Best Practices for Sustainable Forest Management in Southeast Asia

Experiences from 25 Years of German Technical Cooperation

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Published by

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
-German Technical Cooperation-

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Printing

SUNSETMEDIA|CREATIVESTUDIO
Jakarta, Indonesia

June 2007

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Preface

In the process of implementing sustainable forest management (SFM) policies, ASEAN (Association of Southeast Asian Nations) faces a variety of challenges. Information management and a communication strategy that takes into account limited resources for training, difficulties in reaching end users throughout the vast geographical area, and high staff turn-over in member countries are part of them.

German Technical Cooperation (Deutsche Gesellschaft für Technische Zusammenarbeit GmbH) addresses this challenge. Its Regional Forest Policy Programme (ReFOP), a political advisory project to the Natural Resource Unit (NRU) at the ASEAN Secretariat, delivers focused expertise and communication services. Central concerns are transboundary forestry issues such as illegal logging and trade in illegal forest products and its impact on national economies and rural livelihoods, sustainable forest management planning and silvicultural best practices.

Facilitated by ReFOP, a central instrument for knowledge sharing and mutual learning has been installed at the ASEAN Secretariat: The "ASEAN Forest Clearing House Mechanism" (CHM – http://forestchm.aseansec.org) helps users quickly access literature and find resource persons and institutions close to their specific demands. In 25 years of German support to forest sector development in Southeast Asia a wealth of recommendations, guidelines, field manuals and pre-defined table formats for compilation of information to any key area of SFM have been issued, by such projects as the Sustainable Forest Management and Conservation Project, Peninsular Malaysia, or the Forest Management Information System Sarawak, Malaysia (FOMISS). Many of them, though based on specific settings, are generic and suited to a variety of applications.

These handbooks and documents have now been made readily accessible for project managers, partner organizations and other beneficiaries in Southeast Asia, under the auspices of the Sector Network Rural Development (SNRD) Asia of GTZ, an experts' network for exchange of expertise and development of extension approaches.

SNRD and project members have contributed to synthesize the experience from around 20 projects supported by German technical cooperation and Southeast Asian partners in a series of publications ('toolkits'). Here, the user finds concepts and instruments of German forestry cooperation classified according to subject and country, together with annotated bibliographies ('toolboxes') in which all key reports and manuals from projects are listed. The bibliographies provide a brief executive summary of each document and an individual assessment of how to use and apply it in various contexts.

The publication at hand offers all previously condensed information at a glance: the three existing toolkits, together with a couple of selected field guidelines and consultancy reports (see table of contents) .Our intention is to provide a practical user's guide for broad application throughout ASEAN member countries, as a contribution to developing SFM and SFM-related IKM capacities.

The bibliographies in this publication have been supplemented by links to the CHM, where most documents can be conveniently downloaded. This way, the publication at hand is also conceived as a comfortable entry point and add-on to the CHM. All literature which is not yet available in full text from the CHM website can be ordered from the ASEAN Secretariat (asean-forest@aseansec.org).

Best Practices for Sustainable Forest Management in Southeast Asia is also available on CD-ROM at the ASEAN Secretariat, the GTZ Headquarters in Eschborn, Germany, and GTZ Indonesia (address see back cover).

Rolf Krezdorn
for the German Technical Cooperation, SNRD Asia

Contents

I. Best Practices for Sustainable Forest Management in Southeast Asia

II. ANNEX: Supplementary documents (selection from the TOOLBOX)[1]

ANNEX 1a Werner Schindele: Combined Forest Inventory – Field Manual (2001). Short-term consultancy report.

ANNEX 1b Werner Schindele: Proposed Design for a Combined Forest Inventory on State and National Level (2001). Short-term consultancy report.

ANNEX 2 Günther Haase, Werner Schindele: Content and Write-up of State Forest Management Plan (2005). Paper 3f1 in the series *Forest Management Planning Rules and Guidelines (FMPRG)*.

ANNEX 3 Günther Haase, Werner Schindele: Multifunctional Zoning (2005). Paper 2a in the series *Forest Management Planning Rules and Guidelines (FMPRG)*.

ANNEX 4 Günther Haase, Werner Schindele: Yield Regulation (2005). Paper 3c in the series *Forest Management Planning Rules and Guidelines (FMPRG)*.

ANNEX 5 Günther Haase, Werner Schindele: Operational Planning on Compartment Level (2005). Paper 4a in the series *Forest Management Planning Rules and Guidelines (FMPRG)*.

ANNEX 6 Gerd Weinland: Harvesting and Natural Forest Silviculture: Disturbances to the Forest Ecosystem (2005). Paper presented at a seminar on “Best Management Practices for Achieving Sustainable Forest Management”.

ANNEX 7 Günther Haase, Walter Kollert: Financial Analysis of Forest Management (2005): Paper 3d in the series *Forest Management Planning Rules and Guidelines (FMPRG)*.

ANNEX 8 Anke Camphausen, Hannsjörg Wöll: Community-Based Forest Management in Southeast Asia. Best Practices Toolkit (2004).

ANNEX 9 Anke Camphausen: Biodiversity Conservation in Managed Forests. Review of Literature on Methodologies for Biodiversity Assessments and Recommendations for Forest Management in Peninsular Malaysia (2004).

ANNEX 10 Nikolaus Schall: Practitioners Guide: Curriculum / Syllabus Development (2003).

ANNEX 11 Ferdinand Agung PMW, Alexander Hinrichs: Self-Scoping Handbook for Sustainable Natural Forest Management Certification in Indonesia (2000).

ANNEX 12 Georg Buchholz, Anke Camphausen, Christoph Feldkötter: Information and Knowledge Management (IKM) Systems for Natural Resources Management in Southeast Asia. Best Practices Toolkit (2005).

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[1] The documents cover essential aspects of the management cycle for multiple-use forest management, i.e. planning, implementation and monitoring. They were selected as reference documents for being particularly rich and concise in technical information, and being useful for a variety of settings beyond the confines of the present day. However, all institutional aspects referred to in the reports are country specific. It goes without saying that specific generalizations cannot be drawn in that regard.

Acronyms and Abbreviations

AAC	annual allowable cut
CBFM	community-based forest management
CDM	Clean Development Mechanism
GIS	Geographic Information System
FAO	Food and Agriculture Organization of the United Nations
FMP	forest management plan(ning)
FMU	forest management unit
NFP	national forest programme
NTFP	non-timber forest product
PFE	permanent forest estate
RIL	reduced-impact logging
SFM	sustainable forest management
UNCED	United Nations Conference on Environment and Development

CFPQ	Community Forestry Project Quirino (Philippines)
FOMISS	Forest Management Information Systems Sarawak (Malaysia)
IFFM	Integrated Forest Fire Management Project (Indonesia)
SFDP	Social Forestry Development Project (Indonesia)
SFMCP	Sustainable Forest Management and Conservation Project (Peninsular Malaysia)
SFMP	Sustainable Forest Management Project (Malaysia)
SFMP	Promotion of Sustainable Forest Management Systems Project (Indonesia)

Definition

Sustainable Forest Management (SFM): SFM aims to ensure that products and social, cultural and environmental services provided by forests meet the needs of the current generation while at the same time maintaining their availability for the development needs of future generations.

Part 1

General Analysis of Best Practices for Sustainable Forest Management in Southeast Asia

1.1 Background

Despite a long history of forest conversion and forest degradation due to unsustainable logging practices, the natural forests of Southeast Asia still constitute an immense renewable resource and provide vital contributions to the economic and social development of the region. Invariably, the countries of the region commit to the principle of sustainable forest management (SFM), as expressed in their respective forest policies and/or sector strategies. In line with the international policy debate (e.g. UNCED, 1992: Rio Declaration and Forest Principles) the definition of SFM applied by these countries has gradually evolved from a focus on sustained timber production to concepts which embrace economic, environmental and social aspects.

However, the actual management of the bulk of natural forests in Southeast Asia does not conform to the principles of SFM. Annual harvesting rates are far beyond sustainable levels and conventional timber extraction with high environmental impact is still widespread practice. The reasons are manifold and vary with the countries (refer to Chapter 1.2). Experience has shown that the actual implementation of SFM is primarily a socio-cultural and an economic problem or challenge. However, the paradigm shift from sustainable timber production to sustainable multi-purpose forest management also requires a set of new management tools, instruments and standards, which have to be tailored to meet the requirements of a given country.

GTZ has assisted a number of Southeast Asian partner countries in their endeavour to develop and implement the new management paradigm for quite some time. Work in most projects was focused on natural production forests. In line with this, the scope of this document is to capture and analyze the experiences made with regard to developing SFM systems for natural production forests.

1.2 Common framework conditions

Forest cover in Southeast Asia varies considerably. Most countries have incurred significant forest losses during the last four decades due to conversion of forest land to other land uses (e.g. oil palm and rubber plantations), and due to unsustainable timber exploitation and mining. Still, most countries are endowed with more than 50% forest cover, while in the Philippines, Thailand and Viet Nam 20 to 30% of the landmass are stocked with forests (Annex). All countries except Viet Nam continue to incur significant forest losses. During the 1990ies they ranged from 0.4 to 1.4% of forest cover per annum (FAO, 2001[2]).

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[2] FAO: Global Forest Resources Assessment 2000. Rome, 2001.

With the introduction of mechanized harvesting after World War II natural forest resources have been increasingly depleted. As a consequence of this but also due to encroachment of shifting cultivators, illegal logging and forest fires, which are common forest threats throughout the region, forest degradation currently appears to be even a more serious problem than outright loss of forest cover. This is illustrated by comparable low stocking levels per ha (se Annex).

Natural forests are predominantly state-owned. Countries follow different approaches in the organization of forest management. This refers especially to the contractual arrangements with timber companies and the division of tasks and responsibilities between the private and the public sector. Harvesting is usually implemented by private contractors or concession holders. Various concession systems are used, ranging from long-term leases (up to 100 years in Sabah, Malaysia) to short-term logging permits for specific compartments (e.g. Peninsular Malaysia).

As mentioned earlier, most countries in Southeast Asia have formulated sustainable multipurpose forest management as a superior forest policy goal. In view of continued forest loss and degradation, the policy objectives in many of the countries have shifted from production to protection and rehabilitation (e.g. Thailand, Philippines). Furthermore, greater emphasis is placed on forest plantation establishment as a substitute for supply of industrial timber. Likewise, stakeholder participation, alternative ownership systems to state ownership and resolution of land use conflicts are increasingly emphasised in policy and strategy documents.

However, governments pursue divergent, conflicting interests, e.g. short-term economic objectives versus sustainability of resources. Policies of other sectors are often not compatible with SFM. Sometimes priority is given to an erroneous or at least short-sighted concept of ‘development’ at the expense of the forest resource base. On the other hand there is an enhanced public debate on environmental and social services of forests in countries with less dependency on primary production (e.g. Malaysia, the Philippines), which provides an impetus to shift towards SFM.

Most countries have a gazetted Permanent Forest Estate (PFE). This provides the legal basis for protecting the forests against conversion, encroachment and unsustainable use. However, actual enforcement of laws and regulations is generally weak, due to limited resources of enforcement agencies but also widespread corruption. In most countries, levels of field monitoring and enforcement of existing regulations for SFM are inadequate or even totally absent. Hence, there is an environment where performance requirements can be manipulated. The need to create effective enforcement agencies remains a major challenge in the majority of the countries.

Moreover, forest administrations in some countries have not put in place technical standards, guidelines and regulations that can ensure enforcement of better harvesting practices.

The sub-region has long been a major supplier of tropical wood, a position it still holds. However, timber supplies have declined considerably and some countries have become net importers of timber and timber products during the last two decades (e.g. Philippines, Thailand). Still, in other countries the timber industry remains a powerful player who generates significant employment and earns substantial amounts of foreign currency (e.g. Indonesia and Malaysia). The industry has been practising a “logging culture” for decades, based purely on resource exploitation (“timber mining”), and is therefore reluctant to reinvest into forests. In essence, these companies have a strong economic interest to preserve the status quo of inadequate enforcement of SFM regulations.

Downstream processing capacities of the industry are severely oversized in a number of countries; they depend on a continuously high timber supply which can not be sustainably produced within the country. Strategies to cope with reduced timber supplies are either inadequate or even lacking on part of both, the industry and the governments.

However, there are a few dedicated contractors and concession holders who have realised the need to embrace SFM in their corporate strategies. In view of the dwindling resource base and overseas markets that are highly sensitised for tropical timber issues, there is generally increased understanding amongst the corporate sector that the long-term sustainability of their business depends on successful implementation of SFM. Until now, however, decisions are primarily made in favour of short-term objectives like immediate wood supply and quick and high returns on investment.

More detailed country-specific information on the forestry sector and its management is presented in the Annex.

1.3 Common strategies and approaches

There are significant differences in terms of the politico-administrative systems and the ecological, economic and social conditions amongst the different countries. Therefore, there can be no universal model for SFM and each country needs to take up the challenge of determining its own strategy for achieving it.

A common strategy of GTZ projects towards supporting the partner countries in the development and promotion of SFM systems comprises of three distinct steps:

1. development of a practicable SFM concept and system;
2. system implementation, consolidation and further refinement in representative model area(s);
3. system dissemination.

All steps are implemented in close collaboration with the respective partner organizations and relevant stakeholders. Capacity-building and organizational development are integral parts of the strategy during all steps, but particularly during steps 2 and 3. Forest policy advisory services towards the creation of conducive framework conditions (policy, legislation, regulations) are other indispensable components of the project concepts. Increasingly, SFM projects are integrated with the development of national forest programmes (NFP). They contribute to translating NFPs into action at the field level and provide feedback from the field to the NFP process and for use at the policy level (bottom-up approach). If applicable for the partner country, projects will contribute to the development of national forest management certification systems.

As a basis for <u>system development</u> a thorough gap analysis is performed by assessing the regulatory framework (regulations, technical guidelines, performance standards, etc) and the actual forest management system and practices against the requirements for SFM. The internationally recognized principles for SFM and, if available, national or regional criteria and indicators for SFM are used as a reference for this assessment.

System development follows a modular approach, but commonly concepts and guidelines are developed and tested in the following technical areas:

- <u>Forest management planning system</u>: Development of rules and guidelines for long-term, medium-term and short-term planning

- Resource assessments: National forest inventories, forest management inventories, other resource inventories incl. development of data processing software
- Growth and yield research: Design of continuous forest inventories, software development for data processing, development of computer-aided forest growth simulation models
- Harvesting: Guidelines for harvest planning incl. pre-harvest inventories, reduced impact logging guidelines, guidelines for forest road construction and maintenance, promotion of environmentally friendly extraction systems
- Silviculture: Applied research and guideline development
- Financial and economic analysis: Proposals for fiscal and financial incentives for SFM, guidelines for financial analysis of forest management operations, support to financial and economic studies
- Social aspects / community participation: Guidelines for social surveys, implementation of social surveys, concept and guideline for participatory boundary demarcation, community-based forest management concept and system development.[3]
- Monitoring and evaluation systems and tools: Development of forest management information systems, forestry GIS, guidelines for mid-term reviews of forest management plans, self-scoping handbook for assessing progress towards SFM.[4]

GTZ commonly takes a model approach to SFM system implementation. A practical example of SFM in model areas (Forest Management Units – FMU) has proved essential for authenticity and success. It involves a voluntary partnership with the land owners (i.e. the State represented by the forestry administration) and forest managers (i.e. concession holders) who combine their experiences and resources to further develop, apply and monitor the impacts of the SFM system. Through active involvement of the forest managers their management principles and objectives and their economic and operational constraints can be adequately reflected during system development. This forms the basis for a realistic and thus implementable system.

Model areas should be representative for a country's or province's administrative, ecological, economic and social conditions to facilitate replication during the dissemination phase. The most crucial selection criteria, however, is a demonstrated commitment of the top management to SFM. The introduction of SFM has significant financial and operational implications for the participating enterprise, resulting in both additional cost as well as benefits. These costs and benefits have to be thoroughly discussed and made transparent so that the management can make an informed decision. Tying up the application of SFM in the model area with forest management certification is recommended for two reasons: The decision to have one's operations evaluated by external auditors is a strong indicator for the commitment of the company, and the provided advisory services and coaching towards certification serve as an incentive for participation.

The model areas are also essential during the dissemination phase. They serve as practical demonstration sites and can thus stimulate the application of SFM in other FMUs. By demonstrating a practical example for SFM they also proved successful in soliciting support from policy and decision makers, which is a prerequisite for successful dissemination.

Another important dissemination tool is the establishment and organization of specific working groups and discussion fora. These groups should already be established during the SFM

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[3] See also the detailed analysis of GTZ experiences in Annex 8 of this publication: "Community-Based Forest Management (CBFM) in Southeast Asia".

[4] See also the detailed analysis of GTZ experiences in Annex 12 of this publication: "Information and Knowledge Management Systems in the context of Natural Resource Management in Southeast Asia".

model application phase so that a wider range of stakeholder views can be incorporated during system refinement, thus instilling a higher ownership feeling amongst other potential SFM implementers.

The continuous feed-back to the political level (bottom-up approach) needs to be reflected in the project set-up. This can be either achieved by integrating the placement of a forest policy advisor at the national level or by linking the project to a separate policy advisory project. This ensures that realistic policies and legislation can be developed which set conducive conditions for SFM implementation.

Capacity-building is an essential part of the dissemination strategy. Training courses are developed and organized preferably in collaboration with established training institutes.

1.4 Impact of approaches

The transition from a forest management system which was primarily concerned with timber exploitation towards sustainable forest management for multiple purposes has significant ecological, economic and social impacts which are highlighted below:

Ecological impacts

There are a number of positive ecological impacts through introduction of SFM, which are well documented in different project and research publications:

- Negative environmental impacts of forest management operations are minimized, i.e. reduced damage to residual stands, reduced soil disturbance and erosion, reduced impact on water quality and hydrological functions.
- The production capacity of forest sites is maintained (reduced erosion of soil and nutrients).
- Water catchment functions of forests are largely maintained.
- Biodiversity of managed forests is largely conserved through protection of sensitive and rare habitats and species, delineation of buffer zones and minimising forest disturbance during harvesting operations.
- SFM contributes to stabilizing the regional climate.
- Carbon sequestration in logged forests is increased.

Economic impacts

<u>Macro-economic level</u>

In the short to medium-term the introduction of SFM confronts governments as well as the timber industry sector with several constraints. Experience shows that introduction of SFM implies largely reduced annual allowable cuts – AACs (e.g. by 50% in Sarawak and East Kalimantan). This means in the short to medium-term reduced forest revenues for governments, but also a reduced supply of industrial timber for the timber-processing sector. Existing capacities of the sector will have to be downsized, resulting in reduced employment and reduced output of products. This in turn will lead to reduced corporate tax and foreign exchange earnings for the country. The higher the relevance of the timber industry for a given country the more drastic these impacts will be for the national economy.

While these impacts act as a deterrent for the introduction of SFM it needs to be stressed that a reduction of AACs is indispensable if the policy goal of sustainable timber supply is to be achieved.

On the other hand there are a number of positive economic impacts, particularly in the medium to longer term:

- Current AACs are not sustainable. Insecure prospects for timber supply are a disincentive for investments in the timber industry sector. While AACs will have to be reduced, the new levels can be sustained for indefinite time. This will provide a secure planning horizon for new investments in the sector. There will be high job security after restructuring is completed.
- Current utilization rates in the timber-processing industry are very low, e.g. about 50% in Sarawak as compared to 85 to 90% in developed countries. Reduced timber supply and ensuing higher costs of round wood will act as an incentive to invest in more efficient procedures and technologies. Likewise, reduced but secure timber supply might also lead to increased value-added downstream processing, which in turn will result in higher income from personal and corporate taxes.
- Economic analysis studies which apart from timber values also include values of NTFP, recreational values, soil conservation values, carbon stocks and biodiversity values clearly demonstrate that the SFM system provides a higher level of welfare to society as a whole.

<u>Forest concession holders and timber industry level</u>

The following short-term impacts need to be taken into consideration:

- The adoption of SFM and accompanied Reduced Impact Logging (RIL) leads to increased expenses for planning, harvesting and training of the participating companies in the short to medium-term.
- Reduced annual allowable cuts and reduced net production area due to delineation of protection zones for river protection, biodiversity conservation, soil protection on steep slopes, etc., will lead to reduced timber production and thus income for the companies.
- Improved log recovery due to reduced number of logs “lost” in the forest and improved felling techniques (less split logs, less trimming losses).
- Decreased losses of productive area due to reduced opening of forest area for construction of skid trails and log landings.
- Increased productivity per machine unit during timber extraction due to better harvesting planning and more efficient harvesting operations (e.g. less machine time wasted in search for logs).
- Reduced accident rates for tree fellers and other field staff due to better training, resulting in less sick leave and treatment cost.

Case studies of GTZ projects in Malaysia and Indonesia have shown that while the operational costs for RIL are higher (e.g. by 20% in Sarawak), RIL harvesting operations are still profitable and thus, economically feasible. This concurs well with other case studies where RIL harvesting in some cases even proved more profitable than conventional harvesting.

In the medium to long term the following positive financial impacts from SFM are expected:

- Reduced damages to residual stands. This will allow for shorter cutting cycles and better stocking levels and extraction rates during the second cut. Furthermore, there will be less need for expensive stand rehabilitation works.

- Certified forest management enterprises can command higher timber prices as evidenced by the Deramakot Forest Concession (Sabah).
- Improved/secured access to high-value timber markets in Europe and North America for certified forest products.
- Secured long-term timber supply (albeit on lower level than current AAC).
- Potential for additional revenues from other forest functions and services (e.g. for carbon sequestration under the Clean Development Mechanism, CDM).
- Reduced expenses through introduction of fiscal incentives for SFM (e.g. tax reductions, access to preferential loans).

Socio-economic and socio-cultural impacts[5]

- Tenurial security for access to forest land and products
- Protection of forest areas with important socio-economic (non-timber forest products production zones) or socio-cultural (burial or ritual sites) functions
- Secure employment opportunities in the timber industry sector
- Improved supply with forest products and increased income for forest-adjacent communities from village development schemes that are often accompanying SFM introduction.

Impact on policy and public debate

By demonstrating practical examples for SFM in model areas GTZ-assisted projects successfully conveyed the need for a paradigm shift in forest management to policy and decision-makers at various administrative levels. They further enhanced the public debate on forest management issues.

[5] See also the detailed analysis of GTZ experiences in Annex 8 of this publication: “Community-Based Forest Management (CBFM) in Southeast Asia”.

Part 2

Synthesis of German Technical Assistance Projects

2.1 Introduction

Part 2 of this document provides project-specific information and synthesises, gained experience and competencies. Chapter 2.2 provides an overview of projects with SFM focus or SFM components and lists their general strategies and approaches towards SFM. Chapter 2.3 comprises of a matrix which categorizes and synthesizes major implemented measures of GTZ projects by core elements for SFM. Chapter 2.4 takes account of the various services and tools which were provided or developed by GTZ projects in support of implementing the different principles. “Lessons learnt” (Chapter 2.5) is a synthesis of the experiences made by GTZ-assisted SFM projects.

2.2 GTZ-assisted projects dealing with SFM

Country	Project (duration)	Project purpose	General strategy towards SFM	SFM approach
Indonesia	Integrated Forest Fire Management Project (IFFM) (1993-2004)	Contribute to reduce damage caused by fire to mankind and the environment in East Kalimantan and to an improved fire management system in Indonesia.		
	Social Forestry Development Project, West Kalimantan (SFDP) (1989-2003)	Rural population in forested areas uses ecologically and economically sustainable, integrated forest management systems.	Local, forest dependent communities are involved and integrated in state forest management and in concessions.	Participatory methods of sustainable forest management are developed, tested and implemented in a model forest area. A training and information centre on the developed approaches towards social forestry is established and operational.
	Sustainable Forest Management Project, East Kalimantan (SFMP) (1991-2002)	Sustainable management systems for natural production forests in East Kalimantan are supported by national forest policy and implemented by concessionaires and the local population.	Sustainable forest management methodologies are developed and tested in a model concession in the natural production forests. The experiences made in this model concession are fed back to the forest policy dialogue and provide inputs for developing frame conditions and policies supporting sustainable forest management on central, provincial and district level, incl. capacity-building.	The main fields of activities are: forest management, forest and land rehabilitation, social forestry and training. The methodological approaches are: technological development based on practical field experience, implementation support at field level, promotion of certification; integration into partner structures at district, provincial and national level; multi-stakeholder working groups; networking through workshops, training support with national partners at national and local levels; contribute to bottom-up dialogue for policy development.
Malaysia	Forest Management Information Systems Sarawak (FOMISS) (1995-2001)	A sustainable, environmentally friendly and socially acceptable forest management system is applied in Sarawak	Development of a management information system as a basis for sustainable forest management and subsequent development and introduction of sustainable, environmentally friendly and socially acceptable forest management systems,	Co-operation with a private sector company in order to establish a model case for sustainable forest management. The approach is based on the SFM concept developed in Sabah (SFMP). An important tool for management planning is the Geographical Information System (GIS).
	Sustainable Forest Management Project, Sabah (SFMP) (1989-2001)	The sustainable forest management system is tested and progressively implemented.	Integration of forest research with forest management.	1) Strengthening of the capability and capacities of the Forest Research Institute for applied research in relevant topics for SFM. 2. Development and implementation of a scientifically substantiated, ecologically balanced forest management plan in a model forest area in co-operation with private license holders.

Country	Project (duration)	Project purpose	General strategy towards SFM	SFM approach
Malaysia	Sustainable Forest Management and Conservation Project (SFMCP) (1994-2005)	Key elements of sustainable forest management are further refined and applied by the Forestry Department Peninsuar Malaysia on a larger scale in selected forest management units (states).	Support of the forestry department in managing a transition from single-use timber production to multiple-use forest management.	Support on sectoral level (refinement, monitoring and evaluation of the sustainable forest management system) as well as on the operational level (development of operational standards). Main activities are in the areas of forest management, silviculture and harvesting, forest economics and training.
Philippines	Community Forest Project Quirino (CFPQ) (1994-2003)	Local communities, with support from the local government units and the Department for Environment and Natural Resources, manage their renewable natural resources along criteria of sustainability.	Community forest management as core component of sustainable rural development. Additional supplementary measures: participatory land-use planning, promotion of sustainable agriculture and agro-forestry, rural finance schemes, community-implemented / income-oriented infrastructure.	Multi-stakeholder approach working with government institutions and local community organizations. Components: Strengthening the national framework, coordination mechanisms and CBFM techniques; participatory land use planning as basis for the provision of land tenure instruments; transparent and participatory procedures for the preparation of resource use plans and annual work plans for sustainable forest utilization; rural finance schemes designed for the purpose of serving sustainable forest management, sustainable farming systems promotion and income-oriented infrastructure; capacity-building on government and local level.

2.3 Core elements of GTZ’s approach to SFM and project implementation

Policy and legal framework	Forest management planning system	Resource assessment	Growth and yield	Harvesting
Analysis of policy and legal framework *SMCP_Indonesia* *FOMISS_Malaysia* *SFMP_Malaysia*	Development of rules and guidelines for long-, medium- and short-term planning *SFMP_Indonesia* *SFDP_Indonesia* *SFMCP_Malaysia* *SFMP_Malaysia* *FOMISS_Malaysia* *CFPQ_Philippines*	National forest inventories *SFMCP_Malaysia*	Design of continuous forest inventories / growth & yield plots *SFMP_Indonesia* *SFMCP_Malaysia* *SFMP_Malaysia* *FOMISS_Malaysia*	Guidelines for harvest planning incl. pre-harvest inventories *SFMP_Indonesia* *SFMCP_Malaysia* *SFMP_Malaysia* *FOMISS_Malaysia*
Forest policy advisory services *ReFOP_Indonesia* *SFMP_Indonesia* *SMCP_Indonesia* *FOMISS_Malaysia* *SFMCP_Malaysia* *SFMP_Malaysia*		Forest management inventories *SFMP_Indonesia* *SFMCP_Malaysia* *SFMP_Malaysia* *FOMISS_Malaysia* *CFPQ_Phillipines*	Support to analysis of growth & yield research data *SFMP_Indonesia* *SFMCP_Malaysia* *SFMP_Malaysia*	Reduced impact logging guidelines *SFMP_Indonesia* *SFMCP_Malaysia* *SFMP_Malaysia* *FOMISS Malaysia*
		Other resource inventories incl. development of data processing software *SFMP_Indonesia* *SFMCP_Malaysia* *FOMISS_Malaysia*	Software development for data processing *SFMP_Indonesia* *SFMCP_Malaysia* *SFMP_Malaysia* *FOMISS_Malaysia*	Guidelines for forest road construction and maintenance *SFMP_Indonesia* *SFMCP_Malaysia* *SFMP_Malaysia* *FOMISS_Malaysia*
			Development of computer-aided forest growth simulation models *SFMP_Indonesia* *SFMCP_Malaysia* *SFMP_Malaysia* *FOMISS_Malaysia*	Promotion of environmentally friendly extraction systems *SFMP_Indonesia* *SFMCP_Malaysia* *SFMP_Malaysia* *FOMISS_Malaysia*

Silviculture	Financial and economic analysis	Social aspects / community participation	Monitoring & evaluation systems and tools	Capacity-building
Applied silvicultural research *SFMP_Indonesia* *SFMCP_Malaysia* *SFMP_Malaysia* *FOMISS_Malaysia*	Proposals for fiscal and financial incentives for SFM *SFMP_Indonesia* *SFMCP_Malaysia* *SFMP_Malaysia* *FOMISS_Malaysia*	*See the detailed analysis of GTZ experiences in Annex 8: Community-Based Forest Management (CBFM) in Southeast Asia*	Development of forest management information systems *See the analysis of GTZ experiences in Annex 12: Information and Knowledge Management Systems in the Context of Natural Resources Management in Southeast Asia*	Curriculum development for forest training institutes *SFMCP_Malaysia* *UMS_Malaysia* *SFMP_Indonesia*
Guideline development *SFMP_Indonesia* *SFMCP_Malaysia* *SFMP_Malaysia* *FOMISS_Malaysia*	Guidelines for financial analyses of forest management operations *SFMCP_Malaysia* *FOMISS_Malaysia* *CFPQ_Philippines*		Development of guidelines for mid-term reviews for FMP *SFMP_Indonesia* *SFMCP_Malaysia*	Design and organization of training courses on different topics and for different recipient groups (forest workers, forestry field staff, forestry professionals) *SFMCP_Malaysia* *SFMP_Malaysia* *FOMISS_Malaysia* *SFMP_Indonesia*
	Support to financial and economic studies *SFMCP_Malaysia* *FOMISS_Malaysia*		Self-scoping handbook for assessing progress towards SFM *SFMCP_Malaysia*	

2.4 GTZ core competencies with regard to implementation of the Forest Principles

SFM PRINCIPLE	AREAS OF SUPPORT / DEVELOPED TOOLS
Conducive policy and legal framework	• Analysis of the policy and legal framework vis-à-vis requirements for SFM introduction and implementation • Forest policy advisory services • Lobbying for and promotion of SFM
Security of forest tenure and the permanent forest estate	• Support to national or sub-national land use planning → Definition of permanent forest estate • Surveying and mapping tools (GPS, GIS applications) • Forest zoning (classification of productive and protective forests) • Delineation of forest management units • Model contract development for long-term concessions • Participatory forest boundary demarcation • Social surveys
Forest management planning	• Development of concepts, guidelines and field manuals for - forest management plan (FMP) preparation incl. FMP format - forest zoning - volume- and growth-based AAC calculation - annual operational planning - harvesting planning • support to the FMP preparation (model plan development) • forestry GIS development
Permanent definition of forest boundaries	• Participatory boundary demarcation • Delineation of FMUs • Compartmentalization • Forest zoning • Development of forestry GIS and mapping tools • Manual for GPS application in boundary surveys
Effective forest protection	• Development of integrated forest fire management concept and system • Guideline for planning of integrated forest fire management measures as part of medium-term FMP
Maintenance of forest ecosystems and	• Development of concepts, guidelines and field manuals for - Forest zoning

SFM PRINCIPLE	AREAS OF SUPPORT / DEVELOPED TOOLS
site productivity	- Forest site classification and mapping - Reduced impact logging - Road planning and road construction - Silviculture of different forest types - Biodiversity surveys and delineation of buffer zones and wildlife corridors - Environmental impact studies and assessments • Feasibility studies, guideline development and promotion activities for the introduction of environmentally friendly timber extraction systems (long-distance cable yarding, helicopter logging, on-site processing, etc.)
Assessment of forest resources	• Concept, guideline and field manual development for different types of forest inventories: - National forest inventories - Forest management inventories - Pre- and post-harvest inventories • Technical support towards implementation of inventories • Manuals for timber cruising / tree location and topography mapping • Development of tailor-made software applications for processing of inventory data • Assistance to data interpretation
Determination of sustainable harvesting levels	• Growth and yield research (design, data management, data interpretation) • Continuous forest inventories (concept, guideline, field manual) • Development of computer-aided growth simulation models (e.g. DIPSIM, FORMIX)
Appropriate silvicultural system	• Applied silviculture research • Development of silviculture guidelines for different forest types • Guidelines for rehabilitation of degraded forests • Development of systems to ensure procurement of high-quality planting material (e.g. National Tree Seed Projects)
Commercial sustainability and business management	• Proposals for fiscal and financial incentive schemes for SFM introduction • Studies on appropriate forest revenue systems • Economic analysis on other forest functions (e.g. carbon sequestration, ecotourism and forest recreation development, NTFP development, etc.) • Model area development in collaboration with the private sector

SFM PRINCIPLE	AREAS OF SUPPORT / DEVELOPED TOOLS
	• Guidelines for financial analysis • Economic studies, e.g. on RIL, silviculture treatments, deployment of soil conserving timber extraction systems • Development of model contracts for long-term timber concessions • Market analysis for timber and timber products • Studies on processing and marketing of non-timber forest products (NTFP)
Minimization of adverse environmental impacts	• Integration of environmental aspects into guidelines for all stages of forest management, i.e. RIL guidelines, road specifications/road planning guidelines, silviculture) • Environmental impact studies
Community participation	• Guidelines for social and socio-economic surveys • Implementation of social and socio-economic surveys • Development of participatory planning tools: participatory boundary demarcation, participatory forest inventories, participatory land use assessments • Concept development for CBFM (a detailed analysis of GTZ experiences is presented in Annex 8: "Community-Based Forest Management (CBFM) in Southeast Asia") • Development of partnership schemes and village development schemes • Conflict management (GTZ as moderator and mediator) • Capacity-building for communities incl. establishment and support to community-based organizations • Promotion of model cooperation contracts between communities and concession holders
Monitoring and evaluation	• Guidelines for mid-term reviews of FMP • Development of forestry GIS and forest management information systems • Continuous forest inventory • Compliance assessments of harvesting operations (e.g. for RIL) • Self-scoping handbooks for forest management certification
Capacity-building (relevant for all principles)	• Training needs analysis • Assistance to curriculum development for formal forestry training institutes • Development and organization of in-service training courses for forestry staff at all levels (field workers, field officers, forest professionals) • Support to organizational development

2.5 Lessons learnt

Due to the long-standing co-operation with partner countries in the area of SFM system development a wealth of experience and knowledge was accumulated in GTZ-assisted SFM projects in Southeast Asia. This chapter summarises important success factors and approaches that proved crucial for SFM implementation.

General conditions and success factors

- In the framework of GTZ-assisted projects it could be successfully demonstrated that SFM is technically and economically feasible (e.g. Indonesia and Malaysia).
- SFM projects have contributed substantially to initiating and maintaining the public debate on SFM and to conveying the necessity of a paradigm shift in forest management to the political level.
- Successful implementation and dissemination of SFM depends on a stable and conducive policy framework; there has to be a prudent balance between maintaining and enforcing the principles of SFM on one hand and granting the private sector sufficient flexibility and security to be economically successful.
- While SFM is widely accepted as the right strategy to ensure long-term benefits from a country's forest resources, its immediate economic consequences such as reduced timber supply, lower extraction rates, higher operational costs, lower company profits and lower government revenues are deterrents for SFM implementation.
- Without a strong political backing, starting at the national level, the chances for actual SFM implementation on a larger scale are rather slim.
- SFM needs to be integrated into national development policies and plans at national, regional and local level.
- Security of land tenure for both the private sector and the local population is one of the critical success factors for SFM to take off-ground.
- In countries with an oversized timber-processing sector there is a strong pressure to maintain allowable cuts above sustainable levels. Hence, appropriate strategies for restructuring and down-sizing the industry have to be developed to facilitate the introduction of SFM.

Project design

- As listed above, there are a number of critical success factors for SFM to take off ground. Since many of these factors relate to required policy and legal reforms, an SFM project should either comprise a forest policy advisory component or well defined linkages with separate policy advisory projects. This way bottom-up feedback of field experiences can be conveyed to the policy level and lead to the formulation of realistic policies and legislation, thus removing constraints for SFM implementation.
- SFM projects are well positioned to contribute to the development of national forest management certification schemes. Model areas are an excellent development and testing ground for realistic indicators and verifiers for SFM. In turn, there are strong indications that forest management certification can become an effective political instrument to promote change towards SFM.
- Due to their complexity, SFM projects require stamina on the part of all actors and adequate project durations (commonly more than 10 years). Long-term commitments and continuity of seconded experts proved also essential for a good standing amongst and good working relationships with the implementing partners.

Model forest development / cooperation with private sector

- The demonstration of a practical example for SFM through model forest development proved instrumental in garnering support for SFM. Model forests have contributed to an enhanced public debate on forest management issues and to increased awareness amongst policy- and decision-makers on the need for a paradigm shift in forest management.
- Certification under an internationally recognised scheme increases the credibility of the model and renders it an attraction for the highest political level (e.g. Deramakot Forest Reserve, Sabah). Model areas can thus become an effective tool for lobbying amongst decision-makers and the corporate sector, both sparking interest in SFM and enhancing support for required reforms.
- Since actual forest management is implemented by the private sector in most countries, cooperation with the private sector in system development, testing and refinement under pilot area arrangements is indispensable. This way the economic conditions and constraints and the management principles and objectives of these companies can be adequately reflected and thus an implementable system be developed.
- Partners in the private sector are usually not very patient and pursue straightforward financial goals. Important principles of Technical Cooperation and SFM like community participation, social justice and benefit sharing, poverty alleviation and gender-sensitivity are of little if any importance in the decision-making of a logging company. This bears risks for conflicts, inadequate support and slow implementation.
- Without firm commitment of corporate managers no implementation can be achieved. Therefore, the careful selection of partners in model area development is crucial. A genuine support for SFM can be expected from logging companies who have a market-driven and demonstrated interest in forest management certification and who see it as a vehicle to improve the company's image.
- Furthermore, it is important to discuss and create transparency on the expected economic but also procedural implications of SFM and RIL already during the initial negotiations so that the top management can make an informed decision on a possible co-operation. This also allows companies sufficient time to adjust downstream processing, manpower development and investment strategies.
- It also seems important to focus on forest areas in which other required framework conditions are already well in place (e.g. defined forest management unit, signed licence agreement, established basic infrastructure and resources), so as not to waste precious implementation time.
- The private sector expects that governments provide adequate contractual and financial incentives to facilitate the transition process towards SFM. In view of substantial initial investment and expected external benefits, this is a legitimate request which should be supported by the project through developing of and lobbying for appropriate incentive schemes.

Financial and economic analysis

- Experience shows that there is a permanent discussion and reservations on the economic viability of SFM. Projects should enhance this debate by commissioning financial and economic studies on the impact of SFM as soon as sufficient data are available. Economic and financial impacts should be assessed on macro, meso and FMU level so that the results can be used to target different groups during lobbying activities, i.e. politicians, forest professionals and administrators and managers of private companies.

- Studies in Malaysia and Indonesia indicate that Reduced Impact Logging (RIL) in forest concessions is financially viable on short and long-term, even though it requires investments into training, better planning and more complex work procedures. However, traditional timber mining is more profitable in the short-term and therefore more attractive for companies which solely pursue short-term economic objectives.
- To attract such companies any promotion of RIL must focus on short-term financial benefits. Insights into cost structures and operational processes as gained by financial analyses must be used to further improve the cost effectiveness of forest management operations.
- Regarding economic impacts which include an valuation of environmental forest functions RIL is clearly superior to conventional logging.
- The transition from present forest management practices to a SFM system should be supported with adequate incentives for the private sector and the rural population. Towards this end projects should embark on (i) elaborating a community development programme for the local population and (ii) designing an incentive system for the private sector by supporting the transition period through royalty rebates, tax exemption and other financing instruments (e.g. carbon-offset mechanism – CDM).

Technology development and dissemination

- Developed technologies must be practical and implementable with available resources; in view of this, sacrifices on technical perfection are necessary in order to increase chances for actual implementation.
- As a starting point, technology 'prototypes' as developed by other projects can be used. However, they have to be adjusted to national and local needs. The inputs and time required for successful adaptation should not be under-estimated.
- Technology development requires intensive field-testing and continuous refinement based on the testing results. From the beginning, all relevant stakeholders have to be involved in this process, most notably the private sector as the ultimate user.
- Successful introduction of RIL to a forest management unit (concession) requires intensive (i) staff training, (ii) a period of 2-3 years to adjust planning and production procedures and (iii) an effective and reliable internal control system to monitor the implementation progress.
- Technical recommendations and new technologies need to be tested and practically demonstrated in the field prior to their dissemination.
- RIL and other SFM practices must be adopted voluntarily because operators are convinced of their superiority. Workshops for forest managers to convey the advantages of SFM are essential for dissemination.
- In view of the technical, managerial and economic complexity of SFM, the continued provision of backstopping during the dissemination phase is essential.
- Training courses on management practices (e.g. RIL training) must be developed in close cooperation with the industry. They should be based on a thorough analysis of skill gaps.
- Existing training institutes should be charged with the actual implementation of training courses, starting with the dissemination phase. The project's inputs should focus on support for curriculum development and training of trainers.

TOOLBOX

The following pages provide:

(i) a structured overview of the concepts and instruments which German Technical Cooperation has pursued in support of forest sector development in Southeast Asia, together with

(ii) an exhaustive, accessible list of major documents that have arisen out of project work, through 25 years of bilateral cooperation: presentations, recommendations, reports, manuals and templates.

For ease of use, the material has been arranged into ten key aspects of sustainable forest management implementation, to suit the reader's specific focus of interest. An annotated bibliography provides brief executive summaries of each document. It further provides an indication of possible uses of the documents presented. The toolbox not only enables practitioners to identify previous GTZ projects' activities and outputs: Readers are also encouraged to directly get hold of reports and manuals – via the Forest Clearing House Mechanism (CHM) website http://forest-chm.aseansec.org. All documents that can be downloaded in full text from the CHM carry the respective link, in the bibliography. The remaining documents can be ordered as electronic copy from the ASEAN Secretariat, Ms. Setia Dewi (setiadewi@aseansec.org) or from GTZ's contact persons Bernhard von der Heyde (bernhard.heyde@gtz.de) and Rolf Krezdorn (rolf.krezdorn@gtz.de).

Some of the activities carried out by GTZ-assisted projects do not lend themselves to be readily presented by means of a manual or concept paper. This applies particularly to activities in the area of policy advice, lobbying and promotion of SFM, but also technical support towards the implementation of inventories or assistance to data interpretation. The importance of tacit knowledge and its communication in the process of SFM development and implementation must be underlined in this context.

Content: The toolbox contains documents about the following areas of intervention and countries:

Policy and Legal Framework		
Analysis of policy and legal framework vis-à-vis requirements for SFM introduction and implementation	Situation analysis and proposals for strategic actions towards SF (1)[1]	*Peninsular Malaysia*
	Legislative implications for SFM implementation (1)	*Sabah*
	Preconditions and strategies for SFM (1)	*Sabah*
Support to national forest land use planning	National or sub-national land use planning (1)	*Indonesia*

Forest Management Planning		
Development of planning systems and concepts	Analysis of planning system (1)	*Peninsular, Malaysia*
Forest management plan preparation	Guideline for preparation of state forest management plans (1)	*Peninsular Malaysia*
	Guideline for preparation of district forest working plans (1)	*Peninsular Malaysia*
Forest zoning	Guidelines for multifunctional zoning (1)	*Peninsular Malaysia*
	Zoning for wildlife (1)	*Sarawak*
	Wildlife assessment (1)	*Peninsular Malaysia*
Volume- and growth-based AAC calculation	Concept for AAC determination (1)	*Indonesia*
	Guideline for yield regulation (1)	*Peninsular Malaysia*
Annual operational planning	Guideline for preparation of annual operational plans (1)	*Peninsular Malaysia*
	Guideline for operational planning on compartment level (1)	*Peninsular Malaysia*
Planning of integrated forest fire management measures as part of medium-term FMP	Guideline for planning of integrated forest fire management (1)	*Peninsular Malaysia*

[1] Figure in brackets indicates the number of documents. For the sake of simplification all titles are spelt in small letters.

Assessment of Forest Resources		
Continuous forest inventories (2)		*Peninsular Malaysia*
Forest management inventories (1)		*Sabah*
Pre- and post-harvest inventories (1)		*Sabah*
Integrated forest resource assessment (hard copies) (2)		*Sarawak*
Forest site classification and mapping		*Sarawak*
		Sabah (2)
Manuals for timber cruising / tree location and topography mapping	Guidelines for timber cruising and topographical surveys (1)	*Indonesia*
	Manual for pre-harvest assessment (1)	*Peninsular Malaysia*
	Manual for rapid timber reconnaissance survey (1)	*Peninsular Malaysia*
	GIS application for infrastructure and tree location mapping and identification of inventory sample plots (1)	*Peninsular Malaysia*
Development of tailor-made software applications for processing of inventory data	Database manual FRIDAP (1)	*Indonesia*
	Database manual: analysis of forest management inventory data (2)	*Sarawak*
	Overview over developed software applications (1)	*Peninsular Malaysia*
	Manual for MIDAP (1)	*Peninsular Malaysia*
	Forest Geographic Information System (1)	*Peninsular Malaysia*
	Surveying and mapping tools (GPS, GIS applications) (1)	*Sarawak*

Growth and Yield, Computer Modelling	
Growth and yield research (1)	*Peninsular Malaysia*
Development of computer-aided growth simulation models	*Peninsular Malaysia* (3)
	Indonesia (2)
	Sarawak (2)

Timber Harvesting		
Forest harvesting planning		*Peninsular Malaysia*
Forest road specifications	Operators manual for forest road construction (1)	*Sarawak*
	Computer-aided road planning (1)	*Indonesia*
Reduced-impact logging	Reduced-impact logging with tractors (1)	*Sarawak*
	Guideline: RIL with tractors (2)	*Indonesia*
	Guideline: directional felling in selective managed forest (1)	*Indonesia*
	Cable logging systems: overview and feasability studies (2)	*Indonesia*
	Timber harvesting guidelines for commercial class II – Forest reserves (1)	*Sabah*
	RIL guideline (1)	*Peninsular Malaysia*
	Situation analysis on ground skidding (1)	*Peninsular Malaysia*

Silviculture and Research	
Development of silviculture guidelines for different forest types	*Sarawak (2)*
	Peninsular Malaysia
Guideline for rehabilitation of degraded forests	*Indonesia*
Development of systems to ensure procurement of high-quality planting material	*Peninsular Malaysia (2)*
Applied silviculture research	*Sabah*

Financial Analysis of SFM	
Financial and economic analysis of forest management systems	*Sarawak*
	Peninsular Malaysia
	Sabah

Financial and economic analysis of timber harvesting operations (1)		*Sarawak*
Financial and economic analysis of silvicultural treatment operations (1)		*Sarawak*
Proposal for fiscal and financial incentive schemes for SFM introduction (1)		*Sabah*
Economic analysis of other forest functions	Significance and development potential of non-wood forest products (1)	*Indonesia*
	Recreation forest potential (1)	*Sarawak*
	Carbon sequestration (2)	*Sarawak*
Guideline for financial analysis (1)		*Peninsular Malaysia*
Market analysis for timber products (1)		*Sarawak*
Development of model contracts for long-term timber concessions (1)		*Sabah*
Studies on appropriate forest revenue systems (1)		*Sabah*

Social Aspects / Community Participation	
Participatory land use planning	*Viet Nam (2)*
	Indonesia (1)

For more about social forestry please refer to the detailed toolbox in "Community-Based Forest Management in the Context of Natural Resources Management in Southeast Asia" (Annex 8 of this reader).

Monitoring and Evaluation Systems and Tools	
Monitoring Project Impact (1)	*Viet Nam*
Guidelines for midterm reviews of FMP (1)	*Peninsular Malaysia*
Development of forestry GIS and forest management information systems (1)	*Sarawak*
Compliance assessments of harvesting operations	*Peninsular Malaysia*
	Sarawak
Self-scoping handbooks for forest management certification (1)	*Indonesia*

Capacity-Building	
Training needs analysis (1)	*Peninsular Malaysia*
Assistance to curriculum development for formal forestry training institutes (3)	*Peninsular Malaysia*
Support to organisational development	*Peninsular Malaysia* (1)
	Sabah (2)
Training for forest inventories (1)	*Sabah*
Capacity-building on village – level forest protection and development regulations (1)	*Viet Nam*
Integration of CBFM in university education and research (2)	*Laos*

Policy and Legal Framework

Analysis of policy and legal framework vis-à-vis requirements for SFM introduction and implementation

Source	**Implementation of Sustainable Forest Management in Peninsular Malaysia: Some Considerations on Strategic Issues**
Author	v.d. Heyde Bernhard
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	1996
Abstract	The document examines some strategic issues pertaining to the implementation of sustainable forest management (SFM) in Peninsular Malaysia. It critically assesses the effectiveness of Criteria and Indicators with regard to their contribution to improvements on the ground and calls for substantial changes in the organization and behaviour of the public and private sector. Strategic planning is required which focuses on: model development; transformation of forest districts into certifiable Forest Management Units; provision of adequate human, physical and financial resources for SFM; structural adjustment plan for industries; streamlining the legislative framework with the National Forest Policy. Some suggestions are made concerning the transformation process. It is stipulated that the transition from single-use timber production to multiple-use, sustainable forest resource management not only requires market forces (certification) and the mobilisation of financial resources, but also public incentives for the private sector.
Relevance of Document	The paper is deliberately kept succinct because the rapid pace of change in the Malaysian forestry sector would make any written recommendations obsolete once they are published.
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Author

Source	**Legislative Implications for Implementing the Forest Management System in Sabah**
Author	Tuttle Andrea
Project	Sustainable Forest Management Project, Sabah, Malaysia
Year	1993
Abstract	This report examines the statutory authorisation for the Forestry Department to conduct forest management activities, and proposes amendments to provide necessary management capability. The report also addresses funding options to support the program, and issues of competing land use on forested lands. An approach is suggested for complying with federal Environmental Quality Act requirements for assessing the environmental impacts of logging.
Relevance of Document	While it is recognized that statutory changes are a legislative matter, the report provides a technical assessment and no attempt is made to address the political context.
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Author

Source	**Preconditions and Strategies for SFM in Sabah** (in German)
Author	Kleine Michael
Project	Sustainable Forest Management Project, Sabah, Malaysia
Year	1994
Abstract	This document – written in German – describes a comprehensive management system for Sabah's forests comprising planning, implementation and control procedures. Furthermore, it deals with various preconditions required for its implementation.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000642
Resource person	Author

Support to National Forest Land Use Planning

Source	**Forest Mapping for Land Use Planning and Sustainable Forest Management in Indonesia**
Author	Santoso I. & Hinrichs Alexander
Project	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia
Year	2000
Abstract	This document summarises the existing standards of mapping for Land Use Planning (LUP) under the new decentralisation paradigm. It briefly analyses and describes the existing legal base and planning procedures for forest land use planning (FLUP) and its links to LUP. Based on the standards and analysis recommendations are proposed on a more appropriate mapping process for FLUP and LUP. Furthermore, some requirements for forest maps are developed.
Relevance of Document	
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000644
Resource person	Authors

Forest Management Planning

Development of planning systems and concepts

Source	**Analysis of Planning System vs. ITTO "Guidelines"**
Author	Jeffri R.A. & Muziol Christoph
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	1995
Abstract	This report compares the forest management planning procedures of Peninsular Malaysia as of 1995 with the relevant standards of the “ITTO Guidelines for the Sustainable Management of Natural Tropical Forests” (1990) and “ITTO’s criteria for the measurement of sustainable tropical forest management” (1992).
Relevance of Document	Relevant as part of a process description of the on-going process from single use forest management to sustainable multiple use forest management in Peninsular Malaysia. It established the basis for more specific technical guidelines and field instructions.
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Author

Forest Management Plan preparation incl. FMP format

Source	**Content and Write-Up of a State Forest Management Plan**
Author	Haase Guenther & Schindele Werner
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2005
Abstract	Guideline for preparation Forest Management Plans (FMP) on state FMU level in Peninsular Malaysia, which was developed based on internationally acknowledged standards for FMPs and the requirements of the Malaysian Forest Management Certification System (MC&I, 2002). The State Forest Management Plan (SFMP) is a strategic framework plan which describes the forest development policy of the given state and defines management objectives and their hierarchy. It includes an analysis of the forest sector of the state and past forest management. It determines the AAC for the state FMU based on the result of a forest management inventory and further apportions it to the lower administrative level, i.e. the forest districts. Based on the different analytical steps, it sets out

	strategies and general prescriptions for management of forests for multiple functions. The guideline comprises a short introduction and a SFMP template with defined structure, explanatory notes to every chapter and defined table formats for compilation of information. The latter allow for easy aggregation of data for entire Peninsular Malaysia, e.g. by inserting them into the forest management information system.
Relevance of Document	Among others, the plan template is useful as a source for developing FMP formats for other countries
Advantages	Template with defined structure and table formats. Eases FMP preparation and allows for, if applied properly, preparation of coherent and consistent FMPs on national or sub-national levels and easy aggregation of data on these levels
Limitations and Challenges	FMP template is tailor-made for conditions in Peninsular Malaysia (PM). Situation in PM differs from many other countries, in particularly with regard to FMU size, which is unusually large in PM (up to 1,5 Mio ha, comprising the total forest estates of a given “state”). Careful adaptation to given national contexts are therefore indispensable. For preparation of operational FMPs refer to Guideline for Preparation of District Forest Working Plans (below).
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000646
Resource person	Authors

Source	**Guideline for Preparation of District Forest Working Plans**
Author	Haase Guenther & Schindele Werner
Project	Sustainable Forest Management and Conservation Project , Peninsular Malaysia
Year	2005
Abstract	A guideline for preparation of District Forest Working Plans (DFWP) in Peninsular Malaysia (PM). DFWPs are operational FMPs for forest districts (usually comprising < 100,000 ha). It provides a detailed description and analysis of the forest resource base, assesses the implications of past management, defines the allowable cut and contains a semi-detailed planning of silvicultural and other operations, including technical specification, implementation schedule and financial analysis. The guideline comprises a short introduction and a DFWP template with defined structure, explanatory notes to every chapter and defined table formats for compilation of information. The latter allow for easy aggregation of data for the entire state, e.g. by inserting them into the forest management information system.
Relevance of Document	The plan template is useful as a source for developing formats of operational FMPs for other countries
Advantages	Template with defined structure and table formats. Eases DFWP preparation and allows for, if applied properly, preparation of coherent and consistent DFWPs on sub-national levels (i.e. state level in PM) and easy aggregation of data on these levels
Limitations and Challenges	FMP template is tailor-made for conditions in Peninsular Malaysia (PM). Careful adaptation to given national contexts is therefore indispensable.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000647
Resource person	Authors

Forest Zoning

Source	**Guideline for Multifunctional Zoning**
Author	Haase Guenther & Schindele Werner
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2005
Abstract	The guideline describes the procedure for multifunctional zoning in Peninsular Malaysia (PM). It reflects and further operationalises the requirements of the national forest legislation and the Malaysian forest management certification system (MC&I, 2002). The methodology comprises a two-step approach: Step 1: For the entire FMU forest functions and zones are identified based on GIS analysis and analysis of available secondary data. This process provides an estimate of the net production area and a preliminary forest function map. Step 2: Verification and identification of additional forest functions and zones during field surveys. This step is carried out for those compartments that are selected for harvesting during the process of pre-harvest planning. It identifies the actual net production area and defines management prescriptions in line with the designated zones. The functions and zones as identified during Step 1 have to be updated with the information generated in step 2. Step 2 completes multifunctional zoning for a given forest area. Ascertained forest functions (11 different functions) are reclassified to three management zones, i.e. (i) protection zone (commercial harvesting prohibited), (ii) timber production zone 2 (only soil-conserving extraction systems permitted, e.g. cable yarding systems), (iii) timber production zone 1 (ground-based skidding permitted)
Relevance of Document	Methodology can be adjusted to requirements of other countries
Advantages	Through the GIS-based analysis (step 1) a sufficiently accurate estimate of the net production area is possible, a pre-requisite for yield regulation. (Note: Field-based assessments of forest functions in the total FMU are usually not possible in tropical rain forests due to the large size of FMUs (time and cost constraint!) and inaccessibility of majority of forest areas, except for recently harvested compartments). GIS analysis data will be continually amended with field-based information, resulting in a progressively more accurate information on forest functions and zones of forest estate (iterative process).
Limitations and Challenges	Careful adjustments to other countries required. Analysis on macro-level (step 1, refer to above) requires the establishment of GIS capacities within the State Forest Department in terms of hardware/equipment and a critical mass of GIS proficient professionals, i.e. a significant financial commitment on the part of partner countries/state forest administrations.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000648
Resource person	Authors

Source	**Developing Wildlife Zonation Criteria for Forest Management Planning**
Author	Sebastian Anthony
Project	Forest Management Information Systems Project, Sarawak, Malaysia
Year	1999
Abstract and Relevance of Document	The report lists a preliminary set of guidelines on the process of creation of wildlife overlays within Forest Management Units as an integral part of sustainable forest management. They serve as a framework for data gathering. A set of criteria is developed for the creation of wildlife overlays. Analysis of the data enables the setting of priorities for wildlife conservation and maintenance of ecosystem functioning within an FMU.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000649
Resource person	Author

Source	**Wildlife Assessment in KPKKT FMU and Recommendations for Wildlife Conservation**
Author	WWF Malaysia
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	1998
Abstract	The report is the result of a wildlife survey conducted in the KPKKT concession area in Terengganu, Malaysia. The objective of the survey was to investigate the richness of mammalian and avian wildlife, to investigate the spatial variation in wildlife richness within the concession area and to derive from these results management recommendations for forestry practices with the aim to reduce the impact of timber extraction on wildlife.
Relevance of Document	The survey results provide valuable input for improving forest management with respect to wildlife. However, the suitability of the approach and methods used as routine wildlife surveys to be integrated into forest management planning and implementation is limited.
Download	Soon to be obtained from the CHM
Resource person	WWF Malaysia

Volume- and growth-based AAC calculation

Source	**Concept for Annual Allowable Cut Determination for logged over forests based on stocking potential and increment**
Author	Hinrichs Alexander
Project	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia
Year	1998
Abstract	The document presents a transparent way of Annual Allowable Cut determination for Indonesia's forest resource, using the DIPSIM growth and yield model.
Relevance of Document	Offers an approach to fulfil the requirement of the Indonesian criteria catalogue for SFM (SNI) to base the AAC of each individual concession area on its mean periodical commercial volume increment.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000652&cat=66
Resource person	Author

Source	**Guideline for Yield Regulation**
Author	Haase Guenther & Schindele Werner
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2005
Abstract	The document describes the process for yield regulation of Dry Inland Forests of Peninsular Malaysia: Inputs for AAC calculation are the net production area (→ multifunctional zoning), the mean annual increment (→ growth and yield research) and the current standing stock (→ forest management inventory). The application of reduction factors provides allowance for damage to the residual stand during logging (damage factor) and for the retention of mother trees and protected trees (felling intensity factor). The preliminary AAC is determined using the formula methods of Paulsen-Hundeshagen, Heyer and Adjusted Area Control and DIPSIM data. The results of these four methods are weighted to calculate the preliminary AAC. In a further step it is verified whether there are sufficient harvestable areas within the FMU to realize the preliminary AAC. If not, the AAC has to be reduced. A forest area is considered harvestable, if the harvestable volume above the cutting limit exceeds the harvesting threshold set by the management based on economic and silvicultural considerations. The verified AAC for the FMU will be apportioned to Forest Districts and long-term timber concessions. Subsequently the compartments that meet the harvesting criteria will be identified.
Relevance of Document	With adjustments applicable for other countries
Advantages	- Relatively simple method for yield regulation in large FMUs

	- Iterative process for verification of calculated AAC
Limitations and Challenges	Methodology depends on availability of sufficiently accurate growth and yield data and inventory data. Suitability of formula methods and their individual weights need to be ascertained through testing.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000653
Resource person	Authors

Annual Operational Planning

Source	**Guideline for Preparation of Annual Operational Plans (AOP)**
Author	Haase Guenther & Schindele Werner
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2005
Abstract	The guideline comprises a short introduction and a AOP template with defined structure, explanatory notes to every chapter and defined table formats for compilation of information. The latter allow for easy aggregation of data at higher levels (state), e.g. by inserting them into the forest management information system. The Annual Operational Plan (AOP) is the instrument to determine the order and extent of all work of any nature to be carried out during one year. It is based on the prescriptions of medium-term forest management plans. The AOP specifies all resources (manpower, materials, equipment, finances) required for the implementation of scheduled activities. AOPs are prepared for every Forest District.
Relevance of Document	The plan template is useful as a source for developing formats of AOPs for other countries
Advantages	Template with defined structure, standard text modules and standard table formats. Eases AOP preparation and allows for easy aggregation of planning data on higher administrative levels.
Limitations and Challenges	AOP template is tailor-made for conditions in Peninsular Malaysia (PM). Careful adaptation to given national contexts are therefore indispensable (e.g. regarding sequence of working and planning steps).
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000654
Resource person	Authors

Source	**Guideline for Operational Planning on Compartment Level**
Author	Haase Guenther & Schindele Werner
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2005
Abstract	The guideline describes the sequence and nature of all assessments and management activities during the “active” period of a given compartment, the so-called compartment management cycle. The management cycle starts with the selection of the compartment for harvesting and is completed after all planned silvicultural treatments are implemented. It may take a period of up to 13 years and comprises of three major blocks: (1) Pre-Harvest Assessment and Planning: mapping and demarcation of forest functions, pre-harvest inventory (systematic sample with 2.5% intensity), tree enumeration (100% enumeration of all trees >40cm dbh), harvesting planning; (2) Post Harvest Assessments: post-harvest inspection and evaluation (assessment of harvesting work and compliance with harvesting plan and RIL guideline, mapping of canopy density classes as basis for silvicultural planning, post-harvest inventory (systematic sample with 2.5% intensity) (3) Silvicultural Planning and Treatment: planning and implementation of silviculture operations, post-F2 inventory to ascertain success of silviculture operations.
Relevance of Document	Applicable for dry inland/mixed dipterocarp forests or similar tropical forest types in other countries
Advantages	- Assessment and planning steps are closely interlinked with and supported by a forestry information system / GIS

	- Tree enumeration procedure in combination with FMIS (compartment register) can be upgraded to log tracking system for legality certification - Simple method for performance evaluation of harvesting contractors
Limitations and Challenges	Methodology (pre-harvest assessments) is quite time-consuming and thus expensive, but indispensable for sustainable forest management of such forest types.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000655
Resource person	Authors

Planning of integrated forest fire management measures as part of medium-term FMP

Source	**Guideline for Planning of Integrated Forest Fire Management**
Author	Abd Rahman Abd Rahim, Haase Guenther & Schindele Werner
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2005
Abstract	The guideline was developed as a supplement to the guidelines for medium-term forest management planning. It describes the different fire management activities in the areas of (i) fire prevention (topics: public awareness creation, law enforcement, forest fire management map, fire breaks, fire hazard reduction, (ii) fire pre-suppression (topics: suppression equipment, incident command system, basic training requirements, organisation of fire fighting centers and crews, fire danger rating) and (iii) fire suppression (topics: fire detection, suppression strategy).
Relevance of Document	Can serve as a model or checklist for developing similar guidelines for other countries
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000656
Resource person	Authors

Assessment of Forest Resources

Continuous forest inventories

Source	**Combined Forest Inventory: Design Report and Field Manual**
Author	Schindele Werner
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2001
Abstract	The two documents, on the one hand describe, on the other hand, provide details for implementation of the Combined Foerst Inventory (CFI). The objective of the CFI is to provide information on state level for the purpose of medium-term forest management planning, to serve as a control mechanism for sustainable forest management on state level, to provide further information for the development of growth and yield functions, to provide information required for the National Forest Inventory. The inventory is a combination of four resources assessment methods: Forest management inventory, combined forest inventory, permanent sample plots and national forest inventory. It related to two levels: stat e (i.e. Forest Management Unit) and national level.
Relevance of Documents	User manual and general description
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000657&cat=66
Resource person	Author

Forest Management Inventories

Source	**Field Manual for the Medium-Term Forest Management Planning Inventory**
Author	Chai, D. Kilou, P., Kleine M.
Project	Sustainable Forest Management Project, Sabah, Malaysia
Year	1991
Abstract	This field manual contains detailed explanations of all measuring procedures, describes different assessments of area characteristics as well as tree and log parameters. It, furthermore, includes codes for all tree species, a slope correction table and a list of necessary field equipment.
Relevance of Document	The Manual is intended to be used by the leader of a field team throughout the field work for supervising the measurements and to ensure that all data collected are of the desired standard.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000660
Resource person	Authors

Pre- and Post-harvest Inventories

Source	**Stand-level Planning in Logged-over Dipterocarp Forest Based on Diagnostic Sampling**
Author	Faller Ingo
Project	Sustainable Forest Management Project, Sabah, Malaysia
Year	1991
Abstract and Relevance of Document	This report is part of a research project on “tending of selected potential crop trees in logged-over dipteropcarp forests of Deramakot Forest Reserves”. It adapts existing linear regeneration sampling techniques to logged-over forests of different ages and succession stages within a natural forest management system. It elaborates decision-making procedures for identification of appropriate silvicultural treatments. Suggestions are provided for further data analysis and their application in silicultural and harvesting planning.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000661
Resource person	Author

Integrated Forest Resource Assessments

Source 1	**Field Instructions for multi-disciplinary Forest Resource Assessment: Volume A: Forest Vegetation**
Author 1	Jonathan Ricky, Rani Abdul & Hahn-Schilling Bernd
Year 1	1998
Source 2	**Field Instructions for multi-disciplinary Forest Resource Assessment: Volume C/D: Survey of Wildlife and Recreational Potential**
Author 2	Jiwan, Dawend, Pau, Madeline George, Jonathan, Ricky, Hahn-Schilling, Bernd
Year 2	1998
Project	Forest Management Information System Sarawak, Malaysia (FOMISS)
Abstract	Field manual for resource assessment, comprising five parts: A Assessment of Forest Vegetation, B. Forest Site Classification, C. Assessment of Wildlife, D. Assessment of Recreation Potential, E. Socio-economic Survey. Except for the socio-economic survey all assessments are performed concurrently in an integrated manner. The forest inventory is based on systematic sampling (1.5 km grid) with L-shaped sample plots of 0.25 ha size.
Relevance of Document(s)	- Field manuals can serve as examples for other areas
Advantages	- Integrated assessment of forest resources, wildlife, recreational potential and site classifica-

	tion, thus saving resources - Forest resource inventory captures data on both timber and non-timber forest products Simple and practical methodology
Limitations and Challenges	- For assessment of recreational potential a preceding aerial reconnaissance survey is recommended; it appears unlikely that forest management bodies are prepared to bear the costs for this.
Download 1	Only hard copy, available from Rolf Krezdorn, GTZ Vietnam
Download 2	Only hard copy, available from Rolf Krezdorn, GTZ Vietnam
Resource person	Authors

Forest Site Classification and Mapping

Source	**Sarawak Forest Site and Soil Survey Manual**
Author	Glauner Reinhold, Jugi Evelyn, Lagan Peter, Ting Sie Ping
Project	Forest Management Information System Sarawak, Malaysia (FOMISS)
Year	1997
Abstract	This manual instructs in depth on systematic acquisition of site and soil data for natural forests.
Relevance of Document	This Field Manual incorporated more than 15 years of experiences in forest site evaluation in Sarawak including plantation as well as natural forest sites. Detailed descriptions aim to "calibrate" the field staff's eyes and fingers to come to an agreeable conclusion when one site is described by different site mappers.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000662
Resource person	Forestry Department Headquarters, Research Branch, Wisma Sumber Alam / 7th Floor, Jalan Stadium, Petra Jaya, 93660 Kuching, SARAWAK.

