SABAH FORESTRY DEPARTMENT

DERAMAKOT FORESTRY DISTRICT
(DERAMAKOT FR-FMU 19A & TANGKULAP/SG. PINANGAH FR-FMU 17A)

Standard Operating Procedures

Compartment Restoration Plan

Document No.: SFD/DFR/SOP - 013

Approved by:

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Director Of Forestry (25.2.2010)

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1.0 BACKGROUND & PURPOSE

Sabah Forestry Department (SFD) has initiated a policy to pursue certification by meeting the requirements of FSC as well as national standards in its management systems for Sabah. To ensure that its operations are in line with FSC requirements the SFD has developed a series of Guidelines for forest management in 2008 that has been adopted into procedures for use in FMU 19A and FMU 17.

The purpose of this procedure is to provide a general guideline for development of Compartment Restoration Plan (CRP) based on a Mosaic Design, Enrichment Planting & Climber Cutting to meet the requirements of the FSC Forest Management Standard for FMU 19A & FMU 17A.

2.0 SCOPE

The scope of this procedure is limited to **Compartment Restoration Planning** based on **Mosaic,** design, enrichment planting systems & climber cutting within FMU17A managed by SFD. The procedure is to ensure that work may be completed in a controlled, consistent and effective manner.

3.0 RESPONSIBILITIES

The Head of Restoration Planning is responsible for:

- Inventory of forest quality in the compartment
- Section of areas for clearing and planting under the Mosaic design
- Preparation of CRP
- Training of Staff
- Ensuring the implementation of this procedure

The Forest Officer (Forest Restoration) is responsible for:

- Monitoring field operations
- Monitoring planting
- Reporting on CRP implementation

4.0 DEFINITIONS

This procedure contains definitions of common terms used by FSC & SFD in the procedures for forest management.

FSC: Forest Stewardship Council, an international non-government organization who governance the Forest Management and Chain of Custody standard.

FMU: A clear defined forest area with mapped boundaries, managed by a single managerial body to a set of explicit objectives which are expressed in a self –contained multi-year management plan.

Mosaic Design:

CRP: Compartment Restoration Plan that details areas to be cleared and planted based on meeting the guidelines for inventory (SFD/DFR/SOP – 012) and Timber Stand Improvement (SFD/DFR/SOP – 06)

Potential Crop Trees (PCT): commercial trees with diameters below 60 cm that exhibit good form and growth to become viable harvest trees within 1-2 harvest cycles.

5.0 COMPARTMENT RESTORATION PLANNING

Conventional logging practices and repeated logging have degraded the remaining forest resources in Sabah. Poor logging practices have opened up the forest significantly. The increase in light on the forest floor has proliferated the growth of pioneer species, bamboos and climbing vines. Therefore silvicultural treatments are needed in order to regenerate the forest stands following the logging operations.

Compartments can be considered as eligible for harvesting when they contain an average of more than 15 good quality commercial trees greater than 60 cm diameter per hectare. SFD assumes that up to 8 trees per ha can be felled under sustained yield systems. Resulting yield is expected to average 40-50 m3/ha as harvest trees average 6.8 m3/tree. As poor logging practices have depleted the forest resource and quality to become degraded silvicultural treatments are needed to support restoration of the forest.

The silvicultural treatment practiced in Sabah consists of three main types of treatments :

- Climber cutting & liberation thinning
- Enrichment planting
- Mosaic planting design

The selection of silvicultural treatments depends directly on the existing density of Potential Crop Trees (PCT). Based on current methods of inventory (Proc 014) the SFD can identify up to 200 PCT/ha. SFD defines adequately stocked forest for PCT to contain an average density > 100 PCTs / ha. Areas below 100 tree/ha are considered as inadequately stocked and should be planted.

Average Density	Silvicultural Treatment
> 100 PCT/ha	Climber cutting / liberation thinning
50-100 PCT/ha	Enrichment planting
< 50 PCT/ha	Mosaic planting (Clearing and planting areas below 30 ha)

5.1 Steps to Development of Restoration Plan

The basic steps involved in harvest planning for reduced impact logging include:

- Boundary survey of compartment
- Field survey & data collection on PCTs;
- Marking of severely degraded areas for clearing & planting;
- Identification of riparian areas and conservation areas
- Alignment of feeder roads & skid trails and log landings;
- Development of a Compartment Restoration Plan (CRP);
- Approval by SFD

5.2 Boundary Demarcation

Field staff shall conduct and demarcate the boundary of the compartment to be harvested accordingly. A team of forest workers (with a supervisor) shall survey and clearly mark the boundary of the compartment. Often workers clear the boundary and paint trees every 10-20m along the boundary using paint. GPS positioning shall be taken at tie points (at a very minimum) however it is recommended that GPS is taken as frequently as possible when available.

