework for doing this.

Table 2..6.3 Form OP 6 Cost Break-down for Activities for APW

1	2	3	4	5	6	7	8
Activity	Quantity	Units	md/unit	Total man-days	Labour cost '000 cedis	Incremental Staff costs	Material costs '000 cedis

Where column 1 is the particular task/activity. It is intended that during the course of implementation of the new procedures that all tasks and activities likely to undertaken by a DFO as part of his normal duties, will be given a code number. This will enable easier comparison of costs between districts and regions, and the summation of costs for a particular task.

Column 6 is the product of column 5 and the current standard rate for labour. It might be necessary to have a separate line for those activities where there is a wide range in grades of labour .

Column 7 refers to the any costs that will need to be allowed for such items as staff overtime, subsistence, travel etc. in order to get the activity completed.

Column 8 will be any material that need to be purchased to complete the task

Annual Budget

2.7 There are other costs that will need to be considered tin order to derive the total annual operating budget for the district office. These will be made up of such items as:-

1. Maintenance and operation of offices/guard posts (including power and water)
2. Telephone and postal charges
3. Office materials
4. Standard operating costs for district vehicles
5. Any other fixed charges
6. Staff salaries.

ANNEXES

EXAMPLES OF OPERATIONAL PLANNING FORMS

FORM OP 1 FOREST RESERVE OPERATIONAL PLANNING

FORM OP 2 THREE YEAR WORK PROGRAMME

FORM OP 3 YEARS 2 AND 3 OUTLINE COSTS

FORM OP 4 WORK BREAKDOWN STRUCTURE

**FORM OP 5 TIME AND RESPONSIBILITY CHARTS
(GANTT CHART)**

**FORM OP 6 COST BREAKDOWN FOR
ANNUAL PROGRAMME OF WORKS**

**Table OP 1 Forest Reserve Operational Planning
Summary of Main Activities and Targets**

Forest Reserve

Planning Period

Operations	Units	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	5 yr Target	Implementor / Remarks
<u>1 Boundaries</u>								
Boundary maintenance	km	28	28	28	28	28	140	Local contracts, 2km village development programme
Re-survey	km	5	3	0	0	0	8	Regional team/FMSC
Pillaring of external boundaries	no.	2	5	3	0	0	10	Station workers
Pillaring of internal compartments	no.	5	5	5	0	0	15	Station workers
Others								
<u>2 Fire Protection</u>								
Establishment of new fire lines	km	3	2	0	0	0	5	Local contracts
Maintenance of existing fire lines	km	20	23	25	25	25	118	Local contracts/voluntary on 3km
Fire-break establishment	km	2	2	2	2	2	10	Local contracts -taungya
Existing fire-break maintenance	km	12	14	16	18	20	80	Local contracts
Early burning	km	5	5	5	5	5	25	Station staff+ GFS
Intensive fire patrolling (for fire sensitive areas)	ha	300	300	300	300	300	1500	Patrolmen
Demarcation of Fire Protection Block	ha	0	0	0	0	0	0	
Fire tower construction	no.	0	1	0	0	0	1	Contract
Others:								

Example of three year rolling plan

District.....

Region

Period of plan

Form OP 2 3 Year work Programme

Task	Units	Year 1	Priority	Target	Year 2	Priority	Year 3	Priority
Management of TUCs on-reserve								
Closure certificate due	compt	FMU 34 - C11	1	June	FMU 34 - C23 FMU33 C24	1	FMU 34 - C34 FMU 33 - C22	1
New compartment demarcation	compt	x5	1	Sept.	x7	1	x7	1
Yield survey	compt	x3	1	Nov.	x9	1	x7	1
TOS preparation	TUC	TUC 81	1	April	x2	1	x1	1
Protection Activities								
Boundary demarcation	km	15	2	Aug	15	2	15	2
fire break scuffling	km	8	1	Aug	8	1	8	1
track maintenance	km	12	2	Sept	15	2	20	2
track construction	km	3	3	Nov	5	3	0	3
Plantations								
Weeding	ha	50	1	July	50	1	0	1
Pruning	ha	25	3	May	50	3	50	3
Extension								
Nursery establishment	nursery	x2	2	Nov.	x1	2	0	
seedling distribution	plants	10,000	2	June	15000	2	20,000	3
soil erosion protection planting	ha	4.5	2	July	10	2	10	2
School visits	No.	20	3	all year	20	3	30	2