Source	**Guidelines for forest site classification in Sabah (Basics of Site Mapping and Site reconnaissance)**
Author	Lagan Peter & Glauner Reinhold
Project	Sustainable Forest Management Project, Sabah, Malaysia
Year	1992
Abstract	These guidelines provide details on the purpose and implementation of site reconnaissance surveys as well as site mapping. This also includes the description and instructions for usage of field equipment.
Relevance of Document	General guidelines which are widely applicable.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000663
Resource person	Authors

Manuals for timber cruising / tree location and topography mapping

Source	**Basic Guidelines for Timber Cruising and Topographical Surveys**
Author	Yosep Ruslim
Project	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia
Year	1998
Abstract and Relevance of Document	These guidelines intend to facilitate the planning and implementation of field surveys and data processing in the office with regard to data collection on pre-harvest stocking levels and topography. Its aim is to standardise and combine field data collection for both purposes.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000664&cat=66
Resource person	Author

Source	**Manual for Pre-Harvest Assessments**
Author	Haase Guenther
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2004
Abstract	Manual for field assessments and data processing of pre harvest assessments. Describes the following processes: Mapping and marking of forest functions, mapping of topographic features, pre-F inventory, tree enumeration and tree location mapping, preparation of compartment descriptions, data processing
Relevance of Document	Methodology can be adapted to other tropical forests
	Methodology quite time-consuming and expensive (depending on labour costs) but indispensable for achieving sustainable forest management
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Author

Source	**Manual for Rapid Timber Reconnaissance Survey**
Author	Schindele Werner
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2005
Abstract	Description of the methodology for a rapid timber reconnaissance survey, which was developed on the basis of Prodan's "six tree sample method", a point sample design for the estimation of standing volume. Field testing proved that survey methodology results are reliable. Output data of survey: mean harvestable stems and volume per ha, estimate of different forest zones (protection, timber production 1, timber production 2), commercial volume by species groups.
Relevance of Document	Useful survey methodology for forest management planning systems where intensive pre-harvest assessments are prescribed.
Advantages	Time and resource-efficient survey methodology to ascertain whether a compartment which was preliminarily selected for harvesting on the basis of historic information, has sufficient levels of commercial timber volume. Thus, safes cost for time-consuming and expensive full-fledged pre-harvest assessments in case of pre-mature compartments. Easy to comprehend, therefore hardly any training of survey crews required. Customized Excel spreadsheet available for data entry and automatic calculation of results
Limitations and Challenges	It should be tested whether methodology is sufficiently accurate, before applying it to other forest types.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000673
Resource person	Author

Source	**Usability of GPS in Post-harvesting Infrastructure Mapping, Tree Location Mapping and Stocking Inventories**
Author	Buchholz Georg
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2002
Abstract	Consultancy report and manual for training of forest staff in the use of GPS. It describes the methodology for the use of GPS for inventory purposes as well as for mapping of harvesting infrastructure (roads, log yards, etc) and tree location mapping. Furthermore, the concept for field testing of GPS under Peninsular Malaysia forest conditions is described. Finally, the opportunities and limitations of the use of GPS for forest inventory and mapping purposes are discussed.
Relevance of Document	Generally applicable as manual for the use of GPS.
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Georg Buchholz: georg.buchholz@gtz.de

Development of tailor-made software applications for processing of inventory data

Source	**Database Manual FRIDAP (Forest Resources Inventory Data Analysis Program)**
Author	Setje-Eilers Uwe
Project	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia
Year	2000
Abstract and Relevance of Document	This manual describes the structure and content of the database application FRIDAP (Forest Resources Inventory Data Analysis Program). FRIDAP was developed as a tool for comprehensive analysis of forest management inventory data. It was intended to be the standard software package for the Indonesian Ministry of Forestry and Estate Crops for the processing and analysis of data collected during the medium-term inventory of Forest Management Units.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000675
Resource person	Author

Source	**Database Manual: Analysis of Forest Management Inventory Data**
Author	Setje-Eilers Uwe
Project	Forest Management Information System Sarawak, Malaysia (FOMISS)
Year	1998
Abstract	The document describes the structure and content of a database application developed for the Forest Management Information System Sarawak (FOMISS).
Relevance of Document	The user-friendly database application serves as a standard software package for the processing and analysis of data collected during the medium-term inventory of Forest Management Units.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000676

Source	**Development of Program Module for the Analysis of Permanent Sample Plot Data and Development of Database Application for the Analysis of Wildlife Data**
Author	Setje-Eilers Uwe
Project	Forest Management Information System Sarawak, Malaysia (FOMISS)
Year	1999
Abstract	This report is a follow up of the above listed report dealing with structure and content of a database application developed for the analysis of wildlife data in Sarawak. Main objective is to continue the development of the database application, named FOMIDAS, for the processing and analysis of Forest Management Inventory data. It focuses on the development of an additional program module for the processing of Permanent Sample Plot data. Besides, a database application for the analysis of wildlife data is developed and described.
Relevance of Document	Since most of the steps required to work with the newly developed database application are already described in the Manual dated March 1998, this document just focuses on the proper installation of the program and gives some additional specifications on the program by summarising the most important steps necessary to run the wildlife program.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000677
Resource person	Author

Source	**A Forest Inventory and Growth and Yield Database System for Peninsular Malaysia**
Author	Yong Teng Koon; Weinland, Gerd
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2001
Abstract	This Conference Paper presents the forest inventory and growth and yield database system established for Peninsular Malaysia. The database system represents an integrated programme package containing various modules for the analysis of data obtained from five growth and yield study areas, ninety-five growth plots, pre-felling and post-felling forest inventories and the medium-term forest management inventory (MIDAP). These modules produce and prepare datasets for simulation by

	the Dipterocarp Forest Growth Simulator (DIPSIM), which allows for growth projections.
Relevance of Document	Overview over developed software applications
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000678&cat=66
Resource person	Authors

Source	**Manual for MIDAP (Management Inventory Data Analysis Programme)**
Author	Setje-Eilers Uwe
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2004
Abstract	The manual descibes structure and content of the database application MIDAP (Management Inventory Data Analysis Programme). MIDAP is a software package for the processing and analysis of data collected during state and national forest inventories.
Relevance of Document	MIDAP is the standard software package of the Peninsluar Malaysia Forestry Department used for the processing and analysis of the combined forest inventory.
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Author

Source	**Development of the Forest Management Information System (FMIS)**
Author	Hoesli Thomas
Project	Forest Management Information System Sarawak, Malaysia (FOMISS)
Year	1999
Abstract	This consultancy was part of the Sarawak Forest Department's process to introduce a concept of digital GIS. Consistent pre-established procedures for data conversion were required. Within this context, this consultancy report undertakes a review of the current FMIS set up, focusing on data conversion specifications and database management procedures at the GIS Unit of the Forest Department Sarawak.
Relevance of Document	Focus of assessment on system set-up and data management
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000680
Resource person	Author

Source	**The Forestry Geographic Information System – A Decision Support Tool for Sustainable Forest Management in Peninsular Malaysia**
Author	Buchholz Georg, Wan Abd. Hamid Shukri bin Wan Abdul Rahman
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2003

Abstract	Forest managers in Peninsular Malaysia require detailed spatial information to manage forest resources sustainably. This includes information on logging areas such as boundaries, topography, accessibility and the location of harvestable trees. Using data management systems like Geographical Information Systems (GIS) and Management Information Systems (MIS), the forester can easily capture, store and analyze spatial and non-spatial information. With the information gathered, the Forest Manager is in a position to plan, implement, monitor and evaluate all forest operations required for a multiple-use sustainable forest management. In the spirit of Vision 2020, the Forestry Department Peninsular Malaysia is in the process of developing high-tech solutions like GIS and MIS for the sustainable use of forest resources in Peninsular Malaysia. Various projects are being implemented to ensure the use of up-to-date technologies on the ground. One of these projects is the Forestry Geographic Information System, or "Sistem Maklumat Geographi Perhutanan" (SMGP). The objective of this GIS application is to enable the State Forestry Departments to systematically and rapidly produce operational maps such as license maps, forest inventory maps, timber harvesting maps and other maps relevant for forestry operations. Additional to the cartographic output, with the new linkage to the Compartment Register as the newly developed core model of the MIS spatial analysis for planning and monitoring is possible.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000681
Resource person	Authors

Growth and Yield, Computer Modelling

Growth and Yield Research

Source	**Growth and Yield Assessment for Forest Purposes**
Author	Samsuddin b. Musa, Weinland Gerd, Yong Ten Koon, Zahriah bte Anis
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	1996
Abstract and Relevance of Document	This report provides management descriptions of Growth and Yield Research in Peninsular Malaysia and gives suggestions for data analysis and interpretation.
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Authors

Development of computer-aided growth simulation models

Source 1	**DIPSIM - Dipterocarp Forest Growth Simulation Model for Peninsular Malaysia**
Author 1	Kleine Michael
Year 1	1998
Source 2	**DIPSIM - Dipterocarp Forest Growth Simulation Model for Peninsular Malaysia: DIPSIM User's Guide and Database Manual**
Author 2	Kleine Michael & Setje-Eilers Uwe
Year 2	1998
Source 3	**DIPSIM - Dipterocarp Forest Growth Simulation Model for Peninsular Malaysia: Model Concept and Operation**
Author 3	Kleine Michael
Year 3	1998
Project 1 - 3	Sustainable Forest Management and Conservation Project, Malaysia (SFMCP)
Download 1	Soon to be obtained via CHM; or contact asean-forest@aseansec.org

Download 2	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Download 3	Soon to be obtained via CHM; or contact asean-forest@aseansec.org

Source 4	**Database Manual of the DIPSIM Kalimantan Timur Software Package**
Author 4	Setje-Eilers Uwe
Year 4	1999
Source 5	**DIPSIM – Kalimantan Timur Dipterocarp Forest Growth Simulation Model. Model Concept and Guide to AAC Determination**
Author 5	Hinrichs Alexander & Kleine Michael
Year 5	1999
Project 4 & 5	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia (SFMP)
Download 4	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000686
Download 5	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000687

Source 6	**Development of DIPSIM (Dipterocarp Forest Growth Simulation Model) Sarawak Software Package**
Author 6	Settje-Eilers, Uwe
Year 6	1999
Source 7	**DIPSIM Sarawak (Dipterocarp Forest Growth Simulation Model Version Sarawak)**
Author 7	Kleine Michael
Year 7	1999
Project 6 & 7	Forest Management Information System Sarawak, Malaysia (FOMISS)
Download 6	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000688
Download 7	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000689; http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000690
Abstract	DIPSIM is a user-friendly computer-based growth-modelling tool for natural Dipterocarp Forests. It has been developed or adapted for four different regions, i.e. Sabah, Sarawak, East Kalimantan and Peninsular Malaysia. It is designed as individual tree growth model, using location-specific forest inventory and growth and yield data as input. DIPSIM comprises a growth simulator and a harvesting simulator including a yield scheduling tool. Depending on the region, it also facilitates the considerations of different silvicultural treatment interventions (e.g. Sarawak). There are 3 types of documents. Reports on the model concept (source documents 1, 3, 5 & 7) discuss and evaluate the model and recommend steps for their future improvement. Source documents 2, 5 & 7 contain DIPSIM User Guides DIPSIM Database Manuals (source documents 2, 4, 6) describe the structure and content of DIPSIM. The manuals cover the following topics: (i) DIPSIM installation, (ii) organisation of DIPSIM directory and database tables, (iii) description of developed forms and form files, (iv) description of calculation processes.
Relevance of Documents	- Methodology can be adjusted for other commercial tropical forests of high species diversity
Advantages	DIPSIM is a user-friendly modelling tool that facilitates: - Prediction of future yields of forest areas as a tool for yield regulation; through the harvesting simulator, a suitable (but not necessarily the maximum allowable cut) can be determined by simulating several alternative harvesting scenarios - Development of spatial harvesting strategy and assessment of suitability (‘readiness”) of selected compartments/blocks for harvesting in a given year based on user-defined harvesting criteria (max. removal of stems/ha, minimum of PCT in residual stand, economic cut volume threshold) - Prediction of harvesting impact on residual stand; - Simulation of impacts of silvicultural treatments on stand growth (Sarawak)
Limitations and Challenges	- Since DIPSIM is a statistical modelling programme, it depends on long-term growth and yield research so that statistically reliable parameters for growth functions, mortality rates and recruitment rates can be calculated. - Validity of model and hence the reliability of its predictions depend on good representation of

	site and stand conditions when calculating the above parameters. - Furthermore, the following data are required for DIPSIM adaptation and application to other forest areas: reliable resource data (forest inventory for the FMU, comprising 400 to 700 sample plots), damage factor for residual stand and utilisation factor of harvested trees. Even though these data can be generated in a fairly short time, this requires substantial financial and personnel resources.
Resource persons	Authors: Michael Kleine Uwe-Settje Eilers Alexander Hinrichs

Timber Harvesting

Forest Harvesting Planning

Source	**Guideline for Operational Planning on Compartment Level**
Author	Haase Guenther & Schindele Werner
Project	Sustainable Forest Management and Conservation Project , Peninsular Malaysia
Year	2005
Abstract and Relevance	For full abstract of document refer to reference under heading “annual operational planning”. Document includes a description of assessment and planning steps for harvesting planning.
Advantages	
Limitations and Challenges	Procedures specific for Peninsular Malaysia, adaptations required for other countries.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000655
Resource person	Authors

Forest Road Specifications

Source	**Operators Manual for Forest Road Construction**
Author	Benneckendorf Walter
Project	Forest Management Information System, Sarawak, Malaysia (FOMISS)
Year	2000
Abstract	Practical manual for machine operators involved in road construction. Defines relevant terms, road classes and their technical standards; provides technical descriptions on how to use different equipment (bulldozer, grader, etc) in road construction and maintenance work in different terrain conditions. Includes specifications for construction of bridges and culverts.
Advantages	- Application of manual reduces soil erosion and other damages to site and stands due to road construction (note: construction of roads and skid trails is the single most destructive activity in forest management operations) - Application of prescription reduces road maintenance costs - Can serve as a training manual
Limitations and Challenges	- Applicable only for areas where the described machinery is available.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000692
Resource person	Author

Source	**About the Methodology of Computer Aided Planning of Forest Roads within the Scope of the SFMP Case Study - Forest Road Demonstration Project**
Author	Hentschel Swen
Project	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia
Year	1997
Abstract	The document summarises the results of an investigation evaluating opportunities for using modem computer-based planning tools in concession area in East Kalimantan. The objective of the study was to improve the existing procedures for planning and construction of forest roads.
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Author

Reduced-impact logging

Source	**Reduced-impact logging with Tractors in Model Forest Management Area (MFMA)**
Author	Aaron Ago Dagang & Hahn-Schilling Bernd
Project	Forest Management Information System, Sarawak, Malaysia (FOMISS)
Year	1997
Abstract	RIL Guideline, prescribing the following working steps (in sequential order): (i) pre-harvest field inventory and data processing, (ii) preparation of draft harvesting map, indicating harvestable trees and skid trail alignments, (iii) tree marking in the field (incl. climber cutting and marking of PCTs), (iv) skid trail and log ramp preparation, (v) preparation of final harvesting map, (vi) tree felling, (vii) log extraction, (ix) post-harvest works (construction of cross drains, treatment of compacted areas)
Relevance of Document	Can be used as reference for developing RIL guidelines for other areas
Advantages	-Reduced negative environmental impacts and damage to residual stand - shorter cutting cycle
Limitations and Challenges	- higher planning costs as compared to conventional method
Download	Hard copy only, contact Rolf Krezdorn GTZ Vietnam
Resource person	Authors

Source	**Technical Guideline for Reduced Impact Tractor Logging**
Author	Ruslim Yosep, Hinrichs Alexander & Ulbricht Rolf
Project	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia
Year	1999
Abstract	These technical guidelines provide an outline for companies working in natural forests in Indonesia that want to implement Reduced Impact Tractor Logging. It takes a stepwise approach outlining steps which need to be taken for planning and production as well as activities of the planning and production team.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000694
Resource person	Authors

Source	**Study on Implementation of Reduced Impact Tractor Logging**
Author	Yosep Ruslim, Budi Sulistioadi, Alexander Hinrichs
Project	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia
Year	2000
Abstract	This document is a result of a study comparing the two harvesting procedures RIL and conventional logging. The overall aim was to increase acceptance of Reduce Impact Tractor Logging by Indonesian practitioners. The study includes measurements of damage to the residual stands. Time obser-

	vations were conducted to provide an understanding of the time required for felling and skidding activities to analyse the level of work efficiency and productivity. It furthemore includes a financial analysis to provide an understanding of the costs expended for felling and skidding activities in relation to the logging system applied.
Advantages	RIL system has been tested in several Management Units. The results show that its application is practical and results in increasing harvesting performance.
Limitations and Challenges	The study shows that RIL is in particular suitable for operation in terrain with flat to medium slope topography.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000695
Resource person	Authors

Source	**Reduced-Impact Logging. Directional Felling in Selective Managed Forests in East Kalimantan**
Author	Ulbricht Rolf & Elias
Project	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia
Year	1996
Abstract	Manual for directional felling
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000696
Resource person	Author

Source	**Cable Systems for the Selective Logging of Tropical Natural Forests in Mountainous Areas – An Overview**
Author	Becker Gero, Ruslim Yosep & Hinrichs Alexander
Year	2001
Project	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia
Abstract	This report compiles relevant information which is necessary to support investment decisions on re-tooling for timber harvesting in mountainous areas, i.e. introduction of cable yarding systems. It discusses advantages and disadvantages of cable yarding systems; describes and discusses different types of cable yarding systems and their suitability under tropical conditions. It further contains a literature review on the use of cable systems under tropical rain forest conditions and a compilation of technical data on selected cable systems to support investment decisions.
Relevance of Document	Good overview of different cable systems and their suitability for tropical rainforest conditions
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Authors

Source	**Introducing Skyline Cable Logging Systems in Sustainable Forest Management of Natural Tropical Forest under Mountainous Terrain Conditions Lay out and Elements of a Feasibility study for PT.Sumalindo Lestari Jaya II**
Author	Becker Gero, Ruslim Yosep & Hinrichs Alexander
Year	2001
Project	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia
Abstract	More and more cutting areas of forest concessions are located in difficult terrain conditions, i.e. steeper and longer slopes, narrowgullies and valleys with steep river banks, great variation of soil conditions. If logging under these conditions are to be carried out sustainably and certifiable, current standard methods designed for easier terrain conditions will not be adequate. A re-engineering is required to meet SFM and certification requirements under these more difficult conditions. This report is based on suggestions to introduce cable systems for logging in the concession area Sumalindo Unit Long Bagun. The company aims to get certified. The report supports the preparation and implementation of a feasability study for a stepwise re-engineering to cable systems. Special attention is given to the criteria of SFM and certificatio. The feasibility study deals with questions such as logging capacity under a cable system, type of cable system and cable yarder, necessary additional planing and organisational requirements for operating

	a cable system, necessary prediction for productivity and standard costs, monitoring.
Relevance of Document	
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000710
Resource person	Authors

Source	**Timber harvesting guidelines for Commercial Class II Forest Reserves in Sabah**
Author	Benneckendorf Walter
Project	Sustainable Forest Management Project, Sabah, Malaysia
Year	1994
Abstract	These guidelines provide an input for Sabah's transition process from mere timber exploitation to sustainable forest management. It is intended for the practitioner involved in forest harvesting and takes a stepwise approach explaining relevant elements on resource compatible harvesting methods. This includes identifying and setting of forest management standards, i.e. through management plans, calculation of AAC, selection of harvesting area and harvesting system, providing details on harvesting operation itself and elaborating on harvesting costs.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000712
Resource person	Author

Source	**Guideline for Reduced-Impact Logging (RIL) in Peninsular Malaysia**
Author	Weinland Gerd
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2003
Abstract	Operational guidelines for Reduced-impact logging in Malaysia
Relevance of document	The guidelines provide details on harvesting planning and practices. The prescriptions and specifications conform to forest management certification requirements. Confined to ground-skidding systems
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Author

Source	**Best Management Practices for Ground-Skidding in Peninsular Malaysia**
Author	Tuttle Andrea
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	1996
Abstract	This report examines the environmental impacts of ground skidding timber operations in Peninsular Malaysia and reviews a draft Code of Practice which was developed by the Forestry Department Peninsular Malaysia.
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Author

Silviculture and Research

Development of Silviculture Guidelines for different forest types

Source	**Silvicultural Treatment of Logged-over Forest in the FOMISS-Samling Pilot Area (FSPA)**
Author	Jonathan Ricky, Hahn-Schilling Bernd & Tan Sylvester
Year	2000

Project	Forest Management Information System Sarawak, Malaysia (FOMISS)
Abstract	Implementation guideline for silvicultural treatments after logging; treatments will be carried out 5 to 10 years after harvesting and concentrated on one third of the total area to save costs. Following treatments are prescribed, depending on stocking levels with PCT or regeneration with commercial species: (i) liberation thinning for PCT or ACR (advanced commercial regeneration), (ii) regeneration release for saplings of commercial species, (iii) enrichment planting with commercial species (if area is unstocked)
Relevance of Document	- Methodology can be adjusted for other natural forest areas, in particular mixed dipterocarp forests
Advantages	Advantages of recommended silvicultural treatments - Growth potential of selected commercial species maximised - Value of stands increased
Limitations and Challenges	- Treatment scheme requires regular follow-up tending activities until 10 years after initial treatment; this is currently not practised; causes additional costs for managing bodies. - Accessibility of harvested compartments generally poses problems 5 to 10 years after harvesting since forest roads are normally not maintained after closure of stand; additional costs for road maintenance required.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000719
Resource person	Authors

Source	**Silviculture Decision Support System for the Treatment of Harvested Natural Forests**
Author	Richter Frank
Year	2000
Project	Forest Management Information System Sarawak, Malaysia (FOMISS)
Abstract	This report describes a simple, time- and cost-efficient Silivcultural Decision Support System (SDSS) for Sabah's harvested natural forests. To determine criteria for various trreatment options, the actual condition of the logged-over forest needs to be assessed. Standard procedures to determine the need for silvicutural treatment is based on labour-intensive and costly terrestrial inventories. In order to reduce costs for inventories and decision making, the study proposes the integration of three data sources: exisiting GIS-supported data, terrestrial data collection and remotely sensed data.
Relevance of Document	The system described in this report is potentially transferable to other areas, with minor modifications which take into account specific local needs and requirements. This study contributes to: reduce costs of silvicultural stand diagnostic; integrate different data sources; establish the standards needed to determine the need for silvicultural operations; increase the efficiency in silvicultural decision making; enable the decision makers to focus on priority areas of silvicultural intervention; increase the chances for practical application of silvicultural operations.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000720
Resource person	Author

Source	**Management Guideline: Silviculture of Dry Inland Forests of Peninsular Malaysia**
Author	Weinland Gerd
Year	2003
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Abstract	The silvicultural guidelines for dry inland forests of Peninsular Malaysia are targeting silviculturists of the State Forestry Department as well as field staff of the district offices of the Forestry Department Peninsular Malaysia. The guideline is based on the concept that all operations in the field need to be guided by silvicultural management principles. Therefore, all silviculturally relevant issues from various existing concepts and instructions have been incorporated and, where necessary, adjusted in this guideline. It covers silvicultural aspects of the following processes: pre-harvesting inventory, cutting regime determination, tree selection, tree marking and harvesting operations.
Relevance of Document	The silvicultural guidelines combine and, if deemed necessary, refine silviculturally relevant instructions of various different sources in one comprehensive document.
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Forestry Department Peninsular Malaysia

Guideline for rehabilitation of degraded forests

Source	**Technical Guideline for Rehabilitation of Fire-Affected Forests in Concession Areas**
Author	Team of Kanwil Hutbun, UNMUL, BPK Samarinda, SFMP
Year	1999
Project	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia
Abstract	These guidelines provide clear directions aimed at concession holders in Indonesian forests on performing accurate and efficient rehabilitation measures in burnt forests. The steps proposed include: inventory of the burnt forest area; demarcation of areas for rehabilitation and compartmentalisation; formulation of silvicultural systems; infrastructure preparation; establishment of fire breaks; planning and implementation of planting operations.
Relevance of Document	Guideline for practitioners
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000723
Resource person	Samarinda Forest Research Centre; Mulawarman University

Development of systems to ensure procurement of high-quality planting material (e.g. National Tree Seed Projects)

Source	**FORGRIS - Forest Genetic Resources Information System**
Author	Thai See Kiam, Abdul Rahman, Marzalina Mansor & Schmalen Wilhelm
Year	1999
Project	Forestry Planting Material Procurement Programme (FPMPP)
Abstract	FORGRIS is an information system which allows centralised and decentralised information management pertaining to forest seed and plant procurement among all relevant stakeholders in Malaysia. The information system saves important and relevant data about the approved forest reproductive material on different levels. This includes data about resource types, selected plus trees, monthly phenological monitoring as well as seed collection, seed storage and nursery management. Important parts of the FORGRIS scheme follow the OECD-Scheme for the Certification of forest reproductive material in international trade.
Relevance of Document	Comprehensive concept paper on the Forest Genetic Resources Information System for Penisular Malaysia
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000724
Resource person	Forestry Department Peninsular Malaysia

Source	**Seed and Planting Material Production**
Author	Schmalen Wilhelm
Year	1998
Project	Forestry Planting Material Procurement Programme (FPMPP)
Abstract	This consultancy report provides an overview of the various activities and infrastructure requirements for seed and planting material procurement in Peninsular Malaysia, Sabah and Sarawak. The focus is on research and development of indigenous species and not on large scale plant production.
Relevance of Document	Status quo report (1998)
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000725
Resource person	Author

Applied Silviculture Research

Source	**Report on the Forest Management and Silvicultural Development Programme for Deramakot Forest Reserve and Silvicultural Research at FRC, Sepilok**
Author	Burgess, P.F.
Year	1991
Project	Sustainable Forest Management Project, Sabah, Malaysia
Abstract	This report is a background document which provides an overview of history and status of the two above mentioned projects. It critically reviews both projects with regard to Dipterocarp forest management and silviculture and provides recommendations for future operations as well as research priorities in Dipterocarp forest management.
Relevance of Document	
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000726
Resource person	Author

Financial Analysis

Financial and Economic Analysis of Forest Management Systems

Source	**Financial and Economic Assessment of Forest Management Systems at FOMISS-Samling Pilot Area (FSPA) in Sarawak, Malaysia**
Author	Sander Klas
Year	2000
Project	Forest Management Information System Sarawak, Malaysia (FOMISS)
Abstract	Comparative analysis of financial & economic indicators (e.g. Net Present Value (NPV), IRR and - Benefit-Cost Ratio (BCR)) of SFM versus conventional management system (CL). Applied method is a classic Cost-Benefit-Analysis (CBA) which is applied for two time horizons, i.e. 20 and 60 years. Two aspects are captured: financial analysis (only traded goods considered) and economic analysis (includes the following non-tradable costs/benefits: carbon storage, biodiversity, soil conservation, fresh water protection, NTFP, cultural values). Main results: Financial analysis: CL is more profitable than CL according to all 3 indicators Economic analysis: SFM system clearly superior
Relevance of Document	- Methodology applicable for other forest areas - Results may be used as reference for similar studies - Thorough discussion of methodological approach - Good glossary of economic terms
Advantages	- RIL superior to CL regarding results of economic analysis - Certification (secured access to high price markets) and carbon offset trading have potential to increase profitability and, hence, attractiveness of RIL
Limitations and Challenges	- CL more profitable than RIL → need to introduce other financial incentives for Concessionaires/contractors to adopt it - New payment system for harvesting teams needs to be introduced to create incentive for RIL implementation (quality dependent reward component) - Improved and longer tenure security for concessionaires and local communities required
Download 1	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000727
Resource person	Authors

Source	**Dipterocarp Forest Management in Peninsular Malaysia –A Silvicultural and Financial Analysis of the Selective Management System**
Author	Kollert Walter & Weinland Gerd
Year	2002
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Abstract	This conference paper evaluates dipterocarp forest management as documented in approved logging plans in comparison with quantitative and qualitative criteria as prescribed in the Selective Management System. The anticipated impact of logging on the resource base is assessed and amendments to the Selective Management System (SMS) are proposed. A simple cost-benefit-analysis gives an account of the most significant financial results from logging. According to the analysis, SMS is profitable. Finally, the chances to enforce reduced-impact logging are discussed. .
Relevance of document	Paper critically reviews the Selective Management System, presents cost models for reduced-impact logging; demonstrates financial viability of RIL.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000731
Resource person	Authors

Source	**Financial Analysis of Natural Forest Management on Sustained Yield Basis, Case Study Deramakot FR**
Author	Kollert Walter, Uebelhoer Konrad & Kleine Michael
Year	1995
Project	Sustainable Forest Management Project, Sabah, Malaysia
Abstract	In this study the short-term financial implications of natural forest management as prescribed in the Forest Management Plan, are assessed in a cost-benefit analysis. The direct financial input is taken into account on the cost side, and the direct financial ouputs on the benefit side. The cost-benefit analysis compares different management alternatives in order to identify the preferred alternative from an financial point of view. Furthermore, the implications of management alternatives on the distribution of returns and costs to the Forestry Department and the private sector are analysed and discussed.
Relevance of Document	Baseline study for sustainable forest management.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000732
Resource person	Authors

Financial and Economic Analysis of Timber Harvesting Operations

Source	**Financial and Economic Assessment of Timber Harvesting Operations in the FOMISS-Samling Pilot Area (FSPA), Sarawak - Malaysia**
Author	Richter Frank
Year	2001
Project	Forest Management Information System Sarawak, Malaysia (FOMISS)
Abstract	In-depth analysis of Reduced-impact logging (RIL) as compared to conventional logging (CL) with crawler tractors; study considers two timeframes: 1 year and 40 years. Applied method is a classic Cost-Benefit-Analysis involving the calculation of the Net Present Value (NPV). Two aspects are captured: financial analysis (only traded goods considered) and economic analysis (includes all costs and benefits, including non-tradable ones). Main results: Financial analysis: profit per m3 extracted volume is higher for RIL (RM 45/m3 vs. RM 29/m3), but due to higher extraction rates CL is more profitable. Both systems are viable at 10% discount rate Economic analysis: RIL system superior:
Relevance of Document	- Methodology applicable for other forest areas - Results may be used as reference for similar studies - Discussion of innovative Financing and Financial Incentive Mechanisms and their potential for promoting RIL implementation, namely the following are proposed for the model area: introduc-

	tion of new payment system for harvesting teams, provision of security of tenure, improved system for revenue collection, introduction of performance bonds for concessionaires/contractors,
Advantages	- RIL superior to CL regarding results of economic analysis - Certification (secured access to high price markets) and carbon offset trading have potential to increase profitability and, hence, attractiveness of RIL
Limitations and Challenges	- CL more profitable than RIL → need to introduce other financial incentives for Concessionaires/contractors to adopt it - New payment system for harvesting teams needs to be introduced to create incentive for RIL implementation (quality dependent reward component)
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000733
Resource person	Frank Richter: frank.richter@eco-consult.com

Financial and Economic Analysis of Silvicultural Treatment Operations

Source	**Financial Assessment of Silvicultural Treatment Operations in Mixed Hill Dipterocarp Forests of Sarawak - Malaysia**
Author	Richter Frank
Year	2000
Project	Forest Management Information System Sarawak, Malaysia (FOMISS)
Abstract	Financial Analysis, applying the Discounted Cash Flow Analysis of three different management options: (i) conventional system (CS), i.e. no silvicultural treatment, (ii) Silvicultural treatment using the multi-layer approach as developed by FOMISS (ST-MLA), (iii) Enrichment Planting (EP). Applied method is a classic Cost-Benefit-Analysis involving the calculation of the Net Present Value (NPV). Main results: CS has positive NPV, but is economically not viable due to insufficient stocking densities at the end of the cutting cycle. ST-MLA and EP not viable at set discount rate of 10%, but are viable if applied discount rates are below 4.9% in case of ST-MLA and below 6.6% in case of EP. Hence, there is a need to develop treatment schemes that can be implemented at lower costs.
Advantages	- Methodology applicable to other forest areas
Limitations and Challenges	- Of proposed silvicultural treatment system: Not economically viable if market IRR is expected (10%) - Financial incentives have to be provided to private sector (concessionaires) to promote implementation of - Concession periods have to be increased to at least 60 years, so that investor will be able to benefit from investments
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000734
Resource person	Frank Richter: frank.richter@eco-consult.com

Proposal for fiscal and financial incentive schemes for SFM introduction

Source	**Perspectives of Retooling Sabah's Logging Industry for Sustainable Management of Natural Forests**
Author	Uebelhoer Konrad
Year	1994
Project	Sustainable Forest Management Project, Sabah, Malaysia
Abstract	This paper discusses: - Tthe present state of the logging industry in Sabah with regard to yarding equipment. – Requirements for yarding equipment in sustainable harvesting management. – Possible uses of surplus crawler tractors. – Incentives to encourage the purchase of long distance cable crane systems.
Relevance of Document	Baseline paper for conversion from conventional timber extraction to sustainable management systems.
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Author

Economic analysis on other forest functions

Source	**Significance and Development Potential of Non-Wood Forest Products in Central East Kalimantan.- A Case Studi from PT. Limbang Ganeca, Long Lalang and Ritan Baru**
Author	Grossmann Carol
Year	1997
Project	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia
Abstract	The research paper analysis the significance and development potential of Non-Wood-Forest-Products (NWFP) in a natural forest in East Kalimantan, Indonesia. It investigates of socio-economic, natural and technical aspects of NWFP management. The overall result of the research is that NFWP provide only a weak, but not significant argument for the necessity of preserving natural forests in the area. The monetary value of NFWP in the research area today is not high enough to provide a predominant business and economic incentive for sustainable forest management.
Relevance of Document	Background paper for the discussion on the importance of NWFP with regard to income generation for local people and as incentive for the preservation of natural forests.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000736
Resource person	Author

Source	**Recreation and Tourism Development Options for FOMISS-Samling Pilot Area, Upper Baram, Sarawak**
Author	Basiuk Robert
Year	1999
Project	Forest Management Information System Sarawak, Malaysia (FOMISS)
Abstract	The study assesses the potential for tourism to be introduced to timber concession areas in the FOMISS-Samling pilot project area with a view to increasing public awareness with regards to Sustainable Forest Management. A tourism potential assessment and a development plan for tourism in the pilot project area is prepared.
Relevance of Document	
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000737
Resource person	Author

Source	**Forestry-Based Greenhouse Gas Mitigation – A Review and Opportunities for the Forestry Sector in Sarawak**
Author	Costa, P.M.
Year	1999
Project	Forest Management Information System Sarawak, Malaysia (FOMISS)
Abstract	This report is the result of a consultancy mission on the potential of carbon trading as a means to provide financial resources to sustainable forest management activities in Malaysia. The report includes: 1) an overview of climate change policy evolution; 2) definitions of carbon offset concepts and terminology; 3) the relationship between forestry practices and carbon flows; 4) a review of the market evolution of the carbon market and transactions to date; and 5) some case studies.
Relevance of Document	General input paper, not specific to project context.
Download 1	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000738
Download 2	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000739
Resource person	Author, EcoSecurities

Guideline for financial analysis

Source 1	**Guidelines for Financial Analysis of Forest Management**
Author	Haase Guenther & Kollert Walter
Year	
Project	Sustainable Forest Management and Conservation Project , Peninsular Malaysia
Abstract	Supplementary guideline for medium-term forest management planning. Describes a system for cost and revenue centres for Peninsular Malaysia and the process of financial analysis which is based on this system. Financial analysis includes both, the preparation of the financial plan at the beginning of a planning period and the cost-benefit analysis at the end of a period. Both are presented in the same format (financial analysis sheet).. The Annex contains detailed lists with parameters for financial and economic analysis, including various table formats for data collection.
Relevance of Document	- Can serve as a checklist for similar documents
Limitations and Challenges	- Specific to conditions in Peninsular Malaysia
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Authors

Market analysis for timber products

Source	**Market Analysis for Exports of Logs and selected Timber Products from Sarawak, Malaysia**
Author	Sander Klas
Year	2000
Project	Forest Management Information System Sarawak, Malaysia (FOMISS)
Abstract	In this document a market analysis is carried out for logs, sawn timber and plywood in the context of a Cost-Benefit-Analysis (CBA) of forest management systems in Sarawak. The main objective of the analysis was to determine accurate prices per m3 of logs, which are necessary to calculate revenue flows of forest management systems in CBA.It further highlights potential benefits resulting from improved marketing efforts (i.e. forest certification) for the forest industry of Sarawak.
Relevance of Document	Methodology can be used for studies with similar objectives in other countries.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000741
Resource person	Author

Development of model contracts for long-term timber concessions

Source	**Model License Agreement for SFM in Sabah**
Author	Tuttle Andrea
Year	1995
Project	Sustainable Forest Management Project, Sabah, Malaysia
Abstract	The purpose of this report is to offer a standardized set of forest management requirements that should be included in all long-term licence agreements proposed for the commercial Class 11 Forest Reserves in Sabah. The Model Agreement contains a set of requirements that are necessary to define a timber licence as a “sustainable” one.
Relevance of Document	The Agreement is structured so that it can be offered to any potential Licensee.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000742

Resource person	Author

Studies on appropriate forest revenue systems

Source	**Timber Marketing in the Context of the Forest Management System. Assessment of Stumpage Value for the Sale of Standing Timber**
Author	Uebelhoer Konrad
Year	1993
Project	Sustainable Forest Management Project, Sabah, Malaysia
Abstract	This paper proposes a new system of charges for timber utilization which is better adapted to a multiple forest management. The change from a revenue-oriented timber exploitation to a multiple use forest management has consequences on harvest levels. This needs to be reflected in the revenue system. The paper critically assesses the prevailing royalty system in Malaysia and suggests a change from a royalty system to the concept of a stumpage price system.
Relevance of Document	
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000743
Resource person	Author

Social Aspects / community participation

Participatory Land Use Planning and Allocation

Source 1	**LUP and LA in Viet Nam with Particular Reference to Improvement of its Process in the Social Forestry Development Project Song Da**
Author	Christ Herbert & Kloss Dirk
Year	1998
Source 2	**Participatory Land Use Planning and Land Allocation in the Song Da Watershed**
Author	Poel, P.
Year	1996
Project	Social Forestry Development Project Song Da, Viet Nam (SFDP)
Abstract	Methodology developed by the SFDP builds on existing techniques used and executed by government and adapts them to the current local conditions and demands in the region. The major adjustments comprise: a participatory bottom-up approach at village level and a joint approach combining planning and allocation of all land use forms in one process. The main step of this methodology are: a, Preparation on organizational level, i.e. establishing of organizations at district and commune level; b, Conducting PRA in villages resulting in land use maps; c, Land use planning at village level using a 3-D model; d, Land allocation during village meetings (i.e. agreements) and in the field (i.e. boundary demarcation); e, Administrative procedures for approval of LUP/LA results.
Advantages	- LUP at village level guarantees a more active involvement from the actual land user - Brings together officials and villagers - Decision making on land use more transparent - Joint approach allows for more efficient and sustainable overall land use management - Land and forest management issues are already addressed during early stages of planning process
Limitations and Challenges	- Expensive and time consuming - Identifying the appropriate social units for intervention in the land use planning and allocation process with regard to CFBM (formal administrative/political units versus "natural" informal forest user groups) - Training required, in particular of district officials - This process of LUP/LA most beneficial in more densely populated areas with sedentary agriculture

Download 1	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000744; http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000745
Download 2	Soon to be obtained
Resource person	Herbert Christ: Hchrist@gmx.de

Source	**Harmonizing Interests and Reconciling Conflicts between Forest Concessions and Local Community, possible through Participatory Boundary Identification and Demarcation**
Author	Diah Rahardjo & Beukeboom Hans
Project	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia
Year	1999
Abstract	PBID is a tool to address and possibly settle or reduce conflicts among stakeholders (namely industrial concession holders and forest communities) in forest areas. The process includes the following steps: a, Forest use mapping; b, Social zoning using participatory community mapping; c, Evaluation of the identified results based on production, ecological and socio-cultural aspects; d, Socialization of the PBID process; e, Negotiation process resulting in a tentative agreement; f, Identification and fixing of boundaries for commercial use and community use; h, Preparation of legal document and integration in existing regulations
Relevance of Document	- Fulfillment of prerequisite for certification of sustainable forest management - Participatory process involving all stakeholders - Long term legal stabilization of forest area - Legal guarantee of communities' land rights and access to natural resources - Stabilization and security of management area of concession holder - In line with local empowerment and decentralization process in Indonesia
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000746
Resource person	Authors

Monitoring and Evaluation

Monitoring Project Impact

Source	**Manual for Impact Monitoring**
Author	Christ Herbert
Year	1999
Project	Social Forestry Development Project, Song Da, Viet Nam
Abstract	This Manual informs on the rationale, components and data requirements of the Impact Monitoring System (IMS) of the project. It furthermore describes the procedures required to record the IMS data. The IMS is designed to investigate on ecological, economical, social/gender and institutional impacts of project activities. The IMS uses already existing data as well as generates new data from the following sources: Land use and cover maps; village based data and village development plans; commune statistics; annual farmer/household surveys; technology option fact sheets; strategic project documents; commune and village based activities.
Advantages	- The IMS focuses on key indicators in priority areas, mostly using available resources. This allows regular monitoring, preferably integrated into the regular project working routine.
Limitations and Challenges	- Labour intensive - Compromise between scientifically sound and practically flexible observation and quantification procedures - Within timeframe of project long term impacts, in particular with regards to social and ecological changes, cannot be observed
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000747
Resource person	Author

Guidelines for Midterm-Reviews of FMP

Source	**Guideline for Mid-term reviews**
Author	Haase Guenther & Schindele Werner
Year	2005
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Abstract	Describes process for mid-term reviews of forest management plans. Results of the review are to be documented in standardised tabular review and assessment sheets.
Advantages	- Standard formats for assessment and review sheets allow for easy, focussed and time-efficient documentation of results
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000751
Resource person	Authors

Development of Forestry GIS and Forest Management Information Systems

Source	**Development of the Forest Management Information System (FMIS)**
Author	Hoesli Thomas
Year	Forest Management Information System Sarawak, Malaysia (FOMISS)
Project	1999
Abstract	This consultancy was part of the Sarawak Forest Department's process to introduce a concept of digital GIS. Consistent pre-established procedures for data conversion were required. Within this context, this consultancy report undertakes a review of the current FMIS set up, focusing on data conversion specifications and database management procedures at the GIS Unit of the Forest Department Sarawak.
Relevance of Document	Focus of assessment on system set up and data management
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000680
Resource person	Author

Compliance assessments of harvesting operations (e.g. for RIL)

Source	**Guideline for Operational Planning on Compartment level (Chapter on post-harvest assessment)**
Author	Haase Guenther & Schindele Werner
Year	2005
Project	Sustainable Forest Management and Conservation Project , Peninsular Malaysia
Abstract	For full abstract of document refer to reference under heading "annual operational planning"; document includes methodology and assessment sheets for contractor performance evaluation
Relevance of document	Easy methodology for systematic performance evaluation of harvesting contractors, integrated with other post-harvesting assessment procedures. Specific for conditions in Peninsular Malaysia.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000655
Resource person	Authors

Source	**Compliance Assessment of Reduced-impact logging areas in the FOMISS-Samling Pilot Area (FSPA) – Implementation Guideline**
Author	Jonathan Ricky, Dagang Aaron Ago & Hahn-Schilling Bernd
Year	2000
Project	Forest Management Information System Sarawak, Malaysia (FOMISS)
Abstract	Implementation Guideline for RIL Compliance Assessment. Assessment method, which puts emphasis on directly visible harvesting impacts on the forest ecosystem. The inspection is carried out at recording intervals of 100 m along all skid trails. Assessed parameter are amongst others stump height, pushing of soil towards harvestable trees, directional felling, skid trail width and layout, gap openings, integrity of buffer zones, PCTs, protected fruit trees and confinement of tractor to skid trails. Based on RIL Guideline for FOMISS-Samling Pilot Area
Advantages	Methodology for systematic performance evaluation of harvesting contractors. Developed excel tables allow for easy data processing and computation of aggregated compliance assessment results.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000757&cat=66
Resource person	Authors

Self-scoping handbooks for forest management certification

Source	**Self Scoping Hand Book for Sustainable Forest Management (SFM) Certification in Indonesia**
Author	Agung Ferdinandus & Hinrichs Alexander
Year	2000
Project	Promotion of Sustainable Forest Management Systems in East Kalimantan, Indonesia
Abstract	This Self-scoping Handbook provides a simple guidance to SFM certification standards and procedures in Indonesia. It is designed as a tool to assist a Forest Management Unit (FMU) in Indonesia to critical review its performance vis-a-vis the Indonesian certification standards (LEI standards). Self-scoping is an initial identification process that a FMU can undertake to prepare for a certification request. It uses a simplified set of the Indonesian SFM criteria and indicators and can be performed internally by the FMU. The results of this initial investigation can be used to determine the current position of the FMU and to evaluate the needed steps to achieve SFM certification.
Relevance of Document	This Handbook is a support tool for dissemination of SFM in Indonesia through certification, thus helping to overcome technical and non-technical (i.e. framework conditions) obstacles to SFM. It aims to familiarize readers with the concept and objectives of the LEI criteria and indicators.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000758
Resource person	Authors

Capacity-building

Training Needs Analysis

Source	**Training Needs Analysis for Forestry Department Peninsular Malaysia: Assesses organisational and job competency requirements and identifies competency/skill gaps for the various post levels**
Author	Ihrshad Consulting
Year	2003
Project	Sustainable Forest Management and Conservation Project , Peninsular Malaysia
Abstract	The objective of this Training Needs Analysis (TNA) was to conduct a systematic study on current and future training requirements in line with the Peninsular Malaysia Forestry Department's SFM concept (i.e. the Malaysian Criteria and Indicators).

Relevance of document	This document describes in detail the approach and methodology for a Training Needs Analysis within Forest Management. It further provides recommendations and relevant training interventions based on the analysis.
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Forestry Department Peninsular Malaysia; Ihrshad Consulting Sdn. Bhd.

Assistance to curriculum development for formal forestry training institutes

Source	**Curriculum Development: Background Paper**
Author	Schall Nikolaus
Year	2003
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Abstract	This document provides a general introduction into aspects of learning and teaching before further elaborating on the principles and general criteria for designing courses and curriculum in general.
Relevance of Document	Background paper as part of a toolkit, i.e. set of guidelines on curriculum development (see documents below)
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000761
Resource person	Author

Source	**Toolkit / Guideline for Curriculum Development**
Author	Schall Nikolaus
Year	2003
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Abstract	These guidelines set out the general procedure and approaches to be used in order to be able to revise and update a curriculum or syllabus. The document contains the following information: background information on trends in curricula development; description of the proposed process for curricula and syllabus review and revisions in the Forestry Department Peninsular Malaysia; need for and process of formulating job descriptions; curricula and syllabus review and revisions and introduction to templates.
Relevance of document	The purpose of this curriculum development toolkit is to provide trainers and course development specialists with the necessary ingredients in order to be able to review and revise curricula and syllabi. These guidelines are the result of a curriculum development workshop at the Forestry Department Peninsular Malaysia (FDPM). The guidelines are designed for the situation at the FDPM, however, with its general background information and description of approach and methodologies and templates, it can provide a valid input for curriculum development efforts elsewhere.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000762
Resource person	Author

Source	**Practitioners Guide on Curriculum/ Syllabus Development**
Author	Schall Nikolaus
Year	2003
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Abstract	This is a practical guide on the development of curriculum and syllabi. It gives a brief introduction into the method before it describes in detail principles and general procedures. It further lists advantages and disadvantages.
Relevance of document	Comprehensive, easy-to-use guide for practitioners , who are involved in the process of curriculum development.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000763
Resource person	Author (See also www.methodfinder.net)

Support to organizational development

Source	**Practitioners Guide on Formulating Job Descriptions**
Author	Schall Nikolaus
Year	2003
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Abstract	This document provides a general description for the formulation of job descriptions as a crucial component of effective and successful human resource management. It gives a brief description, explains the purpose of the method and provides detailed information on the principles and general procedures of the formulation process. Furthermore, advantages and disadvantages of the method are described.
Relevance of document	General guideline; widely applicable
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000764
Resource person	Author (See also www.methodfinder.net)

Source	**Organizational Development of the Sabah Forestry Department for Implementing SFM System**
Author	Holzhauser Michael
Year	(without year)
Project	Sustainable Forest Management Project, Sabah, Malaysia
Abstract	This consultancy report identifies needs for adjustment of the organisational structure and qualification of personnel of the Sabah Forestry Department as a consequence of the paradigm shift from timber exploitation to sustainable forest management.
Relevance of document	Can serve as sample for other studies on institutional analysis and development
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000765
Resource person	Author

Source	**Management Training of Key Forestry Department Personnel required for the Implementation of the Forest Management System**
Author	Callaham, R.
Year	1993
Project	Sustainable Forest Management Project, Sabah, Malaysia
Abstract	The shift from timber exploitation to sustainable forest management in Sabah requires a reorientation of staff and restructuring of the Forestry Department and its management of human resources. The consultancy report focuses on the aspect of job descriptions and their significance for effective human resources management. It analyses the current situation of human resources and their skills levels and gives recommendations for changes. As part of the consultancy a training course was conducted on human resources management.
Relevance of document	Situation report (status 1993); example for expedient approach to initiate changes in human resource management
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Author

Training on Forest Inventories

Source	**Training Manual on Forest Mensuration**
Author	Kleine Michael & Weinland Gerd
Project	Sustainable Forest Management Project, Sabah, Malaysia
Year	1991
Abstract	This report contains the description of a course on forest mensuration held in Sabah. It is a manual and guideline for mensuration works (i.e. inventory, growth and yield assessment, planning).
Relevance of Document	The report does not provide full account of the comprehensive field of mensuration, but describes the major measurement procedures with special reference to the situation in Sabah.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000767
Resource person	Authors

Capacity-building on Village Level Forest Protection and Development Regulations

Source	**Field Guide – Preparing Forest Protection and Development Regulations at Village Level**
Author	Miagostovich Marco
Year	2000
Project	Social Forestry Development Project Song Da, Viet Nam (SFDP)
Abstract	This document is a facilitator's guide which provides a step-by-step methodology to facilitate village members and forest owners in the design of their own Village Level Forest Protection and Development Regulations. The methodology aims to build each farmer's capacity to analyze their forest resources and traditional regulations, eventually identifying and adopting the forest regulations that will best respond to farmers' and government's forest management needs. The methodology uses "non-formal adult learning education" methods, based on experiential learning techniques and participatory decision-making techniques.
Advantages	- The methodology is a flexible approach, which increases people's participation and strengthens communities capacities - It combines government and communities needs
Limitations and Challenges	- Focuses on teaching methods - It does not provide instructions on technical and administrative procedures and methods required for Village Level Forest Protection and Development Regulations
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000768
Resource person	Author

Integration of CBFM in University Education and Research

Source 1	**Forest Resource Development, Capacity-building and Research**
Author 1	Braeutigam Dietmar, Muziol Christoph & Phanvilay Khamla
Year 1	2001
Source 2	**Management Plan for Forest Resources Development, Training and Research 2001-2010**
Author 2	PROFEP
Year 2	2001
Project	Promotion of Forestry Education Project, Lao PDR (PROFEP)
Abstract	Key element of the academic forestry education at the National University of Lao PDR is the Faculty of Forestry's 'Training and Model Forest' (TMF). The TMF's management reflects the socio-economic and natural resources conditions of wide areas of the Lao P.D.R. It is based on a multi-stakeholder

	partnership of local communities, government authorities and the Faculty of Forestry. As such, the establishment and development of the TMF is a long-term process and commitment for all stakeholders involved. It stimulates innovation and best practices through the pooling of human and financial resources, and promotes positive interactions between forest resources development and conservation, human resource development, and research. Refined and innovative practices are promoted for their application under similar socio-economic and environmental conditions at national level, through information exchange, training courses and technology transfer.
Advantages	The TMF facilitates and guides decision-making processes by providing a forum where stakeholders can share their knowledge, gain better understanding for conflicting views, and combine their expertise and resources.
Download 1	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000769
Download 2	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Khamla Phanvilay: klphanvilay@yahoo.co.uk Dietmar Braeutigam: DietmarBspc@mail.fm

Key Parameters for Forest Management in selected Countries of SE ASIA

Parameter		Cambodia	Indonesia	Lao PDR	Malaysia	Philippines	Thailand	Viet Nam	Total SE Asia
Total Land area (000 ha)		17 652	181 157	23 080	32 855	29 817	51 089	32 550	**436 022**
Forest area 2000	***Natural forest (000 ha)***	9 245	95 116	12 507	17 543	5 036	9 842	8 108	**191 942**
	Forest plantation (000 ha)	90	9 871	54	1 750	753	4 920	1 711	**19 972**
	Total forest (000 ha)	9 335	104 986	12 561	19 292	5 789	14 762	9 819	**211 914**
	% of land mass	52,9	58	54,4	58,7	19,4	28,9	30,2	**48,6**
	ha/ capita	0,9	0,5	2,4	0,9	0,1	0,2	0,1	**0,4**
Area change 1990-2000 (total forest)	***000 ha/ year***	-56	-1 312	-53	-237	-89	-112	52	**-2 329**
	%	-0,6	-1,2	-0,4	-1,2	-1,4	-0,7	0,5	**-1**
Volume and above-ground biomass (total forest)	***m^3/ha***	40	79	29	119	66	17	38	**64**
	t/ha	69	136	31	205	114	29	66	**109**
Forest under management plan	***000 ha***	-	72*	-	14 020	6 935	-	-	-
	%	-	n.ap.	-	73	120	-	-	-
Protected Areas	***ha***	3.3 mio	54 mio	3mio ha + 8 mio ha protection and conservation forests	5.4 mio ha incl. Protection foreests	4.2 mio (out of which 2.7 mio ha forested)	10.6 mio ha	1.3 mio ha PAS + 3.5 mio ha protected forests	
	% of total land mass	18%	26%	12.5% +	17%	14%	20.6%	4% + 10.6%	
	protection status	weak	weak	weak	medium	weak	weak	weak	
Main Forest Threats	***Forest Fires***	serious, significant tracts of forests affected	serious, often started by developers of industrial plantations	serious	not significant	yes	significant, 15% of forests effected annualy	significant	
	Shifting Cultivation	yes	significant tracts affected	significant, 25% of population	insignificant in PM, present in Sarawak	significant		yes, in remote parts	
	Encroachment	serious	serious	yes	insignificant in PM	yes	serious	common	
	Illegal Logging	very serious, exported to neighbouring countries (mainly Thailand, also Viet Nam, Laos)	very serious; estimated 40 to 60 (to 90%) of industrial roundwood supply	serious	reportedly not	yes	serious		
	Unsound Forest Mgt.	serious	serious	yes	partially (not reported)	yes			
	Forest Degradation	serious	serious	serious	partially (not reported)	serious	serious	serious	
Major Forest Policy Goals		Forest Resources Conservation, Poverty Reduction, Economic and Social Development, Good Governance	Rehabilitation of degraded forests; Conservation of the remaining forests; Forests for the People Policy	1. Preserve and improve biological capacity; 2. Improve economic benefits of forests, 3. Link rehabilitation and expansion with socio-economic development; SFM implementation, primarily through community participation; development of plantation sector; improved management of conservation areas; stabilisation and reduction of shifting cultivation; emphasis on watershed management and protection through integrated land use systems.	SFM of Permanent Reserve Forests (PRF) to maximise economic, social and environmental benefits; maintenance of 50% forest cover, gazetted as PRF; Conservation of biological functions and services; Promotion of forest plantation establishment, promotion of forest industries development commensurate with resource flow with emphasis on increased down-stream processing	Equitable access for all citicens to participate in forest development and management and to derived benefits; scientific management and conservation of FR; satisfaction of needs for forest commodities and services on sustainable basis; main strategy: people-oriented forestry programmes	increase forest cover from 25 to 40%; 25 % conservation forests, 15% production forests; protection of the remaining natural forests; rehabilitation of degraded forests; increased development of forest plantations	meet the nation's needs for forest products and sustainable environmental protection; increase social and economic benefits of FR through efficient utilization; increase people's participation in forest protection and utilization; improve the living conditions of the rural population through forestry development.	
Forest Ownership		State	State (all natural forests)	State, but private and communal tenure rights can be granted	State	State, but about 1/3 of forests claimed by indigenous people; CBFM Agreements for 25 years, renewable to 50 years	State	State, but long-term use certificates issued to organisations and individuals	
Imposed Logging and Export Bans		Export ban on logs and sawn timber since 1997	complete logging ban for Java since 2003; export ban for logs and timber since 2001	timber export ban, logging ban since 1991	Log export ban for natural species and rubber in Peninsular, quota system restricting log exports in Sabah and Sarawak	Loggin ban of old growth forests and on slopes >50% since 1991; Total logging bans in several provinces; weak enforcement; log and lumber export bans since 1986 and 1989, repectively	Ban on commercial logging in natural forests since 1989	Log export ban; ban on timber extraction from most natural forests	

Parameter	Cambodia	Indonesia	Lao PDR	Malaysia	Philippines	Thailand	Viet Nam	Total SE Asia
Gazettement of Permanent Forest Estate	planned acc. To Forestry Law, but not yet implemented	designated functional forest areas (1999: 20.6 mio ha conservation forests, 33.9 mio ha protection forests and 58.5 mio ha production forests	???	about 50% of landmass gazetted as Permanent Reserved Forest	gazettement of PFE and national parks called for in constitution, implemented ???	56% of forested area declared National Conserved Forests in 1999		
Framework and Significance for/of Community-based Forest Management	enabling policies and guidelines, implementation slow due to resource constraints; has National CBFM programme	actively promoted, different programmes in place	"Village Forestry" main strategy for SFM; enabling legislation for CBFM	community consultation reflected in MC&I; few examples for CBFM in practice	global leader in CBFM approaches; CBFM primary strategy for SFM	Popular participation encouraged, but no conducive legislation yet	Strong focus on smallholder reforestation and allocation of forest land to private households, etc	
Forest Managers / Concession Systems	most harvesting by private concessionaires	maximum size: 400,000 ha counrtywide, mainly private concessionaires, but recently also tender to cooperatives, small-scale businesses and state-owned companies; proliferation of small concessions up to 100 ha by local governments	mainly state-owned companies or joint ventures of public and private companies	long-term: 100 years in Sabah, 25 years in PM, ?? Years in Sarawak. PM: mainly harvesting licenses for individual compartments	past: mainly licence agreements for large-scale companies; now emphasis on CBFM; 25 year Timber Lease Agreements for natural forest areas	logging of natural forests banned		
Forest Management Objectives	Sustainable multiple-use forest management; increased sector contributions to social and economic development	Sustainable multiple-use forest management, Forest for the People Policy	SFM, mainly through participatory forestry; improved management of conservation areas; increase of forest cover to 70%; improved food production and alternative livelihood for shifting cultivators through forest development	Sustainable multi-purpose management	multiple use forestry, with emphasis on conservation and social equity	see under policy goals	policy to increase forest cover to 43% through reforestation; regeneration and restoration of natural forests; main thrust programme: 'Five Million Hectare Reforestation Programme'	
Forest Management Plans	required for production forests, but only few exist; manual for plan preparation available	Concessionaires required to prepare overall plans (entire period), five-year FMPs and annual management plans	required for all production forests, but only few exist; no guidelines for plan preparation; no appropriate system for AAC allocation	mandatory for all forests since 1950ies; implemented	mandatory, both for companies and CBFM arrangements	preparation of local-level mgt. Plans, but only implemented in pilot areas yet	only for state-controlled forests, not for land allocated to households (areas too small and fragmented)	
Forest Management/Silvicultural Systems for Natural Forests	selective cutting system, but little experience with and knowledge of silvicultural interventions, no post-harvesting mgt	predominantly selective cutting and replanting (TPTI), also clear-cutting with natural regeneration (THPA)	selective, but little systematic silviculture appliedin natural forests	Selective Management System (SMS) for dry inland and peat swamp forests including post-harvest management; clear-cutting with replanting for mangroves	Philippines Selective Logging System with Timber Stand Improvement (TSI) after harvesting; TSI often omitted; also system which involves gradual removal of overstorey (similar to MUS) for dipterocarp forests	no more use of natural forests	focus on rehabilitating natural forests, harvesting largely banned; otherwise selective logging following pre-F inventories and tree marking	
Timber Harvesting	Code of Practice for Forest Harvesting (1999)	Important guidelines in place (silvicultrue, Harvesting Code, guidebook 'Principles and Practices of Forest Harvesting).Tree marking, RIL, Post-harvest assessments standard procedure, but implementation inadequate and rarely enforced	simple technology, National Code of Timber Harvesting Practice since 1997, but no standards for roads, felling or extraction in place; wasteful harvesting	Road Specs, RIL & silviculture guidelines in place; ongoing research and limited implementation of low impact systems (helicopter, modified excavators, tower yarding, etc)	currently logging bans in several provinces; standard system: tree marking, directional felling, Post-F inventories; skidding technologies: truck logging, tractor logging, highlead yarding, animal skidding	logging ban for natural forests since 1989 --> no impetus to develop RIL guidelines and Code of Harvesting Practice	Code of Practice for Harvesting, but logging banned in most natural forests	
Wood Processing Industry	outdated technology, lack of qualified staff --> very inefficient, low quality output	modern industry, leading exporter of forest products, severe overcapacities	small scale, obsolete and inefficient technology	modern industry, leading exporter of forest products, overcapacities	modern industry, overcapacities	Primary source of industrial wood are forest plantations; significant production of sawn timber, panels, paper and furniture; increasing investments in highly-efficient processing technology		

Parameter	Cambodia	Indonesia	Lao PDR	Malaysia	Philippines	Thailand	Viet Nam	Total SE Asia
Forest Administration: Capacities & Efficiency	Undersourced and insufficient institutional capacities; weak law enforcement	undersourced and inefficient; weak law enforcement	undersourced; need for capacity building of personnel; low enforcement level	well established administration; well equipped with finance and equipment; comparatively well trained personnel; enforcement of rules sometimes deficient	inadequate human skill levels, especially at field level; weak enforcement of laws and regulations	insufficient budget allocations, poor law enforcement		
Forest Management Certification	?	Indonesia Ecolabelling Institute (LEI) established in 1994 as national certifying body	?	National certification system: MC&I (2002)	development of national C&I planned (?)	no national scheme	Initiative to develop national forest mgt. Standards started, could lead to national certification scheme	

Sources: Forest Resoruces Assessment (FAO, 2001)
rmation on FAO website (as of June 2005)

Annex

01 a

Combined Forest Inventory - Field Manual

Combined Forest Inventory
Field Manual

W. Schindele

March 2001

Short-term Consultancy Report 26a

Contents Page

Annexes:

List of Figures:

1 Inventory Team and Equipment

An inventory crew consists of

- 1 crew leader
- 1 assistant
- 3-5 workers (depending on the forest condition).