The boundary survey data shall be summarized in the CRP to provide clear description of the compartment area including location, size, existing status, current access roads and skid trails. All survey data should be recorded using standard forms.

5.3 Identification of Existing Infrastructure

Much of the forest areas in Sabah have been previously logged and have existing feeder roads and skid trails that have been abandoned since the last operation. The survey team needs to identify all existing feeder roads, skid trails and log landings. Use of existing structure should be given priority over creating new roads or skid trails. The survey team needs to measure all roads that can be used to access the forest and extract timber. Abandoned log landings can also often be reused since normally the areas are compacted and vegetation does not grow well on those sites.

5.4 Sampling of Potential Crop Trees (PCT) :

An inventory of the compartment would need to be conducted to evaluate the stocking of potential crop trees that will become the future harvest trees within an estimated harvest cycle. The 1st step is to use aerial photography or survey to define poorly and adequately stocked areas of the compartment.

Sampling can be conducted along several linear transects 20-200m lengths chosen separately within poorly stocked and adequately stocked areas the compartment. Typically all trees over 40 cm dbh are measured within 10 m of the line and trees 5-20 cm are measured within 5 m of the centerline. To obtain reliable data sampling intensity should consist of a minimum of 1% of the project area. **Procedure 14 Inventory Guidelines.**

Number of climbing bamboo and woody vines should also be recorded along the 5m strip. The strip line is divided into sections of 20m lengths that form a series of plots along the transect line that can be used to evaluate stand quality and climber density within the poor or adequately stocked forest areas. Inventory data needs to be analyzed to evaluate density of PCTs in the various size classes to determine adequacy of regeneration.

If the average density of PCTs is below 50/ha then the area (below 30 ha) may be cleared for planting. If the average number of PCTs is greater than 50/ha then the area should NOT be cleared but canopy gaps can be enrichment planted.

If the area is about 100 or more PCTs/ha then the area should be retained and climber cutting of areas infested with climbing bamboo and woody vines that average in excess 300 clumps or vines/ha to enhance growth of PCTs.

5.5 Defining Areas for Clearing & Planting – Mosaic Design

The concept of the Mosaic Design for restoration is based on clearing and planting of small patches (<30 ha) of severely degraded areas integrated with better quality residual forest areas to maintain habitat and environmental protection within the compartment. The retained areas of residual forest should provide protection for riparian areas as well as habitat and connectivity for movement of wildlife. The retained forest areas will also serve as future production of natural forest species during the restoration process. The small clear-cut patches will provide quick economic returns based on fast growing species within a 10-15 year harvest cycle.

Restoration objectives under the Mosaic Design must include 15% of the cleared area to be planted with a mix of high value dipterocarp and habitat species (Procedure 07 TSI). This could be in the form of edge planting along the border of the residual forest within each cleared patch.

Severely degraded forest areas that average less than 50 PCTs/ha need to be identified on a compartment level map and marked on the ground. Marking on the ground should be with GPS units and painting of boundaries trees. GPS points along the boundaries of the area to be cleared should be taken in order to locate and map the patch using GIS system. The area of the patch to be cleared and planted should be less than 30 ha and must not be located within riparian buffer zones of 50 m or on steep slopes (>25^{o}). Each patch of severely degraded forest should then be

mapped using GIS and quantified as to the area of each patch. Areas to be cleared and planted should have adequate access to the road network for establishment and maintenance.

5.5 Defining Areas for Climber Cutting / Enrichment Planting

Residual degraded forest areas that contain more than 50 PCTs/ha should be identified on a compartment level map and marked on the ground in conjunction with the areas to be cleared. GPS points along the boundaries shared with the planned cleared areas should be mapped in a GIS. Residual forest areas with adequate PCTs (>90 PCTs/ha) should be treated for climber cutting of climbing bamboo and lianas to support increased growth. Enrichment planting may be needed where there is insufficient stocking of PCTs (between 50-90/ha) based on cluster planting within canopy gaps.

5.5 Defining Areas for Conservation

Areas of forest located within 50m of riparian areas and steep slopes over 25 degrees slope should be identified for protection. Any areas within the compartment that are identified to contain social or environmental HCVF such as salt licks or burial sites, must also be identified for protection.