Indicative Budgets for Years 2 and 3 - Main tasks requiring labour inputs

Form OP 3 Year 2 and Year 3 Outline Costs

Tasks	Yr 2 man-days	Yr 2 '000 Cedis	Yr 3 mds	Yr 3 '000 Cedis
Management of TUCs on-reserve				
New compartment demarcation	475	1425	475	1425
Yield survey -labour - subsistence	2925 100 md	8775	2275 75 md	6825
Protection Activities				
Boundary clearing	135	405	135	405
fire break scuffling	72	216	72	216
track maintenance	150	450	200	600
track construction	100	300	0	
Plantations				
Weeding	750	2250	0	
Pruning	400	1200	400	1200
Extension				
Nursery establishment	100	300	0	
seedling distribution				
soil erosion protection planting	200	600	200	600
School visits				

Additional details of the proposed budget could be added including such items as:-

- Assumed subsistence requirements for staff
- Vehicle operation costs
- Maintenance of buildings and plant
- construction works

Annual Programme of Work - (Year 1) Form OP 4 Work Breakdown Structure

Task	Units	Quantity	Priority	Target
Management of TUCs on-reserve				
T1. Closure certificate due	compt.	FMU 34 - C11	1	June
T2 New compartment demarcation	compt.	x5	1	Sept.
field survey of boundaries	km			July
boundary cutting	km			Sept
T3 Yield survey	compt.	x3	1	Nov.
check survey	compt.	x3	1	Dec
map production	compt	x3		Oct
yield calculation and approval	compt	x3		Nov
T4 TOS preparation	TUC	TUC 81	1	April
establishment of social responsibility agreements	TUC			Jan
setting environmental protocols	TUC			Feb
approval by traditional councils	TUC			March
Protection Activities				
T5 Boundary demarcation	km	15	2	Aug
T6 fire break scuffling	km	8	1	Aug
T7 track maintenance	km	12	2	Sept
T8 track construction	km	3	3	Nov
check new alignment	km			Aug

arrange transport of ballast	loads			Oct
contract construction crews				Oct
Plantations				
T9 Weeding	ha	50	1	July
2 nd weeding of teak C57	ha	20		May
2nd yr weeding of Cedrela C85	ha	30		July
T10 Pruning	ha	25	3	May
3rd pruning of teak C 58	ha			May
Extension				
T11 Nursery establishment	nur- sery	x2	2	March
School nursery at West Tano - agree site				Jan
assistance on nursery bed construction				Feb
provide materials				Feb
Rehabilitate East Tano community nursery				Feb
T12 seedling distribution	plants	10,000	2	June
establish 3 temporary nurseries for distribution				April
move stock form main FD nursery				May
T13 soil erosion protection planting	ha	4.5	2	June
Agree final site(s) with committee				Feb
Site preparation				May
Establish holding nursery				May
Planting				June
T14 School visits	No.	20	3	all year

Table OP 5 Time and Responsibility Charts (Gantt Chart)

Task	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Staff i/c	Others
T1					■	■							KFS	FSG
T2							■	■	■				KFS	MMD
T3								■	■	■	■		MMD	
T4	■	■	■	■										
T5								■	■				FSG	
T6								■	■				FSG	
T7									■	■				
T8								■	■	■	■		FSG	
T9					■	■	■						LLD	
T10					■	■							LLD	MMD
T11	■	■	■											
T12				■	■	■							LLD	SGD
T13		■	■	■	■	■	■						LLD	SGD
T14													SGD	

Form OP 6 Cost Breakdown for APW

Activity	Quantity	Units	md/unit	Total md	Labour Costs '000	Incremental Staff costs	Material Costs
T2 New compartment demarcation	5	compts.					
field survey of boundaries	25	km	2/km	50	150	5 nights subsistence	
boundary cutting	25	km	15/km	375	1125		20 cutlass =20,000
T3 Yield survey							
field survey	3 = 390	compts ha	2.5/ha	975	2925		
map production							map roll = 30,000
yield calculation and approval							
T4 TOS preparation	1 45,000	TUC ha					
establishment of social responsibility agreements						5 night subsistence	
setting environmental protocols						2 night subs.	
approval by traditional councils							
etc							