At least one member of the inventory team needs to be able to identify each species which is recorded in the species list (to be prepared by the forestry department headquarters – cf. Annex 4).

Each inventory crew will need the following equipment:

Table 1: Equipment list (obligatory)

No.	Equipment	Specification
1	GPS	12 channel parallel, built in patch antenna, built in altimeter (e.g. Silva Multinavigator)
2	Rechargeable batteries	For 24 hours use of GPS
1	Solar battery charger	
1	Laser range finder	30 m distance, accuracy ± 1 cm (e.g. LEM™ 30 Jenoptik)
2	Sets of spare batteries	for GPS and laser range finder
1	Bitterlich Relascope	metric CP
1	Altimeter	
1	Tripod stand for relascope	light weight
1	Compass	360° scale (if not inbuilt in GPS)
1	Calliper	95+ cm
1	Telescoping rod	5+ m total length
1	Surveyors rope	30m total length
1	Diameter tape	
1	Clipboard	
2	Field instructions	
1	Set of topo maps	scale 1:25 000 or less
	Pegs for marking	5 per sample unit
	Tally sheets	
	Protractor, pencils, rubber, parangs, etc.	

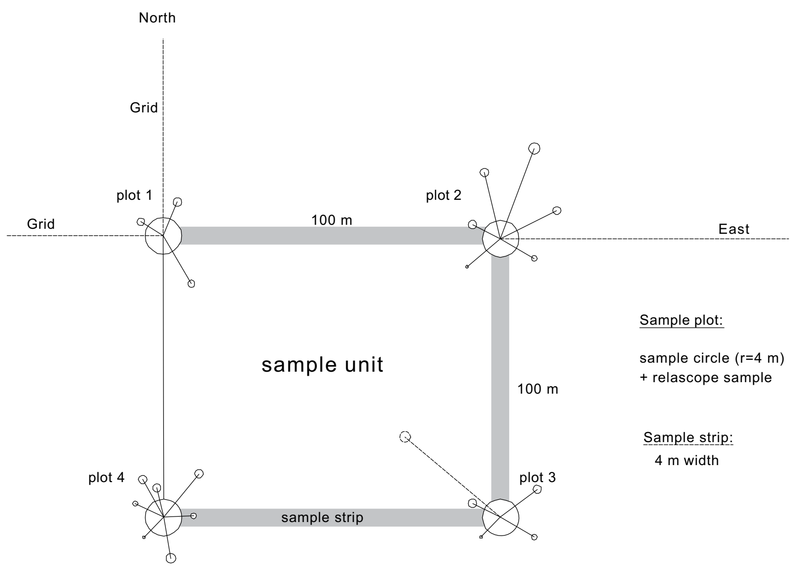
A map plotter attached to the GPS is a useful equipment for navigation. It helps reduce time for identification of the sample unit location. Depending on the plot location camping equipment will be required.

2 Short Description of Inventory Design

The inventory is designed as

stratified satellite sampling based on randomly distributed permanent sample units.

Figure 1: Lay-out of sample unit



Each sample unit consists of 4 sample plots and 3 sample strips (see **Figure 1**). Each sample plot is a combination of a fixed sample circle of 4 m in radius and a point sample.

Within the sample circle only tree species <10 cm Dbh and >1.5 m in height and some key medicinal plants are assessed. The total sample area is about 0,02 ha.

Point sampling is done for all tree species ≥ 10 cm Dbh.

Rattan, bamboo and palms are assessed on 3 sample strips of 4 m width (2 m each side of the centre line) connecting sample plot 1 and 2, 2 and 3, 3 and 4. The distance between the sample plot is 100 m, the total sample area is 0,12 ha.

3 Identification and Lay-out of Sample Unit

The sample plot location is defined by the centre of sample plot 1.

The geo-reference of the sample unit is derived from the inventory map and shall be stored as waypoint in the GPS. Navigation in the field is done with the “goto waypoint” function of the GPS. To save battery power, initial navigation to the sample plot location should be done by topographic map and compass.

Under dense canopy it is sometimes not possible to receive GPS signals and identify the current position in the field. If this is the case, the following procedure should be followed: Try to come as close as possible to the sample plot location by ordinary navigation with compass and topographic map. Then find an open space where it is possible to receive a GPS position fix. This point is your reference point and has to be marked permanently with a durable peg with encarved letters "RF". Then calculate by means of the waypoint function (see GPS user guide) the direction and the distance to the sample plot location. The coordinates of the reference point and the azimuth and direction to the sample plot location have to be entered in the tally sheet. Survey the final distance to the sample plot with compass and measurement tape. Slope correction is obligatory.

All 4 sample plot centres should be permanently marked with durable pegs with numbers indicating the sample plot number (from 1 to 4).

Shifting of sample strip and sample plots[1]

If the sample strip crosses a river, the measurement stops at the edge of the river buffer (30 m) and continues on the other side at the edge of the buffer. The same procedure applies for roads.

---

[1] Whether sample plots are to be shifted depends on the definition of the production forest area. Generally, if a sample plot is located within an area which will be excluded from the production area, the sample unit needs to be shifted. This is generally the case with all roads and rivers which are mapped.

4 Measurement and Observations

Measurement starts with sample plot 1 in the north-west. Assessment is done in the following order using the Forest Inventory Data Record Sheet:

1. General information
2. Site parameters
3. Sample circle with 4 m radius
4. Point sampling with relascope
5. Strip sampling
6. Wildlife Observation.

An example of a filled tally sheet is attached in Annex 6.

4.1 General information

For each sample plot the following data are recorded:

Crew:	name of inventory crew
Date:	date of assessment
Plot no.:	e.g. 126-1 (first sample plot of sample unit 126)
Lat.:	latitude, e.g. 4° 15’ 23’’
Long.:	longitude, e.g. 102° 13’ 56’’
Ref. point (y/n):	record “y” if the starting point (centre of sample plot 1) was identified with the help of a reference point (see Chapter 3).

The following data are only recorded if *Ref. point* is "*y*"

Lat.:	latitude of reference point (GPS reading)
Long.:	longitude of reference point (GPS reading)
Azim:	direction in ° from reference point to centre of sample plot 1
Dist.:	distance in m from reference point to centre of sample plot 1

4.2 Site parameters

For each sample plot the following site parameters are recorded:

Year of logging: for logged-over forests the actual year of logging is recorded. This information should be obtained from the historical records of the responsible district forest office. If no data are available, enter "*unknown*".

Altitude: altitude in m derived from GPS or altimeter reading (note: an exact altimeter reading may help identify the sample plot 10 years later)

Slope: slope in % (mean of uphill and downhill measurement)

Topography: record code (refer to Annex 1), i.e. "fl"

Aspect: record code (refer to Annex 1), i.e. "*NNW*"

Operable:[2] tick "yes" or "no". A plot is considered as not operable if trees cannot be harvested from a technical point of view. If this is the case the reason needs to be specified by selecting at least one (multiple choice) of the following:

Steepness: tick if the sample plot is too steep to be logged (> 30°)

Accessibility: tick if the plot cannot be made accessible (e.g. the sample plot area is locked by river or rocky area)

Others: tick if there is any other reason why the plot is not operable (e.g. non productive area, archaeological site, etc.).

4.3 Sample circle

The assessment of the sample circle is done clockwise starting in the direction to the next sample plot. The border of the sample circle is identified with the telescoping rod, which is extended to 4 m. Care has to be taken to hold the telescoping rod horizontally.

---

[2] This is an important parameter and it is required to estimate the net production area.

All commercial trees of dbh < 10cm and above a height of 1.5 m and all the specified medicinal plants are counted. Dead trees are not counted.

4.4 Point sample

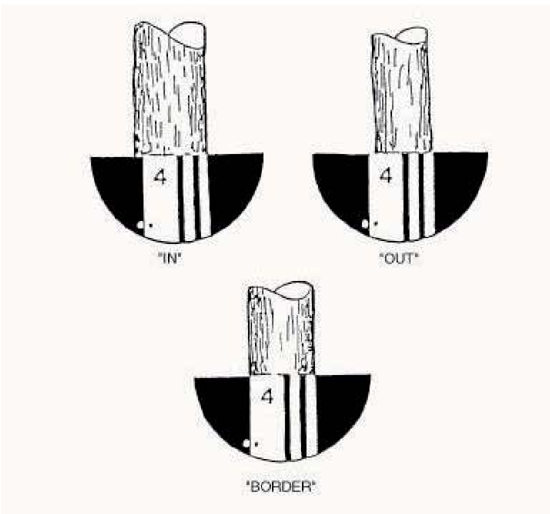
Point sampling is done clockwise for all life trees with a diameter ≥ 10 cm starting in the direction to the next sample plot.

4.4.1 Selection of sample tree

Before any tree is measured, it must be decided whether the tree belongs to the sample or not. The most serious errors in point sampling occur at this stage and great care must be taken to avoid as many as possible. Trees are either IN, OUT or BORDERLINE, there should be no subjective judgement involved in choosing sample trees.

Sample trees are identified with the Bitterlich Mirror Relascope using a basal area factor 4 (see **Figure**). Sight must be taken at the point of Dbh measurement (see Dbh and Dbh-height).

Figure 2: Identification of sample trees with the relascope



Checking of borderline trees

All borderline trees must be checked in the following manner:

- Measure tree Dbh to the nearest centimetre.
- Measure the horizontal distance from the sampling point to the centre of the tree (refer to paragraph below).
- On steep slopes, the horizontal limiting distance measurement needs to be corrected with the slope correction factor (s. Annex 2).
- Read the critical distance for the tree to be measured from the critical distance table. If the distance measured is equal to or less than the critical distance, the tree is counted as “IN” (s. Annex 3).

Distance from plot centre to the sample tree

The distance to a tree always refers to the tree’s inner centre. There are two ways to measure the distance to it with the laser range finder:

1. Take the distance with the laser pointing directly to the middle of the tree. Then take the tree’s diameter and add half of it to the measured distance:

$$\text{Distance} = \text{Distance}_{\text{laser}} + \text{Dbh}/2$$

2. The other way is to point with the laser to the clipboard, which is held by an assistant next to the tree’s inner centre.

If the laser cannot be pointed horizontally to the tree, which is the case for up-hill measurement on steep slopes, the measured distance needs to be corrected by the slope correction factor (see Annex 2).

Hidden trees

When trees are obscured by undergrowth or other trees, there are three procedures to solve the problem:

- The undergrowth can be cut to clear the view.
- If sighting at diameter measurement height is difficult, try to sight the tree in its upper parts. If the tree qualifies as an IN-tree at that height it would also qualify as an IN-tree if it had been sighted below (unless the tree leans towards the observer).
- The tree is designated as borderline tree and treated as such.

4.4.2 Measurement of trees ≥ 10 cm Dbh

Number

The trees are numbered serially starting clockwise in the direction of the next sample plot.

Azimuth and distance

To enable the identification of sample trees for re-measurement after 10 years the location of each sample tree needs to be specified by its azimuth and distance from the sample plot centre.

The azimuth shall be measured in ° (i.e. degrees) pointing to the left side of the bole. The horizontal distance to the tree is measured with the laser range finder to the nearest centimetre.

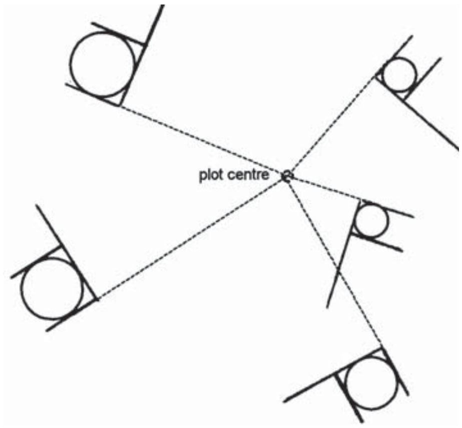
Species and species code

All the species recorded in the species list to be prepared by the forestry department headquarters (cf. Annex 4) need to be identified in the field and must be recorded by their names and codes.

Dbh and Dbh-height

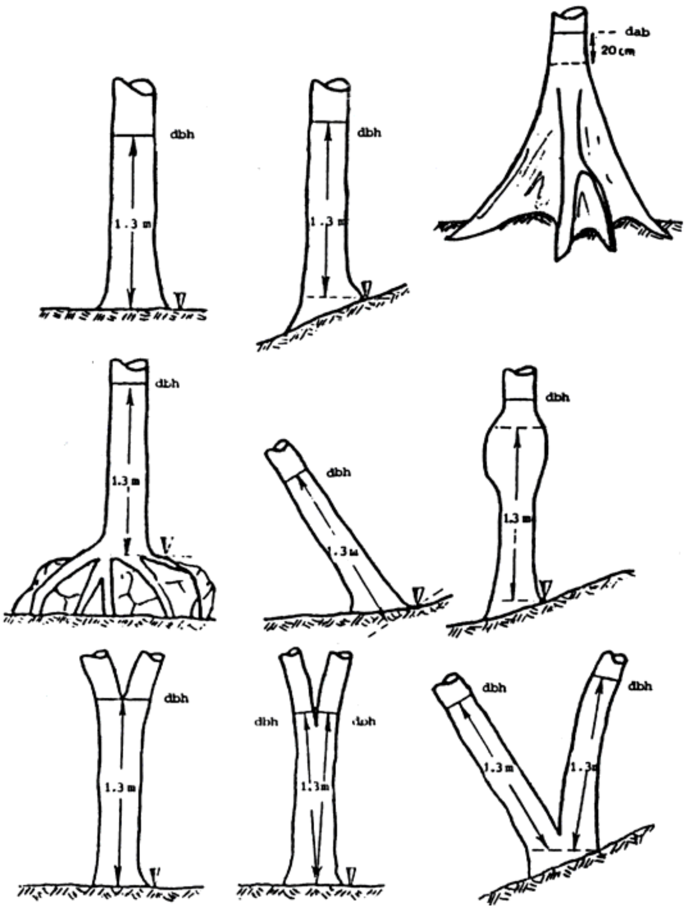
The Dbh of all “IN”-trees must be measured for diameter at breast height using the calliper. For trees above 100 cm in Dbh, the diameter tape shall be used. Attention must be paid that the leg of the calliper always points directly to the centre point of the sample plot (see figure below).

Figure 3: Measurement of Dbh with the calliper



For buttressed or deformed trees, it is necessary to measure above breast height. Buttressed trees are measured 30 cm above the buttress, deformed trees above the defect. The various Dbh measurement heights are shown in the figure below. If the Dbh measurement is taken from a different point than breast height, then the height needs to be measured with the telescoping rod, which is to be placed in front of the tree facing towards the centre of the sample plot. Breast height does not need to be recorded.

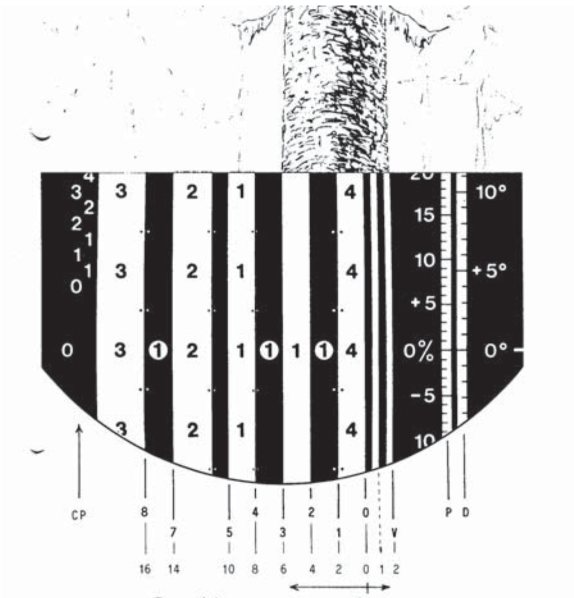
Figure 4: Dbh measurement for buttressed and deformed trees



The tree diameter can only be measured with the calliper up to a height of about 2.5 m. Diameters higher up are to be measured with the help of the relascope. For accurate measurement it is obligatory to mount it on a tripod stand. How to measure the diameter with the relascope is explained in the following:

Select a position within a range of about 4 to 8 m (note: the larger the diameter the larger the distance), from where you have a good visibility to the measurement point. Sight to this point with the relascope. The diameter of the tree is given by the number of bands covered. One full band represents 2% of the distance to the tree, a quarter band 0.5% (see Figure 5). Measure the horizontal distance to the tree with the laser range finder. Attention: Sigh with the laser to the side of the tree by holding the clipboard next to it.

Figure 5: Measurement of tree diameter with the relascope



The Dbh of the tree shown in the above figure is 8% of its horizontal distance from the measurement point, e.g. if the measurement was taken in 5 m distance, the tree diameter is 40 cm.

4.4.3 Measurement of trees ≥ 45 cm

Harv. code

For the estimation of the harvestable volume it is important to know whether a tree is harvestable or not.

A tree is considered as not harvestable if:

- it is cull or defect
- it cannot be felled out of safety reasons
- it is of very poor quality
- it is a nesting or breeding tree for wildlife.

If the tree is not harvestable, *bole height*, *no. of logs* and *log quality* do not need to be recorded.

Bole height

Clear bole height is the length of the bole from the ground level to the first big green branch of the crown. To determine the bole height of a tree the following measurements have to be undertaken:

- Find a point in a distance of the estimated log length away where the upper end of the bole is clearly visible. Measure the exact distance to the tree with the laser range finder (Note: add Dbh/2, see Chapter. 4.4.1).
- Measure the slope in % to the top of the log.
- Measure the slope in % to the stump height.

If the bottom of the tree is below the observer's eye-height, both slope gradients have to be added. If it is above, the lower slope gradient has to be subtracted from the upper slope gradient.
Record the distance in "*Dist.*" and the slope in the column "*%*".

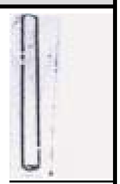
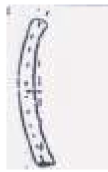
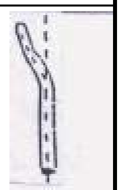
No. of logs

The number of logs of 5 m length can be directly derived from the bole height.

Quality of logs

Divide the whole bole into 5 m logs, starting from the clear bole above stump. The quality of each log is determined by its straightness and by possible visible defects. Both criteria are divided into 3 classes each; i.e. a log classification may read 1/3 or 2/2.

Table 2: Classification of log quality

Log Quality Criterion	Code	Class	Figure
Straight-ness	1	Straight:	
	2	Swept:	
	3	Crooked:	
Visible defects	1	None	
	2	with 1-3 minor defects: - up to 4 live branches with a diameter < 5 cm - minor swellings - superficial bark damage, or deeper wounds that are likely to heal - climbers that slightly affect tree form and growth	
	3	defective: - with more than 3 minor defects - or with 1 of the following major defects: * 4 or more live branches with a diameter < 5 cm * live or dead branches with a diameter > 5 cm * big swellings * large bark damages down to the cambium * signs of rot, e.g. consoles of polyporous fungi * climbers that strongly affect tree form and growth	

4.5 Strip sample

Strip sampling is done along the centre line of the three sample strips starting from plot 1 to plot 2, from plot 2 to plot 3 and from plot 3 to plot 4. The width of the sample strip is 4 m, or 2 m to each side of the centre line, which is defined by the surveyors rope. It is measured with the telescoping rod, which is to be extended to 2 m.

All rattans, bamboos and palms within the sample strips are counted according to species (refer to Annex 5).

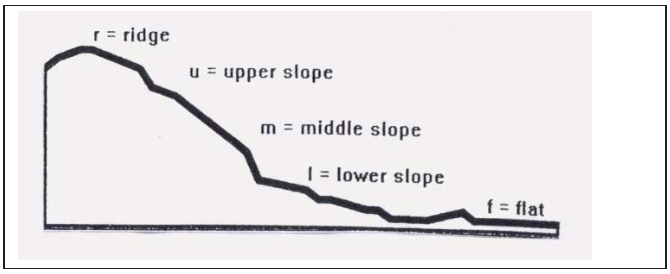
4.6 Wildlife observation

Each member of the inventory crew must report any observation[3] made on the occurrence of rare and/or protected wildlife species during navigation to the sample unit or at the sample unit itself to the crew leader. On the back of the tally sheet he or she records the location, wildlife species and type of observation made, such as tracks, dung, nests etc. in a descriptive way (e.g.“*tapir tracks at 102° 14´12´´ East, 4° 16´ 23´´ North*”).

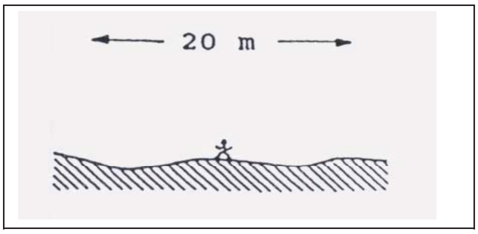
[3] The recording of observation made on wildlife cannot replace more specific wildlife surveys, which need to be carried out on state level. However, it may provide valuable information for those.

Annex 1: Codes for topography and aspect

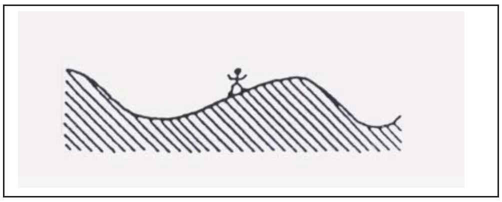
- **Topography**



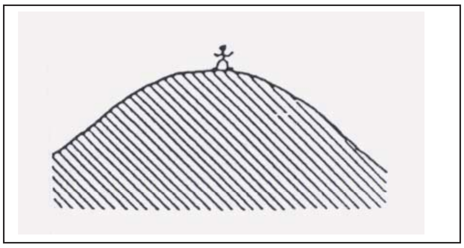
* **fl: flat**
- the slope does not exceed 5° (9%), or
- the difference in altitude between the highest and the lowest point does not exceed 2 m



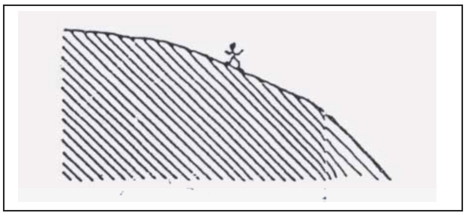
* **rl: rolling**
- the slope ranges from 5 - 15° (27%), or
- the difference in altitude between the highest and the lowest point ranges from 2 to 5 m



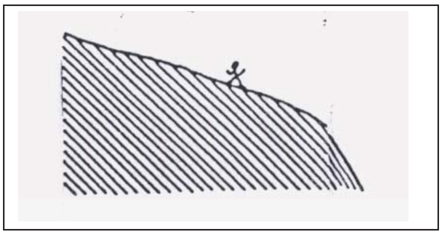
* **rdg: ridge**
  - two slopes of opposite aspects reach their highest point, and
  - the slope exceeds 15°



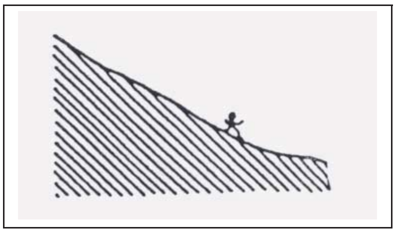
* **us: upper slope**
  - the sample plot is within the upper third portion of the slope, and
  - the slope exceeds 15°



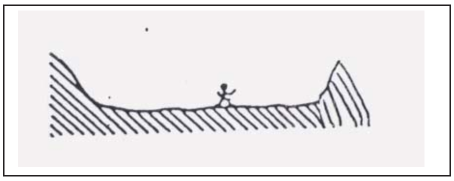
* **ms: middle slope**
  - the sample plot is within the middle third portion of the slope, and
  - the slope exceeds 15°



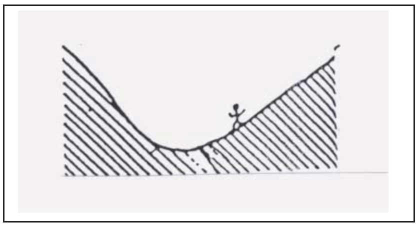
* **ls: lower slope**
  - the sample plot is within the lower third portion of the slope, and
  - the slope exceeds 15°



* **v: valley**
  - the sample plot is in an alluvial area at least 20m wide



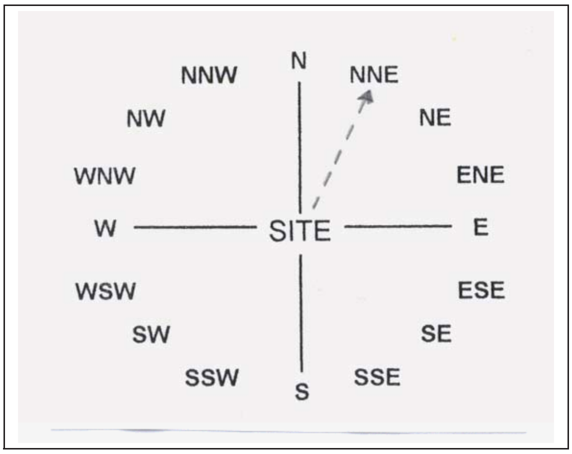
rav: ravine
- two slopes of opposite aspects reach their lowest point, and
- the slope exceeds 15°



Aspect

The aspect (exposure) is determined at the centre point, with a compass in the direction of running water (downhill).

Mark with an arrow the aspect of the site:



Annex 2: Slope correction factors

Slope (%)	Correction factor	Horizontal distance				
		5 m	10 m	15 m	20 m	25 m
15	1.01	5.06	10.11	15.17	20.22	25.28
20	1.02	5.10	10.20	15.30	20.40	25.50
25	1.03	5.15	10.31	15.46	20.62	25.77
30	1.04	5.22	10.44	15.66	20.88	26.10
35	1.06	5.30	10.59	15.89	21.19	26.49
40	1.08	5.39	10.77	16.16	21.54	26.93
45	1.10	5.48	10.97	16.45	21.93	27.41
50	1.12	5.59	11.18	16.77	22.36	27.95
55	1.14	5.71	11.41	17.12	22.83	28.53
60	1.17	5.83	11.66	17.49	23.32	29.15
65	1.19	5.96	11.93	17.89	23.85	29.82
70	1.22	6.10	12.21	18.31	24.41	30.52
75	1.25	6.25	12.50	18.75	25.00	31.25
80	1.28	6.40	12.81	19.21	25.61	32.02
85	1.31	6.56	13.12	19.69	26.25	32.81
90	1.35	6.73	13.45	20.18	26.91	33.63
95	1.38	6.90	13.79	20.69	27.59	34.48
100	1.41	7.07	14.14	21.21	28.28	35.36
105	1.45	7.25	14.50	21.75	29.00	36.25
110	1.49	7.43	14.87	22.30	29.73	37.17
115	1.52	7.62	15.24	22.86	30.48	38.10
120	1.56	7.81	15.62	23.43	31.24	39.05
125	1.60	8.00	16.01	24.01	32.02	40.02
130	1.64	8.20	16.40	24.60	32.80	41.00
135	1.68	8.40	16.80	25.20	33.60	42.00
140	1.72	8.60	17.20	25.81	34.41	43.01
145	1.76	8.81	17.61	26.42	35.23	44.03
150	1.80	9.01	18.03	27.04	36.06	45.07
155	1.85	9.22	18.45	27.67	36.89	46.11
160	1.89	9.43	18.87	28.30	37.74	47.17

Annex 3: Critical distance cd for point sampling (basal area factor 4)

Dbh	cd	Dbh	cd	Dbh	cd	Dbh	cd	Dbh	cd	Dbh	cd
10	2.50	40	10.00	70	17.49	100	24.99	130	32.49	160	39.98
11	2.75	41	10.25	71	17.74	101	25.24	131	32.74	161	40.23
12	3.00	42	10.50	72	17.99	102	25.49	132	32.99	162	40.48
13	3.25	43	10.75	73	18.24	103	25.74	133	33.24	163	40.73
14	3.50	44	11.00	74	18.49	104	25.99	134	33.49	164	40.98
15	3.75	45	11.25	75	18.74	105	26.24	135	33.74	165	41.23
16	4.00	46	11.50	76	18.99	106	26.49	136	33.99	166	41.48
17	4.25	47	11.75	77	19.24	107	26.74	137	34.24	167	41.73
18	4.50	48	12.00	78	19.49	108	26.99	138	34.49	168	41.98
19	4.75	49	12.25	79	19.74	109	27.24	139	34.74	169	42.23
20	5.00	50	12.50	80	19.99	110	27.49	140	34.99	170	42.48
21	5.25	51	12.74	81	20.24	111	27.74	141	35.24	171	42.73
22	5.50	52	12.99	82	20.49	112	27.99	142	35.49	172	42.98
23	5.75	53	13.24	83	20.74	113	28.24	143	35.74	173	43.23
24	6.00	54	13.49	84	20.99	114	28.49	144	35.99	174	43.48
25	6.25	55	13.74	85	21.24	115	28.74	145	36.24	175	43.73
26	6.50	56	13.99	86	21.49	116	28.99	146	36.49	176	43.98
27	6.75	57	14.24	87	21.74	117	29.24	147	36.74	177	44.23
28	7.00	58	14.49	88	21.99	118	29.49	148	36.99	178	44.48
29	7.25	59	14.74	89	22.24	119	29.74	149	37.24	179	44.73
30	7.50	60	14.99	90	22.49	120	29.99	150	37.49	180	44.98
31	7.75	61	15.24	91	22.74	121	30.24	151	37.73	181	45.23
32	8.00	62	15.49	92	22.99	122	30.49	152	37.98	182	45.48
33	8.25	63	15.74	93	23.24	123	30.74	153	38.23	183	45.73
34	8.50	64	15.99	94	23.49	124	30.99	154	38.48	184	45.98
35	8.75	65	16.24	95	23.74	125	31.24	155	38.73	185	46.23
36	9.00	66	16.49	96	23.99	126	31.49	156	38.98	186	46.48
37	9.25	67	16.74	97	24.24	127	31.74	157	39.23	187	46.73
38	9.50	68	16.99	98	24.49	128	31.99	158	39.48	188	46.98
39	9.75	69	17.24	99	24.74	129	32.24	159	39.73	189	47.23

Annex 4: Species List

(to be prepared by forestry department headquarters)

Annex 5: Identification of rattan and bamboo

Vernacular name	Scientific name
Rattan	
A: Rotan manau	*Calamus manan*
B: R. manau tikus	*C. tumidus*
C: R. sega	*C. caesius*
D: R. semambu	*C. scipionum*
E: R. dok	*C. ornatus*
F: R. dahan	*Korthalsia grandis*
Bamboo	
A: Buluh semantan/rayah/gala/ paao/seremai/telur	*Gigantochlea scortechnii*
B: B. betih/raga	*G. wrayi*
C: B. beting/bisa/berang	*G. levis*
D: B. betong/pering	*Dendrocalamus asper*
E: B. semeliang/semenyeh	*Schizostachyum grande*
F: B. dinding/kasap/telur/ belang/nipis	*S. zollingeri*
Palms	
A: Buluh tumpat	*Gigantochlea ligulata*
B: Bayas	*Oncosperma horridum*
B: Nibung	*O. tigillarium*
C: Nipah	*Nypa fruticans*

Annex 6: Example of filled tally sheet

Forest Inventory Data Record Sheet

1	General Information								
Crew	BG-SFMP	Date	12.3.01	Plot No.	123	Lat.	4 ° 15' 23''	Long.	102° 13' 56''
Ref. Point (y/n)	n	Lat.		Long.		Azim		Dist.	

2	Site Parameters	
Year of Logging	1982	
Altitude (m)	150	
Slope (%)	25	
Topography	ms	
Aspect	NNW	
Operable	yes	~~no~~
- Steepness		
- Accessibility		
- Other		

3	Sample circle r = 4 m **(trees > 1.5 m and < 10 cm Dbh, med. plants)**	
Species/Species Group	Number	No.
Dipterocarps	IIIII I	6
Non Dipterocarps, commercial	III	3
Pisang jai *(Alphonsea sp.)*		
Keladi Hutan *(Keladi hutan)*	I	1
Senayan *(Scleria sp.)*		
Kacit Fatimah *(Labisia pumila)*		
Tongkat ali *(Eurycoma longifolia)*	II	2
Halia *(Zingiber officinalis)*		

4	Relascope sample (trees ≥10 Dbh)														
all trees							trees > 45 cm								
No	Azim. (°)	Dist. (m)	Species	Species Code	Dbh (cm)	Dbh height (cm)	harv (y/n)	Bole height Dist.	Bole height %	No. of logs	Log Quality				
1	93	2.55	Bitis bukit	46	32										
2	176	3.78	Kapur	104	82	2.80	yes	12	145	4	1/1	1/1	2/3	2/1	
3	235	2.15	Keladang	137	44										
4	321	5.23	Keruing bukit	164	56	3.50	no								

5	Strip sampling (2m each side of center line)							
Rattan	Number	No.	Bamboo	Number	No.	Palms	Number	No.
R. manau	|||	3	Bamboo A			Bertam		
R. manau tikus			Bamboo B			Bayas/Nibung		
R. dok	I	1	Bamboo C	I	1	Nipah		
R. dahan		2	Bamboo D			Others	III	3
R. sega	III	3	Bamboo E					
R. semambu			Bamboo F					
Others								

Bamboo A: *Gigantochloa scortechinii*: Buluh semantan / rayah / gala / paao / seremai / telur
Bamboo B: *Gigantochloa wrayi*: Buluh beti / raga
Bamboo C: *Gigantochloa laevis*: Buluh beting / bias / berang
Bamboo D: Dendrocalamus asperi: Buluh betong / pering
Bamboo E: Schizostachyum grande: Buluh semeliang / semenyeh
Bamboo F: Schizostachyum zollingeri: Buluh dinding / kasap / telur / pelang / nipis

Annex

01 b

Proposed Design for a Combined Forest Inventory on State and National Level

Malaysian-German
Sustainable Forest Management and Conservation Project

Project No.: 93.2013.6-01.100

Forestry Department Headquarters
Jalan Sultan Salahuddin
50660 Kuala Lumpur, Malaysia

(:
Cooperation

Jabatan Perhutanan
Semenanjung Malaysia
(Forestry Department
Peninsular Malaysia)

Combined Forest Inventory on State and National Level (NFI 4)

for

Peninsular Malaysia

Werner Schindele

2001

Technical Document No. B 26

Contents Page

List of Tables and Figures

Abbreviations

AAC	annual allowable cut
asl	above sea level
CFI	continuous forest inventory
CV	coefficient of variation
CONFORMS	continuous forest resources monitoring system
DFO	District Forest Office
DFWP	district forest working plan
FDPM	Forestry Department Peninsular Malaysia
FMI	forest management inventory
FMP	forest management plan
FMPRG 2000	Forest Management Planning Rules and Guidelines 2000
FRIM	Forest Research Institute Malaysia
GIS	Geographic Information System
GPS	Global Positioning System
NFI	national forest inventory
PFE	permanent forest estate
PFFZM	preliminary forest function and zonation map
PPM	project planning matrix
PM	Peninsular Malaysia
PRF	permanent reserved forest
PSP	permanent sample plot
SE	standard error
SFMP	state forest management plan
SFO	State Forest Office

Preface

The inventory system and design described here was developed in March 2001. The preliminary design was field-tested in Sungai Lalang and finalized after completion of the field test. Adjustments to the originally proposed design were made during a series of meetings conducted at the Forestry Department Peninsular Malaysia (FDPM) especially with regard to the stratification[1], tree species list, saplings and medicinal plants to be assessed. From 16th to the 19th of July, 20 staff of the FDPM received intensive field training in the new inventory design. For training purposes around 10 sample units were established in the Forest Research Institute Malaysia (FRIM), Sg. Gombak and Sg. Lalang. During this process, the inventory design was refined and slightly adjusted. The final version of the field manual was prepared after completion of the field training. The staff trained will be responsible for the training of the contracted inventory field crews and form the control teams.

1 Inventory Design and Justification

1.1 Objective and requirements

The objective of the inventory is to:

- provide information on state level for the purpose of medium-term forest management planning,
- serve as a control mechanism for sustainable forest management on state level,
- provide further information for the development of growth and yield functions,
- provide information required by a 4th National Forest Inventory.

As such it constitutes a combination of four different types of inventories or resource assessment methods:

- National Forest Inventory (NFI)
- Forest Management Inventory (FMI)
- Continuous Forest Inventory (CFI)
- Establishment of Permanent Sample Plots (PSP).

The inventory design will provide information on two spatial levels:

- national level (Peninsular Malaysia)
- state level.

Provision of information for medium-term forest management planning (forest management inventory)

According to FMPRG 2000 a forest management inventory shall be implemented on state-level to provide information on the state's forest resource for the purpose of forest management planning in the medium term. In particular the inventory has to provide sufficient accurate information for:

- the estimation of a sustainable AAC on state-level;
- the allocation of the AAC to its forest districts;
- the set-up of a harvesting scenario on district level.

This requires a stratification of the production forest according to major forest types and logging status.

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[1] The 1st proposal restricted the inventory to the dipterocarp and peat swamp production forest only.

Control mechanism for sustainable management (continuous forest inventory)

Due to the nature of the tropical forest a precise calculation of sustainable yield is difficult to obtain. AAC determination based on formulas or growth simulators (DIPSIM) can just approach a best estimate, even if there are reliable increment data available for different regions.

The best solution to control sustainability in the long run is to implement control inventories periodically and to adjust the AAC accordingly.

In order to avoid bias

- the sample plots need to be permanently marked in an inconspicuous way;
- the individual sample plots need to be re-established exactly as before for re-measurement
- the same trees need to be re-measured at the same height.

Provision of growth and yield data (permanent sample plot)

As all sample trees are re-measured in intervals of 10 years for the purpose of medium-term management planning, the sample plots can also be used to complement growth and yield data derived from growth and yield plots. This, however, imposes the following requirements on the design:

- Exactly the same trees need to be re-measured (tree identification).
- The measurement of the dbh must be exactly at the same position and height (recording of the measurement point).
- All measurements, but particularly the dbh, must be of high accuracy.

Fourth National Forest Inventory (NFI 4)

The fourth National Forest Inventory is scheduled for 2001. However, implementing management inventories on state-level and carrying out a national inventory simultaneously would imply double work and be too expensive. This is why the inventory has been designed in a way that allows it to fulfil both purposes. The following requirements are necessary:

- All samples need to be distributed along the same base grid.
- Same stratification within all states in line with the strata of the previous NFI 3.
- Inventory results should be compatible/ comparable with those of NFI 3.
- 10% control of samples by control team of FDPM.

Relation to compartment-level planning

The combined inventory will provide information on state-level for the determination of a sustainable AAC. However, the inventory data cannot be used for the identification of harvestable compartments. The validation of the AAC[2] shall be done in future based on compartment-level inventories (post-F) combined with growth simulation based on DIPSIM.

1.2 Brief description of inventory designs applied so far

1.2.1 Forest Management Inventory

The Project has developed a forest management inventory design for medium-term forest management planning of forest management units (FMU), which has been adopted from Sabah and which was adjusted to the requirements of Peninsular Malaysia. It has been tested

[2] Validation of AAC means, it has to be checked whether there are enough compartments having a harvestable volume above the economic threshold to realize the AAC (refer to FMPRG 2000, chapter 3d).

successfully in many FMUs in Sabah and in the KPKKT concession in the state of Terengganu, PM.

The FMI has been particularly designed to provide resource-based information for complex FMUs of a size of 10 000 to 100 000 ha.

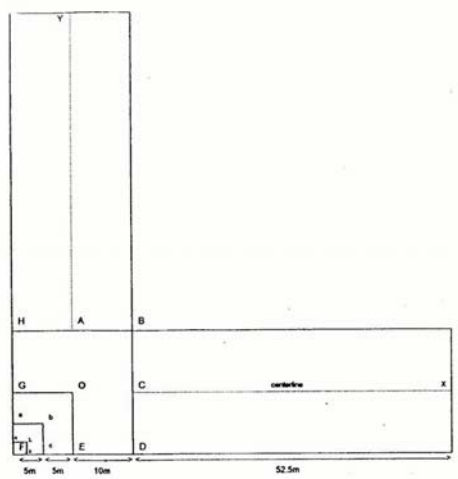
It is a one-stage sampling consisting of systematically distributed L-shaped sample units along a selected grid line. For more details refer to **Table 1** and **Figure 1**.

A justification for not using the L-shaped design for the new combined forest inventory is given in Annex 2, Item 4.

Table 1: Characteristics of the L-shaped FMI design

Type of Inventory	One stage sampling
Distribution of sample units	Systematic, temporary
Line grid	Variable, depending on required number of sample units
Stratification	Two strata (virgin, logged-over)
Area of sample units	0.25 ha
Shape of sample units	L-shape (refer to **Figure 1**)
Enumeration of trees ➢ Trees > 30 cm dbh ➢ Big Poles 15 – 29.9 cm dbh ➢ Small Poles 5-14.9 cm dbh ➢ Saplings < 5 cm dbh, > 1.5 m height ➢ Seedlings .15 – 1.5 cm dbh	 2 legs (0.25 ha) 20 * 20 m 10 * 10 m 5 * 5 m 2 * 2m
Accuracy ➢ Probability Level ➢ Standard Error	 95% 10%

Figure 1: L-shaped sample unit design (Source: PD No. 13)



1.2.2 National Forest Inventories

Altogether three National Forest Inventories (NFI) have been conducted so far in PM:

NFI 1: 1971-1972
NFI 2: 1981-1982
NFI 3: 1991-1993

The first two 2 NFI's can be considered as "*inventories on successive occasions with partial replacement*" as NFI 2 re-measured some of the sample plots of NFI 1.

According to DE MILDE 1993, the Third National Inventory (NFI 3) was designed as high priority inventory and covered only the dipterocarp inland production forest. Upper hill dry inland forest, peat swamp and mangrove forests were excluded as well as forests logged up to 10 years ago, as they were to be assessed by low priority sampling, which is not part of NFI. The strata assessed by NFI 3 are listed in **Table 2**:

Table 2: Strata assessed by NFI 3

Virgin forest	Stratum no.	Logged-over forest	Stratum no.
superior	11	11-20 years ago	23
good	12	21-30 years ago	24
moderate	13	31 + years ago	25
poor	14		

The layout of NFI 3 was different from that of NFI 1 and 2. The cluster area was reduced by bringing the measurement units closer together, the area of the measurement units was reduced and the shape was changed from rectangular to circular. Reasons for the change of the inventory design were the further fragmentation of the forest due to logging, and the inaccuracy of rectangular plots of 20*50 m in steep and broken terrain. As such NFI 3 has not been a continuation of NFI 1 and 2 according to the system of "s*ampling on successive occasions*" (DE MILDE, 1993).[3]

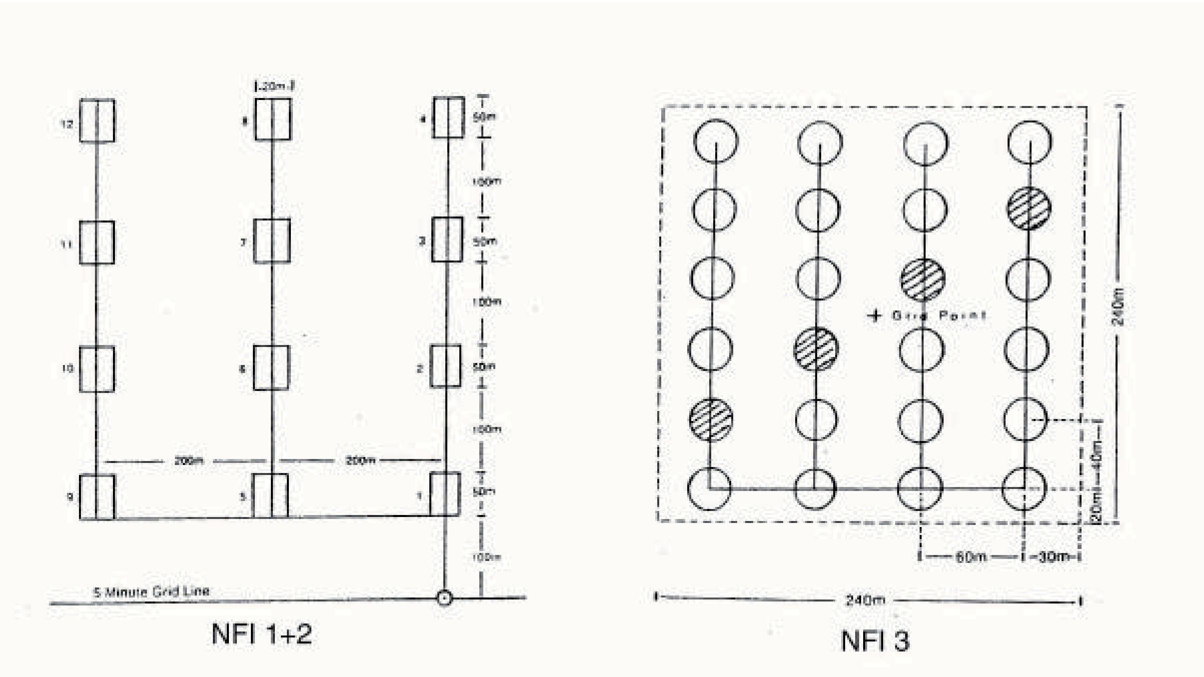
In **Table 3** and **Figure 2** the characteristics of the design and layout of the different National Forest Inventories are shown.

[3]If NFI 4 would be implemented according to NFI 3, it just would be the "second occasion" and not the "fourth occasion". The advantage of sampling on successive occasion is to get more precise information. Following the proposed inventory design, the loss in accuracy by starting the "sampling on successive occasion" again from the beginning, is out-weighted by the much higher number of sample plots now available on national-level, which allows an estimate of the commercial volume below a standard error of 10%.

Table 1: Comparison of design and layout of NFI 1-3

Characteristics	NFI 1 and 2	NFI 3
Type of Inventory	Two stage sampling	Two stage sampling
Distribution of sample units	Random	Random
Line grid	5 minute	2.5 minute
Stratification		Yes, 7 strata
No. of sample units		234[4]
Size of sample units	600 * 600 m	240 * 240 m
Area of sample units	36 ha	5.76 ha
No. of measurement plots	12	24
Shape of measurement plots	Rectangular	Circular
Size of measurement plots	20 * 50 m (0.1 ha)	R = 12.65 m (0.05 ha)
Enumeration of trees ➢ 30 cm ➢ Saplings upwards ➢ Seedlings	 20 * 50 m (0.1 ha) 5* 50 m (0.025 ha)	 R = 12.65 m (0.05 ha), all 24 plots quarter circle r=12.65 m, only 4 plots quarter circle r = 8 m, only 4 plots
Accuracy ➢ Probability Level ➢ Standard Error		 10% or 15% depending on strata

Figure 1: Design and layout of NFI 2 and NFI 3 (Source: DE MILDE 1993)



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[4] Of the 234 sample units assessed during NFI 3 only 190 (81%) could be used for calculations, 44 had to be discarded.

1.3 Design and layout

The inventory design described in the following fulfils all the objectives and requirements as pointed out in Chapter 1. The design chosen can be described as a

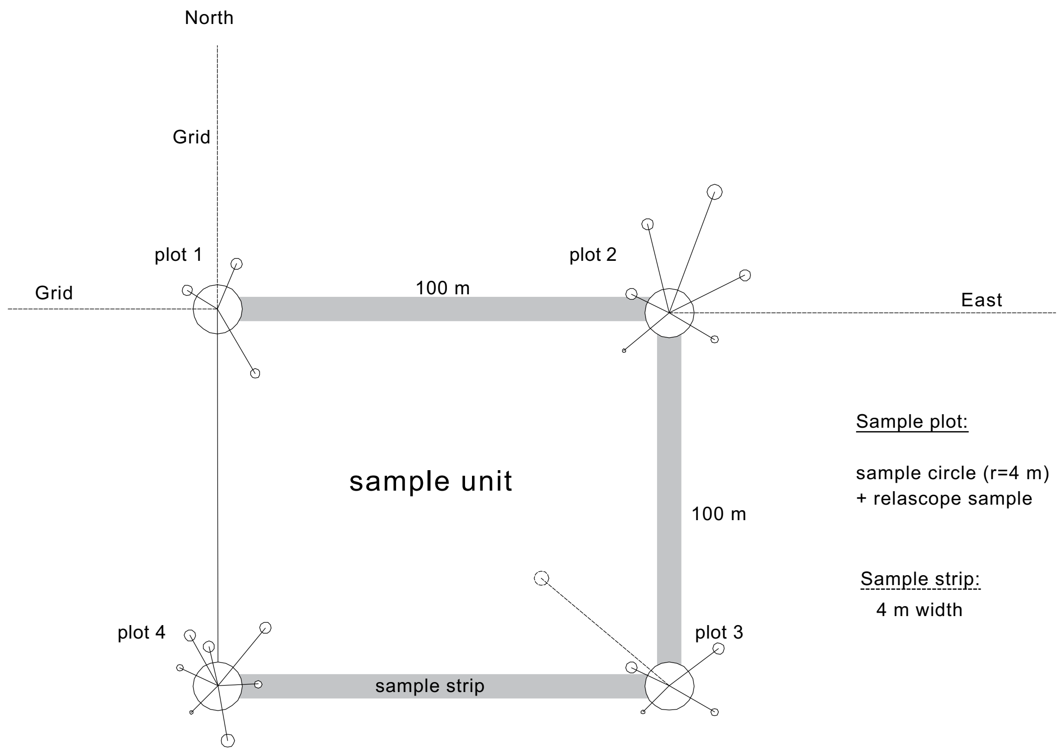
stratified satellite sampling based on randomly distributed permanent sample units.

The sampling design consists of permanent sample units (satellites) of square shape with one sample plot in each corner, altogether 4. Each sample plot consists of a 4m-sample circle for small size trees and a point sample for big trees (see Figure 1).

Rattan, bamboo and palms are assessed on 4 m wide sample strips which are laid out on 2m to each side of the 100m centre line connecting plot 1, 2, 3 and 4.

The sampling units are randomly distributed in each state. The number of sample units is determined based upon the size, the tolerated standard error (SE%) and the coefficient of variation (CV%) of each stratum along a common map grid.

Figure 3: Layout of sample unit



1.4 Justification

Permanent sample units

The sample units serve as continuous forest inventory plots. As it is the objective of the CFI to monitor the change of the forest resource over time and to control the sustainability of forest management, the same sample units need to be exactly re-established after 10 years' time. This requires a permanent marking of the measurement units, which however, must be done in an inconspicuous way in order to avoid biased treatment of the area by the forestry staff and contractors. While for an L-shaped or rectangular design the permanent marking and identification of all corners[5] is necessary, for a circular design only the centre needs to be permanently marked. The combination of sample circles with point sampling minimizes the effort of plot re-establishment after 10 years.

Combination of sample circles, point sampling and sample strips

As the sample units also serve for the calculation of growth and yield (PSP), it is of great importance, to re-measure exactly the same trees. This requires the location of each sample tree to be exactly known. This in turn is simpler to be achieved with a clockwise numbering of sample trees identified by point sampling than on large rectangular plots.

The advantage of small measurement units (sample plots) compared to large ones is the easy and fast set-up, the easy check of border trees, and the avoidance of oblique[6] measurements (ZOEHRER, 1973). For sample circles with a radius of r = 4 m and for point sampling using the Bitterlich mirror relascope, no slope reduction is required at all (ZOEHRER, 1980).

In natural forest the number of large trees per ha is comparatively small but they account for the largest proportion of the standing volume compared to the smaller trees. To assess a sufficient number of large trees requires large measurement units, which bear the above-mentioned disadvantages. With point sampling, sample trees are selected proportional to size (i.e. volume). This means point sampling gives a more precise estimate of the basal area or volume as a fixed sample plot, but is less precise in terms of number of stems per ha. However, by measuring the diameter of the sample tree, stand tables (diameter distributions) can be derived as well.

Recording sample trees below 10 cm by point sampling is too cumbersome. Smaller trees are better estimated according to species groups and abundance on a sample circle following the proposal of DE MILDE, 1993.

Plants which are distributed in clumps such as palms, rattan and bamboo can be best assessed along sample strips.

Basal area factor 4

During the field test several basal area factors were tested. A basal area factor 4 has proven to be practical and provides a sufficient number of sample trees from the statistical point of view. As the recorded data of all 4 sample plots will be added up and count as one sample, the basal area of the sample unit is 1.

Satellite sampling

Satellite or cluster sampling reduces the CV%, which is necessary if comparatively small measurement units are chosen[7].

Random distribution of sample units

The need to get precise information per strata and the basically fragmented forest and strata distribution within the states calls for a random distribution of sample units.[8] The advantage of a random distribution of sample units in contrast to systematic sampling is, that it provides

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[5] For long legs even intermediate permanent marking along the sides need to be established.

[6] I.e. slope correction

[7] According to Zoehrer, 1980, the coefficient of variation increases with decreasing plot size. This problem is solved by satellite sampling, where several relatively small plots are systematically arranged. The individual "sample plot" is merely a unit of record. The statistical unit is the entire satellite system, or the sample plot area is the total area of the sample plots of the whole satellite.

[8] A systematic distribution along a fixed grid (e.g. 2*2 km) will lead to a situation in which there are too many plots in large continuous strata and to less plots in small fragmented strata.

an unbiased estimate of the standard error (ZÖHRER, 1980). So far, all NFIs in PM were based on random distribution of sample units, too.

1.5 Measurements to be taken

The cost of a forest inventory have to be in sound relation to the information provided. Generally not more data should be collected than are really needed and will actually be used during subsequent data processing. The type of data to be collected therefore depends on:

1. the objectives of the inventory
2. technical feasibility of data collection
3. quality of information
4. cost-benefit ratio.

General Information

For each sample plot information on topography (slope, altitude, aspect) is taken. One important parameter to be assessed on each plot is, whether the plot itself is operable or not. This is required to calculate the percentage of inoperable areas within the production forest (Note: Not all the area of the production forest is operable due to topographic features e.g. steep slopes, deep valleys, not accessible. For the purpose of medium-term management planning an estimate of the percentage of inoperable areas is required in order to calculate the net production area. Detailed mapping and zoning of the real production area is part of compartment-level planning, an information which is not available by then.

Also the actual year of logging is recorded.

Table 4 compiles the information to be collected per sample unit/plot/strip. How this is to be done is described in detail in the Inventory Field Manual.

Table 4: Information to be collected per sample unit

Parameter	Sample strip (4 m wide)	Sample circle (r=4 m)	Point sample (basal area factor 4)	
	bamboo, rattan, palms, etc.	trees < 10 cm medicinal plants	trees = 10 cm	trees ≥ 45 cm
Species	name and code	name and code	name and code	name and code
Occurrence	Number	number		
DBH	No	no	yes	Yes
Bole height	No	no	no	all trees
Location	No	no	azimuth, distance	azimuth, distance
Loggable[9]	No	no	no	yes, specify code
Logs	No	no	no	number and quality

Sample circle

The individual identification and measurement of each tree < 10 cm dbh (i.e. saplings, regeneration) is very tedious and does not provide information for AAC calculation, Therefore only the number of trees according to the following species groups are recorded:

- commercial dipterocarp species
- other commercial species
- others.

[9] This parameter is introduced to get an estimate for the harvestable volume. In practice not all trees of harvestable size are logged out of different reasons (e.g. cull tree, too dangerous, etc.).

They are counted separately for the two diameter classes < 5 cm and 5-9.9 cm.

In addition key medicinal plants are to be identified and counted.

Point sampling

Trees selected as sample trees by point sampling need to be identified by species or species group according to the species list. For the purpose of yield regulation it is sufficient to identify only the commercial species. On the other hand, information on biodiversity, especially on protected or endangered species is required for management planning in general. In order to make the data compatible with NFI 3 the same species need to be recorded, too. The species list includes all species recorded in NFI 3, all "*preferred"* and "*acceptable"* species[10] and the most endangered and/or highly protected species.

For trees < 45 cm no bole height is measured. The height can be derived from diameter/-height functions developed from growth and yield plots.

During the field test the problem appeared how to measure the diameter of buttressed trees with sufficient accuracy. The most efficient way to do that is calculating the diameter from a relascope measurement combined with a distance measurement using the laser range finder. For this the relascope should be mounted on a tripod.

Sample strip

The occurrence of rattan, bamboo and palms is assessed by counting the clumps on a 2 m wide strip to each side of the centre line from plot 1 to 2, 2 to 3 and 3 to 4. The total recorded area amounts to 0.12 ha (100m x 4m x 3).

Identification of wildlife

All observations made on the occurrence of rare or protected wildlife species during navigation to and assessment of the sample unit are recorded.

The Inventory Field Manual provides a closer description of which data are to be assessed and how they will need to be measured.

1.6 Area covered by the forest inventory and strata to be distinguished

The inventory shall provide information on the overall forest cover. The number of sample units to be assessed depends on the objective of the inventory and varies according to forest status and type and the desired level of accuracy (refer to Table 5).

Production forest (PFE), state and national level.

Production forest refers to the Permanent Forest Estate (PFE) classified for timber production. It covers the total production forest area within a state, which is subject to forest management planning. The production forest is further subdivided into strata on state-level according to forest types and logging status based on the requirements of medium-term forest management planning (refer to FMPRG 2000). Field inventory is only carried out in dipterocarp inland and peat swamp forests. Mangrove and plantation forests are excluded.

Production forests are managed according to age classes, and yield regulation for medium-term forest management planning is done based on area. This is also in line with NFI 3 and allows the comparison of the results.

In inland dipterocarp production forest altogether 7 forest strata are distinguished (see Table 5). The virgin forest strata are reduced from 4 (NFI 3) to 2 strata, since the area of virgin pro-

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[10] As specified in the "Manual Kerjja Luar" (JPSM 1997).

duction forest was reduced over the last ten years and is more fragmented now. For the purpose of management planning, the strata *"logged-over 1-10 years ago*" and *"logged over more than 40 years ago"* need to be included in the inventory.[11]

In peat swamp forest altogether 4 strata are to be distinguished, one virgin forest stratum and three logged-over forest strata.

State land forest (state and national level)

State land forests are forests, which may be converted to other land uses. In order to quantify the timber available from logging or conversion of state land forests, they are inventorized on state level. They are divided according to major forest types into two strata:

- dipterocarp forest, and
- peat swamp forest.

Protection forest (national level)

There are two categories of protected forests:

- mountain forests above 1000 m asl, and
- PFRs which are classified for other purposes than timber production (i.e. virgin jungle reserves, research forests, recreation forests, etc.)
- forests defined as protection zones by multifunctional zonation.

As these forests are not managed for the production of timber, it is sufficient to collect accurate information on national level only.

National Parks and Nature Reserves such as Endau Rompin have a different legal status. They are managed by the Department of Wildlife and National Parks, and the management objectives are different ones. They are therefore excluded from the field inventory.

For a list of all strata refer to Table 5.

1.7 Desired level of accuracy

The probability level is set at 95%. However the tolerated standard error (SE%) on the standing volume is different for the individual strata. For those strata within the production forest which may be harvestable the SE% is set at 15%, for all others at 20%. This helps to reduce the number of sample units. In recently logged-over areas, the CV% is very high. In this stratum a high number of sample units would be required, however, for the total standing stock on state and national level, the SE% will be less than 10%, which fulfils the accuracy requirement for AAC calculation and for a NFI.