6.0 COMPARTMENT RESTORATION PLAN (CRP)

The function of the CRP is to detail the plans for restoring the economic and environmental viability of the forest area within compartments that are classified as degraded or severely degraded. The CRP must clearly define the activities and areas within the compartment to be cleared and planted and silviculturally treated. The CRP needs to define the species to be planted and projected growth till harvesting.

The following contents are recommended for the development of a Compartment Restoration Plan:

- Description of Compartment;
- Resource survey methods
- Residual forest quality: Areas identified as severely degraded / degraded
- Estimated land clearing volume m^3/ha (mosaic system)
- Environmental attributes & mitigation measures (conservation areas / buffer zones)
- Social issues & mitigation measures;
- Conservation / social areas & net planting area for mosaic system & enrichment;
- Areas for climber cutting
- Summary list of feeder roads & access, log landings (based on mosaic system);
- Planting & Maintenance Plan (species / density / thinning / weeding)
- Estimated growth & harvest yield (cleared & planted / enrichment & climber cutting)
- Monitoring resources and control areas
- Schedule of activities

- **Appendix 1:** List of areas to be cleared and species to be planted);
- **Appendix 2:** Areas to be treated enrichment planting / climber cutting;
- **Appendix 3:** CRP Map.

6.1 Description of Area

The CRP shall attempt to describe the background of the area in regards to production, social & environmental issues associated with the compartment.

6.2 Survey Methods

Brief description of methods or system used to sample the forest quality such as strip lines divided into subplots or stratified random sampling. Sample size; number of samples; plot sizes; percentage of area sampled, etc.

6.3 Residual Forest Quality

The CRP should define the severely degraded areas that contain less than 50 PCTs/ha that are planned for clearing and planting under a Mosaic Design. Total number of patches and sizes of each patch to be cleared and planted.

Areas identified as degraded should be quantified and defined on the methods to be used for planting. Areas that are adequately stocked should be identified and defined for climber cutting.

6.4 Estimated Land Clearing Volume m^3/ha (mosaic system)

The CRP should also provide estimate of total tree volume for trees 20 - 120 cm DBH within the planned clearing areas. The CRP should identify the roads and log landings to be associated with the areas to be cleared.

6.5 Environmental Attributes and Mitigation Measures

Environmental issues such as steep slopes, riparian areas, habitat requirements, etc shall be identified in the CRP. This shall include a list of areas with slopes over 25 degrees, a list of riparian areas with a minimum of 50m buffer to protect and maintain water quality as well as recognized endangered species and habitat requirements for the area accordingly.

The CRP must detail provisions for protection of environmental issues identified within the compartment. This should include a list of measures such as buffer zones; protection of large habitat trees (120+ cm) within residual degraded areas; establishment of wildlife corridors; protection of salt licks; and reducing the sizes of planned cleared patches.

Trees that are very large as 120cm+ dbh are often hollow and can break easily when felled thus should be protected within residual forest areas and NOT included in planned cleared patches.

The CRP must detail the system to monitor that the provisions for protection of environmental issues have been implemented effectively.

6.6 Social Issues and Mitigation Measures

Social issues such as land claims, hunting areas, collection of Non-Timber Forest Products (NTFP), religious & cultural sites, etc. shall be identified in the CRP and the specific areas shall be identified on the CRP map. The CRP shall provide detailed provisions for the protection of social

issues identified within the specific harvest area (such as the protection of areas for cultural or religious sites).

6.7 Conservation / social areas & net planting area for mosaic system & enrichment

Each area in the compartment shall be identified and designated according to the status of the land. Conservation areas are defined for protection where no logging will be conducted that includes riparian areas, steep slopes and areas protected or under special management for social issues such as land claim and protection areas for cultural and/or religious sites.

Mosaic Design:

Areas of forest that are identified to contain less than 50 PCTs/ha and are severely degraded can be planned for clearing and planting. The maximum size area to be cleared & planted within a specific patch is 30 ha under the Mosaic Design. The CRP should contain a list of defined areas (patches) to be planted along with area of each patch.

Planting can consist of fast growing species under a short harvest cycle. Selection of species to be planted should be based on site suitability, market demand, product mix, etc. The CRP should list the species to be planted within the Mosaic Design. The Procedure for Timber Stand Improvement (Proc 07) also requires that 15% of the areas cleared for planting be replanted with a mix of high value dipterocarps and habitat species. These species should be identified in the CRP.