For state land forests the SE% is set at 20% on state level. On national level this will result in a SE% of less then 10%. Protected forests (including mountain forests) are assessed on national level with a SE% of 15.

1.8 Number of sample units (satellites) required

The number of sample units (satellites) required depends on the coefficient of variation (CV%) and the tolerated standard error (SE%) at a given probability level (see Table 5). The formula to determine the number of sample units is:

$$\mathbf{n_i = t^2 * (CV_i\%^2)/(SE_i\%^2)}$$

n_i = total number of plots for stratum i

[11] Not covered by NFI 3 as it was subject to low priority sampling.

t-value on a confidence (probability) level of 95% $\approx$ 2
CV_i% = coefficient of variation of stratum i
SE_i% = standard error

Table 5: Number of sample units per stratum on state and national level

Forest type	Stratum		Statistics		No. of units per	
	Name	No.	CV%	SE%	State	PM
Dipterocarp Production Forest	Virgin forest good to superior	11	30	15	16	
	Virgin forest poor to moderate	12	45	15	36	
	Logged-over 1-10 years ago	20	50	20	25	
	Logged-over 11-20 years ago	21	45	20	20	
	Logged-over 21-30 years ago	22	40	15	28	
	Logged-over 31-40 years ago	23	35	15	22	
	Logged-over 41+ years ago	24	35	15	22	
	Total				**169**	
Peat swamp Production Forest	Virgin	31	30	15	16	
	Logged-over 1-10 years ago	32	45	20	20	
	Logged-over 11-20 years ago	33	40	20	16	
	Logged-over 21+ years ago	34	35	15	22	
	Total				**78**	
State land Forest	Dipterocarp forest	40	50	20	25	
	Peat swamp forest	41	45	20	20	
	Total				**45**	
Protection Forest (as classified by Forest law)	Mountain forest > 1000m asl	50	35	15		22
	Dipterocarp forest	51	40	15		28
	Peat swamp forest	52	30	15		16
	Total					**66**
Total					**282**	**66**

The total number of sample units required per state depends on the number and area of the occurring strata. An estimate based on the results of the NFI 3 map is given in **Table 6**.

Table 6: Estimated number of sample units in each state

State	Inland dipterocarp forest							Peat swamp forest				State land		Total
	Virgin		Logged-over forest					Virg-in	Logged-over forest					
	good	poor	0-10	11-20	21-30	31-40	40+		0-10	11-20	21-30	Dipt.	Peat	
	11	**12**	**20**	**21**	**22**	**23**	**24**	**31**	**32**	**33**	**34**	**40**	**41**	
Perlis		36			28							25		**89**
Pulau Pinang														**2**
Melaka							22							**22**
N. Sembilan	16	36	25	20	28	22	22					25		**194**
Selangor	16	0	25	20	28	22	22		20	16	22	25	20	**236**
Johor	16	36	25	20	28	22	22	16			22	25	20	**252**
Kedah	16	36	25	20	28	22	22					25	20	**214**
Terengganu	16	36	25	20	28	22	22	16				25	20	**230**
Kelantan	16	36	25	20	28	22	22					25		**194**
Perak	16	36	25	20	28	22	22					25		**194**
Pahang	16	36	25	20	28	22	22				22	25	20	**234**
Protection forest (as classified by forest law)														**66**
Total PM	**128**	**288**	**200**	**160**	**252**	**176**	**198**	**32**	**20**	**16**	**66**	**225**	**100**	**1927**

Remark: for the shaded columns, there will be a change in area from virgin towards logged-over strata. In case the stratum area for virgin forest falls below the margin (refer to Chapter 2.3, Step 3) the stratum will be combined with the oldest logged-over forest strata and the total number of sample units within this state will be reduced. The final calculation of the strata area is subject of NFI 4 map preparation.

In Melaka altogether 22 sample units are to be measured. Due to the small size of the forest, these plots are to be distributed systematically.

In Pulau Pinang a forest management inventory has already been implemented using the Post-F inventory design and, based on its results, a management plan has been prepared. For the purpose of the National Forest Inventory it is sufficient to assign 2 sample units within Pulau Pinang ion the stratum with the largest area.

The final number of sample units actually required can only be determined once the forest has been stratified again and the area results are available. The estimated total of 1927 sample plots, however, can be considered as an upper limit, as some strata may be too small to be considered as a separate stratum and need to be combined with each other.

2 Inventory Preparation

2.1 Stratification and preparation of NFI 4 map

The first step of inventory implementation is the stratification and preparation of the inventory map (NFI 4). The NFI 4 shall contain the actual forested area within the PM according to legal status, major forest type and logging status and include all strata as specified in Table 5. The preparation of the NFI 4 map shall be done based on interpretation of latest satellite imagery, analysis of historical records and up-date of the NFI 3 strata. Ideally, the NFI 4 map should be prepared before the field inventory is conducted as it provides the basis for the distribution of sample units. It is estimated that the preparation of the NFI 4 map by the GIS section of FDPM may take about one to two years. Completion of the process of NFI 4 map preparation was expected in 2003.

If the NFI 4 maps cannot be prepared in time, an auxiliary procedure on how to distribute the sample units without the maps is described in Chapter 2.3.

Table 7: Change of dipterocarp forest strata from NFI 3 to NFI 4

NFI 3		NFI 4	
Stratum	**Code**	**Stratum**	**Code**
Virgin forest good to superior	11,12	Virgin forest good	11
		Logged-over 1-10 years ago	20
Virgin forest poor to moderate	13,14	Virgin forest poor	12
		Logged-over 1-10 years ago	20
Logged-over 1-10 years ago	21,22	Logged-over 11-20 years ago	21
Logged-over 11-20 years ago	23	Logged-over 21-30 years ago	22
Logged-over 21-30 years ago	24	Logged-over 31-40 years ago	23
Logged-over 30+ years ago	25	Logged-over 41+ years ago	24
		Logged-over 1-10 years ago	20

2.2 Multifunctional zonation

Before the sample units can be distributed within the different strata, the production forest area needs to be zoned according to functions. This process is described in detail in the FMPRG 2000. It results in a zonation of the forest area into one protection and a number of production zones.

Protection zones are permanently excluded from timber production, therefore they are not considered in yield regulation and need to be excluded from the forest inventory. (i.e. no sample plots shall be located within the protection zone[12]). It is therefore urgently required to implement preliminary multifunctional zonation based on slope classification before the inventory is conducted, otherwise 20-30% (depending on terrain conditions) of inventory units may be measured in vain and need to be replaced by others later on.

It is proposed to start with multifunctional zonation for the state of Selangor as soon as possible. Once the Preliminary Forest Function and Zonation Map (PFFZM) is available the sample units should be distributed and inventory field work should start. In the meantime, contracts for the preparation of slope classification maps (which are the initial products of multifunctional zonation) for the other states should be made, and once available, multifunctional zonation should be conducted and the PFFZM should be prepared for the other states of the PM.

2.3 Random distribution of sample plots

In the following the steps how to distribute the sample units is described based on the assumption that PFFZMs are available. The sample units are distributed at random using the 1 km map grid. For small states or small-size stratum it might be necessary to intensify the grid density (i.e. 0.5 km grid). For stratification, random distribution of sample units and sample unit identification a set of maps is required on state level indicating the stratum[13], topography, infrastructure and inventory grid.

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[12] Protection zones are characterized basically by steep slopes or heavily dissected or rough terrain conditions, which are considered as inoperable. Especially in logged-over forests, these areas are comparatively well stocked, as they have been excluded from logging before. To allocate sample plots in these areas and to consider them in AAC calculation would lead to an over-estimate of the harvestable volume. Therefore, protection zones must be excluded from the inventory.

[13] The stratum should be derived from NFI 3 map and historical records.

Step 1 GIS-Analysis (GIS unit)

For stratification, the following spatial information (GIS themes) need to be linked and analysed:

- Preliminary forest function and zonation map
- NFI 3 map indicating the forest types
- Forest status (PFE production, PFE protection, protected areas, state land forest).

The following EXCEL tables should be prepared by the GIS unit. They provide the required information for the random distribution of the sample units. X and y coordinates can be made available through GIS application.

PFE timber production, without protection zones (per state)

No.	NFI 3 stratum code	x-coordinate	y-coordinate	map reference

State land dipterocarp forest (per state)

No.	x-coordinate	y-coordinate	map reference

State land peat swamp forest (per state)

No.	x-coordinate	y-coordinate	map reference

Mountain forest (for PM)

No.	state	x-coordinate	y-coordinate	map reference

PFE protection dipterocarp forest (for PM)

No.	state	x-coordinate	y-coordinate	map reference

PFE protection peat swamp forest (for PM)

No.	state	x-coordinate	y-coordinate	map reference

Step 2: Stratification (PFE production forest, production zone)

Use EXCEL table produced by GIS section. Sort according to NFI 3 strata. Convert the NFI 3 strata into NFI 4 strata as explained in Table 7 for dipterocarp forest. For virgin forests each grid location needs to be checked whether it is still virgin forest or whether it has been logged in the last ten years. This applies for both the dipterocarp and the peat swamp forest.

Prepare a new excel table with the NFI 4 stratum code and sort again.

Step 3: Combining small size strata based on area (production and state land forest)

Calculate the area per stratum. Each square represents 100 ha (1 km * 1km).

Fill the following table:

Table 8: Area distribution of the production zones in the PFE timber production

Name of strata	New stratum Code	Area (ha)	Area (%)[14]
Inland dipterocarp forest			
Virgin forest good to superior	11		
Virgin forest poor to moderate	12		
Logged-over 1-10 years ago	20		
Logged-over 11-20 years ago	21		
Logged-over 21-30 years ago	22		
Logged-over 31-40 years ago	23		
Logged-over 41+ years ago	24		
Peat swamp forest			
Virgin	31		
Logged-over 1-10 years ago	32		
Logged-over 11-20 years ago	33		
Logged-over 21+ years ago	34		
State land forest			
Dipterocarp state land forest	40		
Peat swamp state land forest	41		

If a stratum area is less than 5% (for large states) or less than 1000 ha (for small size states), the stratum must be joined together with the following stratum (i.e. virgin forest to logged over 40+, logged–over 40+ to logged-over 30-40, etc.). However, the number of plots to be allocated within each of the joined strata is to be distributed according to area-weight (cf. example in **Table 9**. The number of sample units is determined by the stratum with the higher CV%. For the number of sample units to be distributed within each stratum refer to Table 6.

Table 9: Distribution of sample units in joined strata (example)

Stratum	Area of stratum (ha)	Area weight %	No. of units per stratum	No. of units to be allocated
Virgin good	2623	0.81	16	29 (36*0.81)
Virgin poor	609	0.19	36	7 (36*0.19)
Total virgin	3232	1.00	52	36

<u>Step 4: Distribution of sample units for mountain and protection forest</u>

Mountain and protection forests are assessed on PM-level. The corresponding EXCEL tables should be sorted according to states, then the area per state should be calculated as described in Step 3. After that the sample units shall be distributed area-weighted among the different states. For this purpose the following table needs to be generated:

[14] CV% derived from JBSM, undated: Inventori Hutan Nasional Ketiga. This CV% corresponds fairly well with the CV% derived from the FMI conducted in KPKKT concession. For peat swamp forests CV% were estimated following the results of Hahn-Schilling (1994).

Table 10: Distribution of sample units in mountain and protection forest strata within states

State	Mountain forest			PFE protection dipterocarp forest			PFE protection peat swamp forest		
	Area (ha)	Area (%)	No. of plots	Area (ha)	Area (%)	No. of plots	Area (ha)	Area (%)	No. of plots
Perlis									
Pulau Pinang									
Melaka									
N. Sembilan									
Selangor									
Johor									
Kedah									
Terengganu									
Kelantan									
Perak									
Pahang									
Total		**100**	**22**		**100**	**28**		**100**	**16**

Step 5: Random selection of sample units (all strata)

The sample unit locations within each stratum and/or state are selected based on serial number (1st column of the EXCEL spreadsheets) and random figures.

Random figures can be generated using EXCEL as follows:

- open new spread-sheet
- tools/data analysis/random number creation
- number of variables is 1
- number of random numbers is equal to the number of required sample units plus 10% (in case some random numbers are double due to rounding).
- distribution: *uniform*
- between *1* and *last serial number of list*
- output range: specify enough cells.

The selected plot locations are then to be checked on the topographic map and the type of stratum verified. If it is not correct, the stratum code needs to be changed accordingly. If a sample unit is located within or very close (i.e. > 100 m) to an area which does not belong to the production area (i.e. lake, river, settlement, road, etc.) then skip and take next. If, however, the number of locations are limited, which might be the case for small-size strata, then the location can be shifted 200 m to the west. This should only be done if absolutely necessary. The x-coordinates need to be corrected accordingly.

This process is repeated until the required number of sample units per stratum and/or state has been identified.

In case there are not sufficient plot locations within one stratum, intensify the grid using the ½ km grid. This might be necessary in small states and for strata which are small in area size or heavily fragmented.

Step 6: Numbering of sample units, GIS theme "*inventory units"*

Sample units are numbered serially according to state (alphabetic order) and stratum number, which means there are no inventory units with the same number.

Their location is to be properly marked on the inventory map, and entered into the GIS theme "*inventory units* ".

Step 7: Preparation of inventory record sheet

All sample plot locations must be entered in the inventory record sheet. The latitude and longitude shall be calculated from the x-/y-coordinates by GIS application (see Chapter 2.3, Step 1).

Table 11: Inventory record sheet (example)

Plot No.	State	Stratum no.		Latitude	Longitude	Remark	Team	Date
		Act.	Alloc.					
1	Selangor	12	11	100° 41’ 30”	3° 31’ 00”			
2	Selangor	11	11	100° 38’ 00”	3° 30’ 30”			
3	Selangor	15	15	101° 12’ 30”	2° 45’ 00”			
etc.								

The table above is the basic reference table for inventory implementation. There should be always at least 2 back-up files at the FDPM. In addition each state has a list indicating only the plots within its area.

Step 8: Preparation of inventory field map

For each state an overview map at a scale of 1:100 000 showing the location of all the sample units shall be prepared. For field identification and navigation, detailed topographic maps are required at a small scale (preferably 1:10.000 or 1:25 000).

3 Inventory Implementation

3.1 Number and qualification of inventory teams

Inventory field work is to be implemented for all states within a period of 1.5 years (2001-2002) to be in line with the ten-year-frequency of the NFIs. Field test has proven that the measurement of one sample unit can easily be done in 3 to 4 hours. Taking into consideration the time required to reach the unit, an average of 2-3 days per sample unit seems an appropriate estimate for calculating the overall time required for inventory implementation.

Taking into consideration:

- 2.5 days working days per inventory unit
- 5 working days per week
- 40 working weeks per year

the total number of inventory teams required is 16 teams[15].

3.2 Training requirement

The inventory teams shall be intensively trained by the FDPM in

- navigation and identification of sample unit location with the help of GPS, topographic maps and field survey
- set-up of sample units and assessment and measurement procedures
- identification of tree species, protected and endangered species, bamboo, rattan and palms according to the species list.

[15] (1927*2.5)/5/40/1.5 = 16

Only teams may be contracted who have passed a test successfully at the end of the training courses.

3.3 Work organization

Taking into consideration the time required to prepare the PFFZMs for all states and the required intensive control of field work at the beginning of the inventory, the following approach for implementation is supposed to be followed:

Field work is to start with 5 teams consisting out of 3 well trained foresters and 2-4 workers in the state of Selangor. This facilitates control and supervision in the beginning and buys time for the preparation of PFFZMs for the other states. Problems arising under real field conditions can be addressed more easily and the inventory procedure can be adjusted accordingly.

Once control measurements by the independent inventory control teams have proven the reliability of the inventory teams, they are to split into 15 teams, each headed by one trained forester.

When the inventory will be completed in the state of Selangor, the inventory teams are supposed to conduct field work in the other states simultaneously, as soon as the sample units have been allocated and the inventory field maps have been prepared.

The sample units shall be assessed in the following order:

1. Dipterocarp forest strata of the PFE
2. Peat swamp forest strata of the PFE
3. State land dipterocarp forest
4. State land peat swamp forest
5. Mountain forest
6. Protected dipterocarp forest strata
7. Protected peat swamp forest strata.

3.4 Field work

It may be considered to deploy inventory teams that are specialized in certain strata, i.e. peat swamp forest inventory teams, dipterocarp forest inventory teams, mountain forest inventory teams.

Field work has to be implemented according to the prescriptions of the inventory field manual.

At the end of each month, the inventory teams shall report to the FDPM and hand over the inventory tally sheet. This is necessary to monitor the progress of the inventory and evaluate the quality of work by checking the tally sheets and conducting a plausibility test (refer to Chapter 3.5 and 4.1). At the FDPM the following data are entered into the Inventory Record Sheet (see Table 11); the information can be derived from the inventory field forms:

Remarks: Record any extra-ordinary event (e.g. unit was shifted, or inaccessible, etc.)
Team: Name of inventory team
Date: Date of assessment.

3.5 Control measurement

Control of inventory field work is done in two ways:

1. Control of inventory tally sheet including plausibility test
2. Control measurement in the field.

Ad 1) Control of tally sheets

Every end of the month, immediately after the tally sheets have been handed over to the management unit of the FDPM, the inventory tally sheets are checked for completeness and readability, and the data are entered (refer to Chapter 4.1) and checked on plausibility. If recording is not done properly or data are not plausible, the responsible team needs to do the necessary corrections. A warning should be issued and, in case of repetition, sanctions should be imposed. Teams who provide non-plausible data need to receive priority in field control.

Ad 2) Field control

The irregular control of sample units by independent control teams combined with the imposition of sanctions in case of unsatisfactory performance is an important and indispensable means to ensure quality of field assessment. The control teams have to be formed by specialized staff of the management unit of FDPM. Altogether 3 control teams are required from the very beginning. The control teams should be shifted periodically so that each inventory team is controlled in irregular intervals by all the three control teams.

At the beginning, each inventory sample unit needs to be controlled. Depending on the performance of each team, the frequency of control may vary in the long run, but at least 10% of the sample units must be checked. Control measurement is to be taken as soon as possible after the data have been entered and the tree location map is available (refer to Chapter 4.1 and 5.2). The following table provides a checklist for field control and specifies the object, priority class, criteria, tolerance levels and proposed sanctions.

Table 12: Checklist for field control

Object	Priority class	Criteria	Tolerance level	Proposed sanctions and actions (reduction in % of payment if tolerance level is exceeded)
Plot identification and lay-out				
Plot location	1	Deviation of plot 1 from reference point	± 20 m	30% calculate new location
Marking of reference point and plot centres	1	Proper fixation of pegs and numbering	-	5% per peg and redo marking
Lay-out of sample plots	2	Distance between sample plots	± 10 m 10-20 m > 20 m	- 10 % per plot redo plot
Sample circle				
Sample trees	3	Number per species and diameter class	± 20%	2% per sample circle
Medicinal plants	3	Number per species	± 20%	2% per sample circle
Point sample				
Sample trees	1	Number	± 0%	20% per tree that is not recorded
	2	Species	± 0%	1% per tree (same species group) 2% per tree (different species group)
	3	Location, distance/angle	± 10%	1% per tree
	1	Dbh	10-45 cm: ± 10% 46+ cm: ± 5%	2% per tree
	2	Dbh height	± 10%	2% per tree

	3	Log length	± 20%	1% per tree
	3	Log quality	-	warning
Strip sampling				
Sample trees	3	Number per species	± 20%	2% per sample strip

The priority class refers to the importance of the measurement and accuracy required (tolerance level). Further, it is an indicator for the intensity of the control measurement. For example, for class 1 all measurements are to be checked by the control team and the tolerance level is very low (i.e. selection of sample tree in point sampling) while for class 3 (i.e. log quality) it is sufficient to check at random.

4 Inventory Analysis

Data entry and inventory analysis shall be done in a centralized way by the FDPM in order to avoid any wrong doing or mismanagement. The contractor who does the field work must not be involved at all.

4.1 Data entry

As already mentioned earlier, data entry is an important tool for control and a means to verify data validity. It is to be done periodically every end of the month by staff of the management unit. The data entry programme should include a plausibility test to identify wrong measurements and to avoid wrong data entry. At least two back-up files must be kept for all data recorded.

One output of the data entry programme is intended to be a tree location map for each point sample (see chapter 5.2).

The original tally sheets are copied, together with the tree location map. The original is filed and kept by the FDPM, the copy is handed over to the State Forest Office (SFO).

4.2 Data analysis

For data analysis the modified MIDAP programme is to be used. Based on standard result tables for each state an inventory report is to be prepared by the SFO which provides all data required for forest management planning. It is to be supported by FDPM.

The analysis of the data for the NFI 4 and the writing of the NFI 4 report will be done by FDPM.

4.3 Transformation of state-level inventory to national level

The transformation of the state-level inventory to the national level can be done in two ways:

- out of the total number of sample units measured a defined number of sample units are selected at random for each stratum
- the inventory results of each state and stratum are compiled area-weighted.

5 Subsequent Inventory

5.1 Partial replacement

The sample units are permanently re-measured every 10 years for the period of one cutting cycle. Sample units which are located in forest areas which have been logged within the last 10 years' period will be replaced by new ones, as it is very unlikely that the inventory units can be re-located after logging has taken place. The same applies to all other sample plots which cannot be re-located at all during the course of the subsequent inventory: They also need to be replaced.

5.2 Plot re-identification

Altogether there are three means and options to re-identify the sample units in the field after a 10 years' period:

<u>Reference point with proper GPS reading and visible mark</u>

Each sample unit can be identified by the reference point which is properly and visibly marked in the field (refer to field manual). The location of plot 1 of the sample unit can be identified by field measurement following the prescriptions of the previous tally sheet (note: The location of the reference point has been determined by GPS readings of high accuracy).

<u>GPS readings at the centre of each sample plot</u>

At the centre of each sample plot a GPS reading should be recorded. Experience during field testing has shown that it was possible to receive at least one proper GPS reading at one of the four sample plots. Wherever this is the case it is recorded on the tally sheet. If one sample plot location can be identified, the whole sample unit can be re-established.

<u>Tree location map</u>

A tree location map is to be prepared for each sample plot indicating the location, Dbh and species of each sample tree of the point sampling. These maps are to be kept together with the original tally sheets. They are a very useful tool for re-identification of the sample plot centres, even in case the pegs should have been removed. If one tree can be re-identified, the plot centre can be easily re-established (note: the bearing and the distance of each sample tree to the plot centre has been recorded).

Annex

02

Forest Management Planning Rules and Guidelines (FMPRG):

Content and Write-up of State Forest Management Plan

gtz

Jabatan Perhutanan
Semenanjung Malaysia

German Technical Cooperation

SFMCP

Sustainable Forest Management and Conservation Project

Malaysian-German Technical Cooperation

Forest Management Planning Rules and Guidelines (FMPRG)

Guideline 3f1: Content and Write-up of a State Forest Management Plan

Günther Haase

Werner Schindele

August 2005

Technical Document No. B57

Content and Write-Up of a State Forest Management Plan

Section	Medium-term Planning	3
Sub-Section	Content and Write-up of Forest Management Plans	f
Sub-Section	State Forest Management Plan (SFMP)	1

Contents

Note: A detailed table of contents for the SFMP is presented on pages vii-ix.

Acronyms and Abbreviations

AAC	annual allowable cut
AC	annual coup
m^3	cubic metre
CFMP	concession forest management plan
CM	compartment map
CRB	compartment record book
DFO	District Forest Office
DFWP	district forest working plan
DIPSIM	dipterocarp simulation model
EDP	electronic data processing
EIA	environmental impact assessment
FDMP	Forestry Department Peninsular Malaysia
FFM	preliminary forest function map
FMI	forest management inventory
FMP	medium-term forest management plans (refers to all: SFMP, CFMP, DFWP)
FMPG	forest management planning guidelines
FMPR	forest management planning rules
FMPRG2000:	Forest Management Planning Rules and Guidelines 2000
FMM	forest management map
FMU	forest management unit
FZM	forest zoning map
GIS	Geographic Information System
ITTO	International Tropical Timber Organization
mai	mean annual increment
MC&I	Malaysian Criteria and Indicators
MFT	major forest types
MIDAP	Management Inventory Data Analysis Programme
NPA	net production area
NTFP	non-timber forest products
P	protection forest
PFE	permanent forest estate
PSP	permanent sample plots
PRF	permanent reserved forest
R&D	research and development
SFD	state forestry department
SDF	State Director of Forestry
SFMP	state forest management plan
SFO	state forest office
TP1	Timber Production Zone 1 (ground-based skidding permitted)
TP2	Timber Production Zone 2 (soil conserving extraction systems only, ground-based skidding with heavy machinery not permitted)
WC	working circle

1 Introductory Remarks

There are three different types of forest management plans:

- State forest management plans (SFMP),
- District forest working plans (DFWP) and
- Concession forest management plans (CFMP).

On state level, a State Forest Management Plan is prepared including sub-plans for each forest district, called District Forest Working Plans. The DFWPs and the SFMP together constitute the Forest Management Plan for the whole state.

The SFMP is a framework plan which describes the forest development policy of the state, defines the management objectives and regulates yield on a sustainable basis. It includes an analysis of the forest sector of the state.

2 Planning Responsibility and Plan Approval

SFMPs are prepared by experienced forest management planners appointed by the state forest office (SFO). Once the plan is prepared it is to be endorsed by the Forestry Department Peninsular Malaysia (FDPM). Following this, it is forwarded with a covering letter to the state government for formal approval.

3 Content and Structure of the SFMP

The cover page of the SFMP is the letter of plan approval. The preface of the plan comprises the following parts:

Tabular Summary
Table of Contents
Abbreviations and Acronyms
Executive Summary.

The main part of the document comprises six main chapters, namely:

1. Introduction
2. Management Goals and Objectives
3. Present Situation
4. Past Management
5. Management Prescriptions
6. Implementation Schedule.

Chapter 1 provides details on plan preparation, defines the planning period and describes the legal and administrative framework for forest management planning and the interfaces with other plans.

Chapters 3 and 4 constitute the descriptive part of the plan. Chapter 3 analyzes the existing situation with regard to land use in the state, geo-physical and biological resources, economic and socio-economic environment, the forest administration and the forest resource base. Chapter 4 presents a record and critical review of past forest management and draws conclusions for future management.

Chapters 2, 5 and 6 constitute the operational part of the plan. Based on the situation analysis in Chapters 3 and 4 and the directions of superior policies and strategies, the management goal and management objectives are defined (Chapter 2). Chapter 5 defines management prescriptions related to all aspects of forest management. It also details the measures and resources required to implement the plan. In Chapter 6 a schedule for implementation of the measures is presented and procedures for management control are established.

A detailed break-down of the different chapters is presented in the table of contents to the SFMP Template (pp. vii-ix).

4 Guidelines for the Write-Up of an SFMP

Following this chapter a template of an SFMP is attached. It is structured exactly the same way a SFMP is organised. Under the various chapter headings at different levels it is described what kind of information is to be presented by providing explanatory notes, instructtions, examples and formats. The standard table formats presented must be adhered to, as they constitute the link to the Forest Management Information System or are required in the MC&I assessment procedures.

When writing the SFMP all chapters of first and second order have to be prepared. If a chapter/sub-chapter is not relevant, the heading still needs to be maintained and a statement has to be made to this avail. Also, some of the sub-chapters of third or lower order are obligatory for the SFMP. This is indicated by the remark "obligatory" under the chapter heading.

Additional aspects relevant to the FMU, which are not included in the standard table of contents, can be inserted as a sub-chapter under the appropriate chapter of higher order.

In some cases it is not possible to give detailed instructions on how to write a specific chapter or sub-chapter, because the matter might be too complex or requires sector specific knowledge (e.g. planning of eco-tourism activities). If guidelines on a specific subject (e.g. environmental impact assessments, EIA) exist, reference will be made to them.

Following pages:
Template for a State Forest Management Plan

Plan Approval

FOREST MANAGEMENT PLAN
OF

....
(name of state)

FOR THE PERIOD

.... **to** ....

Presented by

....
(name and position)

....
(location and date)

Approved by

....
(name and position)

....
(location and date)

Tabular Summary

State: ....

Working circle:							
	Unit	Years elapsed after logging					
		virgin	1-10	11-20	21-30	31-40	> 40
Total area	ha						
NPA	ha						
V/ha total	m^3/ha						
V/ha > 60 cm	(m^3/ha						
Working circle:							
Total area	ha						
NPA	ha						
V/ha total	m^3/ha						
V/ha > 60 cm	m^3/ha						
Working circle:							
Total area	ha						
NPA	ha						
V/ha total	m^3/ha						
V/ha > 60 cm	m^3/ha						

Forest functions in ha							
Soil		**Water**		**Nature**		**Social / Others**	
Soil Protec-tion		Riparian Buffer Protection		Wildlife Protection		Cultural Sites Protection	
Soil Conser-vation		Water Catchment Protection		Rare Ecosystem Protection		Amenity	
						Education	
		Water Catchment Conservation				VJR	
						Research	
Soil Reclama-tion		*Flood Control Protection*				Fed. Purpose	
						NTFP	

Forest zones	
	Area (ha)
Protection P	
Non-forest area NFA	
Permanent infrastructure	
Non-wood forest production zone	
Estimate of areas > 40° slope	
Sub-total non-loggable area	
Timber production TP1	
Timber production TP2	
Sub-total net production area	
Total area	

Future management and yield		
Working Circles/Plantations	AAC (m^3)	AC (ha)
Total		

Finance	
Total investment costs	RM
Total operating costs	RM
Total revenues	RM
Total net income	RM
Internal rate of return	%

Table of Contents

Annexes

1. List of compartments
2. List of long-term timber concessions
3. PRF by functional class
4. Compilation of inventory results
5. List of forms
6. etc.

Maps

1. Forest resources map
2. Forest function map
3. Forest zoning map
4. Forest management map
5. Geology and soil map
6. Others (e.g. layout of permanent sample plots, etc.)

Acronyms and Abbreviations

Obligatory! Contains all acronyms and abbreviations used.

Executive Summary

Obligatory!

When the main part of the plan is completed an executive summary should be prepared which sets out the primary features of the plan (maximum of three pages). Provide a short summary of the plan on not more than 3 pages, covering:

Plan Rationale:

Briefly describe the goals and strategy in relation to state forest policy and other legal and administrative framework.

Forest Resource Base

Describe the main forest types and their condition, status of logging, the forest functions and zones and the main results of the forest resources assessment.

Past Management

Describe the historical background of the FMU with special emphasis on timber production (past AAC) and silvicultural treatment. Briefly describe the main problems that occured during the past management and point out the implications for future management.

Management Prescriptions

Briefly describe the main management prescriptions, in particular regarding the following topics:

- yield regulation for different major forest types (if any)
- forest protection and conservation
- harvesting systems and forest technology
- financial statement.

1 Introduction

1.1 Plan preparation

State the persons, organisations, etc. involved in preparing this plan, including responsibilities and division of tasks. Specify the time and inputs that were required.

1.2 Planning period

The planning period is 10 years. State the validity period (from year…to year….). State the year in which the mid-term review shall be carried out.

1.3 Legal and administrative framework

Describe the Federal and State constitutional provisions regarding forestry matters and how they relate to the plan and the operations of the State Forestry Department.

Details should include a listing and brief description of (i) policies, (ii) legislation, (iii) international conventions and agreements and (iv) relevant institutions at federal and state level (administration). The chapter may be sub-divided accordingly.

1.4 Integration with other plans

Mention the relevant DFWP sub-plans and the CFMPs (if any) within the state. State how the SFMP influences the contents of both subordinate plans.

2 Management Goals and Objectives

2.1 Goals and strategy

Define the long-term development goal(s) for the FMU and the basic approach towards their achievement (strategies). Describe the basic principles of sustainable forest management such as economic viability, social acceptance, and minimization of ecological and environmental impact.

Relate the goals and strategies to the following policy and strategy documents:

- Forest policy and forest legislation on national and state level
- State and national development plans (e.g. 5-Years Malaysia Plan)
- Vision and mission of state forestry department
- ITTO Year 2000 Objective
- Malaysian Criteria and Indicators (MC&I 2002).

Strategies may refer to the following forest functions and fields:

- Timber production
- Forest resource development
- Forest protection

- Environmental protection/protection of ecological services (water catchment protection, flood control, nature and biodiversity conservation, etc.)
- Social development including forest recreation and environmental education
- Production of non-timber forest produce,
- Forest industry development,
- Human resources and infrastructure development,
- etc.

2.2 Objectives

Define the objectives that have to be pursued in the plan period to arrive at the goals and strategies. Objectives in most instances will pertain to the multiple uses (products and services) for which the forest resources are to be managed.

Since not all these objectives are fully compatible (e.g. production *versus* protection), statements on the hierarchy of objectives have to be made or on the strategy on how to balance conflicting objectives.

3 Present Situation

The SFMP is a framework plan. It focuses on a general analysis of the forestry sector and derives management prescriptions from this. Detailed information and planning on operational level is subject of the DFWPs. Therefore, under this chapter all information, which is relevant to the management and the planned use of the forest resources, should be compiled. The descriptions should be specific and brief. Detailed information, such as statistics, etc. should be relegated to the Annex. If deemed necessary, additional chapters/sub-chapters should be inserted.

3.1 General information

3.1.1 Land use

Obligatory!

Describe the different land use systems and their relevance within the state. Use the table format below. Describe the past and current land use policies and land use plans and their impacts on forest resources and their management.

Table: Land use/ land cover classes

No	Land use classes	Area (100 ha)	Percent of total land area (%)
1	***Forests***		
1.1	• Permanent reserved forest		
1.2	• State land forest		
1.3	• Alienated forest		
2	***Protected wildlife areas***		
2.1	• National park		
2.2	• State sark		
2.3	• Wildlife and bird sanctuaries		
3	***Tree crops***		
3.1	• Rubber		
3.2	• Oil palm		
3.3	• Coconut		
3.4	• Other tree crops		
4	Crop land (annual plants)		
5	Grazing land		
6	Built-up land		
7	Mining		
8	Water bodies		
9	Other		
	Total land area		

Note: Total land area refers to total land area of the state; under “other” all other land uses not explicitly listed in the table are captured.

3.1.2 Total forest area

Obligatory!

Briefly describe the location, size and geographic distribution of the forest resources. Fill in the below table (information source: SMGP).

Table: Forest resources by category and major forest type

Major forest type	Forest category (Area in 100 ha)			
	PRF	State land	Alienated land	Total
Dry inland forest				
Peat swamp forest				
Mangrove forest				
Subtotal natural forest				
Forest plantations				
Total forest area				

3.1.3 Geo-physical resources

Obligatory!

The geo-physical resources are described in detail in the DFWPs. Summarize only briefly the most important ecological aspects under this chapter. Finally, draw some general conclusions regarding managerial implications.

3.1.3.1 Climate

Summarize the main climatic features based on meteorological data, such as the extent and distribution of rainfall, droughts, monsoons, prevailing winds, etc.
Discuss the implications of climatic conditions for silvicultural, management and harvesting activities.

3.1.3.2 Geology and soils

Provide an overview of geology and soil types found in the FMU. Relate to forest growth and productivity and major forest types, siting of roads and availability of materials for road construction.

3.1.3.3 Topography and hydrology

Topography: Describe altitudinal range of the state and of the PRF. Provide break-down of PRF area by slope gradient class (if available). Describe the landforms, geomorphologic and terrain conditions.
Hydrology: List the major drainage systems of the State and their catchment areas. Provide a list of major dams and important water intake points.
Discuss the implications for transportation, harvesting systems and other forestry operations.

3.1.4 Biological resources

Obligatory!

Biodiversity issues are increasingly important and are, amongst other documents highlighted in the MC&I. Use the table formats below for an overview of threatened species. A complete list of endangered species should be annexed to the SFMP. Use the Red Data Book of IUCN as a reference.

3.1.4.1 Vegetation

Describe major vegetation types, their geographic and altitudinal distribution and threats. Include lists of protected species and their habitats (ecosystems) in the Annex.

Table: Forest-dependent plant species

Species group	Number of species		
	Total	Threatened	Endemic
Woody plants			
Other flowering plants			
Ferns			
Other (please specify)			

3.1.4.2 Fauna

Give general information on the abundance of fauna, their spatial distribution, diversity, the endangered species and habitats and the major threats. Include lists of protected animals and totally protected animals in the annex.

Table: Forest-dependent animals species

Species group	Number of species		
	Total	Threatened	Endemic
Mammals			
Birds			
Reptiles			
Amphibians			
Fresh-water fish			
Butterflies			
Other (please specify)			

3.1.5 Special features

Describe any special features of cultural, ecological, environmental or silvicultural interests, such as aboriginal burial grounds, salt-licks, limestone caves, riverine ecosystems, erosion-prone areas, storm forests of FMU-wide significance.

3.1.6 Economic environment

Obligatory!

Describe the overall economic framework conditions for forest management and timber production and the forestry sector as a whole.

3.1.6.1 Infrastructure

Obligatory!

Provide a general assessment of the road network in the state with special emphasis on accessibility of the PRF. Assess the coverage of the State with telecommunication services.
Note: Infrastructure and equipment of the SFD is dealt with under 3.2.2.

3.1.6.2 Timber market

Obligatory!

Describe the present situation of the timber market within the state and its importance in relation to the state's overall economy. Provide statistics for the last 10 years on timber production, timber processing and products, timber export, market prices, etc.

3.1.6.3 Wood-based industry

Obligatory!

Describe the structure of the wood working industry, its production capacities, preferred species, required log dimensions and log allocation to mills. Indicate any plans for expansion, diversification or retooling of mills during the planning period. Discuss the trends or anticipated changes, if any, of resource utilisation (e.g. log quality, species and diameter ranges, residual wood and wood wastes) by processing mills and their implications on the management of the forest resources. Identify development potentials for the wood industry (under-utilized species, log sizes, products).

Table: Wood-based industry

	Type of mill	Number of mills	Estimated production capacity (input in m^3 round wood)
1	Sawmill		
2	Veneer / plywood mill		
3	Moulding plant		
4	Cement board		
5	Particle board		
6	Parquet plant		
7	Furniture		
8	Other		

3.1.6.4 Non-timber forest products

Obligatory!

Analyze the economic importance of the main NTFPs (i.e. bamboo, rattan, etc.) within the state. Provide statistics for the last 10 years on production rates, prices, etc and information on market structure. Highlight development potentials for NTFP (under-utilized species/ products, resources).

3.1.7 Socio-economic environment

Obligatory!

Describe the main demographic parameters such as population, growth, ethnic composition, urban/rural population and other socio-economic parameters such as manpower availability, employment generation of forestry sector and downstream processing of forest products in rural and urban areas, poverty, sources of income, local forest resource use, industry, tourism, etc. Elaborate on trends. Analyze the implications of the socio-economic conditions and their trends for forest management and the forestry sector as a whole.

Special emphasis has to be given on Orang Asli and their interface with the forest estate.

3.2 State forest administration

3.2.1 Organization and human resources

Obligatory!
Present the current organizational set-up of the state forestry administration as an organizational chart. Describe the number and qualification of staff and describe problems and shortcomings (e.g. vacancies, need for skill development).
Use the table format below.

Table: Staff establishment

Staff category	Number of staff					
	State forestry office		Forest districts		Total	
	Male	female	male	female	male	female
Managerial and professional						
Conservator of Forest (G1)						
Conservator of Forest (G2)						
Conservator of Forest (G3)						
Engineer (J2 & J3)						
Economist (E2 & E3)						
Administrative Officer / Administrative and Diplomatic Officer (N2, N3, M2, M3)						
Subtotal						
Supporting group						
Assistant Conservator of Forest (G5 & G6)						
Assistant Administrative Officer (N6)						
Assistant Accountant (W6)						
Technical Assistant (J4 & J5)						
Computer programmers (F5)						
Administrative Assistant (N7/N9)						
Technician (J6/J7)						
Forest rangers (G7 & G8)						
Foresters (G7 & G9)						
Tracers (J7)						
Junior tracers (J9)						
General Assistant and Junior Admin. Assistant (N11)						
Data processing operator (F9)						
General Assistant and file searchers (N13)						
Drivers (R9 & R10)						
General workers (R10 & R11)						
Other support staff						
Subtotal						
Grand Total						

3.2.2 Infrastructure

3.2.2.1 Offices and housing

Describe the locations and conditions of office and housing complexes such as the State Forestry Office, district forest offices, range offices, nurseries, permanent checking stations, staff housing complexes. Use below table format for staff housing complexes if applicable.

Table: Staff housing complexes of the state forestry department

No.	Name/location	Class and No.				Total No.	Forest district
		F	G	H	I		
1	Complex 1	-	6	-	1	7	District 1
2	Complex 2	-	-	-	3	3	District 1
3	Complex 3	-	-	-	1	1	District 2
4	etc.	-	-	2	-	2	etc.
	Total	***0***	***6***	***2***	***5***	***13***	

3.2.2.2 Vehicles and machinery

Compile list of vehicles and heavy equipment (see table format below). Describe age and conditions of vehicle fleet in general terms.

Table : Vehicles and machinery of the state forestry department (year)

No.	Type	Placement and Number of Vehicles			
		SFO (HQ)	District 1	District 2	etc.
1	Land Cruiser	3	3	1	
2	Pajero	1	2	3	1
3	Land Rover	1	4	4	-
4	Toyota Hilux	1	1	-	-
5	Lorry	1	-	1	-
6	Trailer	1	-	1	-
7	Motorbike	-	-	-	-
8	Boat	-	-	-	-
9	Bulldozer	1	-	-	-
10	Tractor	1	-	-	-
	etc.				

3.3 Contractors and license holders

Obligatory!

Provide an overview of the contractors, their experience, their range of services, capabilities and available technologies (e.g. log harvest technologies, transport methods, etc). Analyze the existing licensing system and highlight the problems and shortcomings associated with it. Discuss compliance of contractors with performance standards in harvesting operations (refer to contractor list for information). Differentiate between logging and development contractors. List range of services provided by development contractors. Describe the strategy of the state regarding the improvement of the performance of the contractors.

3.4 Forest resource base of the FMU

Obligatory!

Note: While Chapter 3.1.2 is providing an overview of the total forested area of the state this chapter deals with the forest resources of the FMU only, i.e. the forest areas classified as PRF.

3.4.1 Permanent reserved forests

Provide list of PRF by filling in below table. Describe their distribution within the state in general terms. Attach map of PRF in annex for details.

Table : Permanent reserved forest in (insert name of state)

Forest district / PRF	Total area (ha)	Number of com-partments
Forest district 1		
PRF 1.1		
PRF 1.2		
PRF 1.3		
etc.		
Subtotal		
Forest district 2		
PRF 2.1		
PRF 2.2		
PRF 2.3		
etc.		
Subtotal		
Forest district 3		
etc.		
Sub-total		
Total		

Table: Total PRF area by functional class

Forest Functional Class	Area (in 100 ha)	% of total PRF Area
Timber Production under sustained Yield		
Soil Protection Forest		
Soil Reclamation Forest		
Flood Control Forest		
Water Catchment Forest		
Forest Sanctuary for Wildlife		
Virgin Jungle Reserved Forest		
Amenity Forest		
Education Forest		
Research Forest		
Forest for Federal Purposes		
Total PRF Area		
Total gazetted areas		

Mention if there are long-term timber concessions within the state. Prepare a table indicating name of concession area, PRF, location, size, concession period, concession holder, etc. For more details refer to the respective CFMP.

3.4.2 Natural forest types

Obligatory!

Describe the occurring major forest types, their sizes, location and geographic distribution as well as their potential for commercial timber production and other forest uses (e.g. NTFP, tourism, etc.). Fill in the table below.

Table: Extent and share of forest types

Forest Type	Area (100 ha)	Percent of Total Land Area (%)
Dry inland forest		
Peat swamp forests		
Mangrove forest		
Total		

3.4.3 Logging status of PRF

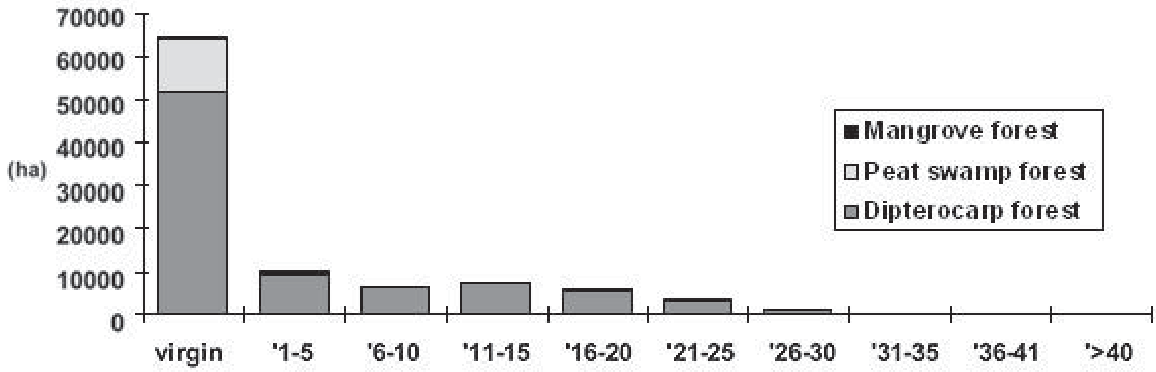
Obligatory!

Stratify the area of each forest type according to their logging status, i.e. the time that elapsed since the last logging operation. Fill in the table below and add a graph.

Table: PRF area by major forest type and logging status

Status of logging	Dipterocarp inland forest (ha)	Peat swamp forest (ha)	Mangrove forest (ha)
virgin			
1-5			
6-10			
11-15			
16-20			
21-25			
26-30			
31-35			
36-40			
> 40			
Total			

Figure: Distribution of major forest types by logging status



3.4.4 Forest functions and forest zones in production forests

Obligatory!

There are two processes for identification and mapping of forest functions. According to Section 10(1)(a) of NFA 1984 the states are required to classify and gazette the PRF or parts thereof into eleven functional classes. The results are presented in 3.4.2 and Annex 2. Apart from this, forests classified for timber production under sustained yield are at the same time fulfilling critical environmental and social functions. These functions are assessed and mapped during the process of multifunctional zoning (refer to FMPG (2a)). Based on the forest function map and the forest zoning map, briefly describe the relevant forest functions and zones and the main results of the mapping. The required statistics and tables are available at the GIS section of the SFD. Attach the forest function map and the forest zoning map of the state to the SFMP.

3.4.4.1 Forest functions of production forests

Obligatory!

Specify the results of the preliminary forest function mapping carried out for the FFC "timber production under sustained yield". Use the table format below.

Table: Forest functions in classified timber production forest

Forest functions in ha							
Ecological functions						Social function / NTFP	
Soil conservation		Water conservation		Nature conserva-tion			
Soil protection		Riparian buffer		Wildlife protection		Cultural sites protection	
Soil conser-vation		Water catchment protection		Rare eco-system protection		Non-timber forest produce	
Soil reclam-ation		Flood control protection					
		Water catchment conservation					

Refer to the DFWPs for a description of the individual functions.

3.4.4.2 Forest zones in production forests

Obligatory!

Prepare the following table and figure:

Table: Distribution of forest zones according to working circles (WC)

Forest zones	WC1 Area (ha)	WC2 Area (ha)	WC3 Area (ha)
Protection P			
Non-forest area*			
Estimate of areas > 40° slope			
NTFP production area			
Total non-timber production area			
Timber production 2 (TP2)			
Timber production 1 (TP1)			
Total timber net production area			
Total area			

* e.g. permanent infrastructure, corridors for electricity lines, water bodies, quarries, etc.

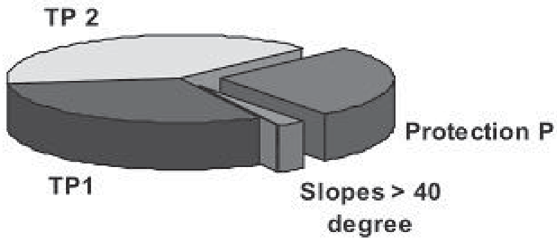


Figure: Distribution of forest zones (example)

3.4.5 Forest condition, standing stock and growth

Obligatory!

Present and analyze the results of the forest management inventory and of periodic measurements of permanent sample plots and growth and growth & yield plots. Derive the stocking of the forests and growth estimates.

3.4.5.1 Method of resource assessment

3.4.5.1.1 Forest management inventory

Obligatory!

Provide a brief description on the scope, inventory design, number of sample plots and method applied. Specify sampling intensity, the desired level of Standard Error (SE%) and Coefficient of Variation (CV%). Briefly justify the selected inventory design. Refer to NFI 4 Manual for details.

Describe the criteria for stratification and the methodology applied (e.g. satellite or aerial photo interpretation, etc.).

Provide a brief description covering survey period, number of teams, equipment and instruments used, mensurational techniques applied, costs etc.

Describe the process of data validation (e.g. computerized plausibility tests, visual data correction, etc.) and the parameters applied (e.g. max. heights, dbh, etc.).

State the software program used for data analysis (e.g. MIDAP).

3.4.5.1.2 Permanent sample plots

Describe the number and location of the permanent sample plots (PSP) and state re-measurement periods and years.

3.4.5.1.3 Special surveys

Describe other resource surveys, which have been implemented, e.g. eco-tourism survey, biodiversity surveys, wildlife surveys, surveys on NTFP, etc.

3.4.5.2 Forest condition and standing stock

Obligatory!

This chapter should not be overloaded with tables on inventory results. Include only the most essential and relevant ones for forest management planning. Relegate all other result tables to Annex 3.

Carry out the analysis of the forest inventory and aggregate data at the following levels:

- by working circles <u>and</u> logging status (i.e. year of logging, 5 or 10 years intervals);
- by working circle;
- for the whole production forests of the FMU.

State that the inventory has been carried out only within the production forest area.
List only the main results for each working circle. Use the standard format of the result tables provided by MIDAP. Relegate additional results to Annex 3.

Present the distribution of the standing stock per ha and the number of trees per ha for the different diameter classes as graphs.

Provide a detailed analysis of the results by comparing the forest condition (i.e. tree species and diameter distribution, natural regeneration status, timber quality, etc.) according to logging status and derive consequences for future management.

3.4.5.3 Growth and increment

Obligatory!

Base growth and increment estimates on the results of the assessment of the PSPs. In case no PSPs exist, explain how the increment and growth figures have been derived.

Table: Increment estimate per working circle

Working circle	Total net production area (ha)	Mean annual increment per ha (m^3/ha)	Total mean annual increment (m^3)
Dry inland forest			
Peat swamp forest			
Mangrove forest			
Total			

3.4.5.4 Non-timber forest produce

Provide a brief description of the occurrence of NTFP in the natural forests.

3.4.6 Forest plantations

Obligatory!

3.4.6.1 Plantation establishment

If plantations are included in the FMU prepare a list of established forest plantations according to below table format.

Table: Forest plantation establishment

PRF	Comp. no.	Area (ha)	Species	Year planted
PRF 1	1	47.38	*Araucaria hunstenii*	1974
	13	84.89	*Pinus caribaea*	1972
	14	163.49	*P. caribaea*	1971
	etc.			
Sub-total PRF 1				
PRF 2	18	10.93	*P. caribaea*	1969
	etc.			
Sub-total PRF 2		***27.17***		

continued	4	6.07	*P. caribaea*	1970
Total FMU				

3.4.6.2 Plantation condition and standing stock

For the most important species present average standing stock per ha by age class and site quality class. Discuss timber quality of plantations.

3.4.6.3 Growth and increment

Present mean annual increment (mai) figures for major plantation species. Differentiate by site, quality class and rotation period if possible.

4 Past Management

4.1 History

Present a brief overview of the history of forest management in the state, in particular on traditional forest use, commencement of commercial timber production, silvicultural and harvesting systems applied. Describe problems encountered in forest management in the past and how they were dealt with.

4.2 Evaluation of past management

Review past management plans and assess their progress and achievements vs. planned targets regarding harvesting and all management operations (planting, silvicultural treatments, forest protection, etc.). Explain reasons for shortcomings. Analyze the impacts of forest management on the forest resource. Derive information on past management from the previous SFMP and DFWPs, the mid-term review and internal assessments reports, and annual reports.

4.2.1 Change in permanent reserve forest area

Obligatory!

Compare the current PRF area with the PRF area established at the beginning of the term of the previous SFMP. Explain changes in area and investigate causes. Use the table format below. If applicable, figures can be differentiated by working circle.

Table: Change of PRF area (1996-2005) by forest district

Forest district	Gazetted at 1.1.1996	Approved by Exco but not yet gazetted	Gazetted between 1.1.96-31.12.2005	Approved by Exco for excision but not yet gazetted	Excised between 1.1.96-31.12.2005	Total established as at 31.12.2005
FD 1						
FD 2						
etc.						
Total						

4.2.2 Natural forest management

Obligatory!

4.2.2.1 Forest management system

Describe the forest management system(s) applied (e.g. SMS, MUS) in the different working circles. Discuss impacts on stand structure, species composition (biodiversity) and stand quality.

4.2.2.2 Harvesting

Compare the planned and officially approved AAC of the previous planning period (10 years) with actually harvested volume and area in tabular form for each working circle. Derive data from the DFWPs. Analyze major deviations and investigate the causes. Use the table format below. Detailed accounts (by forest district, PRF and year) of realised AC and Coupe Area should be presented in the Annex.

Table: Planned and realised AC and coupe area

Working Circle	Planned		Implemented		Deviation	
	AC (,000 m^3)	Coupe area (ha)	Volume (,000 m^3)	Coupe area (ha)	Volume (,000 m^3)	Coupe area (ha)
Dry inland TP2						
Dry inland TP1						
Mangrove forest						
Peat swamp forest						
Total						

4.2.2.3 Planting and silvicultural treatment

Describe the treatments prescribed in the previous management plan and discuss their strengths and weaknesses (impacts on stand rehabilitation, costs, etc.). Draw conclusions for future management.
Compare planned targets with actual achievements for major activities (e.g. enrichment planting, planting of open areas, GCL/CL, etc. by using following table format (one table per treatment/activity). Detailed accounts (by year and PRF) should be presented in the Annex.

Table: Planned and implemented enrichment planting by forest district

Working circle	Forest district	Area in ha		
		Planned	Achieved	Deviation
Dry inland	FD 1			
	FD 2			
	etc			
	subtotal			
Peat swamp forest	FD 1			
	FD 2			
	subtotal			
Mangrove forest				
	subtotal			
Total				

4.2.3 Plantation management

Based on the information derived from the relevant DFWPs, briefly summarize the experiences in plantation management. Compare the planned and implemented plantation establishment and timber production. Use the table formats below. Detailed accounts of plantation establishment (by year and PRF) should be presented in the Annex.

Table: Comparison of planned and achieved plantation establishment

Type of Plantation	Area in ha		
	Planned	Achieved	Deviation
Total			

Table: Comparison of planned and achieved timber production

Type of Plantation	Timber production in m^3		
	Planned	Achieved	Deviation
Total			

As in the previous chapter, also an analysis and evaluation of different tending operations and silvicultural treatments should be performed.

4.2.4 Forest damage and protection

Obligatory!

Briefly describe the damages to the forests caused by abiotic and biotic hazards including human interference. Assess the severity of the damages on a three-point scale (light, medium, heavy). Document carefully the way, in which each of these kinds of damage were defined. Use the table formats below.

Table: Anthropogenic causes for forest disturbance

Type of human activity	Severity of damage and affected areas (ha)		
	Light	Medium	Heavy
Illegal settlements			
Agriculture			
Road construction			
Mining			
Dams			
Uncontrolled fire			
Shifting cultivation			
Nomadic grazing			
Illegal exploitation			
Inappropriate harvesting operations			
Harvesting more than once (re-entry)			
Hunting			
Other forms of damage (please specify)			

Table: Natural causes for forest damage

Cause	Severity of damage and affected areas (ha)		
	Light	Medium	Heavy
Wildfire (caused by lightning)			
Drought			
Storms and natural catastrophes			
Pests and diseases			
Other natural causes (please specify)			

4.2.5 Non-timber forest products

Account for non-timber forest product resource established during the term of the previous SFMP. Use the table format below. If the establishment of NTFP resources was specified in the previous SFMP the actual establishment should be offset against planning targets.

Table: Area planted with non-timber forest products (1996-2005)

Year	**Established area (in ha)**			
	Bamboo	**Rattan**	**Medicinal plants**	**etc.**
1996				
1997				
1998				
1999				
2000				
2001				
2002				
2003				
2004				
2005				
Total				

Briefly discuss the management (tending and harvesting operations) of NTFP and draw conclusions for future management.

4.2.6 Management of protection forest

Describe and evaluate management activities in PRF classified for other functional classes than timber production under sustained yield. Establish sub-chapters as deems fit.

4.2.7 Research and development

If there have been any R&D activities in the past, give a brief description on type of research, trial plots, objectives, methods, results, organisations involved, etc.

4.2.8 Economic analysis and budget

Obligatory!

Provide a brief cost-benefit analysis of the past forest management. Describe budget allocation, major investments, revenue collection and net income.

4.3 Implications for future management

Summarize the past problems based on the description and analysis done in the previous chapters and formulate the consequences for future management.

5 Management Prescriptions

5.1 Management strategy

Briefly describe the general management principles and strategies regarding:

- forest management systems;
- production of NTFP;
- supply priorities for timber industry and markets (i.e. local market, export);
- involvement of the local population in forest management;
- the effect of forest function mapping and zoning on future management in terms of silvicultural systems, harvesting technologies, infrastructure and finance (e.g. required future investments, costs and manpower, etc.);
- introduction of low impact logging (airborne);
- water quality management;
- research and development.

Describe and discuss details in the relevant chapters.

5.2 Change in PRF area and forest functional classes

Describe and discuss the anticipated change in PRF area and in the designation to forest functional classes. Fill in the table below (if applicable).

Table: Planned changes in PRF area by forest functional class

Forest District	As of	PRF area by functional class (ha)											
		i	ii	iii	iv	v	vi	Vii	viii	ix	x	xi	Total
FD 1	Jan 2006												
	Dec 2015												
	Balance												
FD 2	Jan 2006												
	Dec 2015												
	Balance												
FD 3	Jan 2006												
	Dec 2015												
	Balance												
etc.													
Total FMU	**Jan 2006**												
	Dec 2015												
	Balance												

Note:

i. timber production forest under sustained yield
ii. soil protection forest
iii. soil reclamation forest
iv. flood control forest
v. water catchment forest
vi. forest sanctuary for wildlife
vii. virgin jungle reserved forest
viii. amenity forest
ix. education forest
x. research forest
xi. forest for federal purposes

5.3 Formation of working circles

In Peninsular Malaysia there are three working circles in the natural forests, i.e. dry inland forest, peat swamp forest and mangrove forest. Furthermore, plantation forest constitutes a separate working circle. Working circles should only be formed if the area stocked with these different forest types is significant.
Maps and area statistics are available at the respective GIS unit.
Use the table format below.

Table: Net production area by working circle

Working circle	Net production area	
	(ha)	Share in %
Dry inland forest		
Peat swamp forest		
Mangrove forest		
Forest plantations		
Total		

5.4 Management of natural production forest

Describe in general terms the forest management system(s) adopted for each working circle. Appraise their suitability and feasibility. If different working circles have been defined, describe the management of natural forests for each working circle separately.

5.4.1 Dry inland forest

Only if relevant!

5.4.1.1 Management system

Describe the adopted management systems based on an appraisal of their suitability and feasibility.

5.4.1.2 Silviculture

Obligatory!

Describe the silvicultural systems to be applied including the type and sequence of operations. Include procedures used for assessing the requirements for silvicultural treatments. Refer to the silvicultural guidelines for further details as applicable.

5.4.1.3 Timber harvesting

Provide a detailed description of the different harvesting systems (i.e. ground skidding, soil conserving extraction systems), which are eligible in the different timber production zones (TP1 and TP2).

5.4.1.4 Yield regulation

Obligatory!

The process yield regulation is described in detail in a separate guideline (refer to FMPG (3c)).

5.4.1.4.1 Net production area

Obligatory!

The estimation of the NPA is a result of forest zoning and will be provided by the GIS section. For more details refer to FMPG (2). The results of the zoning were already presented under Chapter 2.3.5.2 “Forest zoning”.

In case of dry inland forest, calculate the net production area separately for different forest strata according to the logging status and harvesting systems. Use the table format below.

Table: Net production area according to logging status and harvesting systems

Logging status	TP1 (ha)	TP2 (ha)	Total (ha)
Virgin forest			
Logged 1 to 5 years ago			
Logged 6 to 10 years ago			
etc.			
Total			

5.4.1.4.2 Preliminary AAC determination

Obligatory!

Calculate the AAC based on different formula methods. Preliminarily determine the AAC and justify its determination. State and discuss what external conditions or factors have been taken into account (i.e. capacity of timber industry, etc.).

5.4.1.4.3 Verification of the AAC and allocation to harvestable areas

Obligatory!

Follow the prescriptions of FMPG (3c).
Use pre-defined table formats.

5.4.1.4.4 Allocation of the AAC to the forest districts

Obligatory!

Follow the prescriptions of FMPG (3c).
Use pre-defined table formats.

5.4.1.4.5 Final determination and justification of the AAC

Obligatory!

Follow the prescriptions provided by FMPG (3c). Specify the AAC in the summary table of the SFMP.

In case of dry inland forest, determine the AAC for different harvesting systems (i.e. ground-based skidding in TP1 zone vs. soil conserving extraction systems in TP2) separately. Use pre-defined table formats as specified in FMPG (3c), available online from the Forest CHM.

Table: The overall AAC of the state by forest district/concession

District/concession	AAC (000 m^3)	AC (ha)
Total		

5.4.1.4.6 Revision of AAC during mid-term review

Obligatory!

State for which year the mid-term review is scheduled and that the AAC and AC will be adjusted on that occasion.

5.4.1.5 Environmental impact assessment (EIA)

Obligatory!

Evaluate the impact of forest activities on the natural environment and prescribe measures to mitigate potentially negative impacts, if any. Reference can be made to "EIA Guidelines for Timber Harvesting in Natural Forests" (FRIM 1995). A screening matrix or tabular statements specifying planned activities, their potential impacts which require mitigating measures, can be adopted.

5.4.2 Working circle 2

Only if relevant!

Same sub-division as for Chapter 5.1.4.

Add chapters for other working circles (5.4.3) as required.

5.5 Management of plantation forest

Obligatory!

Notes: For large-scale timber plantation estates separate FMP should be prepared.

The depth and extent of this chapter will depend on the significance of forest plantation management for a given state. If forest plantations are insignificant no division into third order headings is required.

5.5.1 Management systems

Briefly describe the state's policy in terms of plantation establishment (e.g. species choice, silvicultural operations, harvesting, etc.).

5.5.2 Plantation establishment and silviculture

Describe forest plantation establishment targets and silvicultural operations such as site preparation, weeding, cleaning, fertilizing, tending, pruning and non-commercial thinnings. Discuss selection of planting areas and species selection.

Table: Planned plantation establishment

Species/ species mix	Area (ha) of plantations to be established				
	District 1	District 2	District 3	etc.	Total
Total					

5.5.3 Yield regulation

Describe the method of yield regulation. Specify allowable cut by area and/or volume.

5.5.4 Harvesting

Describe the harvesting systems used. Indicate planned harvest areas and harvest volumes by filling in tables below.

Table: Planned timber harvesting in plantations: commercial thinnings

Species	**Timber production: area (ha) and volume (m^3)**									
	District 1		District 2		District 3		etc.		Total	
	ha	m^3	ha	m^3	ha	m^3	ha	m^3	ha	m^3
Total										

Fill in separate table according to above format for **final fellings.**

5.6 Management of protection forest

Describe the general policy of the state in relation to the management of protection forests. Provide a brief description of the types of protection forests within the state (i.e. forest functional classes) and their distribution, etc. Specify the most important management operations. Detailed management prescriptions for protection forests shall be planned in the DFWPs.

5.7 Conservation

5.7.1 Conservation of water and soil resources

Obligatory!
Highlight the importance given to soil and water conservation aspects. Identify and list the objectives of watershed management, which include, among others, the protection of water quality (with respect to nitrogen content, pH, suspended solids, dissolved oxygen) and soil conservation. Describe how these aspects have been considered during forest function mapping and refer to the respective mitigating measures (Chapter 5.4.1.5) in accordance with EIA specifications.

5.7.2 Conservation of biodiversity and genetic resources

Obligatory!
Biological diversity or biodiversity includes ecosystem, species and genetic diversity.

Highlight the importance given to biodiversity conservation during forest management activities and how planning and implementation will be affected. Specify additional measures for the protection of biodiversity, which have not been spelled out in management prescriptions or mitigating measures, such as: preservation of rare plants (i.e. palms, orchids), conservation of snag trees for insects and birds, etc.

5.8 Societal needs

The social environment is described in Chapter 3.1.7. Describe how specific societal needs will be considered and how this will affect forest management for timber production.

5.8.1 Employment

Discuss the potential of the forestry sector for generating employment in rural areas[1]. Include policy statements and highlight employment regulations to be observed by harvesting and development contractors.

Stress on health and safety of forest workers and describe pertinent measures (e.g. training, safety clothes, etc.). Describe how it will be ensured that all workers are properly insured against accidents and invalidity.

5.8.2 Customary land rights

Based on a customary land rights survey describe and analyze in detail the nature of the existing rights and their impact on forest management. Prescribe on how to resolve pertinent conflicts (e.g. granting of use rights, compensation measures).

5.8.3 Recreation and eco-tourism

Recreation is increasingly in demand by the society due to high economic growth, rapid urbanisation and improved quality of life. The importance of a forest area for such services depends mainly on its location, namely the vicinity to urban or densely populated areas. Describe what measures and activities will be undertaken to develop and support outdoor recreation such as picnicking, camping, hiking, swimming, etc.

If an eco-tourism study was carried out for the state, the most important results can be presented under this c76hapter. Following this, a general descriptions of the measures and activities to be implemented in the State FMU should be provided.

5.8.4 Social and community forestry

Briefly describe the state's policy in relation to social/community forestry and people's participation in general and provide prescriptions how to include this aspect in forest management planning and implementation. Programs and measures shall be described in general terms (e.g. planting of fruit trees, establishment of community woodlots, along-the-road tree planting).

5.8.5 Extension

Briefly describe the approach and the planned programme of the state and the requirements for its implementation. Provide a time schedule, estimate the required inputs and describe the responsibilities.

5.8.6 Others

Describe any other activities planned in relation to societal needs, such as education, amenity, etc.

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[1] Note: The focus of this chapter is on direct employment benefits to the rural or urban population in the vicinity of the PRF. General benefits to and impacts of forest management to the society at large is discussed in Chapter 3.1.7.

5.9 Forest protection

Forest protection means the protection of the forests from abiotic and biotic hazards includeing human interferences. While the SFMP only provides broad prescriptions on forest protection, the DFWPs shall describe the planned activities in detail.

5.9.1 Integrated forest fire management

Obligatory!

(Refer to FMPG (3e)).

Due to increasingly prolonged drought periods in combination with the change in forest cover forest fire becomes an increasing threat to the forest resources and to sustainable forest management. It is therefore important to include integrated forest fire management activities into the forest management system.

5.9.1.1 Fire prevention

Describe measures planned to prevent forest fires, such as awareness campaigns, fire risk and danger mapping, establishment and maintenance of firebreaks.

5.9.1.2 Fire pre-suppression

List all measures geared at promoting fire preparedness, such as procurement and maintenance of fire fighting equipment, organisational arrangements (incident command system), training activities and the establishment of a fire danger rating system.

5.9.1.3 Fire suppression

Describe all measures planned in relation to fire detection and fire fighting (e.g. fire fighting strategy and the preparation of fire emergency plans, list of institutions to be informed and to be involved in fire fighting, etc.).

5.9.2 Pest and disease control

Describe a mode of control of forest pests and diseases through the integrated pest management approach, which is biologically effective, environmentally acceptable and economically efficient – for example the use of bio-degradables at/by/in prescribed rates, method and season. Under normal circumstances, this chapter is relevant only for the management of forest plantations.

5.9.3 Boundary control and patrolling

Describe actions taken to control illegal logging, encroachment, shifting cultivation, etc.

5.10 Forest products demand/supply scenario

Compare planned production including timber supply from state land forest with the demand of the timber industry on state level. Differentiate between local supply and export-oriented production. If the planned production is far below the present demand, explain how this will effect downstream processing (e.g. re-tooling, closing of mills, etc.). Strategies for the reconciliation of supply and demands of the local forest industry should be described.

5.11 Infrastructure planning

This chapter is to contain a summary of the infrastructure planning of the individual DFWPs. Describe only the most important measures and refer to the DFWPs for details. Cost figures shall be specified in Chapter 5.14[2]. Use the table formats below to summarize investments

[2] Even though the costs for road construction are currently borne by the harvesting license holder, an attempt to estimate the physical targets for road construction should be made.

in road construction, road maintenance, construction and maintenance of buildings and purchase of machinery and equipment.

5.11.1.1 Forest roads

Table: Estimated road construction by forest district

Type of road	Length of roads in km				
	District 1	District 2	District 3	District 4	Total
Total					

A similar table should be filled in for planned road maintenance operations.

5.11.1.2 Buildings

Table: Procurement of buildings

Type of building	Number and built-up area (m2)									
	District 1		District 2		District 3		District 4		Total	
	No	m^2	No	m^2	No	m^2	No	m^2	No	m^2
Total										

5.11.1.3 Vehicles and equipment

Table: Procurement of machinery and equipment

Type of machinery or equipment	Required number				
	District 1	District 2	District 3	District 4	Total
Total					

5.12 Human resources and organization

Describe the planned organisational structure for forest management and administration and explain and justify the required modifications and adjustments vis-à-vis the planned activities and the current structure (refer to Chapter 3.2). Describe in detail the division of tasks, responsibilities, categories of staffing, etc.

Add organizational chart if organisational changes are proposed.

Include an assessment of the training needs and outline human resources development measures.

Calculate total manpower requirements for implementation of planned field operations. Compare with established manpower and specify the need for outsourcing of field operations to development contractors.

5.13 Research and development

Add additional sub-chapters for each research and development component or project. Describe the research objective, the research and development programme, involved institutions, time frame, responsibilities, expected results, etc.

5.13.1 Assessment of permanent sample plots

Describe the number and location of the permanent sample plots (add map), objective, sampling design, data measurement and recording, data analysis, etc. Add new sub-chapters if relevant.

5.14 Financial and economic analysis

How to implement a financial and economic analysis for forest management is described in detail in a separate guideline (refer to FMPG (3d)). As a general approach the planning data from the DFWPs will be added up and presented in summary tables of the SFMP.

5.14.1 Budget

Provide a budget estimate based on physical targets set out in the previous chapters. Differentiate by the twelve cost centres defined in Section 3d by year. Further differentiate capital investment and operating costs.

5.14.2 Revenues

Estimate the amount of forest revenue (gross income) expected to be collected in terms of premium, royalty, cess, etc. Tabulate the revenue expected by year.

5.14.3 Expected income

Calculate the expected net income as the balance of total revenue minus investment and operational cost.

6 Implementation

6.1 Implementation schedule

Prepare the implementation plan indicating yearly area estimates, location and sequence of operations by compartments.
Fill in the tables below.

Table: Harvestable compartments and schedule for implementation of management activities

Forest district	Forest reserve	Comp	Prod. area (ha)	Period 1					Period 2				
				2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
FD 1	PRF 1.1	2		**X**		**Post-F1**	**T1**						
		4		**X**		**Post-F1**	**T1**						
		22		**X**		**Post-F1**	**T1**						
	PRF 1.2	33		**X**		**Post-F1**	**T1**						
		24		**X**		**Post-F1**	**T1**						
		27		**X**		**Post-F1**	**T1**						
		45		**X**		**Post-F1**	**T1**						
	PRF 1.3	5		**X**		**Post-F1**	**T1**						
		18											
	etc												
Subtotal													
FD2				**BS,Pre-F,TE**	**X**		**Post-F1**	**T1**					
				BS, Pre-F,TE	**X**		**Post-F1**	**T1**					
				Pre-F,TE	**X**		**Post-F1**	**T1**					
				Pre-F,TE	**X**		**Post-F1**	**T1**					
				Pre-F,TE	**X**		**Post-F1**	**T1**					
Subtotal													
					BS,Pre-F,TE								
					BS, Pre-F,TE	**X**		**Post-F1**	**T1**				
				BS	**Pre-F,TE**	**X**		**Post-F1**	**T1**				
				BS	**Pre-F,TE**	**X**		**Post-F1**	**T1**				
				BS	**Pre-F,TE**	**X**		**Post-F1**	**T1**				
				BS	**Pre-F,TE**	**X**		**Post-F1**	**T1**				
Subtotal													

BS = Boundary Survey**, Pre-F**= Pre-F inventory; **TE**= Tree Enumeration; **C**= Climber cutting; **T1**= first tending; **Post-F1**= Post-F1 inventory, **E** = Enrichment planting, **T2**= second tending; **X**= harvesting, **Post-F2** = Post-F2 inventory

Table: Operational schedule for compartments not assigned for harvesting during the planning period (areas in ha)

FD	PRF	Comp.	Year	BS	Pre-F	TE	Post-F1	T1	Post-F2	T2	E
	Besul	1	2006								
	Besul	2	2006								
	Besul	3	2006								
	Besul	4	2006								
	Besul	5	2006								
	Jengai	14	2006								
	Jengai	22	2006								
	Jengai	24	2006								
	Jerangau	35	2006								
	Jerangau	56	2006								
			Total Year 2006								

Prepare same table for each year of planning period, i.e. a total of 10 tables.

6.2 Management control

6.2.1 Monitoring and evaluation of results

Describe the monitoring and evaluation processes. Specify key topics on which monitoring should focus and define them as indicators for operational performance, such as PRF area, legal surveying of outer boundaries, harvesting/log production, revenue collection, etc. Explain the interfaces with forest management certification (MC&I). Define frequencies for monitoring of the selected activities/indicator, monitoring mechanisms/methods and responsibilities.

6.2.2 Recording of achievements, reporting and review of plan

Explain recording and reporting procedures, incl. frequencies and responsibilities. Explain the use and role of the Compartment Register, annual reports. Refer to relevant guidelines for more detailed information.

Define when a mid-term review is proposed to be carried out.

Annexes

The list of annexes may be expanded as deems fit. In general, all technical details of topics discussed in the main text should be annexed. Some examples for annex tables are attached.

1. List of compartments
2. List of long-term timber concessions
3. PRF by functional class
4. Compilation of inventory results
5. List of forms
6. etc.

Maps

1. Forest resources map
2. Forest function map
3. Forest zoning map
4. Forest management map
5. Geology and soil map
6. Others (e.g. layout of permanent sample plots, etc.)

Annex: Forest functional classes by individual PRF (example)

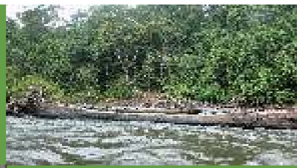
PRF	Area by functional class										
	i	ii	iii	iv	v	vi	Vii	viii	ix	x	xi	Total
Lenggeng	5,422.5	-	-	-	-	-	-	247.6	-	-	-	247.60
S. Gemas	4,004.6	-	-	-	-	-	-	-	-	-	-	
Triang	14,905.3	-	-	-	768.4	-	-	-	-	-	96.34	
Gapau	10,787.1	-	-	-	629.9	-	-	411.8	-	-	-	
Berembun	6,665.9	-	-	-	14,289.6	-	3,250.4	134.1	-	-	437.57	
Tebong	2,459.7	-	-	-	134.5	-	150.9	-	-	-	-	
Sepang	204.3	-	204.3	-	-	-	-	-	-	-	-	
Kenaboi	28,992.7	-	-	-	19,251.9	8,648.2	-	380.0	-	-	750.7	
S. Menyala	1,305.2	-	-	-	-	-	409.9	-	-	-	-	
Pasir Panjang	214.6	214.6	-	-	7,727.5	-	99.6	-	-	-	-	
Pelangai	4,534.2	-	-	-	-	-	-	-	-	-	-	
Angsi	8,694.5	-	-	-	-	-	187.5	325.1	-	-	-	
Galla	4,437.5	-	-	-	222.6	-	-	221.6	-	-	-	
South J. Padang	1,019.1	-	-	-	-	-	-	-	-	-	-	
Pasoh	12,415.6	-	-	-	1,652.0	-	92.3	518.1	-	1,296.8	-	
S. Inas	6,626.6	-	-	-	396.9	-	-	-	-	-	-	
Johol	4,238.9	-	-	-		-	-	-	-	-	-	
Serting	6,814.2	-	-	-	2,403.7	-	203.9	585.7	-	-	-	
East Setul	797.7	-	-	-	-	-	-	-	-	-	-	
West Setul	4,336.3	-	-	-	-	-	-	-	-	-	-	
Total	128,876.5	214.6	204.3	-	47,477	8,648.2	4,394.5	2,824.0	-	1,296.8	1,284.61	

Note:

xii. timber production forest under sustained yield
xiii. soil protection forest
xiv. soil reclamation forest
xv. flood control forest
xvi. water catchment forest
xvii. forest sanctuary for wildlife
xviii. virgin jungle reserved forest
xix. amenity forest
xx. education forest
xxi. research forest
xxii. forest for federal purposes

Annex: Backlog areas silvicultural treatment by year of logging and forest administration district (example)

Forest District	PRF	Com-part. No.	Backlog Areas by Year (ha)								
			93	94	95	96	97	98	99	2000	2001
East	Angsi	38	170.37								
East	Angsi	39	176.00								
West	Angsi	10A							125.85		
West	Kenaboi	81	136.00								
East	Kenaboi	74		118.00							
East	Kenaboi	72			152.00						
East	Kenaboi	73			291.40						
West	Kenaboi	88				192.06					
West	Kenaboi	83								259.00	
East	Serting	30	108.45								
East	Serting	47	331.44								
East	Serting	36		104.81							
East	Serting	17				91.05					
East	Serting	18								152.45	
East	Serting	48									137.19
East	Serting	49									124.24
West	Triang	14	173.20								
East	Triang	46	152.00								
West	Triang	86	230.67								
East	Triang	36		121.81							
West	Triang	60		126.66							
West	Triang	85		389.72							
West	Triang	5			169.16						
West	Triang	16			214.08						
West	Triang	89			203.56						
West	Triang	91			178.47						
West	Triang	75				280.45					
West	Triang	84				467.01					
West	Triang	92				193.44					
West	Triang	8						97.93			
West	Gapau	28				150.54					
East	Pelangai	37						132.74			
Subtotal			***1,658.13***	***1,147.12***	***1,851.9***	***1,537.23***	***0***	***557.65***	***307.56***	***597.61***	***324.93***
Total			**7,982.13**								



Annex

03

Forest Management Planning Rules and Guidelines (FMPRG):

Multifunctional Zoning

gtz

Jabatan Perhutanan
Semenanjung Malaysia

German Technical Cooperation

SFMCP

Sustainable Forest Management and Conservation Project

Malaysian-German Technical Cooperation

Forest Management Planning Rules and Guidelines (FMPRG)

Guideline 2: Multifunctional Zoning

Günther Haase

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Final Draft

August 2005

Technical Document No. B51

Multifunctional Zoning

Section Sub-Section	Multifunctional Zoning	2

Contents

Annex

List of Figures and Tables

Abbreviations

AAC	annual allowable cut
asl	above sea level
DEM	digital elevation model
DFO	District Forest Office, District Forest Officer
DoE	Department of Environment
DID	Drainage and Irrigation Department
EPU	state economic planning units
FDPM	Forest Department Peninsular Malaysia
FFC	forest functional classes
FFM	forest function map
FMIS	forest management information system
FMP	medium-term forest management plan
FMU	forest management unit (=PRF area of a given state)
FZM	forest zoning map
GIS	Geographic Information System
GPS	Global Positioning System
JUPEM	Jabatan Ukor Dan Pemataan Malaysia (Survey and Mapping Department)
KPKKT	Kumpulan Pengurusan Kayu-Kayan Terengganu Sdn. Bhd.
MC&I	Malaysian Criteria and Indicators for Forest Management Certification
MNS	Malaysian Nature Society
NEP	rare ecosystem protection
NFA	non-forest area
NPA	net production area
Non-TPA	non-timber production area
NWP	wildlife protection
NTFP	non-timber forest products
NTFP	non-timber forest products production function
NTFP	non-timber forest products production zone
P	protection zone
PERHILITAN	Department of Wildlife and National Parks
RIL	reduced impact logging
PRF	permanent reserved forest
SC	soil conservation
SFD	state forestry department
Soc	social function
SocC	cultural site protection
SP	soil protection
SR	soil reclamation
Topo-map	topographic map with 20 m contour lines, scale 1:50,000
TP1	Timber Production Zone 1 (no restriction on harvesting system)
TP2	Timber Production Zone 2 (restrictions on harvesting system, no ground-based skidding)
WRP	riparian buffer protection
WCC	water catchment conservation
WCP	water catchment protection
WFP	flood control protection
WWF	World Wide Fund for Nature

1 Introduction

Malaysian forests provide a variety of products and services for the country's socio-economic development. In recognition of this, the National Forest Act (1984) provides under Section 10 for the classification and gazettement of Permanent Reserved Forests (PRF) or parts thereof into the following eleven forest functional classes (FFC):

a) timber production under sustained yield;
b) soil protection forest;
c) soil reclamation forest;
d) flood control forest;
e) water catchment forest;
f) forest sanctuary for wildlife;
g) virgin jungle reserved forest;
h) amenity forest;
i) education forest;
j) research forest;
k) forest for federal purposes.

Apart from these FFC additional forest functions have to be considered and identified during forest management planning. The designation of these additional forest functions is a requirement emanating from the prescriptions of the MC&I and technical guidelines. Whenever a given forest area has to fulfil protective or conservation functions, any planned management operations have to be geared towards the maintenance or even enhancement of these functions. In most cases this will restrict or even exclude timber production in these areas.

This guideline describes the process for identification of forest functions and zones, which constitutes an integral part of forest management planning. It consists of three main chapters:

- Chapter 2 describes the planning framework and provides the definition and objective of the different forest functions. Furthermore, it explains the general procedure for forest zoning.
- Chapter 3 describes the procedure of multifunctional zoning on FMU-level (macro-planning) and serves as a technical guideline for the planning unit of the State Forestry Department, targeting most notably their respective GIS sections.
- Chapter 4 is a technical guideline for mapping of forest functions in the field. It, hence, is directed at the DFOs who are in charge of pre-harvest assessment.

As the individual chapters target different users, some repetitions are inevitable.

2 Concept and Principles of Multifunctional Zoning

2.1 Planning framework

2.1.1 Area coverage

The basis for forest function mapping and zoning is the most recent "Forest Functional Classes" map of the concerned state. The process of identifying and gazetting FFCs is still ongoing in some of the states. Forest areas that are designated for gazettement as a protective FFC should also be depicted in the map.

Multifunctional zoning is only carried out for those parts of the PRF which are classified as "timber production forest under sustained yield" (refer to FMPRG 2000, Preamble).

Forests classified as "water catchment forests" may overlap with timber production forests (refer to Pengelasan Kawasan Hutan, Simpanan Kelal of 1990). This is in line with the National Forestry Act (1984, amended 1993), which clearly states that PRFs or their parts can be classified under more than one functional class, provided that the prescribed uses are compatible[1]. In this guideline, it is therefore prescribed to include water catchment forests in the forest zoning process, provided that regulations of the individual state permit logging in water catchment forests[2]. However, depending on the vicinity of a given forest area to the water intake point, timber production will be restricted or even prohibited.

2.1.2 Regulatory framework

Relevant documents in the context of forest function mapping and zoning include:

- National Forestry Act: Section 10 (1); refer to the foreword for details.
- Malaysian Criteria and Indicators for Forest Management Certification (MC&I), 2002.
- Guidelines for the interpretation of the classification of permanent forest reserves, 1993. Approved at a meeting of the State Directors of Forestry.
- Guidelines for logging in watershed areas, 1992. Elaborated by the FDPM to regulate the management of forests in watersheds. The guidelines are binding part of every license agreement.
- RIL Guidelines, 2003.

2.1.3 Rationale and objectives

Multifunctional zoning is a critically important step in defining and locating the net production area for timber production. Knowledge of the net production area in turn is indispensable for yield regulation.

[1] This is, however, in contradiction to the MC&I 2002, which prescribe that commercial felling of trees in all gazetted water catchment forests is prohibited.

[2] There is currently no uniform peninsular-wide system regarding the water catchment forests in place. In a number of States (e.g. Perak, Selangor and Pahang) gazetted water catchment forest are automatically protected from logging. In Negeri Sembilan, three different classes of water catchment forests are differentiated and gazetted. Logging is prohibited in class 1, but permitted in classes 2 and 3 under certain restrictions.

At the same time, multifunctional zoning is an essential planning tool for multiple-use forest management. The decision whether an area is suitable for timber production depends on many factors. Forest managers have to balance economic considerations with the requirements for safeguarding ecological/environmental and socio-cultural functions. It is the task of forest function planning and mapping to identify and localize the various forest functions and to evaluate them in relation to the economic function of the forest, mainly timber production.

Therefore, the objectives of multifunctional zoning are as follows:

- to identify and delineate the various functions (ecological, environmental, social) of a given forest area
- to balance the maintenance and enhancement of these functions with the objective of sustainable timber production by defining management prescriptions for the identified zones
- to establish a reliable estimate of the net production area.

2.1.4 Planning approach and process

Multifunctional zoning is the first step of forest management planning as it identifies the areas where timber can be produced in a sustainable way. As such, it has a direct impact on subsequent planning procedures such as the implementation of forest management inventories, AAC calculation, infrastructure and harvesting planning, etc. (see also Figure 1).

While some functions can be easily identified, namely those which depend on topographic features (e.g. slope, altitude), others require intensive surveying (e.g. identification of wildlife habitats and rare ecosystems). Some functions require the protection of large and coherent forest areas (e.g. flood control protection, water catchment conservation) while others can already be fulfilled by small forest patches (e.g. rare ecosystems, cultural sites, etc.). And finally, functions can depend on changing criteria such as the demands and requirements of the society (e.g. societal needs) while others depend on invariable factors such as slope and altitude. Finally, there are some functions, which cannot be mapped at all (e.g. production of NTFP such as bushmeat, medicinal plants, tourism) and others, which are fulfilled by the entire forested area (e.g. carbon dioxide sequestration, eco-tourism). In many cases functions may also overlap (e.g. soil conservation and water catchment conservation).

Once the forest functions are identified they are grouped according to their compatibility with timber production. Two groups of functions are distinguished: (i) functions that preclude logging and (ii) functions that are compatible with low-impact logging. This process is called forest zoning and the result is presented in the Forest Zoning Map.

For the sake of clarity the terms *forest function mapping* and *forest zoning* are defined in the context of these guidelines:

Forest function mapping is a process to classify forest areas according to defined functions based on spatial, topographical, floral and faunal information. However, only those functions need to be mapped which require restrictions in forest management activities.

Forest zoning is the classification of an area into productive, restrictive and protective zones based on the determined forest functions.

Accessibility of virgin forest and of forests which were logged a long time ago is very difficult. Therefore, it will not be possible to map forest functions based on field surveys simultaneously for the entire FMU. On the other hand, identification of some forest functions is only possible in the field. Therefore, multifunctional zoning follows a two-step approach:

Step 1: For the entire FMU forest functions and zones are identified based on GIS analysis and analysis of available secondary data. This process provides an estimate of the net production area and a preliminary forest function map.

Step 2: Verification and identification of additional forest functions and zones during field surveys. This step is carried out for those compartments that are selected for harvesting during the process of pre-harvest planning. This step identifies the actual net production area and defines management prescriptions in line with the designated zones.

The functions and zones as identified during Step 1 have to be updated with the information generated in Step 2. Step 2 completes multifunctional zoning for a given forest area.

2.1.5 Mapping responsibility and planning horizon

Multifunctional zoning and the preparation of the forest function and forest zoning maps on FMU level[3] is the responsibility of the State Forestry Departments. Technical assistance should be rendered by the GIS section of the FDPM, if required. The Forest Zoning Map has to be updated every 10 years during the course of medium-term management planning, while the Forest Function Map is updated annually with incoming information from short-term planning.

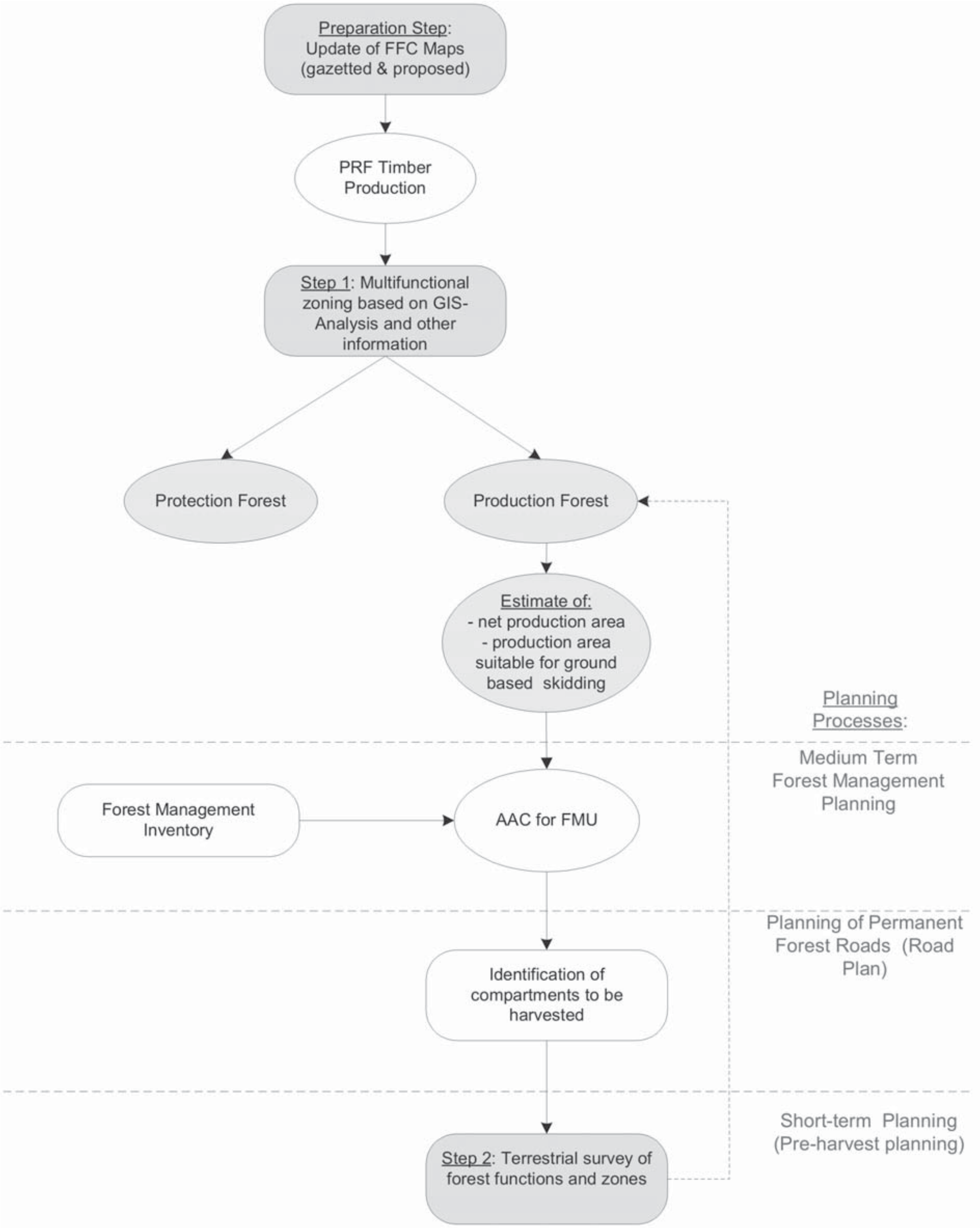
For each compartment due for harvesting, specialized staff of the DFO will prepare a forest function map during the course of pre-harvest assessment. These compartment forest function maps will be revised at the end of the cutting cycle, when the compartment is again due for logging.

2.1.6 Legal validity

Forest function and forest zoning maps are legally binding and as such an integral part of all types of license agreements and contracts.

[3] In Peninsular Malaysia defined as the total area of a given state gazetted as PRF.

Figure 1: Multifunctional zoning in the context of forest management planning



2.2 Definition and description of forest functions

Apart from timber production and other production functions, there are two main groups of functions: ecological/environmental and social functions (refer to Table 1). Each group comprises a number of sub-functions. For the name of a given sub-function the term "protection" is used if any type of logging is incompatible with the function and, therefore, prohibited. The term "conservation" – or a more specific phrase – is used if the function is in principle compatible with timber production provided that certain management restrictions are observed.

Forest functions are grouped as follows:

S Soil protection and conservation functions

W Water protection and conservation functions

N Nature protection and conservation functions

Soc Social functions

Table 1: Forest function groups and functions

Ecological/environmental functions			**Social functions and other functions**
Soil	**Water**	**Nature**	
SP Soil protection	WRP Riparian buffer protection	NWP Wildlife protection	SocC Cultural sites protection
SC Soil conservation	WCP Water catchment protection	NEP Rare ecosystem protection	NTFP Non-timber forest products
	WCC Water catchment conservation		
*SR** *Soil reclamation*	*WFP** *Flood control protection*		

Remark: SR and WFP only occur in freshwater swamps incl. heath forests, peat swamps, and mangroves.

2.2.1 Ecological/environmental functions
Soil

*Relevant **MC&I**:*

6.5 Written guidelines shall be prepared and implemented to: control erosion; minimize forest damage during harvesting, road construction, and all other mechanical disturbances; and protect water resources.

FUNCTION	DEFINITION AND JUSTIFICATION	IDENTIFICATION	MANAGEMENT PRESCRIPTION
Soil Protection (SP)	Soil protection areas are located on very steep terrain, which is extremely sensitive to site degradation. Timber harvesting and the subsequent degradation of the vegetation cover would result in severe soil erosion, loss of nutrients and siltation of adjacent water bodies. Extreme forms of degradation would lead to landslides and flash floods. Rehabilitation of eroded forest land is extremely expensive.	All areas with • an average slope gradient above 40° (applicable slope length 50m) • an average altitude above 1000 m asl • sites with indication of erosion *Rationale for using the slope gradient as criterion for sensitivity of areas to soil erosion:* • *Most important of all risk factors* • *Inter-related to other risk factors (e.g. soil texture, soil fertility)* • *Of all risk factors the one that is the easiest and most reliable to assess, both on maps (GIS-generated slope classification) and in the field (clinometers).*	<u>No logging</u>. However, the construction of access roads to neighbouring harvestable areas is permitted, if otherwise not accessible. Construction has to follow particularly strict standards, among others: use of excavators, extensive drainage, etc. Standards are prescribed in detail in the “RIL Guidelines”, 2003.
Soil Conservation (SC)	Soil conservation areas are located on steep and/or heavily intersected terrain, which is sensitive to soil erosion. The site degradation risk is not as high as in soil protection areas.	All areas with an average slope gradient of 21 - 40° (applicable slope length: 50 m) or which are heavily intersected by small rivers and streams.	<u>No ground-based skidding</u> with heavy machinery, but deployment of soil-conserving timber extraction systems permitted. Road construction standards as in Soil Protection forests.
Soil Reclamation (SR)	Soil reclamation areas are generally low-lying forestlands usually formed through a gradual process of soil accretion and forest formation. They include forests established on reclaimed land.	Areas which are seasonally or permanently subject to inundation, mainly <u>mangroves and swamps</u>. Soil reclamation areas usually do not occur in dry inland forests.	<u>No ground-based skidding</u> with heavy machinery, but deployment of soil-conserving timber extraction systems permitted.

<table>
<tr><td colspan="2">Ecological functions
Water</td><td colspan="2">Relevant MC&I:
5.5 Forest management operations shall recognize, maintain, and, where appropriate, enhance the value of forest services and resources such as watersheds and fisheries.
6.5 Written guidelines shall be prepared and implemented to: control erosion; minimize forest damage during harvesting, road construction, and all other mechanical disturbances; and protect water resources.</td></tr>
<tr><th>FUNCTION</th><th>DEFINITION AND JUSTIFICATION</th><th>IDENTIFICATION</th><th>MANAGEMENT PRESCRIPTION</th></tr>
<tr><td>Water Catchment Protection (WCP)</td><td>Water catchment protection areas are in the immediate vicinity of reservoirs, dams, springs, wells and other facilities for domestic water supply, to prevent the surface run-off, soil erosion, siltation and pollution of water resources.
Water is one of the most valuable natural resources and clean potable water is one of the basic needs for human society. The protection of water resources, therefore, is a top priority in natural resources management.
The water-related forest functions focus on the conservation of the cleanliness of the groundwater and surface water bodies, and the maintenance of a continuous water supply.</td><td>- Areas already gazetted or designated for gazettement as FFC water catchment forest <u>and</u> classified as “protected forest” (e.g. in Selangor, Perak, Negeri Sembilan Class 1)
- A buffer zone of at least 100 m around the perimeter of the water reservoir, including the alluvial zones and swampy and/or waterlogged catchment areas feeding the reservoir.</td><td><u>No logging</u>.</td></tr>
<tr><td>Water Catchment Conservation (WCC)</td><td>Water catchment conservation forests are to ensure the continuous supply of clean water to meet the increasing demand for domestic, industrial and agricultural uses. They prevent surface run-off and/or have good water retention capacities.</td><td>- Areas already gazetted or designated for gazettement as FFC water catchment forest <u>but not</u> classified as “protected forest” (e.g. Negeri Sembilan Classes 2 and 3)
- Catchments located upstream of intakes for public water supply
- Waterlogged, moist or swampy areas.</td><td><u>No ground-based skidding!,</u> but deployment of soil-conserving timber extraction systems permitted.
No logging and machinery movement during the wet season (refer to "Guidelines for Logging in Watershed Areas" [FDPM undated]).
No large scale operations, pattern-wise distribution of logging blocks.
No use of chemicals, e.g. arboricides for girdling.</td></tr>
</table>

FUNCTION	DEFINITION AND JUSTIFICATION	IDENTIFICATION	MANAGEMENT PRESCRIPTION
Flood Control Protection (WFP)	Flood control areas are forests that act as reservoirs for water storage during the monsoon season. The exploitation of such forests would result in massive downstream flooding.	Inland fresh water swamps (incl. heath forests) and peat swamp forests in catchment areas upstream of flood-prone areas.	<u>No logging.</u>
Riparian Buffer Protection (WRP)	Riparian buffers are located along the banks of rivers and streams and around the perimeter of lakes and wetlands. Streamside vegetation stabilizes stream banks and often contains a high diversity of plant and animal species. Riparian buffers provide critical habitats and migration corridors for many mammal and bird species, and maintain ecologically important vertical and horizontal linkages throughout the forest landscape. The objective of the protection of riparian areas is to prevent the negative impact of forestry operations on stream channel stability, water quality and aquatic ecosystem productivity and diversity, and to protect species diversity associated with riparian habitats.	The width of Riparian buffers is measured in horizontal distance and varies with the type of water body: - smaller streams up to 7 m streambed width: 20 m each side - streams/rivers > 7m bed width: three times the bed width each side - small lakes / ponds (<50m diameter): 25 m around the perimeter - large lakes (>50m diameter): 100 m around the perimeter.	<u>No logging</u>. Access roads are permitted as long as bridges are constructed. In the event that trees are accidentally felled into stream or river channels, they have to be removed.

Ecological functions ***Nature***		*Relevant* ***MC&I****:* *6.2 Safeguards shall exist which protect rare, threatened and endangered species and their habitats (e.g. nesting and feeding areas). Conservation zones and protection areas shall be established, appropriate to the scale and intensity of forest management and the uniqueness of the affected resources. Inappropriate hunting, fishing, trapping and collection shall be controlled.* *6.4 Representative samples of existing ecosystems within the landscape shall be protected in their natural state and recorded on maps, appropriate to the scale and intensity of operations and the uniqueness of the affected resources.*	
FUNCTION	**DEFINITION AND JUSTIFICATION**	**IDENTIFICATION**	**MANAGEMENT PRESCRIPTION**
Wildlife Protection (NWP)	Wildlife protection areas are areas where endangered, rare and threatened wildlife (mammal and bird) species occur and where their protection has highest priority. This includes corridors for their movement to other NWP areas.	Wildlife protection areas should be determined in close cooperation with the Department of Wildlife and National Parks (PERHILITAN) and other relevant nature conservation organizations (e.g. WWF Malaysia or Malaysian Nature Society MNS). Criteria for the identification are: - type and number of wildlife species and their protection status - habitat size (dependent on species) - actual condition of habitat (degree of disturbance). Small-size wildlife protection areas (i.e. breeding and nesting sites) are identified during compartment-level planning and are buffered with a 50m zone around the outer perimeter.	No human interference except activities that are compatible with the purpose of wildlife protection (e.g. photo tourism if suitable). No logging.
Rare Ecosystem Protection (NEP)	Rare ecosystem protection areas are rare and/or extraordinarily rich ecosystems and ecological niches. They are generally smaller than wildlife protection areas, and may range between 1 and 100 (or more) hectares in size.	The identification of rare ecosystems should be based on information derived from the Department of Wildlife and National Parks (PERHILITAN). Small-size rare ecosystems are identified during pre-harvest assessment.	No logging.

2.2.2 Social functions and other functions

*Relevant **MC&I**:*

3.3 Sites of special cultural, ecological, economic or religious significance to indigenous peoples shall be clearly identified in cooperation with such peoples, and recognized and protected by forest managers.

FUNCTION	DEFINITION AND JUSTIFICATION	IDENTIFICATION	MANAGEMENT PRESCRIPTION
Cultural Sites Protection (SocC)	Cultural sites protection refers to areas which have a significant cultural value, e.g. religious sites, graveyards, archaeological sites, historical sites, rare topographic formations, viewpoints, waterfalls, etc.	These cultural places have to be protected from logging damages by a buffer zone of at least 50m width around their outer perimeter.	No logging.
Production of NTFP (NTFP)	Forest areas that have a high potential for the production of one or more non-timber forest produce and where the production of such NTFP is not compatible with timber production as the dominant use (e.g. rattan, bamboo).	Areas rich in one or more NTFP and where the capital value of NTFP production is expected to be higher than that of timber production.	No timber production. However, logging is permitted if the felling of individual trees is required in order to increase NTFP production.

2.2.3 Compatibility of forest functions

Forest functions may overlap or exclude each other. In general all forest functions of strictly protective nature are not compatible with timber production, while they are fully compatible with each other. Functions of restrictive nature are partly compatible with timber production. If functions overlap the more restrictive management prescriptions must be applied.

2.3 Identification of forest functions and zones

Due to the size of the FMUs (state) and the inaccessibility of virgin forests and forests which have been logged long time ago, it is impossible to map forest functions in the field for the entire productive forest estate, i.e. all production compartments, simultaneously. This is beyond the capacity of the State Forestry Departments, nor is it actually necessary. For the purpose of medium-term management planning it is sufficient if a reliable estimate of the net production area can be given, and if large-scale conservation zones are identified based on information derived from concerned line departments.

As described earlier, multifunctional zoning is therefore carried out in two steps:

Step 1: GIS analysis based on topographic features and available secondary information. The following functions will be delineated by this analysis:

- SP (soil protection): large and contiguous areas only
- SC (soil conservation): as above
- WCP (water catchment protection): where information is already available
- WCC (water catchment conservation)
- WFP (flood control protection): for inland swamps and heath forests only
- WRP (riparian reserve protection): standardized buffer along water courses
- NWP (wildlife protection): large and contiguous areas only
- NEP (rare ecosystem protection): large and contiguous areas only.

The functional classes maps of the states will serve as a starting point for the analysis.

Step 2: Identification of forest functions in the field during pre-harvest assessment. During this step, functions identified in Step 1 are verified and the following additional information on forest functions is identified:

- SP (soil protection): small areas not identified during GIS analysis
- SR (soil reclamation): mangrove and peat swamps only
- WRP (riparian buffer protection): individual buffer based on entrenchment slopes
- WCP (water catchment protection): water sources used for local water supply
- NWP (wildlife protection): nesting and breeding places of endangered or rare species
- NEP (rare ecosystem protection): small forest patches of rare ecosystems
- SocC (cultural sites protection)
- NTFP (non-timber forest produce).

In addition NFA (non-forest areas) are mapped.

Figure 2 illustrates the process of forest function mapping and zoning. Figure 3 displays the relationship of the forest functional classes as defined in the National Forestry Act (1984, amended 1993) with those forest functions identified during multifunctional zoning.

Figure 2: Process of forest function mapping and zoning

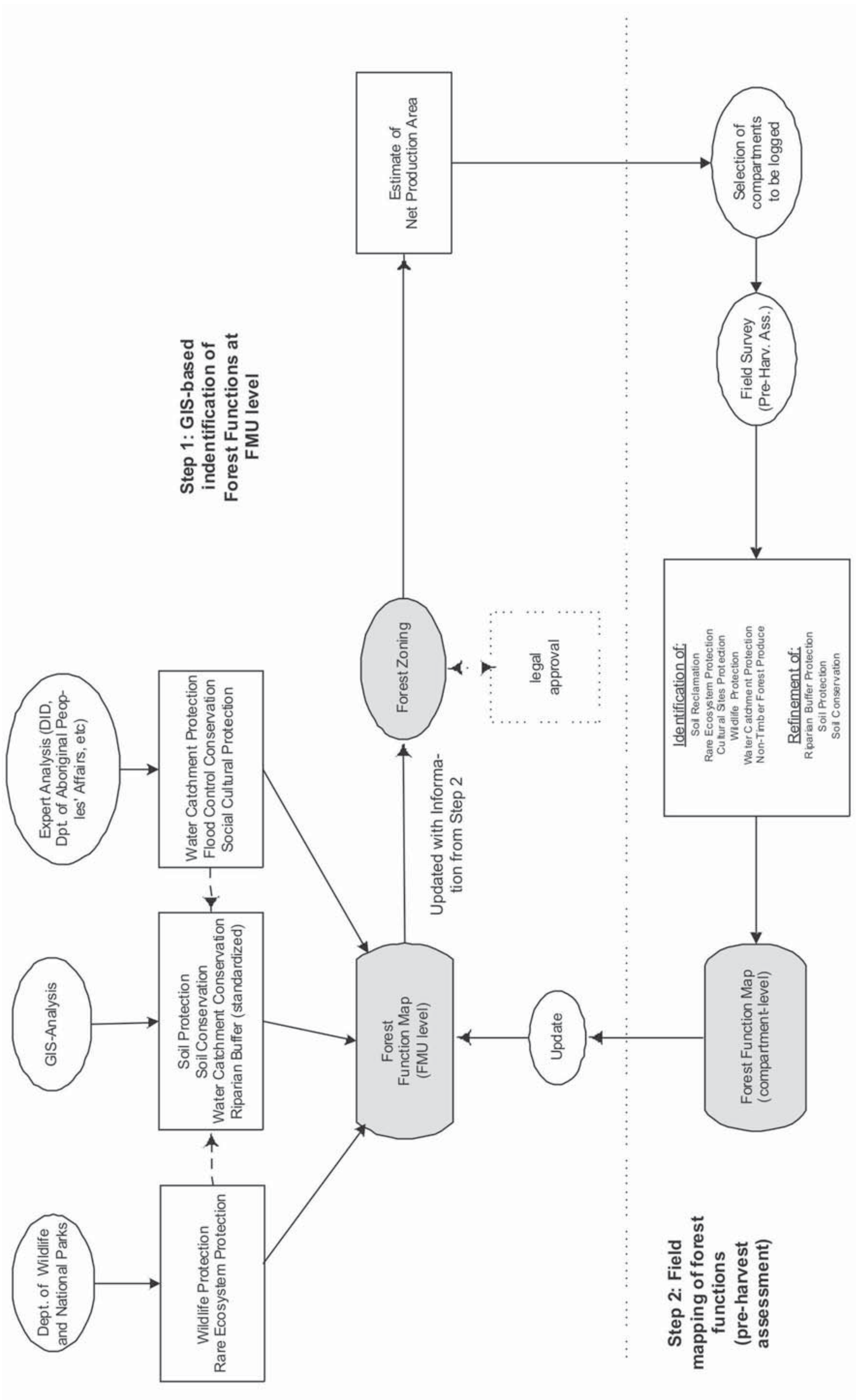
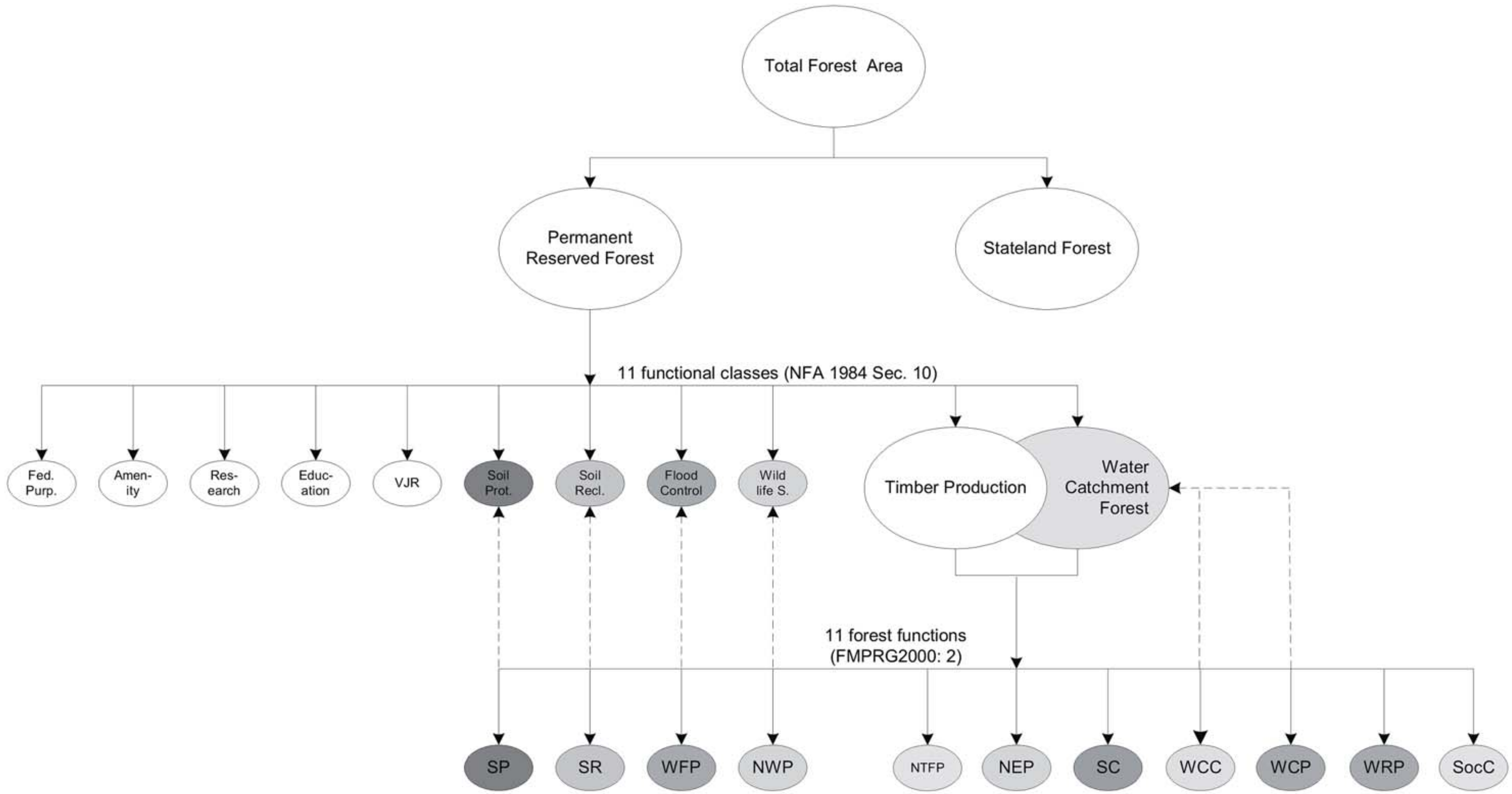


Figure 3: Forest functional classes and other forest functions



3 GIS-based Multifunctional Zoning on FMU Level

This chapter serves as a technical guideline for the planning unit of the State Forestry Department and the GIS unit in charge of map production.

3.1 General issues

3.1.1 Specific objective

The specific objectives of this planning step are
- to provide a reliable estimate of the net production area as a critical step for medium-term forest management planning and
- to identify large and coherent protection zones, which should be excluded from subsequent short-term planning steps (i.e. harvesting assessment and planning).

3.1.2 Strategy

The timber net production area is one of the most important parameters influencing the timber production capacity of an FMU. It is determined by deducting the non-productive area from the total area of the FMU. Non-productive land includes land dedicated to other land uses (permanent infrastructure, water bodies) and land that has been zoned for protective purposes.
In order to maximize the production capacity of a forest area and to make optimal use of its production potential, protective functions should preferably be combined if possible. This refers mainly to functions which are less dependent on site-specific factors. For example, wildlife protection (NWP) areas should be preferably identified in already protected areas (e.g. for soil protection).

3.1.3 Planning horizon

The preparation of the forest function map and the forest zoning map on FMU-level is a one-time exercise. However, both maps need to be updated every 10 years before the new State Forest Management Plan is being prepared. During this revision process the results of terrestrial surveys of forest functions and zones during the previous planning period will be integrated into the maps.

3.1.4 Sources of information

The first step of forest function mapping is to gather all available information, such as topographic maps, thematic maps and reports or studies concerning environmental, ecological or social issues. The following organisations should be contacted and involved in the identification of specific functions:
- Department of Wildlife and National Parks (PERHILITAN)
- Drainage and Irrigation Department (DID)
- State Economic Planning Units (EPU)
- Department of Aboriginal Peoples’ Affairs
- Relevant NGOs.

In case sufficient information should lack on wildlife and flora, biodiversity surveys need to be carried out by qualified organizations.

The following maps will serve as basic tools for forest function mapping. Most of them will be available in digital format at the states' GIS sections. For data analysis, however, sets of hardcopies of each map are required.

Forest functional classes map
As mentioned in Chapter 1, the latest functional classes map of a given state provides the basis of all further mapping of forest functions. The different functional classes are digitized and integrated as different information layers into the GIS. Further identification of forest functions will be limited to the PRF or parts thereof that are classified for sustainable timber production or for water catchment conservation in these maps.

Topographic maps

for the whole state topographic maps at a scale of 1:50 000 and for particular areas of interest (e.g. rare ecosystems) with a larger scale, if available.

Hydrological maps

should be available at the GIS section and/or DID.

Forest resources map

should be available at the GIS section.

In addition to these maps, satellite imagery or, if available, aerial photos are useful for the identification of certain functions (e.g. flood control, soil reclamation).

3.1.5 Recording of metadata

During the process of macro-level forest function mapping all sources of information, their justification for the identification of a specific function and the reliability and precision of these data should be meticulously recorded, with the compartment numbers as a reference. These records should be handed over to the DFO as a reference for field verification during short-term planning.

3.2 Preparation of forest function map

3.2.1 Preparation of base map

The first step towards the generation of forest function maps is the preparation of a base map at a scale of 1:50 000. The map should include the following information:

- PRF classified for sustainable timber production
- compartment boundaries
- settlements and other infrastructure
- rivers and other water bodies
- permanent roads, railway lines, permanent log landings, etc.
- 20 m contour lines
- areas above 1000 m asl
- slope classes.

Slope classification

On this macro planning level, one of the most important pieces of information for the identification of forest functions is the slope. Slope should be classified based on 20 m contour lines into the following classes using GIS application: <15°, 15°-20°, 20°-25°, 25°-30°, >30°.

3.2.2 Identification of forest functions

3.2.2.1 Soil protection (SP)

The risk of soil erosion and soil degradation depends on many factors (e.g. geology, soil type and texture, water saturation, rainfall erosivity and patterns, etc.), but the most important factor is the slope. Conveniently, the slope gradient can be quite easily assessed from topographic maps (while this is not the case for the other factors)[4].

The slope map derived from GIS analysis, therefore, provides the basic information for the identification of soil protection forests. Soil protection forests are delineated by drawing generalized polygon lines around areas with slopes above 30° [5] (cf. example in Figure 4).

3.2.2.2 Soil conservation (SC)

The threshold for soil conservation forests is set at 20° slope gradient in the field, which corresponds to a GIS-calculated slope of about 15°. In addition, very rough and/or heavily dissected terrain should be included. Mapping procedure is the same as for soil protection (see example in Figure 4).

3.2.2.3 Water catchment protection (WCP)

The location of facilities for domestic water supply should be identified on hydrological maps from the DID and from the GIS section of the FDPM in close consultation with DID. Water catchment protection areas include a buffer zone of at least 100 m around the perimeter of water reservoirs, springs, wells, dams, and other facilities used for public water supply. They include the alluvial zones, poorly drained or waterlogged sites, moist areas and swamps in the upper catchment areas.

3.2.2.4 Water catchment conservation (WCC)

Water catchment conservation areas are located upstream of the intake for public water supply (refer to water catchment protection). Water catchment forests already classified in the forest functional classes maps of the states are included.

3.2.2.5 Flood control protection (WFP)

Inland fresh water swamps and peat swamp forests in catchment areas upstream of flood-prone areas should be classified as “flood control conservation”. The identification of WFP should be done in close co-operation with DID.

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[4] Although it would be desirable to base the identification of the soil protection function on the erodability risk derived from the analysis of all influencing factors, this is at present not feasible, as most of the information does not exist to the degree required.

[5] The legal threshold for timber harvesting is 40°. However, slope classes derived from GIS analysis tend to underestimate the real slope considerably, especially the larger the interval of the contour lines and the steeper the areas are. Ground-truthing revealed that GIS-calculated slopes > 30°, which were calculated based on 20 m contour lines, in reality contain already a very high percentage of inoperable and steep areas (>40°). These areas, therefore, need to be protected from timber production.

Figure 4: Example of the delineation of soil protection and soil conservation forests

3.2.2.6 Riparian buffer protection (WRP)

On macro-planning level it is impossible to buffer each stream individually. However, for the purpose of management planning an estimate of the area of riparian buffers is required.

For this purpose water bodies are classified and buffered as follows:

• perennial water courses which are indicated as lines in data sets:	25 m each side
• rivers which are depicted as polygons in data sets:	50 m each side of the polygon
• around small lakes/ponds (<50m diameter)	25 m buffer around perimeter
• around big lakes (>50m diameter)	100 m buffer around perimeter

3.2.2.7 Wildlife protection (NWP)

The identification of wildlife protection areas has to be done in close consultation with PERHILITAN. WWF Malaysia and other relevant NGO may also provide useful information which should be channelled through PERHILITAN. A good solution is to commission a specialized organization with the implementation of a biodiversity survey, which should propose wildlife protection areas and wildlife corridors. In particular areas should be protected which harbour rare and protected wildlife species. Preferably, wildlife protection areas should be allocated in areas that are already protected for other functions (e.g. SP). Protected areas should be linked with wildlife corridors, to allow the movement of the protected animals from one refuge one refuge area to the other. A simple methodology for identification of NWP areas was proposed by Shamsudin Ibrahim *et al* (2003)[6].

3.2.2.8 Rare ecosystems (NEP)

The identification of rare ecosystems should be based on information provided by PERHILITAN and/or on the results of a biodiversity survey. Small-sized rare ecosystems can only be identified during field mapping (Step 2).

3.2.2.9 Non-forested areas (NFA)

Permanently non-forested areas such as lakes, settlements, permanent forest roads, electricity lines, quarries of larger size, etc. which are located within the PRF need to be identified and mapped. This information is derived from topographic maps and satellite imagery and, if available, from aerial photos.

3.3 Multifunctional zoning

The different forest functions are grouped into 3 zones according to the need for restrictions on the harvesting system (see Table 2).

P: Protection zone: These areas have significant environmental or social values. The maintenance or enhancement of these functions is the major management objective of these areas. It is not compatible with timber production and harvesting is therefore not permitted in this zone

TP2: Timber production zone 2: For this zone soil conservation or water catchment conservation functions were identified. These functions are partly compatible with the timber production. However, in order not to compromise these values, disturbance levels have to be kept to the minimum and, therefore no ground-based skidding with heavy machinery is permitted in this zone.

TP1: Timber production zone 1: In this zone wood production is not bound by other forest values. Therefore, no restrictions on the harvesting system except those prescribed by the Harvesting Guideline are required.

Table 2: Multifunctional zoning by forest function

Protection (P)	Timber Production (TP2)	Timber Production (TP1)
Soil protection	Soil conservation	
Soil reclamation	Water catchment conservation	
Riparian buffer protection		
Water catchment protection		
Flood control protection		
Wildlife protection		
Rare ecosystem protection		
Cultural sites protection		
Non-timber forest products		

6 Malayan Forest Records No. 46: Management Prescriptions for non-Production Functional Classes of Forest, FRIM, 2003.

3.4 Map preparation

The forest function map and the forest zoning map should be prepared by the SFD's GIS section. The FDPM GIS unit should provide technical support. Two sets of forest function maps are to be prepared:

- one for the entire state, at a scale of 1:100 000 or 1:250 000,
- one for each forest district and concession at a scale of 1:50 000 or 1:100 000.

The maps contain the following information:

- PRF boundaries
- compartment boundaries
- compartments already covered by terrestrial forest function surveys
- infrastructure (roads, settlements, etc.)
- water bodies (perennial, seasonal streams, rivers, etc.)
- contour lines (20 m)
- forest functions and non-forest area (forest function map)
- forest zones and non-forest area (forest zoning map).

All functions are shown on one map layer, using the standard legend developed and provided by the GIS section of FDPM. The map should contain statistics in tabular form indicating the area of each individual function.
For more details on map preparation refer to FMPG Section 6.

3.5 Zoning report (FMU level)

At the end of the mapping process a report is prepared with the following content:

Preface:
Date of mapping
Mapping Agency (institution, location, persons involved)
Legal approval (when, by whom).

1 Objective and Definitions

Brief descriptions on the objectives of forest function mapping and zoning. Explanation on how the development policy of the respective State is reflected.

2 Data Collection and Sources of Information

Indication of the data source on which the delineation of PRF for timber production is based; description of all data and information used and their relevance for a specific function. Also, in this chapter the reliability of data should be discussed and a justification for their use provided. For future reference data gaps should be identified.

3 Forest Functions

Description of the identification process for the individual functions, problems incurred, need for verification, brief description of spatial distribution, size of different functions in ha and as percentage of total forest area.

4 Forest Zones

Short description of the zones and the resulting implications for commercial logging (logging restrictions).

5 Area Statistics and Net Production Area

The following two tables are prepared by the GIS section, providing area statistics for forest functions and zones. For those compartments in which terrestrial mapping of forest functions has already been completed, the final (real) areas are recorded.

Table 3: Area statistics for forest functions

Permanent reserved forest (PRF):													
Comp. No.	Field survey com-pleted (y/n)	Soil			Water				Nature		Social		NFA
		SP (ha)	SC (ha)	SR (ha)	WCP (ha)	WCC (ha)	WFC (ha)	WRP (ha)	NWP (ha)	NEP (ha)	SocC (ha)	NTFP (ha)	(ha)
1	N	123	145					12	123				
etc.													
total													

Table 4: Area statistics for forest zones and net production area

Permanent reserved forest (PRF):									
Comp. No.	Field survey comple-ted (y/n)	Total	P	TP2	TP1	within (4)+(5) only		NFA	NPA
						> 40° slope	perm. infrastr.		= (2)-(3)-(6)-(7)-(8)
(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	N	389		145	226	14		4	371
2	N	135	135						
3	Y	478	13	217	244		1	3	461
etc.									
total									

Column (1):
Indicates, whether a compartment has already been mapped on compartment-level.

Column (3):
This is the total of all areas that are strictly protected. The calculated areas of the riparian buffers have to be included in the total! The figure also includes acreage set aside for production of NTFP.

Column (6):
Especially in timber production areas (TP1 and TP2) within hilly and mountainous regions there will be a number of small patches of steep and inaccessible terrain above 40°, which have to be considered as inoperable or non-loggable. These areas can only be identified during field surveys. To get a fairly reliable estimate of the net timber production area, these areas need to be deducted. This is achieved by calculating the areas with a slope above 30°. This value will be replaced by the real figure, upon completion of field assessments for a given compartment.

Column (7):
This only refers to infrastructure which is mapped, e.g. main roads, buildings, electricity lines etc.. Temporary roads, skid trails, etc. are not deducted from the net production area. The acreage of rivers and streams does not need not to be calculated, as they are already included in the area of the riparian buffers (WRP).

Column (8):
On FMU level 1% of the productive compartment should be added as non-forest area. This figure will be replaced with the real value once field surveying is completed.

Annexes

- Notes
- Forest Function Map (DIN A3)
- Forest Zoning Map (DIN A3)

4 Terrestrial Mapping of Forest Functions and Zones

4.1 General remarks

4.1.1 Specific objective

Multifunctional zoning on compartment level provides essential information for harvesting planning. It identifies the real net timber production area (i.e. the areas to be logged), provides management prescriptions for different forest sites depending on the functions and prescribes restrictions concerning the harvesting system (i.e. ground-based logging, airborne systems, on-site processing, etc.).

4.1.2 Strategy

Field surveying of forest functions is an integral part of the pre-harvest assessment and is carried out simultaneously with the tree enumeration and the pre-F inventory. The detailed procedure is described in the field manual for pre-harvest assessment. It is only carried out in the productive compartments identified during multifunctional zoning on FMU level.

4.1.3 Responsibility

Multifunctional zoning is the responsibility of the DFO or, for long-term concessions, of the manager in charge of field operations. Pre-harvest assessment starts once the compartments have been officially approved for harvesting. Multifunctional zoning reports need to be formally approved by the DFO and are endorsed by the state.

4.2 Preparation of base map (working map)

Based on the GIS-generated forest function and forest zoning maps prepared on FMU level, a base map for the specific compartment and its surroundings should be prepared. It should depict the following features:

- forest functions and zones identified from GIS analysis (refer to Chapter 2)
- compartment boundaries
- contour lines
- infrastructure
- water bodies
- existing and planned roads (refer to FMPG section *Forest Harvesting Infrastructure Plan*)
- pre-harvest assessment grid (i.e. survey lines for Pre-F).

The map is prepared at a scale of 1:5000 by the GIS unit of the state or of the long-term concession and handed over to the DFO or operation manager in charge of pre-harvest assessment.

4.3 Identification process for different forest functions

The identification of forest functions during pre-harvest assessment is carried out in 3 steps:

Step 1: Preliminary identification in the office based on secondary information
Step 2: Verification and identification in the field during pre-harvest assessment
Step 3: Final determination of forest function boundaries.