Enrichment Planting:

Degraded areas that contain and average of 60-90 PCTs/ha can be identified for enrichment planting under the residual forest canopy. These areas must be clearly defined and quantified. Enrichment planting should be done using high value dipterocarps and habitat trees within clusters containing 3-4 seedlings in canopy gaps identified along strip lines. The CRP should define what species are to be planted within the enrichment design and that the mix should contain at least 15% habitat trees.

6.8 Areas for Climber Cutting

Areas that contain adequate stocking of PCTs (>100 PCTs/ha) must be identified and quantified. These areas should be evaluated for the need for climber cutting to reduce competition with existing PCTs. If the area is infested with climbing bamboo and woody vines that average in excess 300 clumps or vines/ha climber cutting should be conducted to enhance growth of PCTs. Research has demonstrated increased diameter growth rates can average over 100%.

6.9 List and Summary of Feeder Roads, Skid Trails, Log Landings

The CRP shall contain a comprehensive list and summary of all Feeder Roads, & Access trails and Log Landings. This list shall document accordingly the following:

- List of existing & proposed feeder roads (name / number / length in meters, density in m/ha, % area coverage);
- List of existing & proposed skid trails (name / number / length in meters, density in m/ha, % area coverage); and
- List of log landings (location (GPS) and size, area of each landing, and % total area coverage).

The lists shall be compared with the allowable limits under the RIL guidelines to ensure compliance to sustainability criteria. To avoid excessive skid-trail density a net allowable area of 6% of total compartment area, and a maximum of 0.7% for log landings should not be exceeded.

6.10 Planting & Maintenance Plan

Planting & Maintenance Plan must clearly describe the activities to be conducted under the mosaic design and enrichment planting systems. The planting & maintenance plan should include a schedule for land clearance and planting of areas identified under the Mosaic Design as well as preparation for enrichment planting as appropriate. The Planting Plan needs to define the species and density for planting according to the Mosaic or Enrichment Designs. The planting plan needs to incorporate the requirement for 15% of seedlings to consist of high value dipterocarps or habitat species (Appendix)

The plan needs to define the maintenance system for weeding and possible replacement of planted seedlings that die within 6 months of the initial planting date. Maintenance of weeding and replanting of dead saplings could be conducted every 3-6 months following the initial planting for a period of 2 years. Replanting should only be conducted if there is greater than 20% mortality within the first 2 years or if an area of greater than 1 ha has been significantly damaged by browsing with losses greater than 50%.

List of Areas to be cleared & planted (Mosaic Design)

Sub Block	Patch #	Area (ha)	Date Clearing	Date Planting	Species

6.11 Estimated Growth & Harvest Yield (cleared & planted / enrichment & climber cutting)

The CRP needs to provide an estimate of growth and yield in the Mosaic system based on species, planting areas, mortality, average potential yield and harvest cycle. The CRP should also be able to project growth of enrichment planting areas as well as climber cutting areas. Enrichment planting areas have been recorded to attain an average annual diameter growth of

dominant trees 1.2 cm/yr, while PCTs released from competition shown a 100% increase in growth vs suppressed trees.

6.12 Monitoring resources and control areas

The CRP needs to define the system to monitor the resources that includes planted areas under both mosaic and enrichment planting as well as fro climber cutting areas. Permanent Sample Plots (PSP) need to be set up in the plantation areas as well as in

6.13 Schedule of activities

Appendix 1: CRP Map

Each CRP shall contain the CRP restoration map that highlights the following attributes of the harvest plan:

- Identification of areas to be cleared and planted under the Mosaic Design;
- Identification of enrichment planting areas
- Identification of climber cutting areas
- Conservation Areas (including Rivers/Water Bodies and Buffer Zones & Steep Slopes);
- Existing & Proposed Feeder Roads, Bridges & Culverts;
- Sample Plots for recording growth of planted areas & silvicultural treatments

Appendix 2: Schedule of Planting & Maintenance

Example Planting Plan: Mosaic Design

Sub Block 18 A:

Patch #	Area (ha)	Species	Spacing	# Saplings	Plant date
1	12 ha	Binuang	5x2	12,000	Mar 09
2	19 ha	Laran	5x2	19,000	Mar 09
2	3 ha	Dips & Fruit	4x5	1,500	Mar 09
3					

Sub Block 18 B:

Patch #	Area (ha)	Species	Spacing	# Saplings	Plant date
1	22 ha	Binuang	5x2	22,000	April 09
1	4 ha	Dips & Fruit	4x5	2,000	April 09
2	13 ha	Laran	5x2	13,000	May 09
3	9 ha	Magas	5x2	9,000	May 09