4.3.1 Preliminary Identification

Before actual field surveying starts, it should be checked with the DFO, the SFO, other relevant line departments (e.g. Dpt. of National Parks and Wildlife, DID, Dpt. of Aboriginal Peoples' Affairs) and adjacent communities, whether – to their knowledge – one or more of the following forest functions occur in the compartment. If so, their approximate location should be indicated on the base map:

<u>Water catchment protection (WCP):</u> Is any of the water resources within the compartment used for local water supply? Are there any springs, water reservoirs or other facilities for the local supply of water located in the compartment?

<u>Flood control protection (WFP):</u> Only relevant for inland swamps and heath forests. Have any floods occurred in the past along streams originating from/draining the relevant compartment?

<u>Wildlife protection (NWP):</u> Is there any knowledge on the occurrence of rare and endangered wildlife (a list of rare and endangered species is to be prepared by FRIM).

<u>Cultural sites protection (SocC):</u> Are there any cultural sites (e.g. graveyards, archaeological sites, caves, viewpoints, picnic places, waterfalls, etc.) located within the relevant compartment?

<u>Non-timber forest products (NTFP):</u> Are there any sites with licenses for the production of NTFP located within the compartment?

If any of these functions are identified, the means of protection or required management restrictions have to be discussed and defined and included in the stand description of the compartment.

4.3.2 Verification and identification in the field

The following functions need to be identified in the field and their boundaries need to be indicated on a sketch map. The notes prepared during multifunctional zoning, which are attached to the multifunctional zoning report (FMU level), provide information for field verification of already identified functions.

4.3.2.1 Soil protection (SP) and soil conservation (SC)

The boundaries of soil protection areas identified on FMU level need to be verified in the field and, if necessary, be adjusted.

All areas indicated on the base map with a slope class above 25° should be particularly checked. If their real slope (checked with clinometer) is 40° or above and if they extend for more than 50 m in length, they should be classified as "soil protection areas".

Sensitive sites below 40° which show signs of soil degradation or erosion should also be included.
Areas with assessed slope gradients between 20 and 40° on slope lengths of 50 m and above should be classified as "soil conservation areas".

4.3.2.2 Soil reclamation (SR)

Only relevant for mangrove and peat swamp forests!

All forest areas which are seasonally or permanently subject to inundation, mainly mangroves and swamps (generally low-lying forest lands usually formed through a gradual process of soil accretion and forest formation including forests established on reclaimed land).

4.3.2.3 WFC flood control protection (WFP)

Only relevant for inland swamps and heath forests!
In case downstream areas are flood-prone the swamp or heath forest should be classified as “flood control protection”.

4.3.2.4 Riparian buffer protection (WRP)

Riparian buffers need to be redefined because on FMU level only standardized buffers were determined. Each watercourse has to be assessed individually and the category (i.e. seasonal, perennial, size class) has to be identified. Depending on the nature of the watercourse the size of the riparian buffer has to be determined. Whether there is a need to buffer seasonal streams depends on the surrounding terrain and the steepness of the river valley. The decision is made on the spot. However, all perennial streams need to be buffered with a Riparian Buffer Zone. For streams the minimum buffer width is 20 m horizontal distance to both sides of the stream edge (see Figure 5). Riparian buffers of streams with a streambed width of 7 m or above are buffered with three times the streambed width.

Figure 5: Sketch of a riparian buffer

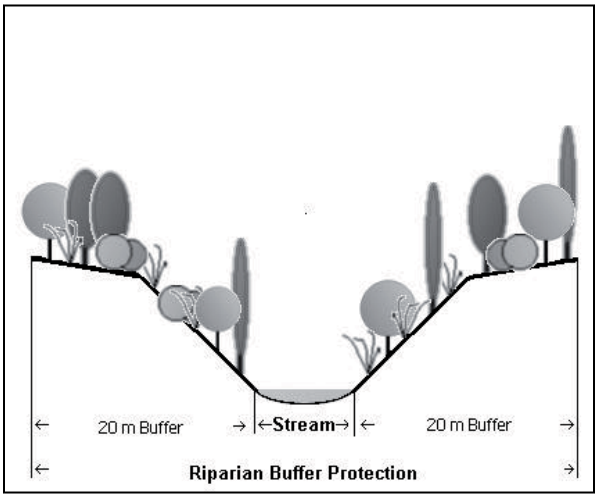

Table 5: Riparian buffer by type of water body

Type of watercourse	Buffer width on each side
Perennial streams (< 7 m width)	20 m
Perennial streams and rivers (> 7 m width)	three times riverbed width
Small lakes/ponds (< 50 m diameter)	25 m
Big lakes (> 50 m diameter)	100 m

4.3.2.5 Wildlife protection (NWP)

At this level only nesting and breeding places of protected or endangered wildlife (i.e. mammals and birds) species should be identified based on the information derived during step 1 or if found during tree-marking. A buffer zone of 50 m in width around the outer perimeter of the site is classified as “wildlife protection area”. Species names are recorded on the base map (for a list of protected wildlife species refer to the Annex).

4.3.2.6 Rare ecosystem protection (NEP)

Parts of the forest, which are extraordinarily rich in species diversity or where rare plants occur should be classified as “rare ecosystem protection”. In dipterocarp forests this may include moist or swampy areas stocked with different vegetation types.

4.3.2.7 Non-timber forest products (NTFP):

Parts of the forest which are well stocked with NTFP of commercial value (e.g. Durian, medicinal plants, rattan, bamboo) and where there production is not compatible with timber production should be classified as “NTFP production areas”.

4.3.2.8 Cultural site protection (SocC)

Cultural sites which have been identified during Step 1 or which are additionally identified during tree marking are buffered with a 50 m zone around their perimeter.

4.3.2.9 Non-forest areas

Quarries, rocky outcrops, settlements or any other sites which are permanently non-forested are classified as “non-forest areas”.

4.3.3 Final determination of forest function boundaries

The DFO checks the sketch map prepared by the field team and finally decides on the forest function classification. At this stage forest function boundaries may be extended or linked with those of other functions. This refers particularly to NWP in which corridors could be formed and linked with riparian buffers or soil protection areas.

4.4 Multifunctional zoning

The transfer of forest functions to zones follows the prescriptions of Chapter 3.3. In addition to the zones indicated there (TP1, TP2, P) one additional zone will be created: the NTFP zone. The NTFP zone comprises those forest areas in which the production of NTFP was identified as the dominant use. Hence, all areas which were designated the NTFP function during field survey will be transcribed as NTFP zones.

4.5 Update of forest function and forest zoning map

Following the approval of the sketch map by the DFO, it is handed over to the GIS unit of the state for digitizing and map preparation. The forest function and forest zoning maps resulting from the GIS-based process are <u>updated</u> accordingly. Forest functions and zones are also transferred to the tree location map, which is prepared for each compartment after the pre-harvest assessment is completed. This map then provides all the information required for harvesting planning and is part of the license agreement.

4.6 Update of area statistics

The area statistics on FMU level are updated accordingly.

4.7 Multifunctional zoning report (compartment level)

For each compartment, at the end of the mapping process a brief report is prepared comprising the following information:

Preface

Date of mapping
Persons involved

1 Forest Functions

Description of the identification process for the individual functions, problems incurred, brief description of spatial distribution, area size of function and percentage of total forest area. For cultural site protection a short description of the object and the specific protection needs should be provided. The same applies for wildlife protection (e.g. species, population, signs, etc.), rare ecosystem protection and non-timber forest products areas. For flood control protection information on past floods should be compiled.

2 Forest Zones

Description of the size and spatial distribution of the zones and the consequences for harvesting planning.

3 Area Statistics and Net Production Area

The following two tables are prepared based on information derived from the GIS unit in charge of map preparation.

Table 6: Area statistics on forest functions by compartment

Forest function	Symbol	Area	
		(ha)	(%)
Soil protection Soil conservation Soil reclamation	SP SC SR		
Water catchment protection Water catchment conservation Flood control protection Riparian buffer protection	WCP WCC WFP WRP		
Wildlife protection Rare ecosystem protection	NWP NEP		
Cultural site protection Non-timber forest product production	SocC NTFP		

Note: Since functions may overlap, the sum of all forest functions (total ha) may exceed the compartment size.

Table 7: Area statistics on forest zones by compartment

Forest zone	Symbol	Area	
		(ha)	(%)
Protection	P		
Timber production 2	TP2		
Timber production 1	TP1		
Non-forest area	NFA		
Total area			

Annexes

- Forest function map (DIN A4)
- Forest zoning map (DIN A4)

Annex

04

Forest Management Planning Rules and Guidelines (FMPRG):

Yield Regulation

gtz

Jabatan Perhutanan
Semenanjung Malaysia

German Technical Cooperation

SFMCP

Sustainable Forest Management and Conservation Project

Malaysian-German Technical Cooperation

Forest Management Planning Rules and Guidelines (FMPRG)

Guideline 3c:
Yield Regulation

Günther Haase

Werner Schindele

Final Draft

August 2005

Technical Document No. B54

Yield Regulation

Section	Medium-term Planning	3
Sub-Section	Yield Regulation	c

Contents

List of Figures

List of Tables

Acronyms and Abbreviations

AAC	annual allowable cut
AAC_a	AAC calculated with area control formula
AAC_d	AAC calculated based on DIPSIM
AAC_h	AAC calculated with Heyer formula
AAC_{final}	finally determined AAC
AAC_{ph}	AAC calculated with Paulsen/Hundeshagen
AAC_{prel}	preliminary AAC
AAC_{TP1}	AAC for TP1 timber production areas
AAC_{TP2}	AAC for TP2 timber production areas
AC	allowable cut (for the whole planning period)
C_a	annual coupe
C_t	total coupe for the whole planning period
C_{t-prel}	preliminary total coupe for the whole planning period
DFO	District Forest Officer
DIPSIM	dipterocarp simulation model
f_d	damage factor
f_{dTP2}	damage factor for TP2 areas (soil conserving harvesting systems)
f_{dTP1}	damage factor for TP1 areas (ground-based logging)
f_i	felling intensity factor (accounts for losses at harvesting)
f_{i1}	felling intensity factor in relation to harvestable volume
f_{i2}	felling intensity factor in relation to total volume
FMIS	forest management information system
FMU	forest management unit
FMPG	Forest Management Planning Guidelines
hc	harvesting cycle
I_c	mean annual increment at current stocking
I_t	mean annual increment at target stocking
m^3	cubicmeters
MIDAP	Management Inventory Data Analysis Program
NPA	net production area
NPA_{annual}	annual net production area
NPA_{tot}	total net production area
NPA_{harv}	harvestable net production area
NPA_{TP2}	net production area in TP2 timber production zone
NPA_{TP1}	net production area in TP1 timber production zone
post-F	post felling inventory
t_{ad}	adjustment period
TP1	Timber Production Zone 1 (ground-based skidding systems permitted)
TP2	Timber Production Zone 2 (only soil-conserving harvesting systems permitted)
V_c	current standing stock of commercial species
V_t	target standing stock of commercial species
V_{harv}	harvestable standing stock (above cutting limit)
$V_{harvvir}$	harvestable standing stock of virgin forest
V_{tresh}	maximum harvestable volume = 85 cbm/ha

1 Introduction

1.1 Objective and principles of yield regulation

The objective of yield regulation is to calculate the amount of timber that may be harvested annually, or periodically, from a specified forest area over a stated period of time in accordance with the principle of sustained yield and other management objectives. It includes the calculation and its formal written expression of the Annual Allowable Cut (AAC) and its allocation to the localities to be harvested.

The determination of the AAC is one of the most important tasks of forest management planning. It provides a basis for deriving a log harvest which is in balance with forest increment, thus ensuring the continuous supply of timber in perpetuity.

The yield is regulated on state level. The AAC calculated for the entire state FMU will be apportioned to the different forest districts and forest concessions, depending on the availability of harvestable areas (spatial allocation of the AAC).

The total allowable cut (AC) for the planning period is calculated as AAC * 10 years. It forms the upper ceiling for harvesting and it should by no means be exceeded; it may, however be underutilized.The actual annual cut may vary from year to year within the planning period depending on the forest condition of the harvested areas or on management considerations (e.g. demand of wood processing industry).

1.2 Definition of terms

Yield in the context of this guideline is defined as the standing volume of commercial timber. This is the clear bole standing volume of commercial species in m^3 above 45 cm dbh in case of non-dipterocarps and 50 cm dbh of dipterocarp species[1].

Sustainable yield means the continuous production of commercial timber with the aim of achieving an approximate balance between net growth of the forest and the harvest.

The Allowable Cut (AC) is the commercial timber volume that may be extracted from a forest management unit (FMU) or defined parts thereof during the ten-year planning period. The Annual Allowable Cut (AAC) is the AC expressed on an annual basis.

The total Coupe (C) or Cutting Area is the area of production forest that may be cut during the ten-year planning period. Both terms are used synonymously. The Annual Coupe (C_a) is the average forest area that may be harvested during one year.

2 The Process of Yield Regulation

2.1 Working circles

In Peninsular Malaysia three different major natural forest types are distinguished: dry inland forest, peat swamp forest and mangrove forest. Yield is regulated separately for each of the working circles. The total AAC of a state FMU is the sum of the AACs of all working circles which occur in a given state.

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[1] At the time of reporting it was discussed to raise the minimum cutting diameters to 55 cm for non-dipterocarps and to 65 cm for dipterocarps.

2.2 Data requirements

Yield regulation has to be based on up-to-date forest resource information. The following information is required for every working circle:

1. Net production area: An estimate for the NPA is obtained from the forest zoning process.
2. Stocking levels: The combined forest inventory generates information on mean commercial volumes by logging status and type of production zone (TP1 and TP2).
3. Increment data are derived from the analysis of (i) *growth and yield plots* and (ii) the observational *growth plots*. In future, data from the Continuous Forest Inventory will constitute an additional source of incremental data.
4. Target volume: Commercial volume of stands at which growth is maximal.
5. Correction factors: The damage factor and the felling intensity factor provide allowance for damage to a residual stand during logging and for trees that cannot be harvested despite meeting some of the formal requirements (commercial species, dbh above minimum diameter threshold).

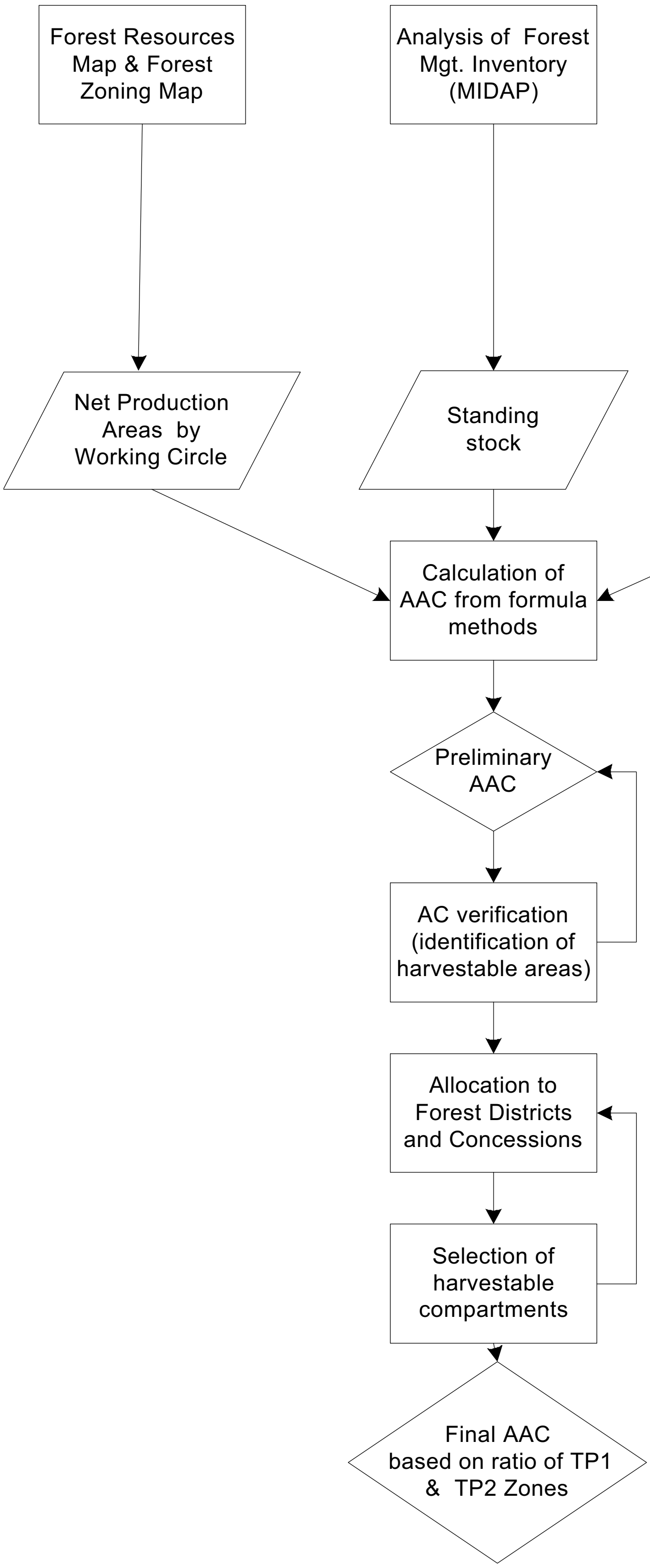
2.3 Steps for yield regulation

Yield regulation comprises the following steps:

1. Compilation of required information and data (refer to Chapter 2.2).
2. Calculation of different AAC indicators and formula methods, i.e. Paulsen-Hundeshagen modified, Heyer modified, Area Control, AAC determination by growth modeling. Depending on the overall forest condition (predominantly virgin or previously utilized) the AAC calculated by means of the different indicators are weighted. This results in the preliminary AAC.
3. Calculation of the available net production area of harvestable forests (i.e. virgin forests and forests logged-over more than 30 years ago). If the harvestable forest area is less than the required coupe (Step 3), the allowable cut needs to be reduced accordingly.
4. Distribution of the allowable cut to the different forest districts and forest concessions within the state, based on the distribution of the harvestable forest area and other criteria.
5. Selection of compartments to be harvested during the planning period for each forest district. The selection is based on the following criteria: years elapsed after logging, distribution of timber production zones, spatial distribution and accessibility of compartments.
6. Adjustment of AAC according to the ratio of TP1 (ground-based skidding) and TP2 (soil conserving extraction systems) zones. As the damage to the residual stand is lower when deploying soil-conserving timber extraction systems, the extractable volume from the TP2 zone is higher than in the case of TP2. This adjustment results in the final AAC.

Yield regulation ends with the justification of the AAC, i.e. the decision-making process has to be made transparent. The entire process is illustrated in Figure 1.

Figure 1: Process of yield regulation



3 Yield Regulation in Dry Inland Forest[2]

Yield in the dry inland forest working circle is regulated by volume. For AAC determination a number of different AAC indicators are calculated. AAC indicators to be used are the formula “modified Paulsen Hundeshagen”, “modified Heyer” and “Area Control”, and results obtained from application of the Diperocarp Forest Growth Simulator (DIPSIM).

3.1 Collection of information and compilation of data

For AAC calculation a number of different information and data are required which are described in the following.

3.1.1 Area-related information

One of the most important factors for AAC calculation is the net production area (NPA). An estimate for this is a direct output of multifunctional zoning (refer to FMPG Section 2a “Multifunctional Zoning”, enclosed as Annex 3 in this publication) by subtracting the protection zones and non-forested areas from the total forest area. Area-related information should be compiled by the GIS unit and can be directly retrieved from the Compartment Register (CR), the forest zoning map or the forest resources map.

Table 1: Area-related information

Variable		Description
Total net production area	NPA_{tot}	Calculated as: Total PRF area minus area of protection zones minus non-forested area.
Total harvestable net production area	NPA_{harv}	Equals the net production area of harvestable forests. A forest is considered as harvestable if it is either virgin or if more than 30 years have elapsed after the last logging.[3]

3.1.2 Standing stock

Information on standing stock is directly derived from the results of the combined forest inventory on state or concession level as calculated by the Management Inventory Data Analysis Programme (MIDAP). All volume-related data refer to standing clear bole volume[4] in m^3/ ha of commercial species.

[2] Similar, individual guidelines will need to be developed for peat swamp forest, mangrove forest and plantation forest.

[3] It is assumed that the forest stratum 30+ comprises of all forests which have been logged 30-40 years ago. The average age then is 35 years, which matches with the harvesting cycle of 35 years.

[4] Refers to the standing stock as measured by the forest management inventory. It is the bole volume of the tree including the stump up to the first branch (refer to the field instructions of the Forest Management Inventory).

Table 2: Standing-stock-related information

Variable/unit		Description
Current standing stock (m^3/ha)	V_c	This is the weighted average standing stock of all commercial species per ha for the dry inland production forest strata (NFI 4 Strata 11, 12, 20, 21, 22, 23) as assessed during the NFI 4.
Target standing stock (m^3/ha)	V_t	Level of growing stock at which the (current) annual increment culminates. Based on analysis of growth plots, growth and yield plots, this is at about 70% of the standing stock of an undisturbed virgin forest. V_t can be derived from the results of the NFI4 (Note: V_t refers to <u>undisturbed</u> virgin forest and not to the virgin forest stratum).
Harvestable standing stock (m^3/ha)	V_{harv}	The harvestable standing stock V_{harv} is the average total standing stock of all commercial species per ha above the cutting limit for the whole dipterocarp production forest strata (No. 11, 12, 20, 21, 22, 23).
Harvestable standing stock of virgin forest (m^3/ha)	$V_{harvvir}$	This is the average harvestable standing stock of dipterocarp virgin forest strata (no. 11 and 12).
Harvestable standing stock of forest logged >30 years ago (m^3/ha)	$V_{harv30+}$	This is the average harvestable standing stock of dipterocarp forest stratum no. 23 (logged-over more than 30 years ago).
Average harvesting threshold	V_{thresh}	The harvesting threshold V_{thresh} is defined as the maximum amount of timber to be extracted per ha. It is set at 85 cbm/ha. This threshold has no direct effect on the allowable cut, but on the working area required, to realize it. As this threshold is an upper limit, which cannot be exceeded, the average removable volume will be less.

3.1.3 Increment

The actual growth of the forest is a very important parameter for yield regulation. Ideally, timber removal shall not exceed regrowth of timber volume during the planning period. Maximum production is achieved when the mean annual increment culminates. The average standing stock at this culminating point is the target or desired standing stock (see above and Figure 2). Once the average standing stock of the forest resources is equal to the targeted standing stock, maximal production is achieved.

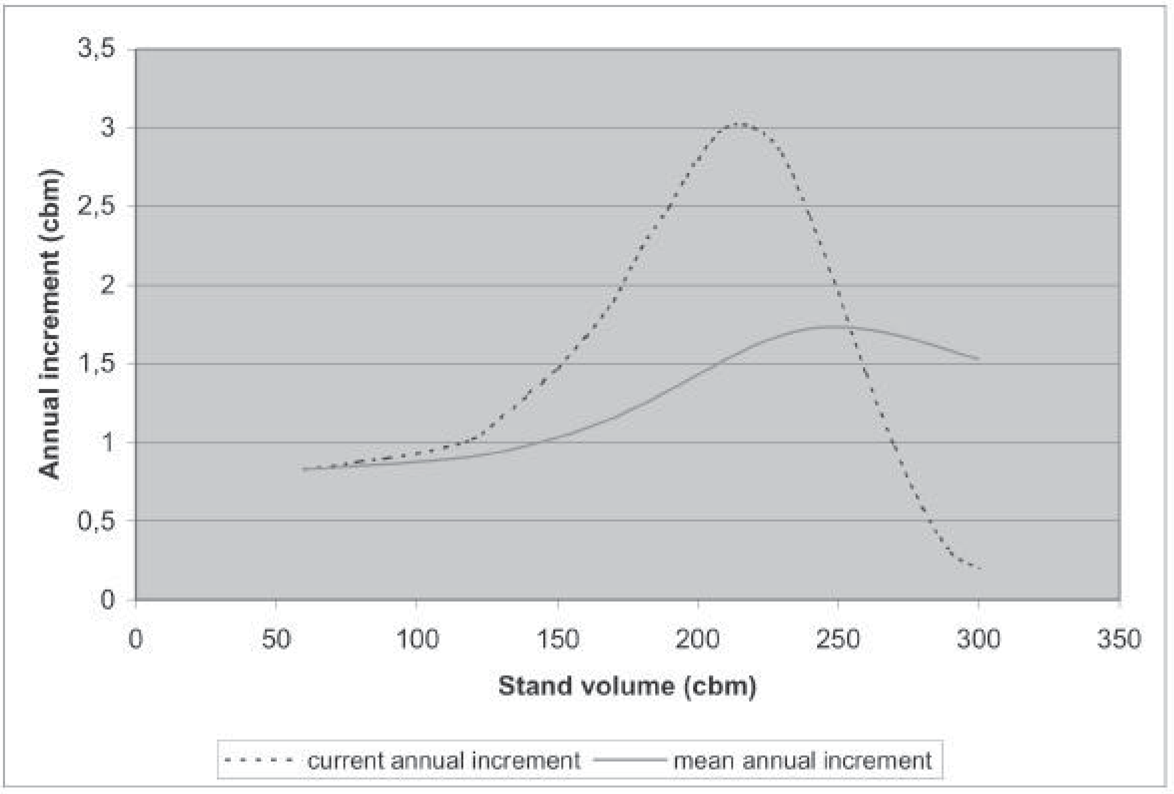
The increment data which are used for yield regulation are derived from the analysis of growth and yield plots and from growth plots.[5]
The increment is expressed in m^3 commercial volume/ha/year.

[5] To increase accuracy, it is recommended to develop increment functions for different growth zones based on already existing growth and yield data. Once the second combined forest inventory (NFI5) has been conducted (i.e. by 2013), yield can be regulated based on real increment values for each state.

Table 3: Mean annual increment

Variable		Description
Mean annual increment at <u>target stocking</u>	I_t	This is the mean annual increment of commercial species at target standing stock. Based on the analysis of growth plots in Peninsular Malaysia, the I_t for dry inland forest is estimated at 1.6 m^3/ha/year (see Figure 2).
Current annual increment at <u>present stocking</u>	I_c	This is the annual increment at the average standing stock V_c of all dry inland production forest strata (No. 11, 12, 20, 21, 22, 23). It can be derived from the graph in Figure 2[6].

Figure 2: Mean and current annual increment over stand volume (example)



[6] This graph needs to be updated based on the results of NFI4.

3.1.4 Other factors

Apart from standing stock and increment some more parameters need to be considered when the allowable cut is calculated. These factors are described in Table 4.

Table 4: Other parameters required for yield regulation

Factors		Description
Harvesting cycle	h_c	Time period after which a logged forest can be harvested again. It is set for dry inland forests at 35 years. It should be adjusted to reflect the share of MUS-treated forest area[7].
Adjustment period	t_{ad}	Time span after which the targeted stocking levels should be reached (i.e. $V_c = V_t$). It depends on many criteria such as the existing stocking levels, the estimated harvesting cycle, the management objectives, the economic situation (timber market), etc. In general, the larger the difference between V_t and V_c, the longer t_{ad} should be.
Damage factor	f_d	The damage factor f_d captures the reduction of the residual standing stock and its volume increment due to damage inflicted to the residual stand. This factor depends largely on the harvesting system applied and on the degree of compliance with harvesting standards.
	f_{dtp1}	For ground-based skidding (TP1 Zone) this factor is set at 0.75.
	f_{dtp2}	For soil conserving harvesting systems (TP2 Zone) this factor is increased to 0.85, as the damage caused by ground-based skidding is eliminated.
Felling intensity factor	f_{i1}	The factor f_i expresses the proportion of the harvestable standing stock, which is actually felled (excludes mother trees, protected trees[8] and unusable trees[9]) . It is set at 0.7 in relation to the harvestable volume V_{harv} (i.e. for AAC-formula 3).
	f_{i2}	In relation to the total volume it should be set at 0.85 (i.e. for AAC-formula 1 and 2)[10].

[7] The adjusted hc is calculated by applying the following formula:
$h_{c\text{-}adjust}$ = (35 * area under SMS + 55 * area under MUS)/total production area.

[8] Protected trees are: trees located on slopes >40° within zones TP1 and TP2, trees of protected species, trees which cannot be felled for safety reasons, etc. Protected trees are identified during pre-harvest assessment. For more details refer to Annex 5 of this publication: “Operational Planning at Compartment Level” (MPG Section 4a).

[9] Unusable trees are old/over-mature, decayed or defect trees, which cannot be processed into timber.

[10] This is based on the assumption that in average about 40% of the total volume will be harvestable.

3.1.5 Data compilation

Before AAC calculation starts all required data shall be compiled by filling the table below. Shaded cells contain standard values.

Table 5: Data compilation for AAC calculation

Variable	Value	Unit
NPA_{tot}		ha
NPA_{harv}		ha
V_c		m^3/ha
V_t		m^3/ha
V_{harv}		m^3/ha
$V_{harvvir}$		m^3/ha
I_t	1.6	m^3/ha/year
I_c		m^3/ha/year
h_c		years
t_{ad}		years
$f_d = f_{dtp1}$	0.75	
f_{i1}	0.70	
f_{i2}	0.85	

3.2 Calculation of AAC based on formula methods

According to the FMP-Rules the AAC is calculated by applying the following formulas:

<u>(1) Paulsen-Hundeshagen, modified</u>

$$AAC_{ph} = I_t * \frac{V_c}{V_t} * f_d * f_{i2} * NPA_{tot}$$

Note: I_t: <u>mean</u> annual increment at target standing stock

This formula is suitable for all stocking conditions.

<u>(2) Heyer, modified</u>

$$AAC_h = \left(\mathrm{Ic} + \frac{V_c - V_t}{t_{ad}} \right) * f_d * f_{i2} * NPA_{tot}$$

Note: I_c: annual increment at current average standing stock

This formula is a good AAC indicator for logged-over forests. However, for heavily degraded forests this formula is not as suitable (rule of thumb: the actual standing stock V_a should be at least 170 m^3/ha). The result depends on the selected adjustment period and can, in contrast to the other formulas, be influenced by the management planner. The shorter the adjustment period, the sooner the target standing stock is reached.

In situations where the actual standing stock is below the target standing stock ($V_c < V_t$) it may be helpful to calculate the time required until the forest resource would reach the target standing stock without harvesting. This is done as follows:

$$t_{ad} = \frac{V_t - V_c}{I_c}$$

This should be the starting point for simulation.

(3) Area control

$$AAC_a = V_{harvvir} * f_{i1} * \left(\frac{NPA_{tot}}{h_c} \right)$$

This formula depends largely on the harvesting cycle, which is set at 35 years. The area control formula should only be used for FMUs which have a high proportion of virgin forests and where only virgin forests will be logged within the planning period.

3.3 AAC based on DIPSIM harvesting simulation

DIPSIM is a growth and harvesting simulator, which has been developed for logged-over dipterocarp forests. It is a very good tool for AAC calculation, as it simulates the growth of the forest under different harvesting scenarios.

The use of the DIPSIM harvesting simulator for AAC calculation is described in the “User Guideline for DIPSIM”[11].

3.4 Determination of preliminary AAC

The AAC derived from the different formula may vary considerably. The suitability of the different formula depends largely on the ratio of logged-over forest to virgin forest. Table 6 presents a suitability rating of the different AAC indicators in relation to the proportion of logged forests.

Table 6: Suitability matrix for different AAC indicators in relation to the proportion of logged forests

AAC calculation method		Proportion of logged forests in %		
		> 80%	10 – 80%	< 10%
(1) Paulsen/Hundeshagen	AAC_{ph}	3	3	2
(2) Heyer, modified	AAC_h	2	3	2
(3) Area control	AAC_a	0	1	3
(4) DIPSIM	AAC_d	3	3	3
Total suitability scores		8	10	10

0: not suitable; 1: suitable with restriction; 2: suitable; 3: very suitable

[11] DIPSIM Sarawak (Dipterocarp Forest Growth Simulation Model Version Sarawak): Doc.1; available for download from the Forest CHM:
http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000689

Note: (2) Modified Heyer should not be used for heavily degraded forests.

The AAC can be determined as a weighted mean of the different indicators according to Table 6. For example, in case the proportion of logged forests is 35%, then the AAC could be derived as follows:

$$AAC_{prel} = \frac{3 * AAC_{ph} + 3 * AAC_{h} + AAC_{a} + 3 * AAC_{d}}{10}$$

However, apart from this purely mathematical approach, other criteria should also be taken into account – such as market requirements, processing capacity and demand of the timber industry and certification-related aspects. Considering these factors, the AAC_{prel} as calculated according to the above formula may be increased or decreased, but only within the range provided by the various individual indicators. For any deviation of more than 10% from the calculated AAC_{prel} a detailed justification is necessary (refer to Chapter 3.8).

3.5 Verification and allocation of the AAC

Before the AAC is finally determined, it needs to be verified, whether it can be actually realized, i.e. whether there are enough forest areas, which are harvestable. If this is not the case, the AAC needs to be adjusted accordingly as described below.

3.5.1 Verification of the AAC and allocation to harvestable areas

The first step of AAC verification is to identify the area of harvestable forest. A forest is considered as harvestable if it is a virgin forest or a forest that was logged more than 30 years ago. For this purpose the table below needs to be completed. Data can be derived from the forest resources map and the forest inventory.

Table 7: Harvestable forest area

Forest strata	**Net production area** **NPA**	**Average harvestable volume** **V_{harv}/ha**	**Total harvestable volume** **(2) * (3)* f_d * f_{i1}**
(1)	**(2)**	**(3)**	**(4)**
Virgin forest (good to superior)			
Virgin forest (moderate to poor)			
Logged-over (30+ years)			
Total / weighted average			

Column (4) of table 7 provides an estimate of the total harvestable volume. The total harvestable volume has to be compared with the preliminary allowable cut (AC_{prel}), which is calculated by multiplying the AAC_{prel} with 10 (ten years planning period). If the total harvestable volume as computed in table 7 is below the AC_{prel}, the latter has to be reduced accordingly.

Note: Since the removal threshold is set at 85 m^3 it needs to be checked whether the average harvestable volume of a given stratum is in line with this. Due to uneven distribution of harvestable trees it is expected that the average harvestable volume will be less than 85 m^3. Therefore, a correction factor has to be applied. Until a proper correction factor is calculated from field tests, the factor is set at 0.9. Hence, the average removal of standing volume to be applied in column 3 shall not exceed 77 m^3.

3.5.2 Allocation of coupe and AC to forest districts and forest concessions

Once the allowable cut has been determined, it has to be allocated to the individual districts and forest concessions. This should be done together with the responsible DFOs. In a first step the AC as prescribed in the approved management plans for the concessions has to be subtracted from the total AC calculated for the state. The resulting balance will be distributed to the different forest districts.

There is no fixed rule how to distribute the AC to the districts, but it should be guided by the available harvestable volume. Table 8 below is used to distribute the total allowable cut to the different districts:

In a first step the resource potential is established. Separately for virgin forest and forest logged more than 30 years ago, the net production areas (source: CR) and the average harvestable volumes per ha (source: NFI 4 results) are entered. Following this, the total extractable volume is computed in columns (4) and (7) respectively, by multiplying the production areas with the average harvestable volume per ha. The sum of columns (4) and (7) results in the total harvestable volume per forest district (column (8)). As a guidance for AC allocation the share of the total harvestable volume of a given district of the total harvestable volume of the entire state is calculated in column (9). Finally, the proposed AC per district is entered in column (10).

Table 8: Distribution of AAC to individual forest districts

Forest district	Virgin forest (good to superior)			Virgin forest (bad to moderate)			Logged-over 30+ years ago			Total harv. volume (4)+(7)+(10) (m^3)	% of total harv. volume	Pro-posed (AC*) (m^3)
	Net production area (ha)	$V_{harvvir}$ (m^3/ha)	Total V_{harv} (2) * (3) (m^3/ha)	Net production area (ha)	$V_{harvvir}$ (m^3/ha)	Total V_{harv} (5) * (6) (m^3/ha)	Net production area (ha)	$V_{harv30+}$ (m^3/ha)	Total V_{harv} (8) * (9) (m^3/ha)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(10)
District 1												
District 2												
etc.												
Total												

3.5.3 Selection of compartments to be harvested

The next step is to select the compartments which shall be logged within the planning period. A compartment is considered as harvestable if it comprises of virgin forest or of forests, which have been logged more than 35 years ago. As the planning period is ten years all compartments that have been logged more than 30 years ago at the beginning of the planning period are theoretically harvestable.

The selection of a compartment for harvesting depends also on the type of timber production zone (i.e. TP1 or TP2). Harvesting within TP2-zones is only permitted if soil-conserving harvesting systems are applied. As long as such systems are not introduced, only compartments shall be selected which have a high proportion of TP1 zone. When compartments are selected already a time frame needs to be taken into account until when such systems can be introduced.

For the selection of compartments to be harvested also spatial and accessibility aspects are to be taken into account.

To allow management flexibility, the total harvestable area of selected compartments should exceed the area which is required to realize the AC[12] by about 30%. The final decision which compartments will be actually harvested is subject of the road plan.

A list of all compartments that are eligible for logging shall be prepared according to Table 9. The information can be retrieved from the compartment register.

The table will be filled in district by district. In a first step all compartments stocked with virgin forest that are eligible for logging will be listed. A subtotal for “virgin” compartments is computed for columns (4) to (6). In column (7) the average harvestable volume per ha for virgin forest as ascertained by the forest management inventory ($V_{harvvir}$) is inserted. By multiplying this value with the calculated NPA (column (6)) the total harvestable volume from virgin forest is calculated.

Now all compartments stocked with forest that have been logged more than 30 years ago will be listed in order of the year of logging, starting with the oldest logged compartment. Again, subtotals for production area and harvestable volume are computed, the latter by multiplying the NPA with the average harvestable volume for forest that were logged more than 30 years ago ($V_{harv30+}$).

As many compartments should be selected as are required to match 130 % of the allocated AC of the respective district as allocated in Table 8 (i.e. AC * 1.3 for 30% increase as explained above). These compartments are entered into Table 9 below (one row per compartment). If not enough compartments can be identified which fulfill the harvesting criteria the AC for the district needs to be adjusted accordingly. If the necessary reduction in one or more districts cannot be compensated by higher AC allocations in other districts, the AC for the entire State also needs adjustment.

The compartments earmarked for harvesting shall be indicated on the forest management map.

[12] It is not advisable to exactly define the areas to be logged in the planning period, as there are uncertainties regarding future developments. To identify 30 % more harvestable areas will provide enough flexibility to react to changes regarding e.g. the timber market (demand of species and products), availability of harvesting technologies, etc. It may also occur that a compartment which has been pre-selected for harvesting does not qualify for harvesting, based on the results of the reconnaissance field check (refer to FMPG Section 4b1, available through the CHM: http://forest-chm.aseansec.org).

Table 9: List of compartments to be harvested

Forest district / PRF	Comp. No	Year of last logging	TP2-zone NPA_{TP2} *(ha)*	TP1-zone NPA_{TP1} *(ha)*	Total production area (NPA)*(in ha)*	Harvestable volume per ha *(m^3/ha)*	Total harvestable volume (*m^3/ha*) (6) * (7)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
District 1							
PRF 1	1	---					
“””	2	---					
“””	5	---					
“””	etc.	---					
PRF 2		---					
PRF 3		---					
Etc		---					
Subtotal district 1 virgin						***$V_{harvvir}$***	***calculate***
PRF 1	3	1965					
	7	1968					
	etc	1971					
PRF 2							
PRF 3							
Etc							
Subtotal district 1 logged-over 30+						***$V_{harv30+}$***	***calculate***
Total district 1			**calculate**	**calculate**	**calculate**		**calculate**
Distribution of NPA (%) district 1			**calculate**	**calculate**	**100 %**		
District 2							
continued							
Total State FMU			**calculate**	**calculate**	**calculate**		**calculate**
Distribution of NPA (%) state FMU			**calculate**	**calculate**	**100 %**		

Compartment selection based on simulation of Post-F inventory data

In case post-F data are available for most of the compartments and are keyed into the DIPSIM software application the selection of the compartments should be based on the projected harvestable standing stock.

3.6 Final determination of the AC based on timber production zones

The final AC for every district is determined based on the distribution of the timber production zones. So far, the AC was calculated based on the damage factor $f_{dTP1} = 0.75$ for ground-based logging systems. However, for the TP2 zone, a different damage factor is applicable due to reduced damage ($f_{dTP2} = 0.85$). Therefore, the following calculation is made to take account of that:

TP1% = share of TP1 zone (e.g. 0.31 if 31% of the selected compartments belong to the TP1 zone)

TP2% = share of TP2 zone (e.g. 0.69 if 69% of the selected compartments belong to the TP2 zone)

Note: The area percentage of TP1 and TP2 zones for every district can be calculated from Table 9 (rows “Distribution of NPA (%)”).

$$AC_{TP1} = AC * \%TP1$$

$$AC_{TP2} = AC * \%TP2 * \frac{f_{dTP2}}{f_{dTP1}}$$

$$AC_{final} = AC_{TP1} + AC_{TP2}$$

The resultant final AC will be inserted in the District Forest Working Plan (DFWP). The AC for the state is then the sum of the ACs for all district and forest concession ACs.

By filling in Table 7, the yield is finally determined for the planning period. Table 10 has to be filled in for both, the forest districts and the state.

Table 10: Determination of yield (example)

Yield parameter		TP1-Zone	TP2-Zone	Total (TP1+TP2)	Unit
Total allowable cut	AC	500000	280000	780000	m^3
Annual allowable cut	AAC	50000	28000	78000	m^3/year
Total coupe	C_t	6500	3200	9700	ha
Annual coupe	C_a	650	320	970	ha/year

Notes:

AC = AC_{final} as calculated above

AAC = AC_{final} / 10

C_t = forest area required to realize AC_{final} (source: Table 9)

$C_a = C_t / 10$

Important note:

The distribution of TP1 and TP2 zones are preliminary estimates derived from GIS analysis. Actual distribution of TP1 and TP2 zones can only be assessed during field mapping of forest functions and zones which is carried out during pre-harvest assessment. Therefore, the actual coupe area might deviate from the one expressed in Table 10, i.e. if the total net production area is bigger than assessed during GIS analysis, the coupe area can be increased accordingly during mid-term review and vice versa. If the actual ratio of TP2 to TP1 deviates from the one calculated in Table 9 the AC can be adjusted accordingly.

3.7 Scheduling of the AC

The total AC forms the upper threshold, which shall, by no means, be exceeded.

Although it is advisable to keep the AAC and the annual coupe at the same level throughout the planning period, in some cases it may be advisable or even necessary to plan for different annual working areas. This, for example applies, if the new AAC is considerably less than the previous one and it may take time to downsize the timber processing industry, accordingly. Another example is that it may take time to introduce soil conserving harvesting systems.

The scheduling of the coupe area and the AAC within the planning period is carried out by using the table format below.

Table 11: Scenario for realization of the allowable cut (example)

Year	TP1 zone		TP2 zone		Total (TP1+TP2)	
	Coupe area	Expected AAC	Coupe area	Expected AAC	Coupe area	Expected AAC
	(ha)	(m^3)	(ha)	(m^3)	(ha)	(m^3)
1	1200	92000			1200	92000
2	1000	77000	100	9000	1100	86000
3	900	69000	150	13000	1050	82000
4	750	58000	200	18000	950	76000
5	600	46000	300	26000	900	72000
6	550	42000	350	31000	900	73000
7	500	39000	400	35000	900	74000
8	400	31000	500	44000	900	75000
9	300	23000	600	52000	900	75000
10	300	23000	600	52000	900	75000
Total	**6500**	**500000**	**3200**	**280000**	**9700**	**780000**

Note: This may serve as an example for a situation where it is necessary to gradually downsize the timber processing industry on hand and to introduce soil conserving harvesting technology on the other. The figures for the expected AAC are rounded values.

3.8 AAC justification

The final AAC needs to be briefly explained and justified. If, besides the AAC indicators (formulas), other criteria were applied they have to be clearly pointed out and justified (refer to Chapter 3.4). It also needs to be discussed how the AAC will influence the overall stocking (i.e. whether the AAC is below the ***final*** mean annual increment or above). In case the working areas are not equally distributed throughout the planning period (refer to scenario above) this must be justified in detail.

3.9 Revision of AAC during mid-term review

During the mid-term review it needs to be checked whether

(1) the assumptions made under AAC justification are still valid;
(2) the annual working area has been exceeded;
(3) the actual NPA and the ratio of TP2 to TP1 deviate from the estimates made in Table 9 (estimates based on GIS analysis);
(4) the harvesting systems applied were in line with the prescriptions;
(5) the estimated harvestable volume per ha was realized.

In case the actual average harvested volume per ha was considerably below the estimated average harvestable volume it follows that the total working area needs to be increased.

Depending on the above analysis, the AAC for the remaining five years' period may need to be adjusted. The procedure is described in FMPRG Section 3g (available through the CHM: http://forest-chm.aseansec.org).

Annex

05

Forest Management Planning Rules and Guidelines (FMPRG):

Operational Planning at Compartment Level

gtz

Jabatan Perhutanan
Semenanjung Malaysia

German Technical Cooperation

SFMCP

Sustainable Forest Management and Conservation Project

Malaysian-German Technical Cooperation

Forest Management Planning Rules and Guidelines (FMPRG)

Guideline 4a: Operational Planning on Compartment Level

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Final Draft

August 2005

Technical Document No. B62

Operational Planning on Compartment Level

Section	Operational Planning	4
Sub-Section	Operational Planning on Compartment Level	a

Contents

List of Figures and Tables

Annex

Acronyms and Abbreviations

AAC	annual allowable cut
CFMP	concession forest management plan
CR	compartment register
CRB	compartment record book
DFWP	district forest working plan
DFO	District Forest Office, District Forest Officer
DIPSIM	dipterocarp simulation model
FDPM	Forest Department Peninsular Malaysia
FFM	forest function map
FHIP	forest harvesting infrastructure plan
FMIS	forest management information system
FMPG	forest management planning guidelines
FMPRG2000	Forest Management Planning Rules and Guidelines 2000
FMU	forest management unit
FRIM	Forest Research Institute Malaysia
GPS	Global Positioning System
NEP	rare ecosystem protection
NPA	net production area
NTP	non-productive (zone)
NWP	wildlife protection
P	protection zone
Post-F	Post-F inventory
Post-F2	Post-F2 inspection
SC	soil conservation
SDF	State Director of Forestry
SFD	state forestry department
SMGP	Sistem Maklumat Geografi Perhutanan (Forestry GIS)
SocC	cultural site protection
SP	soil protection
SR	soil reclamation
TP1	Timber Production Zone (without restriction on harvesting system)
TP2	Timber Production Zone (no ground-based skidding with heavy machinery; suitable systems are: long-distance cable yarding systems (air- and soil-borne, helicopter logging, etc.)
WCC	water catchment conservation
WCP	water catchment protection
WFC	flood control protection
WRP	riparian buffer protection

1 General

1.1 Definition and types of plans

Operational planning on compartment level is the detailed planning of forest management activities (i.e. harvesting and silvicultural operations) to be implemented within a specific compartment.

For every working area or compartment a harvesting plan is prepared. Moreover, annual operational plans are prepared on district and forest concession level[1].

1.2 Planning unit

The relevant planning unit is the compartment. Compartments are permanently defined areas for the purpose of planning, implementation of management activities and cost and resource accounting.

1.3 Planning responsibility and approval

The overall responsibility for operational planning lies with the District Forest Officer (DFO). Depending on the specific situation some planning steps or assessment procedures may be delegated to the contractor or concessionaire. The GIS unit of the SFD technically supports the planning exercise.

The SDF formally approves all types of operational plans, i.e. the harvesting plan and the annual operational plan.

1.4 Integration of different planning processes

Operational plans are based on the prescriptions of medium-term forest management plans. The district forest working plans contain a list of compartments that are expected to be ready for harvesting during the medium-term planning period (10 years). These lists are compiled during the preparation of the forest harvesting infrastructure plan; they are merely based on historic information on harvesting of the different compartments, i.e. the years elapsed after logging. Since it cannot be taken for granted that the identified compartments actually have sufficient stocking levels of commercial timber, and to allow for flexibility, the aggregated production area of the listed compartments exceeds the total coupe by 30%.

To ascertain the actual stocking levels of the pre-selected compartments a rapid timber reconnaissance survey (*reco survey*) is carried out. Based on the results of this survey it will be decided whether a compartment is ready for harvesting.

With this decision, the management cycle is opened for the selected compartments, and all planning and assessment processes as described in this guideline will be carried out.

As an output of the pre-harvest planning a harvesting plan will be prepared for these compartments.

Furthermore, the compartment-level planning data provide the information for the preparation of the annual operational plans on district and state level. These plans show the order and extent of all work of any nature to be carried out during one year.

The data generated during assessment and planning on compartment level also provide important inputs for the preparation of the new medium-term forest management plans, i.e. the preparation of state forest management plan (SFMP), district forest working plan (DFWC) and concession forest management plan (CFMP). For example, by growth model-

[1] Detailed prescriptions on the preparation of the different plans are provided in Sections 4b1 and 4b2 of the FMP Guidelines (available through the CHM: http://forest-chm.aseansec.org).

ling based on post-F inventory data potentially harvestable compartments can be identified and the AAC can be estimated with higher accuracy.

The multifunctional zoning on compartment level verifies and refines the forest functions and zones identified on a macro-level zoning during long-term planning. The forest function map and the forest zoning map are updated accordingly. At the end of one cutting cycle the final forest function map and forest zoning map for the whole FMU will be available (refer to Section 2 of FMPG for details).

1.5 Relation to ISO 9002 and other technical guidelines

This guideline describes and regulates the overall planning framework and strategy based on the requirements set by the Malaysian Criteria and Indicators (MC&I) of 2002. As such it sets the frame for technical guidelines which further detail and prescribe the individual assessment and planning steps.

The “Dokumen MS ISO 9002, Dokumen Prosedur Kerja” from April 2001 and the “Manual Kerja Luar Sistem Pengurusan Memilih” of 1997 provide detailed technical prescriptions for specific resource assessment, planning and monitoring procedures, which in some cases need to be adjusted to the prescriptions set by the FMPRG2000.

The “Management Guideline on Silviculture” contains prescriptions for silvicultural planning and implementation, while the “RIL Guidelines for Peninsular Malaysia” defines the procedures and standards for harvesting operations.

For field implementation, separate technical field manuals are prepared for the different planning steps or procedures, following the prescription of the above-mentioned documents including the required adjustments. They provide very specific technical working prescriptions and contain all the forms, tally sheets, etc. required. They serve as supplementary technical guidelines to the FMPRG2000, which can be adjusted at any time.

1.6 Compartment register and compartment record book

All compartment-related information is stored in the compartment register (CR). The CR consists of a relational databank, which is linked with the sistem maklumat geografi perhutanan (SMGP), the Geographic Information System (GIS) on state level. The CR is continuously updated with incoming planning and implementation data. Once the cutting cycle is completed and all compartments have been harvested, detailed information is available for every compartment of the PRF. Hence the CR provides essential information for forest management planning.

The compartment record book (CRB) is an output report from the CR, which provides the forest manager with all important information about a specific compartment. It comprises statistics on forest functions and zones, stand and site descriptions, historical data (i.e. implemented activities and incidents) and planning and implementation data of the current management cycle.

1.7 Compartment management cycle

Management operations in a given compartment are only implemented during a specific time period. This “active” period of a compartment is referred to as the compartment management cycle. Selecting a compartment for harvesting opens the management cycle and completion of all planned silvicultural treatments closes the cycle (refer to Figure 1 for details). The total management cycle may take a period of up to 13 years and comprises of three major blocks:

(1) Pre-harvest assessment and planning

(2) Post-harvest assessments

(3) Silvicultural planning and treatment.

The compartment management cycle contains an array of different types of steps, i.e. assessment and planning steps, administrative steps and implementation steps. The different steps are presented in detail in Chapters 2 to 6 of this document.

2 Pre-Harvest Assessment and Planning

2.1 Selection of compartments to be harvested

For all compartments listed in the FHIP a timber reconnaissance survey is carried out. The objective of the reconnaissance survey is to ascertain in a quick and simple way, whether a compartment has potential for harvesting, i.e. sufficient standing stock of commercial species above the diameter cutting limit. Furthermore, it provides information on stand structure and site conditions. Only if stocking levels indicate harvesting potential, a fully-fledged pre-harvest assessment will be carried out. The survey is supposed to be carried out approximately three years before the actual harvesting. The field manual for the timber reconnaissance survey is included in Section 7 of the FMPG (to be downloaded from the ASEAN's Forest CHM).

2.2 Boundary demarcation

The compartment boundary is surveyed and demarcated in the field following the prescriptions of the ISO 9002. In preparation of the survey the GIS unit of the state prepares a working map for boundary demarcation. The map depicts the compartment boundary as currently stored in the SMPG and the proposed survey stations. Tabular information on the location of the survey stations is attached to the map (bearings and distances in between proposed survey stations).

Upon completion of the boundary survey the coordinates of the boundary survey stations and of the boundary marker trees will be entered into the SMGP. A so-called compartment area map will be generated.

2.3 Preparation of base map (working map)

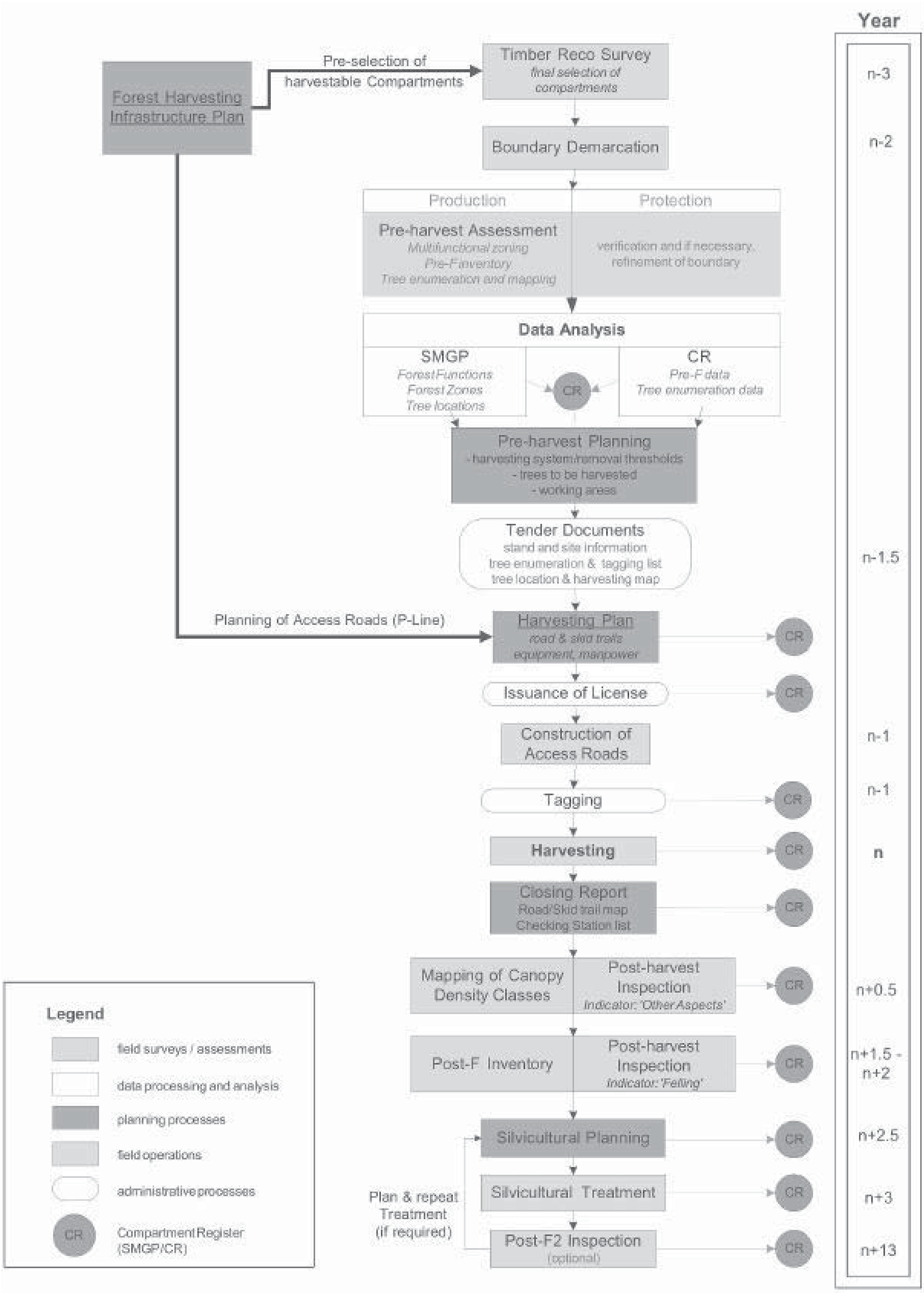
2.3.1 Lay-out of basic survey grid

In accordance with ISO 9002 the basic survey grid has a spacing of 50m * 50m. It consists of a baseline from where the cruising lines start at 50m intervals. Numbering of the base grid is done in accordance with ISO 9002 and as prescribed in detail in the "Field Manual for Pre-Harvest Assessment". The DFO is responsible for the alignment of the base line. Once the baseline is defined, the basic survey grid itself is generated automatically by the SMGP.

For the determination of the base line, the following aspects need to be considered:

- the base line must be linked to a reference point in the field, which can be clearly and reliably identified on the base map
- ideally, a base line shall cut the working area into half
- to facilitate field work, cruising lines shall follow the contour lines as much as possible; this can be achieved if the base line is oriented in a way that it cuts across the contour
- cruising lines need to be as short as possible (maximum length 1000 m).

Figure 1: The Compartment Management Cycle



The base line is the reference line for fieldwork. It needs to be maintained until post-harvest assessment (post-F inventory) is completed. Therefore, its bearing and starting point will be stored in the SMGP/CR.

2.3.2 Map preparation

The GIS unit of the SFO or of the long-term concessionaire prepares working maps for the field teams at a scale of 1:2 500. To facilitate handling the map will be broken down in DIN A 3 sheets. Map generation is supported by SMGP. The base maps contain the following information for a given compartment:

- compartment boundaries including boundary stations and marker trees
- protection zones as identified during macro-level multifunctional zoning
- contour lines
- infrastructure
- waterbodies
- existing and planned permanent roads
  (refer to FMPG Chapter "Forest Harvesting Infrastructure Plan")
- basic survey grid.

2.4 Fieldwork

The pre-harvest assessment comprises three different assessments that are carried out concurrently, namely forest function and infrastructure mapping, pre-F inventory and tree enumeration. The assessments are confined to the timber production zones (TP1 or TP2). With regard to protection zones, only the boundaries are verified and marked in the field.

The "Field Manual on Pre-Harvest Assessment" prescribes the practical implementation of fieldwork in detail. It also contains samples of all field forms and tally sheets to be used and prescribes the way data are recorded, lists the equipment required and how it is used and refers to other specific issues.

2.4.1 Field team and work organization

Fieldwork is carried out by two trained teams of the DFO.

The mapping team is responsible for the establishment of the basic survey grid in the field and for verification and further mapping of forest functions and infrastructure, while the cruising team is responsible for the inventory work.

The mapping team starts work around one week ahead and provides the cruising team with a sketch map indicating the boundaries of the protection zones, which they have already marked in the field. The cruising team follows the survey lines established by the mapping team and marks and measures all trees above 40 cm dbh and indicates their position on the tally sheets.

2.4.2 Establishment of basic survey grid

The establishment of the basic grid starts with the survey of the base line as specified on the working map. The reference point and the start and end of the base line (intersection with compartment boundary) are permanently marked in the field. The starting points of the cruising lines are marked with pegs in such a way, that they last at least until the post-F inventory is conducted. The location of the pre-F plots is marked permanently with a strong peg. All pegs are marked with the reference number of the base grid in accordance with ISO 9002.

2.4.3 Multifunctional zoning and infrastructure mapping

The objective of multifunctional zoning is to identify the net production area and to determine management prescriptions based on the different functions of the forest. During the process, functions and zones identified during macro-level planning will be verified or corrected, as required. Additional functions will be identified and mapped based on field judgements. A detailed description of multifunctional zoning is provided in section 2 of the FMPG.

Before the actual field mapping starts, the DFO or delegate investigates with the local population and relevant authorities whether there are any of the following sites located within the compartment (relevant forest functions in brackets):

- cultural sites (→ Cultural site protection)
- sources for domestic water supply (→ Water catchment protection)
- sites where rare or endangered wildlife species were observed (→ Wildlife protection).

The approximate location of such sites will be sketched onto the base map. In addition, for inland swamps and heath forests, it has to be investigated whether any floods have occurred in the past along streams originating from or draining the compartment in question (→ Flood control protection).

Mapping in the field is done following the basic grid. Already identified functions and zones are verified, and additional ones are identified and indicated on the working map. Taking slope gradient measurements identifies soil conservation and soil protection functions. The boundaries of protection zones are marked in the field in such a way that the boundaries can be detected by the cruising team and during timber harvesting operations.

A working map indicating the location of protection zones is handed over to the cruising team. Once the whole compartment has been mapped, the DFO finally approves the sketch map and hands it over to the GIS unit of the state for digitising.

2.4.4 Tree enumeration and tree location mapping (timber cruising)

Timber cruising is a 100% inventory of all trees above a specific diameter (>40 cm dbh) within the timber production zone. It produces precise information on the harvestable standing stock and its spatial distribution. Knowledge of the location of harvesting trees facilitates the planning of forest roads and skid trails and the determination of the felling direction.

Following the cruising lines, the cruising team measures and marks all trees above 40 cm dbh, whereby distinction is made between protected and non-protected trees. They are marked with different colours and tree numbers. Mother trees are not yet selected at this point[2].

Protected trees are trees:

- of a protected species;
- located on steep slopes, which are not mapped;
- located on a rocky or swampy area, which is not mapped;
- within a distance of 10m from the edge of an entrenchment slope or riverbed;
- that should not be felled for any other reason (e.g. safety, nesting tree, etc.).

Table 1 depicts the types of measurements taken during tree enumeration. All information will be recorded in the tree enumeration list.

Table 1: Measurements to be taken during tree enumeration

Tree status	Location	Tree-no.	Species	dbh	Quality	No. of logs
Non-protected	yes	yes	yes	yes	yes	yes
Protected	yes	yes	yes	yes	no	no

[2] Mother trees are identified upon completion of the tree enumeration list and the tree location map. Using both these inputs, harvesting trees and mother trees are selected.

Presently, the position of a tree within the 50m grid is visually estimated based on an imaginary 10m grid. With improving GPS technology (i.e. better reception and higher accuracy) this method should be replaced by taking of GPS readings.

The process of tree enumeration and tree location mapping is described in detail in the "Field Manual for Pre-Harvest Assessment".

2.4.5 Pre-F inventory

The pre-F inventory is a forest resources assessment within the timber production zone with a 2.5% sampling intensity. It provides a general overview of the resource condition before timber harvesting. Important outputs of the pre-F inventory are stand and stock tables and species composition tables. Since the post-F inventory produces the same outputs, comparing the results of both inventories can assess the logging impact (i.e. differences in stocking levels, differences in species composition). The implementation of the pre-F inventory follows the standard procedure as described in the "Manual Kerja Luar Sistem Pengurusan Memilih" and in the ISO 9002 with the following modifications:

- The spacing of the inventory grid is 200m * 200m equivalent to a 2.5% sampling intensity (1 plot of 0.1 ha per 4 ha).
- Only those plots are included in the sample that fall completely into the timber production zone.
- As the same plots are re-measured after logging (post-F inventory), the starting point needs to be permanently marked with a peg. In addition, the location of the starting point to a not harvestable reference tree is measured. Distance and bearing to the starting point are indicated on the reference tree with red paint and also recorded on the inventory tally sheet.

For further details refer to the field manual. Tally sheets are handed over to the DFO for data entry. Data analysis is done using the analysis module of CR.

2.4.6 Compartment description

At the end of the fieldwork, both teams jointly prepare a short description of the forest stand and the site following the prescriptions of the field manual. This description is entered into the CR.

The stand description is to include: type of forest, main and dominant species, structure, logging status, general condition, particularities, verbal description of functions and prescription of management restrictions.

The site description is to include: topography (aspect, slope, altitude), drainage, geology and soil type and other particularities.

2.5 Data analysis and mapping

2.5.1 Data processing

All data are transferred to the SFO and entered into the CR (e.g. stand and site description, inventory results) or the SMGP (sketch maps and all geo-referenced information). The results of multifunctional zoning are digitised and the corresponding GIS layer is updated accordingly. The SMGP prepares area statistics for the different forest functions and zones as specified in FMPG Section 2a and calculates the net production area. The results are transferred to the CR.

The following outputs with tabular information are prepared for the assessed compartment:

- tree enumeration list
- stand and stocking tables
- species composition tables
- area statistics on forest functions and zones.

2.5.2 Map preparation

2.5.2.1 Forest function map

The SMGP prepares a compartment Forest Function Map according to the specifications of sections 2a and 6 of the FMPG. Based on this map forest zones will be delineated.

2.5.2.2 Tree location and zoning map

Following the prescriptions of section 6 of the FMPG ("Mapping", available for download from the ASEAN's Forest CHM), the GIS unit of the state prepares a draft tree location and zoning map at a scale of 1:2 500, which contains the following information:

- forest zones

TP1 Timber Production1
TP2 Timber Production 2
P protection
NFA non-forest area

- location of marked trees

tree status and tree number
size of trees (according to dbh classes)
species group

- existing infrastructure (roads, etc.)
- contour lines
- waterbodies.

2.6 Pre-harvest planning

Pre-harvest planning is the responsibility of the DFO, but needs formal approval by the SFO.

2.6.1 Decision on harvesting system

The DFO decides on the harvesting system(s) to be deployed within the compartment and delineates the area(s) on the tree location and zoning map. Main criteria to be applied are:

- spatial distribution and size of the different production zones, i.e. TP1 and TP2
- the minimum area to be assigned for a given harvesting system (varies with system)
- topographic features: slope, length of slopes, relief (degree of dissection).

2.6.2 Selection of trees to be harvested

Using the tabular and mapping outputs described under chapter 2.5, the DFO selects the trees to be harvested. The following criteria/issues have to be taken into account:

- specified removal thresholds (i.e. max. number of trees per ha or max. standing volume per ha) per production zone[3]
- minimum diameter cutting limit
- species composition and spatial distribution of species
- standing volume (by dbh class)
- distance to the next harvestable tree (distance rule)
- availability of four mother trees per ha.

The process of tree selection for harvesting is prescribed in the "Management Guideline on Silviculture". Trees selected for harvesting are assigned a serial tag number as specified in the ISO 9002; the number is recorded in the timber tagging list[4]. The tagging list has to be approved by the SDF.

Once the trees are selected, the GIS unit of the state prepares the tree location and harvesting map. This map is based on the tree location and zoning map. In addition to the latter it depicts the prescribed harvesting system and the selected harvest trees.

2.6.3 Identification of working area

As a general rule the working area for a logging license should be equal to the compartment. However, a compartment may be divided into two or more working areas for the following reasons:

- Two different harvesting systems have been identified, but local contractors are specialised in one harvesting system only.
- The production zone of one compartment is very large and its harvesting within a limited time frame is beyond the capacity of one contractor.

It is prohibited that working (license) areas cover parts of two or more compartments.

2.6.4 Data entry in CR

The section planning and implementation of harvesting in the CR allows the planning of two different harvesting systems. For each harvesting system (or working area) the net production area, the cutting limit and the tagged standing volume need to be recorded. In addition, the systems are described including the applicable management prescriptions.

2.7 Selection of contractor (tender)

This chapter refers to short-term licenses for harvesting only. It is not applicable to long-term concessions. The licensing procedure follows the prescriptions of the ISO 9002.

2.7.1 Preparation of tender documents

Tendering is the standard procedure for awarding harvesting licenses. For each working area the SFD prepares the tender documents, which contain the following attachments as hard and softcopies:

- Compartment record sheet of the specific compartment: This contains the estimate of the net production area, results of the pre-F inventory (stand and stock tables), the harvestable standing volume by harvesting system and the management prescriptions.

[3] The thresholds may vary depending on the employed harvesting system.

[4] Note: The timber tagging list evolves from the tree enumeration list by indicating the tree status and the tag number.

- Timber tagging list: Provides information on tree species distribution, tree dimensions, timber quality, number of logs, etc.
- Forest function map: Depicts the different functions of the forest.
- Tree location and harvesting map: Provides all required information to plan infrastructure, equipment and manpower requirements, and to prepare the road and skid trail plan.

2.7.2 Preparation of harvesting plan

Based on the information provided by the tender documents the competing contractors prepare a proposal for the harvesting plan, which is an obligatory component of the offer. The harvesting plan is prepared in accordance with ISO 9002.

Main components of the harvesting plan are:

- road and skid trail plan including other infrastructure (preferably as GIS layer)
- list of equipment and machinery to be used
- specification of manpower (number and qualification)
- time schedule for activities.

For more details refer to Section 4b2 of the FMPG (available online from the ASEAN's Forest CHM) which describes the preparation of harvesting plans.

2.7.3 Issuance of license

Short-term licenses for timber harvesting are issued in accordance with the ISO 9002.

Based on the offer and the attached harvesting plan, the DFO and SFO will award and issue the license. Main criteria for the selection of the contractor are:

- quality of technical bid (proposed road and skid trail density, standard of equipment used, skill of manpower, etc.)
- past performance (refer to contractors list)
- financial bid.

Once the license is issued, the harvesting map (road and skid trail plan) is entered into the SMGP by the GIS unit of the SFD. The harvesting plan incl. road and skid trail plan (harvesting map), the tree location and harvesting map, the forest function map, and the tagging list are also issued to the licensee and are legally binding.

2.8 Harvesting preparation

Harvesting preparation is coordinated by the DFO and carried out successively at least one month prior to the harvesting of a given logging block. It mainly entails the marking of roads and skid trails and timber tagging. This work should be integrated with the monitoring and controlling of the logging operations, which is also of the responsibility of the DFO or his delegate.

Roads and skid trails are aligned in the field according to the harvesting plan and roadside trees are measured, recorded and tagged. Trees selected for harvesting are tagged and the felling direction will be indicated by the position of the tag on the tree. For the determination of the felling direction the position of the trees in relation to the planned roads or skid trails will be decisive. At this stage, also the selected four mother trees per ha will be marked.

Timber tagging follows the prescriptions provided in ISO 9002.

3 Closing Report of Contractor

3.1 Preparation of road map

Upon completion of the harvesting operations, the contractor maps all roads, skid trails and other infrastructure. The resulting road map depicts the following information:

- alignment of (i) main roads, (ii) secondary roads and (iii) skid trails;
- permanent log yards;
- temporary log landings and
- bridges and culverts.

Mapping of these features is supposed to be done with GPS. The survey data and the road map are handed over to the DFO together with the closing report (refer to Chapter 3.2). The GIS unit of the SFO enters the information into the SMGP. Following this, the actual alignment is compared with the planned one and deviations are recorded. The result is forwarded to the DFO for post-harvest inspection and evaluation.

3.2 Closing report

The contractor prepares a closing report once harvesting operations are completed. The content of the closing report is specified in the ISO 9002 and comprises information on logged areas, harvested timber volumes, paid royalties and fees, trees removed, constructed roads and skid trails, etc. The road map and the log production list are to be attached to the report. All data should also be provided as softcopies for easy data entry into the CR.

This closing report will be checked by the DFO on completeness and plausibility (refer to Chapter 4.2.1).

4 Post-Harvest Assessment

4.1 General

Post-harvest assessment starts after closing of the working area. Its objectives are:

- to evaluate the overall work performance of the contractor, i.e. the compliance with plans, standards and management prescriptions. The evaluation is based on defined performance indicators, which are assessed in the field. These performance indicators are important criteria for internal assessment and certification.
- to assess the forest condition after logging in order to plan for silvicultural follow-up measures and to provide data for growth modelling. This is done by mapping the area according to different forest canopy density classes and by implementing a post-F inventory.

The post-harvest assessment is carried out by a specialized team of the DFO.

The GIS unit of the state prepares a working map for post harvest assessment at a scale of 1:5000. This map contains roads, skid trails and other infrastructure, the location of the mother or other retained trees, and the basic grid established for pre-harvest assessments.

Specific technical guidelines for fieldwork including checklists, forms, tally sheets and mapping procedures are described in the “Field Manual for Post-Harvest Assessment”.

4.2 Post-harvest evaluation

The post-harvest evaluation comprises (i) the validation of the closing report, (ii) the comparison of tagged and extracted (recorded) timber volume and (iii) the assessment of performance indicators in the field. In case a compartment has been divided into different working areas separate post-harvest evaluations are carried out for each working area (i.e. contractor).

4.2.1 Validation of closing report

The DFO checks the closing report of the contractor on completeness and plausibility (refer to ISO 9002 for report standards) and forwards it with his comments to the SFO for approval.

4.2.2 Comparison of tagged timber volume and logs recorded at checking station

The log data recorded at the checking station are entered into the compartment register and are compared with the timber tagging list. The following questions are analysed:

- Have all the tags issued reached the checking station?
- Is the difference between the tagged standing volume and the measured log volume within an acceptable margin?

The relation of the logged volume/tagged volume expresses the amount of timber left in the forest as logging waste (i.e. exploitation factor) and is a good indicator for the logging performance. The tolerable exploitation factor f_e is set at 0.8. If it’s value drops below 0.75 then logging waste is high, if it is above 0.85 then the logging waste is low. This factor is entered into the checklist for calculation of the performance indicator “Other aspects” (refer to Chapter 4.2.3 and to the Annex).

4.2.3 Assessment of performance indicators

In addition to the prescriptions of the ISO 9002, the DFO checks the quality of work in relation to the compliance with other regulations (i.e. RIL Guideline) and the harvesting plan. The assessment is based on field inspections. The objectives of this assessment are twofold:

1. to evaluate the impact of the harvesting operation on the remaining stand and site,
2. to evaluate the performance of the contractor.

The final output of the post-harvest evaluation is a rating for two performance indicators, which are described below. The procedures for the inspection are described in the “Field Manual for Post-Harvest Assessment” and the indicators are determined by filling the respective forms attached in the Annex. Both performance indicators are recorded in the CR. The comparison of these performance indicators at periodic time intervals indicates whether the overall working performance has improved or not, which is an important aspect of internal assessment and certification.

4.2.3.1 Performance indicator: felling

The felling performance indicator refers to the effects of harvesting on the remaining stand and will provide an indication on the actual felling intensity, the damage caused to the residual stand and the work performance of the logging contractor.

The assessment of this performance indicator is carried out concurrently with the post-F inventory, i.e. 1.5 to 2 years after harvesting. In all post-F plots the following criteria are assessed:

Criteria	No.
No. of trees felled, which were not marked for felling	
No. of residual trees damaged	
No. of un-felled trees which were marked for felling	
No. of protected trees felled	
No. of high stumps	

Using a scoring system, the performance indicator ”felling” is calculated which will have a value between 1 (bad performance) and 3 (good performance). The scoring sheet is attached in the Annex.

4.2.3.2 Performance indicator: other aspects

This parameter indicates the compliance of the contractor with technical standards of road construction, lay-out of skid trails, application of prescribed harvesting technology and the observation of protection and buffer zones.

While some of the information required can be directly derived from the SMGP (i.e. road and skid trail density, deviation of alignment from plan) other information has to be checked in the field. This refers mainly to the compliance with feeder road standards and the integrity of protection zones.

Feeder road standards are checked for permanent feeder roads only at 10 sample spots, which are systematically laid out. This is carried out concurrently with the mapping of canopy density classes after completion of harvesting (Figure 1). Based on a scoring system, all parameters are combined and a performance indicator “Other aspects” is calculated. The scale ranges again from 1 (bad) to 3 (good).

4.2.4 Contractor list

The performance indicators are recorded in the contractor list, which is kept by the SFO and which is part of the FMIS. Past performance of contractors should be one of the most important criteria for selection of contractors for new logging licenses.

4.3 Mapping of canopy density classes

Based on the working map for post-harvest assessment prepared by the GIS unit of the SFO the forest is mapped according to three canopy density classes using the road and skid trails and the basic grid as a reference: The density classes are:

Class no.	Name	Canopy density of dominant or emergent trees
1	Closed canopy	> 75 %
2	Broken canopy	25 – 75 %
3	Open canopy	< 25 %

The field sketch map is handed over to the GIS Unit of the SFO for digitising and preparation of the draft silvicultural treatment map. The mapping of canopy density classes is an important tool for silvicultural planning since it identifies and locates those areas that are heavily disturbed and, hence, require a high input of planting and tending operations.

Further details are specified in the “Management Guideline on Silviculture”.

4.4 Post-F inventory

A specialized team of the DFO carries out the post-F inventory around 1.5 to 2 years after harvesting. The objectives of this inventory are:

- to assess the forest condition after logging;
- to provide data for the assessment of the logging impact (comparison pre-F/post-F);
- to provide data for growth modelling.

The post-F inventory plots should be identical with those of the pre-F inventory. The post-F is done following the prescriptions of the “Manual Kerja Luar Sistem Pengurusan Memilih”). Outputs of the post-F inventory are stand and stock tables and species composition tables.

4.4.1 Comparison pre-F/post-F

By comparing pre-F and post-F data, the logging impact on the forest can be assessed. For this purpose the species composition and tree numbers per diameter class are compared. If there is a considerable change in the number of trees per ha in the lower diameter classes, then the damage caused to the remaining stand by logging operations is high (for an example refer to Figure 2).

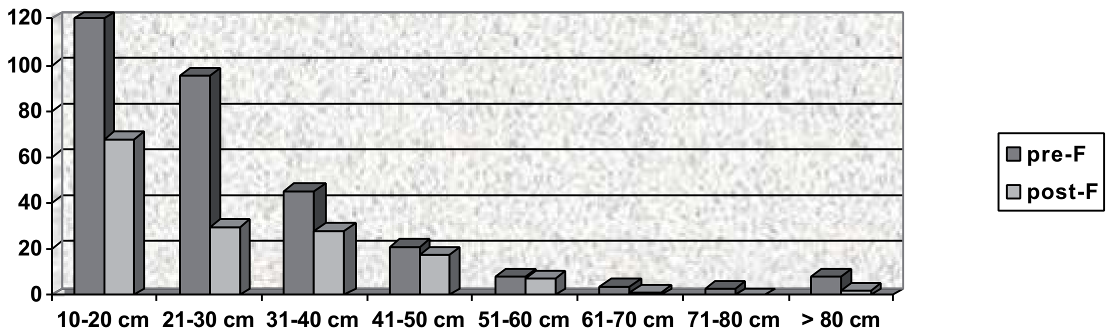
The damage factor f_d as an expression of the logging damage is calculated as follows:

$V_{pre\text{-}F}$ Total standing volume before logging
V_{tagged} Total standing volume tagged
$V_{post\text{-}F}$ Total standing volume past logging

$f_d = V_{post\text{-}F}/(V_{pre\text{-}F}-V_{tagged})$.

If the damage factor (f_d) for ground-based skidding drops below 0.75 and for airborne logging below 0.80 then the damage caused to the residual stand is below the tolerable margin. In this case it shall be recorded in the contractor list (refer to Chapter 4.2.4).

Figure 2: Diameter distribution of a stand with high logging damage



4.4.2 Growth modelling

Based on the post-F inventory data and on the tree enumeration list, the growth of the forest after harvesting is simulated with the help of the DIPSIM growth simulator. The harvestable volume and the year for the next cut are predicted. This information is of great importance for AAC calculation and the preparation of the harvesting scenario in medium-term forest management planning.

4.5 Stand description

The stand condition after harvesting is described and replaces the previous stand description (i.e. before harvesting) in the CR. The stand description is based on the post-F data, the distribution of canopy density classes as indicated on the draft silvicultural treatment map and on visual observations made during field assessment. It shall include: type of forest, main and dominant species, structure, logging status, general condition, particularities, verbal description of functions and prescription of management restrictions. For details, refer to the “Management Guideline on Silviculture” (available online through the ASEAN’s Forest CHM).

5 Silvicultural Planning and Treatment

Silvicultural planning is the responsibility of the DFO. It is done as soon as the stand & stock tables from the post-F inventory are available from the SFD.

Silvicultural operations are planned for each canopy class separately based on the information derived from the stand & stock tables. They shall be indicated on the silvicultural treatment map. The procedure is described in detail in the “Management Guideline on Silviculture”.

For plantations it is recommended that specialists from SFO or FRIM carry out a site survey.

Planned operations shall be prescribed and recorded in the compartment register.

The responsibility for the implementation of silvicultural operations lies with the DFO.

6 Post-F2 Inspection

For compartments containing areas with canopy densities below 25% in which intensive silvicultural treatments were implemented, a post-F2 inspection is carried out 10 years after harvesting. Its objective is to ascertain the regeneration status. If regeneration is insufficient further silvicultural treatment has to be planned and implemented.

Annex : Checklist for calculation of the performance indicators

Performance Indicator "Other Aspects"

Assessment is done after termination of the harvesting operations (post harvest assessment).

Information on standard of performance	unit	Score 1	Score 2	Score 3	score	weight	total
Compliance with perm. feeder road standards (see box: compliance with …)	% yes	< 50	50-80	> 80		1	
Feeder road alignment deviation from plan	-	heavily	tolerable	minor		4	
Length (m) of all feeder road per ha production zone	m/ha	> 40	30 - 40	< 30		1	
Cross drains for temporary feeder roads established, natural drainage pattern restored	y/n	no		yes		2	
Skid trail alignment deviation from plan	-	heavily	tolerable	minor		2	
Length of skid trails per ha production zone	m/ha	> 300	200 - 300	< 200		2	
Cross drains for skid trails established, natural drainage pattern restored	y/n	no		yes		2	
Exploitation factor: Relation of logged volume to tagged volume	%	< 75	75-85	> 85		4	
Harvesting equipment used as prescribed	y/n	no		yes		4	
Felling of trees in protected areas and buffers	y/n	yes		no		4	
						total score	
Performance indicator "other aspects"	score	< 42	42-62	> 62			

Remark: total = score x weight

Box: Compliance with permanent feeder road standards

Standards for permanent feeder roads are checked at 10 sample spots, for culverts and bridges the closest ones to the sample plot are checked. Distance between the sample spots is total length of permanent feeder roads within the compartment / 10.

Checking list for permanent feeder roads
(fill at sample spot, enter y/n)

sample spot No.	1 gradient	2 camber	3 cross fall	4 carriage way	5 v-shape drain	6 culvert	7 bridges	8 right of way	9 drainage clearing
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Road Standard (see below)

Results Total	No.	%
yes		
no		

No.	Specification of road standards
1	Gradient of road <= 20%, but will follow natural benches and features and when using existing roads or as specified by the Forest Engineer
2	Road camber at least 1:20 (5%)
3	Cross-fall at least 1:33 (3%)
4	Carriage way (single lane) with width of at least 4m, except at corners and lay-bys
5	V-shaped side drains (earth) along feeder roads constructed
6	Adequate culverts of log/concrete/metal/high density polyethylene (HDPE) located at stream or river crossing, where required or as specified by the Forest Engineer
7	Bridges of timber/concrete box culvert/steel of at least 3.5m in width at stream or river crossing
8	Right of way <= 15m
9	Drainage, culverts are cleared, no debris or sediment does obstruct water flow

Performance Indicator "Felling"

The felling performance indicator is assessed in conjunction with the Post-F Inventory in all post-F sample plots.

harvesting block 1	Features to be checked	number of stems per sample plot																				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
	Felling of trees not marked for felling																					
	Felling damage to the residual trees																					
	Unfelled trees which were marked for felling																					
	Felling of protected species																					
	High stumps (> 50 cm)																					

Features to be checked	score			score	weight	total
	1	2	3			
Felling of trees not marked for felling	> 2	1 - 2	0		3	
Felling damage to the residual trees	> 6	3 - 6	< 3		2	
Unfelled trees which were marked for felling	> 2	1 - 2	0		1	
Felling of protected species	> 2	1 - 2	0		3	
High stumps	> 8	4 - 8	< 4		1	
					Total Score	
Performance indicator "Felling"	**< 15**	**15 - 25**	**> 25**			

Annex

06

Management Guideline

Silviculture of Dry Inland Forests of Peninsular Malaysia

gtz

Harvesting and Natural Forest Silviculture: Disturbances to the Forest Ecosystem

Paper presented at the Seminar on
Best Management Practices for Achieving Sustainable Forest Management –
20 years of Malaysian-German Cooperation in Tropical Forest Management
Kuala Lumpur[1]

7-8 September 2005

Gerd Weinland

Abstract

Harvesting disturbs the forest ecosystem. The speed with which a harvested forest will return to a mature state depends on harvesting intensity, disturbance level, floristic composition of the remaining vegetation and the likelihood of the economic species to establish in the harvested forest. The recovery of the harvested forest to a productive state requires certain improvements in the management and operational measures, esp. concerning specifications for selection of harvestable trees (multiple threshold approach), reduced-impact harvesting including retooling of the harvesting machinery/equipment, training of field operators at all levels and early silvicultural treatment of the harvested areas. To prevent possible decline in genetic diversity, loss of productivity and environmental fitness it is important that damages to the seedling/sapling bank of the commercial species present at the time of harvesting are minimized, that good quality adult trees are retained as mother trees and that harvesting damages to them are minimized.

Key words: Silviculture, silvicultural systems, harvesting, forest disturbance, forest ecosystem, succession.

[1] slightly updated edition of June 2007.

Contents

Annexes

1. General

In countries with a long-standing forestry tradition silviculture is perceived as indispensable and integral part of forest management decisions and operational practices. As a definition of silviculture states (Ford-Robertson 1971):

“Generally, silviculture is the science and art of cultivating (i.e. growing and tending) forest crops based on the knowledge of silvics and more particularly, the theory and practice of controlling the establishment, composition, constitution and growth of forests.”

In tropical forests, the enormous economic pressure and the established practice of timber exploitation have largely denied silviculture such control. Field operations are usually inconsiderate and conflict with the specified objectives of natural forest silviculture, which aims at a swift establishment of the new forest by natural regeneration that would contain a high proportion of value-timber species. Human interventions, mainly road construction and logging, have adverse medium- and long-term ecological effects of – sometimes – alarming proportions on species and habitat diversity and on forest ecosystem structure and functioning (see Table 1).

The Selective Felling System applied in Peninsular Malaysia’s forest operations in general acknowledges that harvesting operations should be carried out with restraint in order to minimize disturbances and damages to forest stand and site. Such reduced-impact approach can only be effective and displays its full benefits if all elements of the current forest management practices are properly adjusted. Everywhere in the tropical production forests the structure and constitution of the stands are substantially changed by logging. The negative effects of logging practices in Malaysia were investigated and described since long, e.g. by Burgess (1971), Fox (1968), Liew & Ong (1986), Uebelhoer (1989).

The continuing criticism of the logging practices everywhere in the tropical region eventually made it inevitable that codes for road construction and logging were set up, e.g. in Peninsular Malaysia (Forestry Department HQ 1988a/b/c, 1996a/b, 1997, 1999) and outside Malaysia e.g. by Guayana Forestry Commission (1996), South Pacific Forum (1995), and by FAO (1999). There is a huge pool of established practical knowledge on proper logging operations available. It is striking that after so many years of successful research on logging and issuance of technical guidelines, especially on reduced-impact logging, which according to some researchers has proven its feasibility (e.g. Holmes et al. 1999), there appears to be as yet no large-scale implementation everywhere in the tropics.

To quote from Ford-Robertson’s definition of silvicultural system (1971):

„Silvicultural system is a process following accepted silvicultural principles, whereby the crops constituting forests are tended, harvested and replaced, resulting in the production of crops of distinctive form. Systems are conviently classified according to the method of carrying out the fellings <u>that remove the mature crop with a view to regeneration</u>.“

The definition stresses the close link between the way in which the mature crop is removed (harvesting) and the way in which the new crop established (regeneration). In the Malaysian context this link between crop removal and regeneration establishment was deliberately disconnected when in 1966 a policy shift was formulated stating that inadequacy of “seedling stocking before felling should not be allowed to hinder the progress of exploitations” (Ismail Ali 1966). Similarly, Mok (1977) clearly expressed that the forests should be managed by selective fellings and that the then new management system for Malaysia should “emphasize judicious management and perpetuation of the existing forest resource than its regeneration”.

These two statements mark a fundamental deviation from established silvicultural system principles, which were developed for good reasons of the continuity of a controlled regeneration process including the seedling/sapling stage.

Leslie (2001) emphasises that reduced-impact harvesting should be embedded into the objectives of sustainable forest management, namely:

(1) There is no long-term disturbance to the stability and dynamics of the forest ecosystem (within limits of system elasticity).

(2) There is no irreversible damage to the environment on which that ecosystem depends or to the environments and the societies which depend on the ecosystem.

(3) RIL (Reduced-Impact Logging) must not hinder, and, preferably, should assist regeneration of the harvested parts of the forest in a form that maintains ecosystem integrity.

Leslie states: "These three conditions set the degree of impact reduction that must be achieved and not the damage that may be tolerated". Furthermore, it is assumed that the implementation of reduced-impact logging means a reduction in output from the forests and of profits to be expected.

2. Ecological Aspects

Succession is the gradual supplanting of one community of plants by another. Under undisturbed conditions the succession is called primary. Disturbances, e.g. harvesting interferes with the primary succession and a secondary succession is set in motion supplanting the whole or part of the original vegetation.

Primary natural forests appear to be rather stable plant communities showing a mosaic structure of forest patches in different states of development. It is assumed that succession in primary forests takes place in these rather small patches (starting with gaps in the canopy) the size of which should correspond to the size of the crown projection area of one or two dominant/emergent trees that have died from natural or exogenous causes (e.g. lightning strike or wind-throw). Usually, these disturbances are confined to comparatively small areas (patches) giving the humid tropical forests a finely tuned complex vertical and horizontal structure with the patches in various stages of succession.

The Mosaic Cycle Concept of ecosystems deals with the succession process in such patches (Remmert 1991, Rosauer 1998). "Succession within ecosystems progresses between several species associations which will each dominate a patch in turn. While this cycle takes place on a particular patch of forest, similar processes are taking place on adjacent patches, but out of phase with each other." The initial stage of a patch is the gap. Dipterocarps are late seral species and are especially suited to exploit these initial gap conditions. They are considered "gap opportunists" (Lamprecht 1989), meaning that the young trees from the seedling/sapling reservoir are able to take immediate advantage of the improved light conditions in the natural gap openings, since they have been selected for immediate response displaying fast height growth as soon as canopy gaps come into being. In parallel, they have been selected for traits such as comparatively frequent fruiting, thus keeping a continuous reservoir of young regeneration on the shaded forest floor, and the ability to survive under closed canopy for some time. The importance of gaps in the early development of dipterocarps may suggest carrying out low intensity harvesting operations by emulating gap dynamics, which would then be on individual tree scale. While such an approach could be considered suitable for specific ecosystem management/research purposes (e.g. maintenance of mature or old-growth forest structure and function while allowing some timber extraction; investigations of the effect of gap size on ecosystem processes), for practical/technical reasons harvesting with today's technology would probably always be at "intermediate disturbance levels". However, to ensure the successful establishment of the new crop it first of all would be required that (1) sufficient potential regeneration (young and advanced) is left in the harvested area (see also minimum stocking standards acc. to Tang (1978) and Thang (1987, 1988) and (2) pioneer vegetation of the inhibiting type is effectively kept under control.

In their Successional Pathway Model Connell & Slatyer (1977, cit. Rosauer 1998) deal especially with the support function of the pioneer vegetation (support to the establishment of later seral species). They distinguish three support classes.

(1) The first class of pioneer species establish following disturbance and gradually <u>facilitate</u> the establishment of later seral species by altering the environmental conditions.

(2) With successional <u>tolerance</u> any species establishes under the site conditions and environmental changes caused by them have little or no impact on the vitality of later successional stages.

(3) With successional <u>inhibition</u>, however, the disturbed area is colonized by vegetation that inhibits the establishment, growth and survival of the later seral species and in extreme cases virtually arrests the succession progress be it by actions in the soil layer (e.g. through allelopathy) or by persistently shading out later seral species.

Observations by Wyatt-Smith (1949, 1965) suggest that there is a group of secondary pioneer species which are more favourable to the survival and growth of late seral species to which the economically important species of dipterocarps belong than other pioneer species (called "weed species"). While much of the colonizing vegetation is rather tolerant even in the beginning facilitating the establishment/performance of late seral species (e.g. *Macaranga spp*, *Mallotus sp*.) some colonizers may significantly inhibit the successional process. Examples for strong inhibition are the colonisation of logged areas with bamboo species and the exuberant growth of bertam and persistent climbing/strangling/rambling vegetation in many parts of the Malaysian Hill Forests (e.g. Gill 1968, Wyatt-Smith 1965). In all these cases the succession cannot proceed in an orderly manner and would require extensive external silvicultural input to set a swift, desirable successional progress in motion. Harvesting and silviculture have to be designed and carried out in a manner that ensures that development of inhibiting vegetation is kept under control.

The vegetation found in harvested areas not only consists of colonizing pioneer species, but also of vegetation that has remained. After removal of merchantable timber tree advance and young regeneration of commercial and of undesirable species, shrubs and dormant seeds remain and constitute the initial vegetation pool in various states of abundance and destruction. Egler (1954, cit. Rosauer 1998) shifts the attention to the importance of this "initial floristic" component and considers it much more important to the composition of the later seral stages than the floristic component that invades from outside the harvested areas (called "relay floristic" component). This is especially so in case of large openings and of species with limited dispersal distances as is generally observed in dipterocarps. The larger the openings the more relevant is the "initial floristic" component of the vegetation for a swift successional progress. Anthropogenic (harvesting) interventions into natural forests often create openings of stand level size accompanied by heavy disturbance of the vegetation (see Table 2). In extreme cases the pool might have been destroyed completely with the nutrient sink (vegetation, soil) heavily disturbed and the internal nutrient cycling disrupted. The remaining vegetation and soil nutrient sink, which can be called a "biological legacy", is important to the progress of revcovery. In large open areas the successional progress of the dipterocarp element depends first of all on the presence of a young/advance regeneration of dipterocarps in the initial vegetation pool. In case the biological legacy has been squandered by excessive destruction the recovery depends on outside seeding from adjacent and intact trees or parcels of forest with the regeneration establishment starting from the fringes of the openings. In case mature commercial trees are not available in the vicinity the disturbed area cannot be regenerated with commercial timber trees by natural means and the area has to be considered degraded or derelict (Wyatt-Smith 1965).

If managers want to ensure that a specific association, group of trees etc. returns to an opened site, the “initial floristic” element is a most relevant element regarding the establishment of dipterocarps. It has to be ensured that regeneration of dipteorcarps is present after harvesting when post-disturbance succession begins. The timing of the disturbance by harvesting operations in relation to the presence of young regeneration (seedlings, saplings) and the retention of mature trees on the site are the most important factors in the eventual species composition of the site. Whether the site needs only to be left undisturbed for a sufficient period of time for the rain forest species to develop once regeneration has commenced, depends on the presence and development of aggressive and persistent weed plants (bamboo, rattans, wolf trees with dense crowns etc.) swamping the opened site and shading out the more important tree species and consequently arresting the succession and requiring silvicultural interventions. On the other hand, if seed dispersal from adjacent forest (relay floristic model) can substantially contribute (small openings), different treatment would be required.

Although unintentional, harvesting of the biggest trees appears to remove the more desirable genetic traits from the population thus representing a negative directional selection. Together with the sudden disruption of the forest environment and the habitat fragmentation on stand and even landscape scale, an anthropogenic development process has in many cases been set in motion, which has to cope with loss in species diversity and genetic erosion within the commercial species. Ho et al. (2003) investigated the immediate effects of logging on genetic diversity of Shorea curtisii. They concluded from their investigation that:

(1) the reduction of genetic diversity measures was in the sequence saplings <seedlings <adults;

(2) a single selective logging event under SMS caused a significant loss in genetic diversity of adult trees in the logged stand;

(3) an existing good seedling or sapling bank may compensate for these immediate losses in genetic diversity;

(4) it is crucial that sufficient undamaged good quality adolescent or bigger trees be left behind to ensure good regeneration in the residual stands.

Current logging practices represent high grading of sort by size and lead to a reduction in genetic diversity. There is mounting evidence that tree populations that suffered genetic losses seem to be more susceptible to productivity decline and decline in environmental fitness (Ho et al. 2002). Habitat fragmentation, creation of small isolated populations of species/species groups and serious disruption of flowering and pollination patterns are additional negative consequences of current logging practices.

It is concluded:

(1) Harvesting should only be carried out in blocks containing sufficient stocking (young/advance regeneration of economically important later seral species).

(2) Harvesting should be carried out in a manner that minimises losses of the young and advance regeneration of commercial species.

(3) An existing good seedling/sapling bank may compensate for losses in genetic diversity caused by the removal of the biggest trees during harvesting.

(4) Harvesting should be carried out in a manner (reduced-impact on vegetation and soil structure) that minimizes soil erosion and nutrient loss and supports the restoration of the internal nutrient cycling.

(5) Harvesting should concentrate on trees of young mature status when productivity of individual trees is near or at its maximum, which leads to higher cutting limits than currently applied resp. formulated.

(6) The selection process during harvesting planning should ensure that a sufficient number of good quality adult trees is left in the harvested area that could occasionally replenish the young regeneration and help to maintain genetic diversity. Harvesting operations should ensure that these adult trees are not damaged.

(7) Post-silvicultural operations should focus on early removal of inhibiting vegetation.

3. Logging

Logging is defined as felling and extraction of timber, particularly as logs (Ford-Robertson 1971). "Reduced impact" means that logging should be done with as little damage to residual stand and forest site as possible. Damages are inflicted at different operational stages, from opening-up to hibernation of the harvesting site.

The management cycle, of which the logging/harvesting operations are part and parcel, usually stretches over several decades from one to the next pre-harvesting operation (see Fig. 1). In Peninsular Malaysia the cutting/harvesting cycle covers 30 years (SMS) to 55 years (MUS).

Harvesting of forests cannot be done without inflicting some kind of damage to forest soil and forest stands. What is important is that the long-term strains which are considered irreversible are minimized or altogether avoided. Hendrison (1990) has given a description of the overall impact of logging operations concerning the stress factors, the subsystems affected and the reversibility and irreversibility of the strains to the forest ecosystem and its parts (see Table 1). The harvesting damages to the forest site and stands have been studied from the inception of large-scale logging operations (e.g. Abdulhadi et al. 1981, Appanah & Putz 1984, Borhan et al. 1987, Boscole & Vincent 1998, Burgess 1973, Buteaud 1998, Cedergren et al. 1995, Fox 1968, Griffin and Caprata 1977, Hendrison 1990, Kamaruzaman 1988 and 1994, Malmer & Grip 1990, Nicholson 1958, Nik 1994, Tuttle 1996). In the Malaysian context guidelines and operational manuals for harvesting and road construction have been formulated (e.g. Benneckendorf 1994, Forestry Department HQ 1997, 1999, 2003, Lohuji & Taumas 1998, Nik 1994, Borhan & Guglhoer 191998, Weinland et al. 1999, Weinland 2003).

If properly enforced and applied there should be no major problem to reconcile environmental requirements and forest ecosystem integrity with timber management requirements. It is, thus, no wonder that impact reduction is high on the agenda of formulating and implementing criteria and indicators for sustainable management of natural tropical forests (Thang 1996) and the resp. internal and external assessment procedures (Appanah et al 1999). In Peninsular Malaysia, a guideline for road construction and harvesting issued in 2003 emphasises the choice of technology and field procedures with regard to impact reduction.

The multitude of specifications so far formulated tends to conceal the fact that only a small number of factors are responsible for most of the undesirable long-term and irreversible strains to forest site and stand. In the context of strategic considerations for technology changes in the field of harvesting Tuttle (1996) advises not to compound the implementation of improved road construction and harvesting operations with too many issues, but to concentrate instead on improvements, which have immediate and greatest effect stating that: (1) changes that can be implemented with existing equipment should be made first, and (2) changes that produce the greatest environmental benefit should be made first.

Improvements should thus focus on the following:

(1) reduction of erosion originating from roads
(2) reduction of road instabilities
(3) reduction of uncontrolled tractor movements into forest stands
(4) reduction of forest road openings
(5) reduction of harvesting losses on harvestable trees
(6) reduction of fatal damages to the residual stand
(7) reduction of fatal damages to the regeneration of commercial trees.

Reduced-impact logging involves more than the technical execution of the operations during harvesting proper. Restrictions on the logging operations are imposed in order not to violate forest management and stand management objectives. Reduced-impact logging should not only be seen as an isolated, albeit good, technical execution of operations but as part and parcel of the whole natural regeneration process.

Dykstra (2001) points out that many elements of reduced-impact logging were developed and are applied in temperate countries and in this sense would be nothing new. Indeed, the existing guidelines of Peninsular Malaysia formulate most of the elements of reduced-impact logging demonstrating awareness of the potential hazards of logging operations when carried out improperly. <u>It appears that the problem is not so much lack of awareness, but rather lack of implementation.</u>

According to Dykstra (2001) reduced-impact logging proper would require the following:

(1) pre-harvest inventory and tree location mapping
(2) pre-harvest planning of roads, skid trails and landings considering minimal soil disturbance, and disturbance of streams and waterways
(3) pre-harvest climber cutting
(4) pre-harvest construction of roads, landings and skid trails by adhering to engineering and environmental standards/guidelines
(5) use of directional felling including cutting stumps low to the ground
(6) use of appropriate bucking techniques to reduce waste
(7) winching of logs to planned skid trails with the skidder remaining on the skid trail
(8) in steep terrain yarding systems with suspending logs above the ground
(9) post-harvest performance assessment.

Armstrong & Inglis (2001) emphasise that the important changes required to implement reduced-impact logging are behavioural rather than technical. Chances of implementation success would be higher if the following is observed:

(1) All actors are involved in the process of change from conventional logging to reduced-impact logging.
(2) Direct benefits are demonstrated to all actors.
(3) Impractical recommendations are avoided.
(4) The forest management system is strong.
(5) Incentives are provided to retain skilled people.
(6) Proposed changes build on current resources, systems and skills.
(7) Training approaches are flexible from one-to-one coaching to formal training courses.

In addition to the above, Putz et al. (2000) mention a number of reasons that cause poor logging practices to persist in the tropics. Among them is the perception that logging impact reduction was too expensive – despite abundant evidence that both environmental damage and the financial cost of logging can be substantially reduced through proper training of workers, pre-planning of skid trails, directional felling, and a variety of other well known reduced-impact practices. Dykstra & Heinrich (1997) mention that according to conventional wisdom reduced-impact logging (RIL) is more expensive than conventional logging (CL) and that the economic proof is with those proposing RIL, thus hampering pro-active implementation efforts. Other studies, however, have shown that with properly planned and supervised operations costs of RIL are at least equal or may even be lower than costs of CL practices (Barreto et al. 1998, Bull et al. 2001, Elias 1999, Holmes et al. 1999, Karsenty 1998). Putz et al. (2000) conclude that by changing from unmitigated forest exploitation for timber to forest resources management all actors will benefit on the long-term, including forest industry. Increasing communication between loggers, concession holders, forest owners, forest researchers, environmentalists, and policy-makers to further the cause of reducing the deleterious environmental impacts of uncontrolled logging is recommended. Furthermore, it is suggested that for widespread adoption of RIL financial incentives might be required; but what would be required first of all is a cultural change from timber mining to sustainable forest management, and away from maximum profit expectations to expectations which are compatible with the long-term productivity of the forests.

While the logging of primary forests advances more and more into higher elevations and steeper terrain, logging operations will have to focus on more sophisticated and suitable extraction methods, for instance, the application of long-distance air-borne cable systems (e.g. Uebelhoer & Nydegger 1996; Bauernfried 2000).

In the Malaysian context another important obstacle concerns the organization of the harvesting operations (see Figure 2). In general, pre-harvesting and post-harvesting operations are under the responsibility of the forest administration. The harvesting operations proper are under the responsibility of different field actors, such as licence-holder, contractors, field-operators, in a tiered set-up, resulting in a lack of transparency as far as investment into road construction and harvesting operations is concerned. The lock-up of funds in unproductive sub-contract layers prevents investment in techniques and technology urgently needed for the implementation of reduced-impact logging, which the greatest setback. The more tiers are involved the smaller is the budget that would be available for field operations proper. As a result harvesting becomes destructive. The purpose of higher investment in harvesting planning and infrastructure operations to reduce damage and save costs at later stages of the stand management cycle will be defeated. Thus, one of the most important steps to improve the harvesting practices is to prevent unproductive layering in the contracting set-ups.

Technically, the main shortcomings of current on-site procedures in Peninsular Malaysia and elsewhere are:

(1) Construction of roads in sloping terrain exclusively with the bulldozer
(2) Wasteful and environmentally damaging clearing of road corridors and construction of roads
(3) Excessive side casting of soil, trees and organic material into the adjacent areas
(4) Insufficient stabilization and compaction of the road surface
(5) Excessive blading of skid trails
(6) Lack of proper water management along roads
(7) Neglect of climber cutting prior to felling
(8) Largely neglect of directional felling
(9) Wasteful tree felling (high stumps, felling damages).

The main changes required for Peninsular Malaysia would be:

(1) Implementation of pre-harvesting climber cutting
(2) Full implementation of the existing road construction and harvesting guidelines
(3) In terrain above 20° slope gradient replacement of ground-based hauling technology (crawler tractors or skidders) with cable-based technology (e.g. Rimbaka or Logfisher technology for shorter distances and less sloping terrain and air-borne systems for steeper terrain)
(4) Retooling (see table 3)
(5) Strengthening and expanding training (see table 4)
(6) Adjustment of the contracting system.

4. Silviculture

The Selective Management System (SMS) of Peninsular Malaysia allows choosing between three silvicultural systems based on the findings of the pre-felling inventory (e.g. Mok 1977, Whitmore 1979, Appanah & Weinland 1991):

(1) The areas richest in adolescent trees of commercial species (residual trees) are assigned to be managed on basis of a polycyclic system;
(2) the areas without such trees are to be managed by the Malayan Uniform System; and
(3) the areas in which natural regeneration of desired species is inadequate or absent are to be enriched by planting or to be replaced by plantations.

The inconsistencies of the Selective Management System have been discussed (e.g. Whitmore 1979, Wyatt-Smith 1987, 1988, Appanah & Salleh 1991, Appanah & Weinland 1991) and shall not be repeated here. Instead it would be important to enquire whether the silvicultural management as designed and practiced allows for the implementation of reduced-impact harvesting. Focus is on the prevalent silvicultural system, which is a selective felling system based on minimum diameter limit cut prescriptions.

The currently applied silvicultural concept for the selective felling system is contained in Thang (1987, 1988).

The first element of the silvicultural concept is that the forests shall be harvested by **selective fellings** in a polycyclic system. The cutting cycle, which is the period between two harvesting interventions, is set at 30 years derived from growth, mortality and ingrowth studies.

The second element is the prescription of **minimum diameter cutting limits** set separately for dipterocarps and non-dipterocarps based on pre-F inventory data. Any tree above these limits may be harvested irrespective of felling intensity. Clustering of harvestable trees and species composition are of no concern.

The third element is the formulation of **stocking targets for the managed forests,** which says that the harvested stands should contain at least the same or a higher proportion of dipterocarps across the size classes below the cutting limits. This objective indicates a process of transformation from the unmanaged primary forests to managed forests with a higher proportion of high-value timber trees, meaning that tree felling has to consider the integrity of the residual stand.

While the first and the third element are compatible, they are both not compatible with the second element, the prescription of an unrestricted felling based solely on diameter cutting limits. Being the simplest "silvicultural system" doubts have been expressed, whether long-term sustainability would be generally achievable with selective felling systems (e.g. Dawkins 1960, Smith 1986, Lamprecht 1989). Most outspoken is Dawkins (1960), who states that even under the most favourable assumptions the selection to the disadvantage of the most vigorous trees of each species will "inevitably ruin the forest". Though such assumed genetic erosion though high grading has lately been questioned (Lowe & Sudronamawati 1999), Ho et al. (2003) found that such genetic erosion does indeed take place.

The large-scale move into the old logged forests for the second cut is due in the near future. The major issue will be in the pre-harvesting operations and here especially the selection of harvestable trees for felling. Contrary to the stand management objectives, which state that at least the same proportion of dipterocarps should be present in the logged forests (Thang 1987, 1988), we have to expect that the dipterocarp proportion has considerably decreased and that occurrence of dipterocarps is now spatially more aggregated and clusters are more widely spaced than was the case before the first logging. Both observations call for a conscientious tree-marking procedure preserving as far as possible harvestable dipterocarp trees as mother trees. Application of the diameter limit cut prescription alone could mean the permanent removal of dipterocarps from large stretches of land. This would contradict reduced-impact principles in the wider context. Therefore, the amount of removal should not exceed certain thresholds and special attention should be paid to the preservation of the dipterocarp element.

Once going into field practice there is definitely a need to formulate some general orientation and specifications with the aim to achieve the silvicultural objective of a swift regeneration and growth progress (succession starting from "initial floristic" composition) after harvesting. Silviculture has at least to rest on:

(1) Reduced-impact harvesting operations, which would include pre-harvesting climber cutting (see e.g. Appanah & Putz 1984)
(2) Strict observation of upper thresholds for the removal
(3) Retention of mother trees with the aim to periodically replenish the seedling bank
(4) Post-harvesting regulation of competition (weed control), which for practical reasons should be carried out as long as the skid trail infrastructure is still open; operations should be limited to opener areas, which were mapped immediately after the harvesting operation.

As to item (2) the following multiple-threshold approach for tree selection is proposed:

(1) The minimum diameter **cutting limits** are set at **65 cm for dipterocarps** and at **55 cm for non-dipterocarps.** The formulation of these limits was based on a tentative re-assessment of about 56,100 growth observations. Diameter limits are now set closer to the beginning maximum productivity (Weinland 2003) and not as in the past defined by beginning technical maturity alone.

(2) The stem/volume removal may never exceed **85 m³/ha** of standing volume.

(3) Threatened/endangered/protected species are not to be selected for felling.

(4) At least **24** healthy and undamaged **residual trees** per ha of good form of a diameter of **45 cm** for **dipterocarps** and of **40 cm** for **non-dipterocarps** have to be present immediately after harvesting, of which **5 trees/ha** should be dipterocarp species.

(5) The **distance between trees** to be felled should not be less than **25 m**, equivalent to a removal of not more than **16 trees/ha**.

(6) Instead of being felled **adult** (even if defective) **trees of dipterocarp species** of otherwise **good form** serve as **mother trees** and have to be retained.

The thresholds formulated above are <u>upper limits</u> never to be exceeded. It is important to be clear about the fact that the thresholds are not targets to be achieved but are values which may never be exceeded. In most cases the actual removals in terms of volume and trees will be lower dependent on terrain, stand structure and results of the pre-F inventory. Based on simulations Kassim et al. (2001) have proposed for Kapur and Seraya stands, which are different in structure from the most common "Red Meranti-Keruing' forest type, that the threshold for volume removal be set at a net volume of 90 m³/ha, which is equivalent to a gross volume (standing volume) of about 120 m³/ha. This would mean that from these more uniformly structured stands around 1/3 of the standing volume will be removed in one harvesting intervention, which is for reasons of severe disturbances not recommended.

With reference to Indonesia Sist et al. (2001) propose more restrictive thresholds. Number of trees/ha that may be removed are restricted to 8-11 trees/ha dependent on slope conditions, which corresponds to the minimum distance between trees assigned for felling of ~35 m. Based on the results of a reduced-impact trial in East Kalimantan Sist et al. (2001) concluded that RIL will not work by minimum diameter cutting alone and that current minimum-diameter cutting limit prescriptions have to be complemented by "additional logging rules" limiting the removal from the forest at each and every harvesting intervention. Four general rules are proposed:

(1) Minimum diameter cutting limit is based on stand structure.
(2) Minimum spacing distance between harvested trees is 35 m (8-9 trees/ha removal).
(3) Gaps do not exceed 600 m².
(4) Maximum diameter cutting limit is 100 cm (10-11 trees/ha removal in the 60-100cm size class).

These "additional logging rules" result in lower threshold values for the removal than the SMS proposal. Table 5 contains comments on the proposal by Sist et al. (2001) from the perspective of the forest management situation in Peninsular Malaysia.

The second important part in the silviculture of logged-over forest is the early removal of the vegetation inhibiting the regeneration of the commercial trees, especially that of the dipterocarps. The treatment is to be carried out as soon as the most noxious weed species can be detected and as long as the skid trails are still open and can be used to approach the areas to be treated. Sketches of the treated areas on the infrastructure map, which has to be supplied by the logging contractor as part of the normal procedure, support the operation. The sequence of operations for road construction, harvesting and post-harvesting silvicultural operations should be embedded in a well carried out planning and documentation for the whole planning cycle so that such useful information would be available for the successive planning cycle.

5. Conclusion

(1) Harvesting is being carried out only in blocks containing sufficient stocking (young/advance regeneration of economically later seral species).

(2) The selection process follows a multiple threshold approach consisting of diameter cutting limits, maximum limits for volume/tree removal per ha and minimum distance between trees to be harvested.

(3) The selection process ensures that a sufficient number of good quality adult trees are left in the harvested area that could replenish the young regeneration and maintain genetic diversity. Harvesting operations ensure that these adult trees are not damaged.

(4) Harvesting is carried out in a manner that reduces damages to the young and advance regeneration of commercial species seedling/sapling bank in order to curb genetic erosion, productivity decline and loss of environmental fitness.

(5) Harvesting is carried out in a manner (reduced-impact on vegetation and soil structure) that minimizes soil erosion and nutrient loss and supports the restoration of the internal nutrient cycling.

(6) Harvesting concentrates on trees of young mature status when productivity of individual trees is near or at its maximum, which leads to higher cutting limits than currently specified.

(7) Implementation of reduced-harvesting requires retooling of the logging machinery and equipment, introduction of air-borne systems in harvest areas >20° slope gradient, implementation of a training programme for forest harvesting at all operational levels and reorganisation of the logging contracting system.

(8) Post-silvicultural operations concentrate on early removal of inhibiting vegetation in order to reduce mortality in the seedling/sapling bank of commercial species caused by competition from re-growth of non-commercial species.

(5) An existing good seedling/sapling bank may compensate for losses in genetic diversity caused by the removal of the biggest trees during harvesting.

References

Abdulhadi, R., Kartawinata, R.A.K. & Sukardjo, S. 1981: Effects of mechanised logging in the lowland dipterocarp forest at Lempake. East Kalimantan. The Malaysian Forester 44(2&3):407-418.

Abdulhadi, R., Mirmanto, E. & Kartawinata K. 1987. A lowland Dipterocarp forest in Sekundur, North Sumatera, Indonesia: Five years after mechanized logging. In: Kostermans A.J.G.H. (ed.) Proceedings of the Third Round Table Conference on Dipterocarps. UNESCO: 255-273.

Abrams, D. & Scott, M.L. 1989. Disturbance-mediated accelerated succession in two Michigan forest types. Forest Science 35(1):42-49

Appanah, S. 1985. General flowering in the climax rain forests of South-East Asia. Journal of Tropical Ecology 1:225-240.

Appanah, S. 1998. Management of natural forests. In: S. Appannah & J. M. Turnbull (eds.) A review of dipterocarps. Taxonomy, ecology and silviculture. Centre for International Forestry Research. Chapter 8: pp. 133-149.

Appanah, S. & Putz, F. E. 1984. Climber abundance in virgin dipterocarp forest and the effect of pre-felling climber cutting on logging damage. The Malaysian Forester 47(4).

Appanah, S. & Ratnam, L. 1993. The importance of forest biodiversity to developing countries in Asia. Journal of Tropical Forest Science 5(2):201-215.

Appanah, S. & Weinland, G. 1991. Will the management systems for Hill Dipterocarp Forests, stand up? Journal of Tropical Forest Science 3(2):140-158.

Appanah, S. & Chan , H.T. 1981. Thrips: the pollinators of some Dipterocarps. The Malaysian Forester 44:234-252.

Appanah, S.; Harun, I.; Chong, P.F. & Kleine, M. 1999. Development of Internal Assessment Procedures and a Monitoring System for Sustainable Forest Management in Malaysia. Part I: Main Report, Part II: Assessment Forms. Consultancy Report to the Malaysian-German 'Forest Certification Project'. Forestry Department Headquarters, Kuala Lumpur.

Appanah, S. & Putz, F.E. 1984. Climber abundance in virgin dipterocarp forest and the effect of pre-felling climber cutting on logging damage. The Malaysian Forester 47(4):335-342.

Appanah, S. & Rasol, M.A.M. 1991. Smaller trees can fruit in logged dipterocarp forests. Journal of Tropical Forest Science 3(1):80-87.

Appanah, S. & Salleh, M.N. 1991. Natural regeneration and its implications for Forest Management in the Dipterocarps Forests of Peninsular Malaysia. In: Gomez-Pompa, A., Whitmore, T.C., Hadley, M. (eds.): Rain forest regeneration and management. MAB Series 6:67-90. UNESCO, Paris.

Armstrong, S. & Inglis, C. 2001. Addressing the gap between the theory and practice of reduced-impact logging. Paper presented at the “International Conference on Application of Reduced-impact Logging to Advance Sustainable Forest Management: Constraints, Challenges and Opportunities”, 26 February – 1 March 2001, Kuching, Sarawak, Malaysia. 11 pp.

Ashton, P.S. 1989. Dipterocarp reproductive biology. In: Lieth, H. & M.J.A. Werger (eds.) Tropical Rain Forest Ecosystems. Elsevier Science Publishers, Amsterdam:219-240.

Ashton, P.S. 1988. Dipterocarp biology as a window to the understanding of tropical forest structure. Ann. Rev. Ecol. Syst. 19:347-370.

Ashton, P.S., Givnish, T.J. & Appanah, S. 1988. Staggered flowering in the Dipterocarpaceae: New insights into floral induction and the evolution of mast fruiting in the aseasonal tropics. American Naturalist 132(1):44-66.

Barnard, R.C. 1950. The elements of Malayan silviculture, 1950. Lowland Dipterocarp Forest. The Malayan Forester 13: 122-129.

Barreto, P.; Amaral, P. ; Vidal, E. & Uhl C. 1998. Costs and benefits of forest management for timber production in Eastern Amazonia. Forest Ecology and Management 108:9-26.

Bauernfried, P.W. 2000. The preparation of a large-scale harvesting trial. Malaysian-German Sustainable Forest Management and Conservation Project. STC Report No. 17. 60 pp.

Benneckendorf, W. 1994. Operator's Manual for Forest Road Construction. Malaysian-German Sustainable Forest Management Project Sabah. Report no. 194. 33 pp.

Bertault, J.G. 1996. What is the outlook for the second cycle of dipterocarp harvesting? In: S. Appanah & K.C. Khoo (eds.) Proceedings of the Fifth Round-Table Conference on Dipterocarps, Chiang Mai, Thailand, 7-10 November 1994. pp. 424-451.

Blate, G.M.; Putz, F.E. & Zweede, J.C. 2001. What facilitates and what impedes the adoption of reduced-impact logging in Brazilian and Bolivian Amazon. ITTO Tropical Forest Update 11(2):8-9.

Borhan, M. & Guglhör, W. 1998. Reduced-impact logging in Peninsular Malaysia: Re-design and re-tooling of Ground Skidding Logging System. Malaysian-German Sustainable Forest Management and Conservation Project. Project Document no. 12: 135 pp.

Borhan, M.; Johari Baharuddin & Quah, E.S. 1987. Studies on logging damage due to different methods and intensities of harvesting in a hill dipterocarp forest of Peninsular Malaysia. Malaysian Forester 50: 135-147

Boscolo, M. & Vincent, J. 1998. Promoting better logging practices in tropical forests: A simulation analysis of alternative regulations. Harvard Institute for International Development. 46 pp.

Bull, G.Q.; Pulkki, R.; Killmann, W. & Schwab, O. 2001. Does it cost or does it pay? ITTO Tropical Forest Update 11(2):12-13.

Burgess, P.F 1971. Effect of logging on Hill Dipterocarp Forests. Malayan Nature Journal 24:213-237.

Burgess, P.F. 1973. Silviculture in the Hill Dipterocarp Forest. Research Pamphlet no. 64. Forestry Department Headquarters, Kuala Lumpur.

Buteaud, J.F. 1998. Damage assessment of Hill Dipterocarp Forests subject to reduced-impact logging guidelines. Malaysian-German Technical Cooperation Project. Forest

Management Information System Sarawak (FOMISS). Junior Professional Report no. 10: 73 pp. + App.

Cedergren, J.; Falck, J.; Garcia de Chavez, A.; Goh, F.A.S. & Hagner, M. 1995. Impact of selective logging on silvicultural values in a mixed dipterocarp forest in Sabah, Malaysia. Swedisch University of Agricultural Sciences, Working Report no. 105: 15 pp.

Clements, F.E. 1936 (cit. Rosauer 1998). Nature and Structure of the Climax. In: Real, L.A. & J.H. Brown (eds. 1977) Foundation of Ecology: Classical Papers with Commentaries. University of Chicago Press, Chicago: 55-97.

Clements, F.E. 1916 (cit. Rosauer 1998). Plant succession: an analysis of the development of vegetation. In: Frank B. (ed. 1977). Ecological succession. Dowden, Hutchinson & Ross Inc. Strousburg: 185-186.

Coates, K.D. & Burton, P.J. 1997. A gap-based approach for development of silvicultural systems to address ecosystem management objectives. Forest Ecology and Management 99:337-354.

Dawkins, H.C. 1960. New methods of improving stand composition in tropical forests. Proc. 5th World Forestry Conference, Seattle.

Denslow, J.S. 1980. Gap portioning among tropical rainforest trees. Tropical Succession:47-55.

Dogse, P. S.A. Sustainable Tropical Rain Forest Management; some economic considerations. Manuskript. pp. 59.

Durant, C.L. 1940. Meranti tembaga and secondary growth. The Malayan Forester 9:103-110.

Dykstra, D. 2001. The old and new reduced-impact logging. ITTO Tropical Forest Update 11(2): 3-4.

Egler, F.E. 1954. Vegetation Science Concepts I. Initial floristic composition, a factor in old-field vegetation development. Vegetation 4:412-417.

Elias, 1999. Reduced-impact timber harvesting in the Indonesian Selective Cutting and Planting System. Bogor Agricutural University Press (IPB Press), Bogor, Indonesia. 76pp.

FAO 1999. Code of Practice for Forest Harvesting in Asia-Pacific. FAO Regional Office for Asia and the Pacific. RAP Publication 1999/12:133 pp.

Ford-Robertson, F.C. 1971. Terminology of Forest Science, Technology Practice and Products. The Multilingual Forestry Terminology Series No. 1. Society of American Foresters Washington D.C. 349 pp.

Forestry Department HQ 1988a. Spesifikasi Jalan-Jalan Hutan untuk Semenanjung Malaysia. Forestry Department Headquarters, Kuala Lumpur.

Forestry Department HQ 1988b. Garis Panduan Pembakalan dalam Kawasan Bukit Semenanjung Malaysia. Forestry Department Headquarters, Kuala Lumpur.

Forestry Department HQ 1988c. Panduan Membalak di Kawasan Tadahan Air.

Forestry Department HQ 1996a. Forest Road Specifications for Peninsular Malaysia. Draft no. 1.

Forestry Department 1996b. Deraf Kod Amalam Pengusahasilan Hutan Asli Semenanjung Malaysia. Forestry Department Headquarters Kuala Lumpur. 71pp.

Forestry Department HQ 1997. Kod amalam pengusahasilan hutan darat asli Semenanjung Malaysia. Jabatan Perhutanan Semenanjung Malaysia. 45 pp.

Forestry Department HQ 1999. Spesifikasi jalan hutan (Jalan tuju dan lorong penarik) untuk Semenanjung Malaysia. Jabatan Perhutanan Sememanjung Malaysia. 47 pp.

Fox, J.E.D. 1968. Defect, damage and wastage. The Malayan Forester 31(3): 157-164.

Fox, J.E.D. 1968. Logging damage and the influence of climber cutting prior to logging in the Lowland Dipterocarp Forest of Sabah. The Malayan Forester:31:326-347.

Gill, L.S. & Wan Hassan, A.H. 1968. Some problems of natural regeneration establishment in the Hill Dipterocarp Forests of Perak. The Malayan Forester 31(4): 297-304.

Griffin, M.; & Caprata, M. 1977. Determination of cutting regimes under the Selective Management System. Paper presented in ASEAN Seminar on Tropical Rain Forest Management. November 7-10, 1977, Kuantan, Malaysia, Mimeograph. 26 pp.

Guayana Forestry Commission 1996. Code of Practice for Forest Operations. 2nd Draft for Internal Discussion.

Heinrich, R. 1994. Environmentally sound forest harvesting to sustain tropical forests. In: W.M. Wan Razali, I. Shamsudin, S. Appannah & M. Farid (eds.) Proceedings of the Symposium on Harvesting and Silviculture for Sustainable Forestry in the Tropics. Forest Research Institute Malaysia. p. 102-110.

Hendrison, J. 1990. Damage-controlled logging in managed tropical rain forest in Suriname. Agriculture University, Wageningen, The Netherlands. 204 pp.

Ho, W.S., Wickneswari, R., Mahani, M.C. & Shukor, M.N. 2003. Immediate effects of logging on genetic diversity of Shorea curtisii (Dipterocarpaceae) revealed by DAMD-PCR markers. In: Aminah, H., Ani, S., Sim, H. C. & Krishanpillay, B. (eds.) Proceedings of the Seventh Round-Table Conference on Dipterocarps. 7-10 October 2002, Kuala Lumpur:10-15.

Holmes, T.P.; Blate, G.M.; Zweede, J.C.; Pereira, R., Jr.; Barreto, P.; Boltz, F. & Bauch R. 1999. Financial costs and benefits of reduced-impact logging relative to conventional logging in the Eastern Amazon. Tropical Forest Foundation USDA Forest Service Southeastern Center for Forest Economics Research, Research Triangle Park, NC USA. 48 pp.

Ismail, Ali 1966. A critical review of Malayan Silviculture in the light of changing demand and form of timber utilization. The Malayan Forester 29:228-233.

ITTO 1992a. Criteria for the measurement of sustainable tropical forest management. ITTO Policy Development Series no. 3.

ITTO 1992b. ITTO guidelines for the sustainable management of natural tropical forests. ITTO Policy Development Series no. 1.

ITTO 1993. ITTO Guidelines for the Conservation of Biological Diversity in Tropical Production Forests. ITTO Policy Development Series 5.

Jackson, R.W. & Jackson, J.M. 1996. Environmental Science. The Natural Environment and Human Impact. Longman, Harlow. pp. 370.

Kamaruzaman, J. 1988. Soil compaction from off-road transportation machine on tropical hill forest land. Pertanika 11(1): 31-37.

Kamaruzaman J. 1994. Site disturbance in relation to logging season and soil texture. In: W.M. Wan Razali, I. Shamsudin, S. Appannah & M. Farid (eds.) Proceedings of the Symposium on Harvesting and Silviculture for Sustainable Forestry in the Tropics. Forest Research Institute Malaysia. p. 197-202.

Karsenty, A. 1998. The economic impacts of reduced-impact and conventional logging. In: J.G. Berthauld &K. Kadir (eds.) Silviculture research in a lowland mixed dipterocarp forest of East Kalimantan. Cirad-Forêt, Montpellier, France. 163-170.

Kassim, A.R.; Ismail, H.; Shamsudin, I. & Ridza Awang, M. 2001. Evaluation of the stocking, size structure and species composition of Kapur forest and Seraya-Ridge forest: Its implication to current timber management practices. Paper presented at the 13. Pan-Malaysian Forestry Conference, 20-25 August 2001, Johor Baru, Malaysia.

Klasson, B.,1995: Principles of directional felling. Some experiences of directional felling in tropical rain forest of Sabah. Swedish University of agricultural sciences, Department of silviculture, Working reports 106.

Lamprecht, H. 1989. Silviculture in the Tropics. Tropical Forest Ecosystems and their Tree Species – Possibilities and Methods for their Long-term Utilization. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, Eschborn. 296 pp.

Landon, F.H. 1955. Malayan Tropical Rain Forest. The Malayan Forester 18:30-37.

Leslie A. 2001. The trouble with RIL: Reduced-impact logging is a requirement of sustainable forest management, but it falls short of being the complete answer. ITTO Tropical Forest Update 11(2):3-27.

Liew, T.C. & Wong, F.O. 1973. Density, recruitment, mortality and growth of Dipterocarp seedlings in virgin and logged-over in Sabah. The Malayan Forester 36(1):3-15.

Lohuji, P.L. & Taumas, R. 1998. RIL. Operation Guide Book specifically for tracked skidder use. Sabah Forestry Department. 33 pp.

Lowe, A. & Sudarmonawati, E. 1999. The impact of logging on genetic diversity in tropical moist forests. Final technical report to DFID. Department for International Development, UK.

Malmer, A. & Grip, H. 1990. Soil disturbance and loss of infiltrability caused by mechanized and manual extraction of tropical rainforest in Sabah, Malaysia. Forest Ecology and Management 38:2-12.

Mok, S.T. 1977. Forest management strategies for sustained maximum socio-economic benefits. Malaysian Forester 40:14-26.

Ng, F.S.P. 1966. Age at first flowering in Dipterocarps. The Malayan Forester 29(4): 290-295.

Ng, F.S.P., Low, C.M. & Sanah, M.A.N. 1990. Endemic Trees of the Malay Peninsula. Forest Research Institute Malaysia. Research Pamphlet 106:118pp.

Nicholson D.I. 1958. An analysis of logging damage in tropical rain forest, North Borneo. Malay. For. 21(4):235-245.

Nicholson, D.I. 1960. Light requirements of seedlings of five species of Dipterocarpaceae. The Malayan Forester 23:344-356.

Nicholson, D.I. 1965. A review of natural regeneration in the dipterocarp forests of Sabah. The Malayan Forester 28:4-27.

Nik, M.S. 1994. Environmental guidelines for Selective Management System: A case study on logging impacts in Peninsular Malaysia. M.Sc. thesis University of Wales. Unpublished.

Putz, F.E.; Dykstra, D. & Heinrich, R. 2000. Why poor logging practices persist in the tropics. Conservation Biology 14:951-956.

Raich, J.W. & Khoon, G.W. 1990. Effects of canopy openings on tree seed germination in a Malaysian dipterocarp forest. Journal of Tropical Ecology 6:203-217.

Remmert, H. 1992. Ökologie. Springer-Verlag. pp. 363

Rosauer, D. 1998. Forest Disturbance and Succession. Australian Forest Ecology FSTY 6514. Australian National University. 20pp.

Sarre, A. 2001. Extending the reach of RIL. ITTO Tropical Forest Update 11(2):19.

Sasaki, S. & Mori, T. 1981. Growth responses of Diptercarp seedlings to light. The Malaysian Forester 44(2+3):319-344.

Sist , P. 2001. Why RIL won’t work by minimum-diameter cutting alone. ITTO Tropical Forest Update 11(2):5.

Sist, P.; Bertault, J.-G. & Picard, N. 2001. Why minimum diameter cutting alone cannot fit with RIL objectives. Paper present at the “International Conference on Application of Reduced-Impact Logging to Advance Sustainable Forest Management: Constraints, Challenges and Opportunities. Febr. 26 – March 1 2001, Kuching, Sarawak, Malaysia.

Sist , P.; Dykstra, D. & Fimbel, R. 1998. Reduced-impact logging guidelines for Lowland and Hill Dipterocarp Forests in Indonesia. Bulungan Research Report Series No. 1. CIFOR Occasional Paper No. 15. 19 pp.

Smith, M. D.M. 1986. The practice of silviculture. Wiley, New York. 527pp.

South Pacific Forum 1995. Code of Conduct for logging Indigenous Forests in Selected South Pacific Countries.

Strugnell, E.J. 1936. The effect of suppression on young regeneration. The Malayan Forester 5:115-117.

Tang, H.T. 1978. Regeneration stocking adequacy standards. The Malaysian Forester 41(2):176-183.

Thang, H.C. 1987. Forest Management Systems for Tropical High Forest, with special reference to Peninsular Malaysia. Forest Ecology and Management 21: 3-20.

Thang, H.C. 1988. Selective Management System: Concept and Practice (Peninsular Malaysia). Forestry Department Headquarters Kuala Lumpur. 19 pp.

Thang, H.C. 1996. Formulation and Implementation of Criteria and Indicators for Sustainable Forest Management in Malaysia. Paper presented at the Workshop on Forest Management Certification, Forest Research Institute Malaysia, 12-13 December 1996. 67 pp.

Turner, I.M. 1990. A shading experiment on some tropical rain forest tree seedlings. Journal of Tropical Forest Science 1(4):383-389.

Turner, I.M. 1990. Tree seedling growth and survival in a Malaysian Rain Forest. Biotropica 22(2): 146-154.

Tuttle, A. 1996. Best Management Practices for Ground Skidding in Peninsular Malaysia: Suggestions for a Code of Practice. Malaysian-German Sustainable Forest Management and Conservation Project, Forestry Department HQ, Kuala Lumpur. Consultancy Report. 23 pp. + App.

Udarbe, M.P.; Übelhör, K.; Klemp, C.D.; Kleine, M.; v.d. Heyde, B.; Glauner, R. & Benneckendorf, W. 1993. Preliminary standards for sustainable management of natural forests in Sabah. Malaysian-German Sustainable Forest Management Project. Report no. 180.

Uebelhoer, K. & Nydegger, E. 1996. Sky-line yarding systems for low-impact harvesting in Sabah's natural forests. Malaysian-German Sustainable Forest Management Project. Sabah Forestry Department, Sandakan, Sabah.

Walton, A.B. 1954. The regeneration of dipterocarp forests after high lead logging. Empire Forstry Review 33:338-344.

Watson, J.G. 1931/33. The silvicultural classification of the commoner trees. The Malayan Forester 1+2: 92-100.

Weinland, G. 1995. Silviculture of logged-over natural forests in Peninsular Malaysia: Suggestions for improvement. Malaysian-German Sustainable Forest Management and Conservation Project. Report B2.

Weinland, G. 2002. An assessment of diameter measurements from the growth plots in Peninsular Malaysia. Paper presented at the Malaysia-ITTO Workshop on Growth and Yield of Managed Forests, Kuala Lumpur. 15pp.

Weinland, G. 2003. Update of Growth data from Growth & Yield Plots and from Growth Plots. Unpublished Project Document. 16pp.

Weinland, G. 2003. Guideline for reduced-impact logging (RIL) in Peninsular Malaysia. Malaysian-German Sustainable Forest Management and Conservation Project.

Weinland, G., Bauernfried, P. & Gan, B.K. 1999. Immediate solution to an old problem: Re-designing and re-tooling of the traditional ground-skidding system. Paper presented at the Conference of Forestry and Forest Products Research, 20-24 November 1999. Kuala Lumpur.

Welden, C.W., Hewett, S.W., Hubbell, S.P. & Foster R.B. 1991. Sapling survival, growth and recruitment: relationship to canopy height in a neotropical forest. Ecology 72(1): 35-50.
Whitmore T. 1979. Tropical Rain Forests of the Far East. 2nd edition. Oxford University Press. 352 pp.

Wyatt-Smith, J. 1988. Letter to the Editor. Forest Ecology and Management 24: 219-233.

Wyatt-Smith, J. 1987. The management tropical moist forest for the sustained production of timber: some issues. IUCN/IIED Tropical Forest Policy Paper No. 4. International Institute for Environment and Development (IIED). 20 pp.

Wyatt-Smith, J. 1949a. Survival of seedlings of meranti sarang punai (Shorea parvifolia Dyer.) and kempas (Koompassia malaccensis Benth.) in belukar (Perak South Sample Plot No. 37). The Malayan Forester 12:144-148.

Wyatt-Smith, J. 1949b. Natural Plant Succession. The Malayan Forster 12:148-152.

Wyatt-Smith, J. 1995. Treatment of abnormal and derelict stands. In: Wyatt-Smith, J. and W.P. Panton. Manual of Malayan Silviculture for Inland Forest. Malayan Forest Records No. 23, Chapter III-5/G1.

Yong, T.K. 1997. A compilation of growth and yield studies/data in Peninsular Malaysia. Forestry Department HQ 44 pp.

Annexes

Table 1: Impacts of logging operations (Source: Hendrison 1990, modified)

Logging operation	Stress factor	Subsystem affected	Short-term strain (reversible)	Long-term strain (irreversible)
Felling	falling tree, lianas	forest ecosystem	species loss, structural disturbance, pests	cleared forest, large gaps
		individual trees	crown and bark, damage, disease	uprooting, breakage, crown and bark injury, wood rot
		saplings, seedlings, other organisms	disturbance	destruction, injuries
Skidding (yarding)	wheel/track action, sliding and sweeping logs	forest ecosystem	structural disturbance	cleared forest
		individual trees	bark damage	uprooting, bark injury, root injury, rot
		saplings, seedlings, other organisms	disturbance	destruction, injuries
		soil	structural disturbance	structural degrading, erosion, compaction, nutrient loss
Forest road construction	machinery action	forest ecosystem	structural disturbance	cleared forest, tree mortality along roads following side-casting of soil
		soil	structural disturbance (skid trails without blading)	compaction, erosion

Table 2: Characteristics of some silvicultural systems vis-à-vis current selective cutting practices (SMS)

System	Description	Canopy conditions	Opening size (ha)
Clearcut	Removes part or all of a stand or several stands in one cut	Open conditions, dominant over canopy effects	>0.5 or >1.0 (depending on canopy tree height) to >100
Shelterwood	Successive regeneration fellings that retain a forest cover over all or part of the stand until regeneration phase is completed	Protective canopy cover during regeneration phase; progress of successive canopy removal dependent on subsystem (uniform, group, irregular etc.)	<0.01 to 0.1: enlarged over time
Selection	Single or group removal (small) over all of the stand area	Continuous canopy cover	<0.01 (single) to 0.1 (group)
Selective cuttings within SMS (current practice)	Removal determined by tree size alone; no other parameters	Distinctly irregular within a very wide range; in harvested parts of the forest open conditions dominate over canopy effects	Undefined; range of opening size from clearcut system to selection system; dependent on abundance and spatial distribution of harvestable trees
Selective cuttings within SMS (proposed)	Removal determined by tree size (minimum diameter raised), limit on trees, volume removed, minimum distance between trees removed	Irregular with a range; in most cases in harvested parts canopy effects dominate over open conditions	>0.1 to 0.3

Figure 1: Stand Management Cycle

(FMP=Forest Management Plan; AOP=Annual Operational Plan)

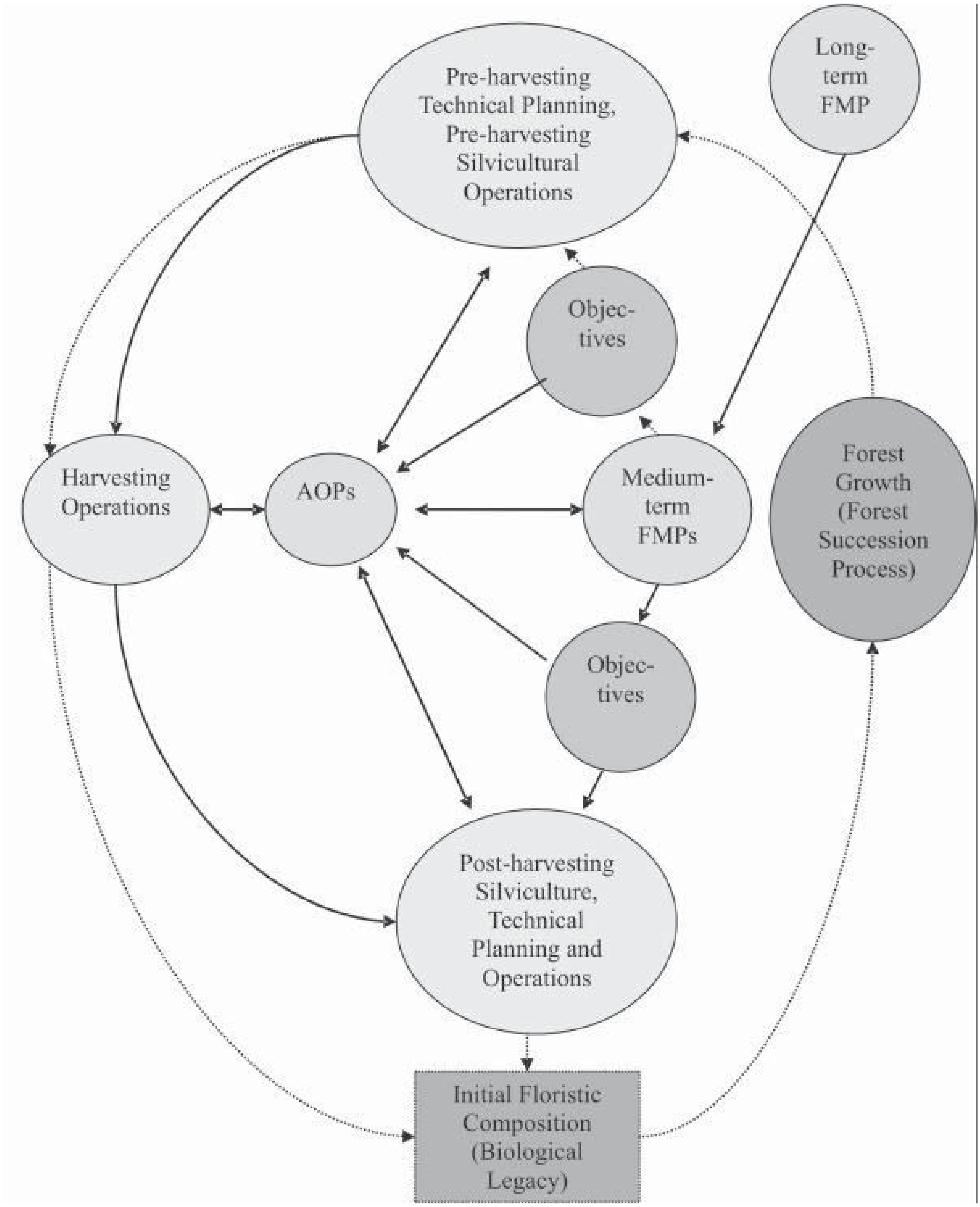


Figure 2: Responsibility and stand management operations

(FD=Forestry Department; DFO=District Forest Office)

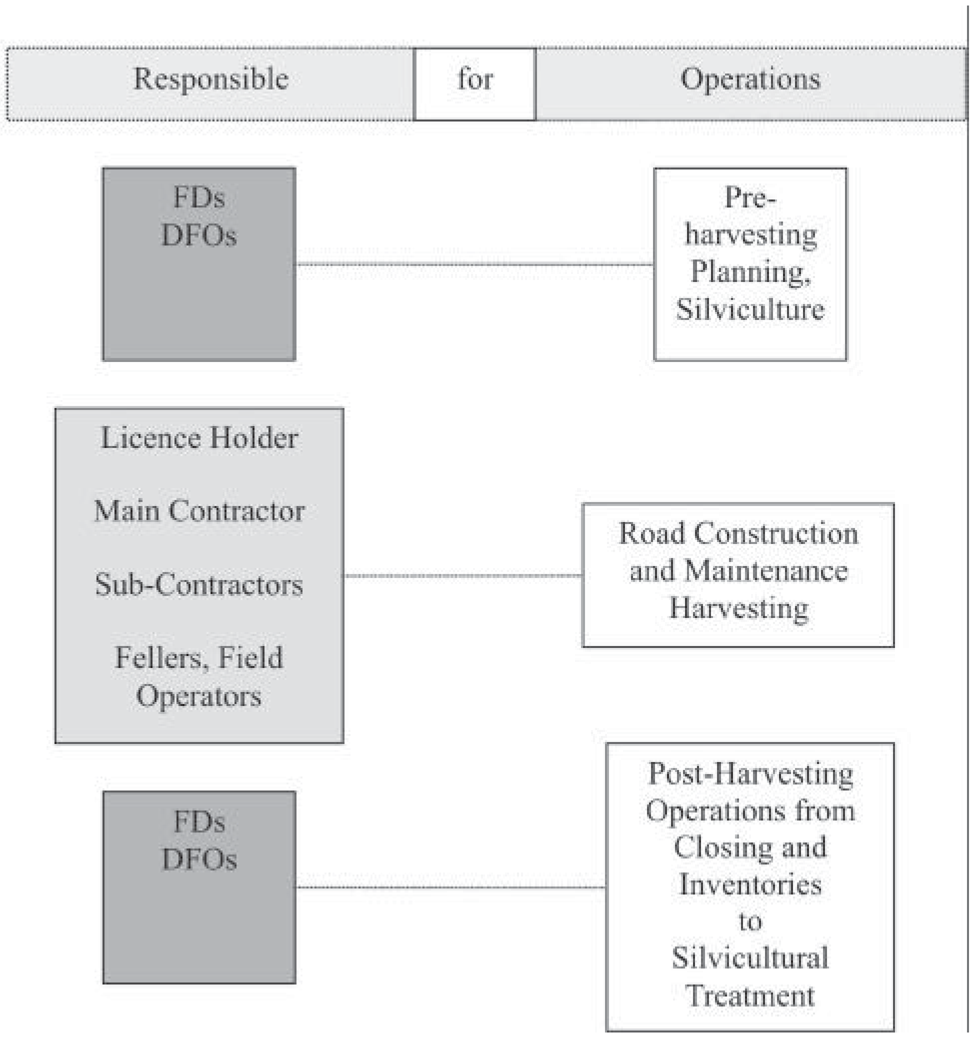


Table 3: Re-tooling recommendations (Weinland et al.)

Operation	Recommended equipment/machinery	Remarks
Road construction	**Excavator** in the weight class of 20 tons with bucket (angled corner teeth) for clearing, formation cut, slope stabilisation, construction of culverts and the like **Crawler tractor** (bulldozer) for longitudinal transport, distribution of earth, widening and grading of the road surface; equivalent to the D6 caterpillar class **Grader** for formation of camber and longitudinal ditches **Vibration Roller** or heavy wheeled machinery for road surface compaction	Training of operators in reduced-impact tecniques
Road maintenance and/or restoration	**Wheeled excavator** for slope maintenance, slope restoration and slope stabilisation **Crawler tractor** for longitudinal transport, distribution of earth, widening and grading of the road surface **Grader** for formation of camber and longitudinal ditches **Vibration Roller or** heavy wheeled machinery for road surface compaction	Training of operators in reduced-impact techniques
Felling	**Chainsaw (6 KW, 70-80 cm bar), chainsaw (4-5 KW, 40-50 cm bar), chainsaw (3-4 KW, 40 cm bar)** with antivibration handles and chain brake (quick stop) **Wedging** devices only recommended with specifications	Training in felling mechanics and felling techniques most important
Extraction/ Skidding	**Crawler tractor** for winching (stationary on the skid trail, if wheeled skidders are used for skidding at longer distances to log landing) **Self-pulling winch** with a 2-stroke chainsaw engine (e.g. Stihl 070) with a pulling force of 1 ton for pulling the main cable to the log **Wheeled skidder** (with chains) for skidding the log from the skid trail to the log landing (test phase!) **Excavator** equipped with winch and counterweights for extraction in steeper terrain (test phase!)	Training of operators in reduced-impact techniques
Transport to log yard	**San-tai wong** **Boom loaders, wheeled cranes, excavator with grapple** (12-ton class) on smaller log landings **Wheeled loaders** on log yards	Training of operators in reduced-impact techniques

Table 4: Training Proposal (Weinland et al. 1999)

Subject	Content
Pre-logging tree mapping survey	• Tree mapping • Tree marking • Use of GPS and other instruments. • Tree identification
Forest road and skid trail alignment (For permanent and non-permanent forest roads)	• Road alignment techniques • Forest road specifications.
Forest work study	• Work measurement and work design • Time study methods and analysis
Damage assessment	• Damage assessment procedures and analysis
Felling	• Tree assessment, felling patterns & techniques • Grading and scaling
Chainsaw	• Operation and maintenance; chainsaw parts, chainsaw models
Excavator operator Bulldozer operator Loader operator Grader operator	• Machine operations and maintenance • Retooling of machines (concept)
Ergonomics and work safety	• Ergonomics • Work safety and safety equipment and gear

Table 5: Additional logging rules according to Sist et al. (2001) with comments

Features (Sist et al.)	**Principles** (Sist et al.)	**Constraints/ Limitations** (Sist et al.)	**Comments with reference to Peninsular Malaysia**
Density	- Rare species must not be felled - Logging intensity must be density dependent	- Definition unclear - Complex	- Knowledge of rare and endangered species is available (e.g. Ng et al. 1990 with comprehensive list and descriptions) - Higher logging intensities may be justified in the usually dense and more uniformly structured Kapur and Seraya Forests. However, intensities would still stay within the specified limits, which indicate the maximum intensity under the most favourable stand and terrain conditions never to be exceeded; not a minimum intensity to be achieved
Structure	- Mean diameter cutting limit must be flexible to the type of structure	- Poor knowledge of the minimum diameter of adult trees - Poor knowledge of regeneration strategies	- The minimum limits are set at a diameter when the maximum diameter increment can probably be expected; based on increment studies (e.g. Yong 1997, FRIM 2002, Weinland 2002, Lamprecht 1989) - For practical purposes knowledge sufficiently established (flowering and pollination patterns, fruit dispersal, survival patterns); e.g. Appanah 1985, 1987, 1993; Ashton et al. 1988
Regeneration (dipterocarps)	- Minimum spacing between harvested trees in areas with high density of timber to limit gap size <600 m² - Trees with dbh >120 cm not be felled	- Definition of spacing not based on reliable experience nor data - Reluctance from loggers	- Gap size difficult to control; questionable whether emulation of gap dynamics through forest stand management is feasible - Damaged/injured dominants/emergents ≥ 55 resp. 65 cm diameter are to be preserved in harvested areas
Breeding systems	- Minimum spacing distance between adult trees	- Poor knowledge of pollination and seed dispersal distances	- Knowledge available (e.g. Appanah 1985; Appanah & Chan 1981)

Table 6: Proposed sequence and timing of harvesting operations and silvicultural treatment (Weinland et al. 1999)

Year	Operation
n-3 to n-2	• road planning using available topographic maps and delineation/demarcation in the field resp. old infrastructure maps for once logged forests and up-dating • road construction (except skid trails) using excavator; timber below cutting limit is utilised; restoration of old road system in once logged forests • Stratification of area into protected and productive areas and mapping; in once logged forests only needed, where no stratification has earlier been carried out • pre-felling inventory using systematic line-plots in production areas only to determine the stocking level • pre-felling climber cutting • determination of the cutting-regime based on diameter limits
n-1 to n	• timber cruise (tree-marking), mapping • skid trail construction
n	• felling of all trees as prescribed
n+1/4 to n+1/2	• survey on un-felled trees and on damage to residual trees • road maintenance using excavator (wheeled), grader
n+1.5 to n+2	• infrastructure mapping • silvicultural assessment and planning of tending operations in sub-stands • first tending (cleaning operation: removal of inhibiting vegetation)
n+2 to n+5	• post-felling inventory using systematic line-plots only in production areas to determine the residual stocking and second tending (cleaning operation)
n+20	• inventory to determine the stocking and silvicultural status of the forest

Annex

07

Forest Management Planning Rules and Guidelines (FMPRG):

Financial Analysis of Forest Management

gtz

Jabatan Perhutanan
Semenanjung Malaysia

German Technical Cooperation

SFMCP

Sustainable Forest Management and Conservation Project

Malaysian-German Technical Cooperation

Forest Management Planning Rules and Guidelines (FMPRG)

Guideline 3d:
Financial Analysis of Forest Management

Günther Haase

Walter Kollert

Final Draft

August 2005

Technical Document No. B55

Financial Analysis of Forest Management

Section	Medium-term Planning/Monitoring and Evaluation	3
Sub-Section	Financial Analysis of Forest Management	d

Contents

List of Tables

Acronyms and Abbreviations

CL	climber cutting
CR	compartment register
CRB	compartment record book
DFO	District Forest Officer
FMP	forest management plan
FMU	forest management unit
GCL	girdling and climber cutting
ha	hectare
m3	cubic metre
NTFP	non-timber forest products
PRF	permanent reserved forest
RM	Malaysian Ringgit

1 Purpose and Objective

The financial analysis of the forest management plan is a managerial tool for (i) financial planning prior to the inception of a forest management plan and (ii) for analysing and monitoring the economic performance of forest management at the end of a certain planning period in order to provide factual information for future planning activities.
The financial analysis provides insights into the financial and organizational requirements of plan realization and makes forest management more transparent.
While both forest departments and private forest enterprises should carry out financial analyses, this guideline is focused on the requirements of state forestry departments.

Financial planning prior to the inception of a forest management plan ensures realistic planning and serves as a basis for budget allocation. It gives a preliminary estimate of the expected cost, revenues and the surplus/loss generated through the foreseen forest management activities. The financial plan basically forecasts cost that are required to implement the planned physical targets, by estimating and pricing the resources (human, financial, equipment and materials, fixed assets) required for their implementation. These cost are set off against the expected revenues.
The financial analysis should include a forecast of major investments (e.g. machinery) to allow for an appropriate cash or liquidity management. Also a forecast of manpower requirements is needed. The estimated requirements serve as a basis for the planning of manpower development and organizational changes of the forest administration.

Analysing and monitoring the economic performance of forest management at the end of a certain planning period can be done with a simple cost-benefit-analysis in form of a cash-based accounting. This provides factual data and information for the subsequent planning period and is important for realistic planning. The cost-benefit-analysis may be implemented annually, every five years at the occasion of the mid-term review or every ten years at the end of the FMP's term. Depending on the available data it may cover an entire forest management unit or parts of it. An indispensable prerequisite for a meaningful cost-benefit-analysis is the existence of a systematic process of collecting records on expenditures, revenues and other sales proceeds during the planning period.

2 Sources of Data

The core element of any economic assessment is a comprehensive cost and revenue monitoring system as described in Section 5 „Financial Analysis on District and FMU Level“. All compartment-related data will be stored in the Compartment Register. In case a proper cost and revenue monitoring system is not in place, economic data and information can be collected from other administrative records, official statistics or technical literature. The „List of Parameters for Economic and Financial Appraisals“ provided in Annex 1 can be used as a guidance for the collection procedure.
All cost and revenues are accounted for as actual values as recorded in the year in which they incur. For reasons of simplification they are not compounded or discounted with any interest rates during the planning period.

3 Assessment procedures

From the point of view of a forestry department forest charges such as premium, royalties and silvicultural cess constitute revenue, while forest development activities constitute cost. Cost and revenues are structured according to cost and revenue centres, which indicate the operational unit where the cost or revenues incur (e.g. harvesting, silviculture, recreation). Structuring cost and revenues in this way helps link the relevant financial data to the planned or implemented activities in order to facilitate management control.

3.1 Structuring costs

The definition of the cost centres is outlined in Section 5 of the FMPG. Available cost records, organized according to cost centres, indicate the operational unit where the costs incur (see Table 1).

Table 1: Cost centres for financial analysis of the management plan

Cost centre		Description
1	Timber harvest planning	a) Boundary survey, demarcation and maintenance b) Pre-harvest assessment and planning (forest function mapping, pre-F, tree enumeration and tree location mapping) c) Road planning d) Timber tagging
2	Monitoring of timber harvesting operations	a) Monitoring of timber harvests incl. operation of checking stations b) Post-harvest inspection (closure of compartment after logging) c) Monitoring of the construction and maintenance of roads and bridges to be done by licence holders
3	Planting and tending of plants	a) Enrichment planting, plantation establishment (e.g. rubber, teak, mahogany, mangroves), planting of open space and roadsides b) Respective monitoring (mortality counts) and tending operations (beating-up, cleaning, etc.) until successful establishment
4	Silviculture	Post-F inventory and post-harvest treatment, e.g. CL, GCL, silvicultural tending and thinning
5	NTFP development and production	a) Survey and demarcation of NTFP license areas b) Monitoring of NTFP harvests, e.g. harvesting of bamboo/rattan/charcoal/medicinal plants, exploitation of sand/gravel c) NTFP development: planting and tending of NTFP such as rattan/bamboo/fruit tree/medicinal plants
6	Forest protection	Measures against fire, encroachment, illegal logging etc.
7	Forest recreation	Management of recreation forests, establishment and maintenance of recreation and ecotourism facilities
8	Agro- and village forestry	Measures to promote and assist agro- and village forestry
9	Nurseries	Establishment and maintenance of nursery infrastructure, plant production
10	Other field operations	Research, educational forestry, field demonstrations
11	Vehicles and machinery	Machinery owned by the forestry department

12	Buildings	Investment and maintenance costs of buildings, offices, staff quarters, etc.
13	Administration and personnel	Salaries and wages of permanent staff, stationary and other administrative expenses which can not directly be related to the cost centres 1-12

3.2 Structuring revenues

Revenues are assigned to those cost centres where revenue or income is generated. These are:

Table 2: Revenue centres according to corresponding cost centres

Revenue centre	Remarks
Timber harvest (C1 - C4)	a) premium, royalties, cess and other fees (boundary and hammer fee) on timber harvests by licence holders
NTFP harvest (C 5)	a) premium, royalties, cess and other fees collected in the framework of NTFP harvesting licenses b) sales proceeds of products (e.g. NTFP) if harvested by FD itself
Recreation (C 7)	Revenues generated from recreational activities (entry fees, eco-tourism)
Nurseries (C 9)	Proceeds from sales of seeds or seedlings
Vehicles and machinery (C 11)	Revenues generated from rental of FD's owned vehicles and machinery
Buildings (C 12)	Revenues generated from rental of buildings
Administration (C 13)	Income from fees and taxes not accounted for under any of the above revenue centres, e.g. fines, other income

Note: Values in brackets refer to the corresponding cost centres

4 Economic and Financial Analysis

The results of the analysis are used to predict the financial feasibility of the management plan.

4.1 Financial analysis

The results of the financial assessment are compiled and presented in the „financial analysis sheet“ that provides condensed information on all expenses and returns made during a certain planning period (see Table 3). Both the financial plan at the beginning of a planning period and the cost-benefit-analysis at the end of a period are presented in the same format. This facilitates comparisons between both assessments.
Economic reference figures are calculated by simply subtracting costs from revenues, relating the monetary figures to the planned or realized harvest volume (RM/m^3), the total forest area (RM/ha) or the net timber production area (RM/ha Net-TPA) and by calculating overall performance indicators (surplus/loss, cost-benefit ratio). The reference figures allow the forest manager to identify strengths and weaknesses in the operations and management performance and facilitate comparisons with other districts and management units. The computation of the numerical results is greatly facilitated by PC-based spreadsheet programmes (e.g. Microsoft Excel).

Table 3: Financial analysis sheet

Financial analysis				
Name of FMU or district	Total PRF area (ha)		Net-PA (ha)	
Period of assessment	Harvested* log volume (m3)			
Revenue/benefits	**Total (RM)**	**RM/ha**	**RM/ha Net-PA**	**RM/m3**
Timber production				
NTFP production				
Recreation				
Nurseries				
Buildings				
Administration (incl. machinery)				
Total benefits				
Costs according to cost centres				
Timber harvest planning				
Monitoring of timber harvesting and road construction				
Planting and tending of plants				
Silviculture				
NTFP development and production				
Forest protection				
Recreation				
Agro- and village forestry				
Nursery				
Other field operations				
Vehicles and machinery				
Buildings				
Administration and personnel				
Total cost				
Surplus/loss (total benefits minus total cost)				
Benefit/cost ratio (total benefits/total cost)				

* In case of the *ex-ante* analysis the planned harvesting volume (i.e. the AC) has to be inserted here.

Note: The calculation of an Internal Rate of Return (IRR) to assess the financial profitability of an FMU is not suitable as it bears a hard-to-come-by methodical problem. The calculation of an IRR requires by definition the initial investment of capital to run a certain business venture. Natural forests, in particular primary forests, however, are ready-made assets that do not require a substantial initial capital investment for commercial use. The proceeds from timber sales usually exceed investment and operational cost, thus rendering the financial results positive from the first year of the operation. Thus, an IRR cannot be determined as, in a pure financial sense, there was no capital investment made that would initially turn the profit and loss account negative. The determination of an IRR for natural forest management is theoretically possible if the value of the land and forest stands were included in the calculation assuming that the forest user would have to purchase the land and the growing stock prior to the use of the resource. Practically however this path can hardly be taken as land values, let alone stand values, for the permanent reserved forest do not exist and a purchase price cannot be ascertained. State land values are no substitute for land values inside the permanent forest estate as state land by definition is to be converted to other land uses and therefore would fetch a much higher price than would permanent forest land.

4.2 Budget plan and liquidity

The budget for forest management comes either from budget allocations by the government, or from the Forest Development Fund. A budget plan, set up at the beginning of a planning period, gives an overview on the anticipated sources of funding (see Table 4). The budget plan should match the total cost as estimated in the financial plan.
At the end of a planning period the budget plan is compared with the actual budget allocations (see Table 4, column (3)). Any deviations between budget plan and budget allocation have to be reconciled through adjustments of physical targets.

Table 4: Budget plan and sources of funds

Sources of funds	**Budget plan (beginning of planning period)**	**Actual budget allocation (end of planning period)**
Direct government allocations:		
• State funds		
• Federal gvt. funds		
- Development budget		
- Export levy		
• Others (e.g. Ministry of Tourism)		
Subtotal Direct Gvt. Alloc.		
Forest development fund		
Total		

A budget plan should be prepared and presented for every second year during the ten years' planning period. The budget plan will be compared with the costs of all planned activities within the considered period (by relating the costs in Table 3 to the considered period). If major investments are foreseen, a bi-annual investment plan needs to be developed (comprising of a list of type and year of each major investments; e.g. two 4x4 vehicles in 2004/5). Comparing both plans will allow the forest manager to assess whether the predicted costs can be covered throughout each part of the planning period (assessment of liquidity).

5 Planning of Personnel

Since personnel is an important cost factor in forest management, the forecasting of manpower requirements is an essential part of the financial analysis. Manpower planning essentially compares the work volume that is generated if all field operations are implemented as planned, with the available manpower capacity and its anticipated development. In case of a gap between work volume and work capacity, strategies to overcome a shortage or surplus in manpower must be developed. Strategies are e.g. an increase or decrease of personnel, outsourcing of tasks, postponement or advancement of development activities, etc.

To arrive at a meaningful analysis, the forest manager needs to compile reference or standard work norms for each activity. E.g., he needs to know how many man-days are required for one ha of monitoring, planting or silvicultural treatments. The data can be retrieved from the compartment register or from previous plans. The „List of Parameters for Economic and Financial Appraisals“ provided in Annex 1 provides guidance on the type of information to be collected. The work volume (man-days) is calculated by multiplying the planned workload of each activity with the known work standard (refer to Table 2 of Annex 1). For those activities which are generally implemented by contractors, only time requirements for monitoring their work have to be considered.

To assess whether the given workforce can implement the planned work volume, the forest manager has to determine the average annual productive working time per person employed by analysing the available working time records. Based on this, he can compare the planned work volume with the given manpower capacity and develop and evaluate organizational alternatives.

Annex

List of Parameters for Economic and Financial Appraisals

A: Parameters for cost calculation

The parameters are organized in Tables 1 to 5. Tables 1 and 2 are structured by cost centre. Table 1 captures area data and information on technical specifications of operational activities, such as planting densities, frequencies of operations (e.g. of cleaning and silvicultural treatments) and material inputs required for their implementation.

Table 2 focuses on work norms and standard unit costs of field operations. Depending on the type of the financial analysis (e.g. medium-term financial analysis or preparation of annual budget plans), the physical targets have to be entered in column (3) (No. of units) for the given planning or analysis period. For preparation of budget plans physical targets of a given year have to be entered, while the financial analysis of a Forest Management Plan (e.g. SFMP or DFWP) requires the entry of planning targets for the entire ten-year-planning period. Work norms can be derived from the economic reports of the Compartment Register or from analysis of implementation records such as the ‘Workers Attendance Sheet’.

Table 3 serves as a supplementary table for calculating costs of permanent staff. The calculated total costs can be used for preparing a budget plan. For ex-post financial analysis the staff cost have to be related to and accounted for under the cost centre where the cost are incurred. For example, if field staff is deployed for enrichment planting, the labour cost have to be accounted for under cost centre 3 (‘Planting and Tending of Seedlings’). Whenever it is not possible to attribute staff assignments to cost centres 1 to 10, they will be accounted for under cost centre 13 (Administration and Personnel).

Tables 4 and 5 describe the calculation process for costs of machinery and equipment. As for staff expenses the calculated costs have to be considered under the applicable cost centres. If, for example, a truck is used to transport seedlings from the nursery to the planting site and a light vehicle for the transport of field staff, the incurred costs (kilometres recorded in log book * vehicle costs/km) shall be accounted for under Cost Centre 3. Machinery cost that cannot be related to any of the Cost Centres 1 to 10 will be accounted for under Cost Centre 11 (‘Vehicles and machinery’).

All tables only serve as templates. They have to be adjusted to the actual requirements of the respective state forestry departments.

Table 1: Area data, technical prescriptions and material input costs

Parameter	Unit	No. of units	Unit cost (RM)	Total cost (RM)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
Area Information					
Total forest area in SFD/DFO - PRF - State land forest (SL) - Alienated land (AL)	ha				
1. Harvest planning (CC 1)					
Permanent reserve forests to be licensed (PRF) - TP1 area - TP2 area	ha				
State land to be licensed (SL)	ha				
Alienated land to be opened (AL)	ha				
3. Planting and tending of seedlings					
Annual planting area - Forest plantations - Open areas - Enrichment planting	 ha/yr ha/yr ha/yr				
Spacing - Forest plantations - Open areas - Enrichment planting	 m by m m by m m by m				Seedlings per ha: - Plantations:….. - Open Areas:…. - Enrichment:…..
Seedling cost (production in SFD nursery)	piece				
Seedling cost (market price)	piece				
Fertilizer cost	RM/kg				
Fertilizer application rates	Kg/ha		yr 1….., yr 2……, yr 3……		
Fertilizer cost/ha	RM/ha				
Climber/weed control	ha		Rounds per year: yr 1….., yr 2……, yr 3……		
4. Silviculture (CC 4)					
Release/liberation of PCTs (T1, T2, T3)	ha/yr		T1 in yr…., T2 in yr…., T3 in yr….		
5. NTFP (CC 5)					
Costs of Planting Material					
- Bamboo	culms/yr				

Parameter	Unit	No. of units	Unit cost (RM)	Total cost (RM)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
- Rattan	pieces/yr				
- Other (specify)	Seed-lings/yr				
7. Forest Recreation/eco-tourism Activities (CC 7)					
Area assigned to eco-tourism projects	ha				Number of Projects:…
Estimated number of visitors per year	No/yr				
Establishment of recreation facilities	RM				
Maintenance of recreation facilities	RM/yr				
Planned investment into eco-tourism infrastructure*	RM/yr				
Estimated costs of eco-tourism operations per year	RM/yr				
8. Agro- and village forestry					
(fill in planned activities and material inputs)					
9. Nursery management (CC 9)					
Nursery establishment cost	RM				
Nursery maintenance cost	RM/yr				
Seedling production in own nursery (production target / unit cost)	piece				
Production of other planting material (production target / unit cost)	piece				
10. Other field operations (CC 10)					
(fill in planned activities and material inputs)					
11. Vehicles and machinery (CC 11)					
11.1 Procurement cost	***RM***				
Note: List all vehicles and machinery planned to be procured within 10 years planning period (one row per type of equipment)					
11.2 Operating Cost	***RM***				
- fuel and lubrication	RM/yr				
- repair and maintenance	RM/yr				
- other cost	RM/yr				
Note: list all the existing and newly procured equipment and calculate costs individually for every type					

Parameter	Unit	No. of units	Unit cost (RM)	Total cost (RM)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
12. Buildings (CC 12)					
12.1 Construction					
- of administrative building	RM				
- of staff quarters	RM				
- of stores and workshops	RM				
Note: List all construction activities planned for 10 years planning period (one row per type of building)					
12.2 Maintenance					
- of administrative building	RM/yr				
- of staff quarters	RM/yr				
- of stores and workshops	RM/yr				
Note: list all the existing and newly constructed buildings and calculate maintenance costs individually for every type					
13. Administration and personnel (CC 13)					
Estimated overheads State Forest Office	RM/yr				
Estimated overheads District Forest Office	RM/yr				
Cost of forest inventory	Lump sum (RM)				
Cost of forest management plan	RM				
Cost of consultancies on management planning	RM				
Cost for PR activities	Lump sum				

Notes to Table 1

- Unless otherwise stated, all listings of planned activities and investments refer to the 10-year-planning period of the Forest Management Plan.
- For CC 11 (Vehicles and Machinery) all costs incurred from the purchase and operation of machinery for budget planning purposes can be calculated as per Table 1. For ex-post financial analysis vehicle and machinery costs should be apportioned to the activities (and thus cost centres) where the vehicles and machines are deployed. This will be done based on the unit costs (costs per available machine hour or costs per km) which are recorded in the vehicle or machinery log books multiplied with the unit costs calculated under Table 5 below.

Table 2: Calculation of work volume and cost for common field operations

			Implementation by SFD					Implementation by Contractor		
Parameter	**Unit**	**No of total units**	**No of units**	**Work norm (units /man-day)**	**Total work load (man days)**	**Standard costs (RM/unit)***	**Total costs (RM)**	**No of units**	**Unit costs (RM)**	**Total Costs (RM)**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1. Harvest planning (CC 1)										
1.1 Boundaries										
Compartment boundary survey and demarcation	km									
Boundary maintenance	km									
Monitoring of survey activities	ha									
1.2 Pre-harvest assessment										
Forest function mapping/ pre-Felling Inventory/Tree Enumeration	ha									
Data processing	ha									
Timber tagging	ha									
Monitoring of assessment activities	ha									
1.3 Road planning										
Road corridor survey	km									
Road planning	km									
Road mapping	km									
2. Harvest monitoring (CC 2)										
2.1 Monitoring										
Monitoring of timber harvests in PRF	ha									
Monitoring of timber harvests in SL	ha									

			Implementation by SFD					Implementation by Contractor		
Parameter	**Unit**	**No of total units**	**No of units**	**Work norm (units /man-day)**	**Total work load (man days)**	**Standard costs (RM/unit)***	**Total costs (RM)**	**No of units**	**Unit costs (RM)**	**Total Costs (RM)**
Monitoring of timber harvests in AL	ha									
2.2 Post-harvest inspection										
Post-harvest inspection	ha									
Canopy density mapping	ha									
2.3 Road construction and maintenance										
Monitoring of road corridor marking	km									
Monitoring of road construction	km									
Monitoring of road maintenance work	km									
Construction of permanent roads (FD)	km									
Construction of secondary/feeder roads (FD)										
Maintenance of primary roads (FD)										
Maintenance of secondary/feeder roads (FD)	km									
3. Planting and tending of seedlings (Cost Centre 3)										
3.1 Enrichment planting										
Planting (including opening of lines)	no									
Beating-up	ha									
Fertilizing	ha*									
Climber/weed control	ha*									

			Implementation by SFD					Implementation by Contractor		
Parameter	**Unit**	**No of total units**	**No of units**	**Work norm (units /man-day)**	**Total work load (man days)**	**Standard costs (RM/unit)***	**Total costs (RM)**	**No of units**	**Unit costs (RM)**	**Total Costs (RM)**
Monitoring by forestry officers	ha									
3.2 Planting of open areas										
Planting (including land preparation)	ha									
Beating-up	ha									
Fertilizing	ha*									
Climber/weed control	ha*									
Monitoring by forestry officers	ha									
3.3 Plantation establishment										
Planting (including land preparation)	ha									
Beating-up	ha									
Fertilizing	ha*									
Climber/weed control	ha*									
Monitoring by forestry officers	ha									
4. Silviculture treatment (CC 4)										
Post-F inventory	ha									
Release: - CL - GCL	ha*									
Liberation of PCTs	ha*									
Monitoring of silvicultural treatments	ha									

			Implementation by SFD					Implementation by Contractor		
Parameter	**Unit**	**No of total units**	**No of units**	**Work norm (units /man-day)**	**Total work load (man days)**	**Standard costs (RM/unit)***	**Total costs (RM)**	**No of units**	**Unit costs (RM)**	**Total Costs (RM)**
5. NTFP harvesting and development (CC 5)										
Monitoring of NTFP harvesting in SL	ha									
Monitoring of sand/ gravel collection in SL	No. of licences									
Monitoring of NTFP harvests in PRF	ha									
Monitoring of sand/ gravel collection in PRF	No. of licences									
Bamboo planting	ha									
Rattan planting	ha									
Planting of medicinal plants	ha									
Planting of fruit trees	ha									
6. Forest protection (CC 6)										
Legal survey and demarca-tion of PRF boundaries	km									
Patrolling of boundaries	km									
Others										
7. Forest recreation activities (CC 7)										
List applicable activities apart from construction and main-tenance works, if any										
8. Agro- and village forestry										
List applicable activities										

			Implementation by SFD						Implementation by Contractor		
Parameter	**Unit**	**No of total units**	**No of units**	**Work norm (units /man-day)**	**Total work load (man days)**	**Standard costs (RM/unit)***	**Total costs (RM)**	**No of units**	**Unit costs (RM)**	**Total Costs (RM)**
9. Nursery management (CC 9)										
Seedling production in own nursery/unit costs	piece									
Purchase of seedlings from outside/unit costs	piece									
Cost of production of other planting material/unit costs	piece									
10. Other field operations (CC 10)										
List applicable activities										

Notes:

Column	Description
(3)	Total units planned for implementation
(4)	Units to be implemented with own staff
(5)	Work norm for implementation of activity with own staff
(6)	Column (4) * column (5)
(7)	Includes all labour costs
(8)	Column (4) * column (7)
(9)	Units to be implemented by contractors
(10)	Standard unit costs for contractor implementation
(11)	Column (9) * column (10)

Table 3: Salaries and field allowances for permanent staff

Position	No of staff	Avg. monthly salary* (RM)	Estimated days per month spent in the field (avg.)	Total daily field allowance (RM)	Attributable to Cost Center
General Manager					13
Deputy					13
Assist. Managers					13
Forest Officers					13
Forest Rangers					CC 1 to 10, depending on activity
Foresters					CC 1 to 10, depending on activity
Clerks					13
Secretaries					13
Drivers					11
Machine operators					11
General workers					13

* incl. everything except field allowance

Table 4: Parameters for calculation of machine costs

Parameter	Unit	Value	Remark
Purchase price	RM		
Residual value (R)	RM		
Useful life (U)	years		
Available machine hours (AMH) per life (AMH (U))	hours		
AMH per year			
Cost of repair per life	RM		Usually ranging from 80 to 120% of purchase price
Cost of service per life	RM		Wage rate per hour
Average investment	RM		(I-R) * (N+1)/2N + R I = Initial Investment R = Residual value N = Current Age
Interest rate	%		
Insurance	RM		
Cost of fuel per AMH	RM		Litre/AMH * Price/litre
Cost of lubrication per AMH	RM		Litre/AMH * Price/litre

Source: Saharudin Bin Ahmad (1997)[1]

Notes:
- The different parameters have to be specified for every type of equipment.
- For light vehicles the AMH have to be replaced with km.

The cost per available machine hour (AMH) will be calculated as per Table 5:

[1] Saharudin Bin Ahmad, 1997: An economic study of alternative timber harvesting systems in Peninsular Malaysia: Analysis of the costs of sustainable management.

Table 5: Calculation of machine costs per AMH

Cost Item	Cost in RM	Remarks / calculation process
A Fixed costs per AMH		AMH = available machine hour
(i) Depreciation		(Unit cost – residual value)/AMH (U)
(ii) Interest		Interest rate * average investment / AMH (year)
(iii) Insurance		costs per year / AMH (year)
(iv) other fixed cost (e.g. license cost)		costs per year / AMH (year)
A Subtotal		
B Variable costs per AMH		
(i) Repair		Repair cost (U) / AMH (U)
(ii) Service		Service cost (U) / AMH (U)
(iii) Fuel		See above table
(iv) Lubrication		See above table
B Subtotal		
C Operator costs per AMH		Wage per shift/AMH per shift
Total Machine costs per AMH		**A + B + C**

Note: The machine cost should be attributed to the relevant cost centres by multiplying the calculated unit costs with the hours a given machine was deployed for a given task.

B: Parameters for Revenue Calculations

There are two tables for capturing forest revenue data. Table 6 collects data on volume-based timber revenues. In case of ex-ante analysis harvesting estimates (column (2)) can be calculated from results of the national forest inventory by multiplying the average volume shares of species with the defined AAC. Alternatively, species shares can be obtained from production records of past years (Source: Forestry Statistics Peninsular Malaysia). Market prices (column (5)) can be obtained from the Economic Unit of FDPM. While market prices do not relate to income or revenues in case of state forestry departments, they are important for analysing the appropriateness of royalties and for analysis of economic significance of forest production.

In Table 7 all forest revenues and income are captured. Estimates of volume-based timber revenues will be summed up and transferred from Table 6.

Table 6: Market prices, royalties and export levy for important timber species

Timber species	Estimated annual harvest in m^3 log volume	Royalties (RM/m^3)	Export levy* (RM/m^3)	Market price at mill gate (RM/m^3)
(1)	(2)	(3)	(4)	(5)
Balau				
Bitis				
Cengal				
Giam				
Keranji				
Membatu				
Merbau				
Penaga				
Resak				
Tembusu				
Tempinis				
Lain-lain/Others				
Subtotal KKB/HHW				
Jati				
Kapur/Keladan				
Kasai				
Kelat				
Keledang				
Kempas				
Keruing				
Kulim				
Mata Ulat				
Mengkulang				
Merpauh				
Punah				
Rengas				
Simpoh				
Tualang				
Lain-lain/Others				
Subtotal KKs/MHW				
Acacia Mangium				
Batai				

Timber species	Estimated annual harvest in m^3 log volume	Royalties (RM/m^3)	Export levy* (RM/m^3)	Market price at mill gate (RM/m^3)
(1)	(2)	(3)	(4)	(5)
Bintangor				
Durian Hutan				
Geronggang				
Gerutu				
Hujan-hujan				
Jelutong				
Kedondong				
Kembang Semangkok				
Kungkur				
Medang				
Mahogany				
Melantai				
Melunak				
Mempisang				
Meranti Bakau				
Meranti Kuning				
Meranti Merah				
Meranti Merah Tua				
Meranti Paya				
Meranti Putih				
Merawan				
Mersawa				
Nyatoh				
Penarahan				
Ramin/Melawis				
Sena				
Sepetir				
Sesendok				
Terap				
Terentang				
Yemane				
Lain-lain/Others				
Subtotal KKR/LHW				
Araucaria				
Damar Minyak				
Kayu Getah/Hevea Logs				
Pine				
Lain-lain/Others				
Jumlah/Total				

Accronyms: **HHW** = Heavy Hardwood, **MHW** = Medium Hardwood, **LHW** = Light Hardwood

Notes:
Column (2): For budget planning purposes (ex-ante) the volumes by species or species group can be estimated from previous harvesting records or inventory results such as the NFI 4.
Column (4): per m^3 sawn timber.

Table 7: Total revenues

Parameter	Unit	No. of units	Revenue per unit (RM)	Total revenue (RM)	Remarks
Annual allowable cut	m^3				
1. Timber harvesting					
Premium PRF dry inland virgin	ha				
Premium PRF dry inland logged-over	ha				
Premium state land dry inland virgin	ha				
Premium state land dry inland logged-over	ha				
Premium peat swamp virgin	ha				
Premium peat swamp logged-over	ha				
Premium mangrove virgin	ha				
Premium mangrove logged-over	ha				
Add other types of premium	ha				
Royalties for logs *(transfer information from Table 4)*	Lump sum				
Royalties for poles, firewood and charcoal	Lump sum				
Timber export levy *(transfer information from Table 4)*	Lump sum				
Cess	m^3				
Other fees (e.g. license fees)	Lump sum				
Subtotal timber revenues					
2. NTFP production					
Premium bamboo	ha				
Premium rattan	ha				
Premium other NTFP	ha				
Royalties bamboo	piece				
Royalties rattan	piece				
Notes: (i) add different royalty size classes for bamboo and rattan if applicable (ii) add royalties for other NTFP as applicable					
7. Forest recreation activities (CC 7)					
Estimated number of visitors/yr	No/yr				
Estimated annual revenues	Lump sum				
Nursery management (CC 9)					
Sale of seedling/planting material	piece				
Vehicles and machinery					
Estimated income/yr from rent	RM				
Buildings					
Estimated income/yr from rent	RM				

Annex

08

Community Based Forest Management

Experiences from 25 Years of German Technical Cooperation

gtz

Community-Based Forest Management (CBFM)
in Southeast Asia

Toolkit

Anke Camphausen
in cooperation with Hannsjörg Wöll

November 2004

gtz

Sector Network Rural Development Asia

Preface

German Technical Cooperation – namely the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH – has supported the forest sector in Southeast Asia for nearly 30 years. Sustainable Forest Management (SFM) has been the subject of at least 20 projects supported through GTZ. Although much of the knowledge gained has been documented within these projects, a systematic and comprehensive assessment, analysis and documentation of the entire knowledge has not been undertaken. In order to enable future German Technical Cooperation projects in the sector as well as partner organizations and other beneficiaries to share the knowledge, expertise and lessons learnt of previous SFM projects, a knowledge management process was initiated in the forestry sector in Southeast Asia.

Its general objective was to

- systematically assess and analyse existing knowledge with reference to future demand
- make available the experience, lessons learnt and knowledge of relevant SFM projects for users
- identify and provide access to resource persons and institutions.

During the knowledge management process five core topics in the context of SFM were identified on which documented experiences and knowledge exist and which are considered to have a current and future demand:

Community-Based Forest Management
Best Management Practices
Capacity-Building
Information Management
Land Use Planning.

This document covers the first topic, community-based forest management. The documented knowledge and experiences are processed in a way to allow quick access to and overview of the relevant information. Documents from project work are listed in an annotated bibliography ('toolbox'), together with brief summaries of each document and hints at usability and potential applications. For direct access to the papers please refer to the Forest Clearing House Mechanism (CHM) website (http://forest-chm.aseansec.org), where many documents are available for download. Other reports can be ordered from the ASEAN Secretariat (asean-forest@aseansec.org).

Contents

Abbreviations

ADB	Asian Development Bank
CBFM	community-based forest management
CHM	clearing house mechanism
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH
IKM	information and knowledge management
LA	land allocation
LUP	land use planning
NGO	non-governmental organization
PNRM	participatory natural resources management
SFM	sustainable forest management
CFPQ	Community Forestry Project Quirino
CGFP	Cambodian-German Forestry Project
FOMISS	Forest Management Information System Sarawak
ReFOP	Regional Forest Programme Southeast Asia
SFDP	Social Forestry Project
SSFFM	South Sumatra Forest Fire Management Project
SFMP	Sustainable Forest Management Project

Part 1

General Analysis of CBFM Processes in the Region

Background

CBFM in the broad context of Southeast Asia can be defined as the acknowledged formal management of forest resources and/ or forest land by local communities (indigenous and migrant population). This can range from participatory integration of local communities in state and/or private forest management to full authority and responsibility over a defined forest land and its management for the benefit of the concerned indigenous and migrant population.

In the mid-19th century, colonial governments in Asia introduced forest management concepts that centred on the paradigm that forest and forest lands are the domain of the state unless legally documented otherwise through title or lease agreement. After independence, most states retained this policy. Ancestral domain claims of indigenous populations received no or little recognition and migrant settlers were considered illegal squatters. Local peoples' natural resources (traditional) rights and practices had to yield more and more to the widespread expansion of industrial legal and illegal logging with unsustainable rates of extraction as well as too often vast mining activities and estate crop establishment including timber plantations. An influx of migrants following the conversion activities in search for agricultural land further aggravated the culminating loss and degradation of the region's forest resource, additionally causing conflicts over unsettled land and user rights.

Since state ownership and government-controlled management of forest resources was neither able to prevent forest destruction nor to assure sustainable forest management, the promotion of CBFM is seen as one ecologically and socio-economically viable option to shift to a sustainable management of forests. The vital role of local responsibility or decisive participation in planning and implementation of forest management has gradually gained wide acceptance during the last 20 years in mainstream development endeavours. In many parts of Asia, governments are devolving control over forests and forest lands to local communities and small farmers thus contributing to secure or improve livelihood opportunities for millions of poor rural households of forest-dependent communities. Along with the provision of tenure security other underlying important causes of deforestation are addressed in the wide range of approaches put together under the CBFM umbrella (e.g.: community forestry, social forestry, collaborative forest management, joint forest management). However, depending on the local conditions, some programmes retain many conventional state-centred management features, whereas others are more oriented to truly community-based systems.

Common frame conditions for the development of CBFM in Southeast Asia:

- Depleted forest resource and forest loss
- Lack of capacity of government institutions to manage and protect forest resources
- General paradigm shift from timber oriented forest exploitation systems to a more multi-functional and sustainable use of forest resources
- General decentralization efforts
- Commitment of governments towards poverty reduction

The advanced CBFM-approaches address the complex site-specific situations and needs of the local population through multi-sectoral collaborative management. Different services of decentralized government administration and other assisting organizations or institutions are integrated to capacitate the communities in the long run to protect, manage and use autonomously forest and forest lands. At the same time this strategy aims at incorporating the site-specific context of the human-environment relationship and participatory and transparent decision-making into national formal forestry systems.

In practice most of the Southeast Asian countries' multifold participatory approaches are applied only at project or programme level. Debates are ongoing to find appropriate policy mechanisms to incorporate on the national level a range of site and situation-specific collaborative CBFM arrangements. The Philippines provide an example, where so-called people-oriented forestry pilot projects – after a long series of failures and disappointing results – gradually evolved into a national CBFM programme, this now being accepted as the primary strategy for upland development. At this stage the challenge is to implement broad policy concepts by the promotion of operational networks for site- and situation-specific multi-sectoral action programmes.

The enabling conditions for CBFM common in the region can be summarized as follows:

- organizational and structural prerequisites to clarify and secure long-term land tenure titles
- planning, implementation, utilization and marketing capacities to empower indigenous people or to mandate village communities with the decentralized management and use of forest resources and forest land still under public domain
- in-country technical support and capacity building in all essential components of sustainable land use and resource utilization including aspects of rural regional development
- development and institutionalization of cross-sectoral partnership and coordination mechanisms specifying roles and functions between legitimized local community organizations, local government units, forest administration and other partners

- internal organization of the local CBFM community and the unequivocal collaboration with the village, municipal, provincial government institutions, the forestry administration, NGOs and other stakeholders
- legitimization and institutionalization of clearly defined obligations and responsibilities of CBFM communities and assisting partners from the local to the national level
- decentralized service provision to forest dependent indigenous people and rural communities
- modifications/ changes of state forest policies and administration structures
- strong political will and a nationwide commitment based on the political reality of decentralization and initial democratization. Forestry, including CBFM, cannot be viewed separately from this slowly progressing general political development.

Expected Benefits

- The community's boundaries, forest and land resource claims are acknowledged by the neighbouring population. The zoning of the village district area in forest production, protection and agricultural lands as well as private domains is internally agreed upon, delineated, mapped and documented.
- The community obtains forest land and resource tenure instruments, which provide security of tenure and incentives to protect, manage and use forests and forest land. Roles and functions of central government and decentralized local government units as well as of traditional structures are conciliated and interactive collaboration and partnership relations are defined and effective.
- The community makes active use of available service systems and cross-sectoral support mechanisms from government agencies and other collaborating organizations to improve and adapt capacities according to priority development needs in sustainable utilization, management and protection of forest and forest lands. The ecological impacts and benefits of an integrated forest utilization concept are recognized.
- The community and its committees define in consultation with the village district authorities modalities to manage and protect forest and agricultural land use zones in line with public rules and regulations. They dispose of guidelines and procedures on utilization and marketing of forest products, on administration of funds and forest revenues including compensation of labour, re-investment and profit-sharing as well as of mechanisms on supervision and internal sanctions for non-compliance with the terms of the community agreement.
- The community contributes by improved, environmentally-friendly forest land use and forest management systems as well as value-added production and revenues of forest products to the sustainable development and livelihood needs of the village district.

General Issues and Challenges

The following section provides a simplified overview of the most important issues affecting community-based forest management approaches at different development stages in the region.

- **Unstable policy environment**

- The encouraging policy shift from monopolistic state forest resource control to CBFM is an ongoing dynamic process in several Southeast Asian countries, e.g. Viet Nam, Cambodia, Philippines. However, it is still hampered by various degrees of resistance from politicians, government and forest departments to give away authority to lower administrative levels and local communities. It is not unusual that governments practice tandem ‘top-down’ and community-based forest management approaches. Furthermore, it can be observed in most of the countries that governments are (only) willing to change their policies and share management authority with communities as forest conditions have already deteriorated, e.g. Indonesia, Viet Nam, Cambodia. Substantial reform of several countries’ CBFM legal and institutional framework is underway but its pace is slow and does not keep up with the growing need for providing a stronger unequivocal basis for implementation and enforcement. Regardless of the degree and stage of the CBFM process – ranging from centralized paternalistic employer-labourers to equal decentralized multi-stakeholder partnerships – an often unstable policy environment in the countries leads to weak implementation of CBFM and questionable sustainability of CBFM areas (e.g. Indonesia).

- An emerging civil society in several Southeast Asian countries has become an important stakeholder effecting community forestry reform. However, urban-based conservation NGOs[1], environmental groups, media, NGO-CBFM networks, community federations and research institutions are too sporadically involved in the information, dialogue, conflict mediation and decision-making process to be able to effectively facilitate the policy interface between state forest management and CBFM systems. Yet, the policy making process was and is significantly influenced by some of the non-government networks (especially Philippines, Indonesia, Thailand).

- **Inadequate national CBFM implementation mechanisms**

- The means and mechanisms for strengthening and institutionalizing the dialogue and partnerships between all levels of government, communities and other stakeholders on devolved CBFM functions, are still rudimentary and sometimes not well adapted to changing needs and demands. Several countries are still struggling and/or unwilling to find appropriate mechanisms to empower and capacitate local communities (e.g. Indonesia, Ma-

[1] Some of the urban-based NGOs are at odds with CBFM.

laysia). Those who passed this stage and adopted various site- and situation-specific CBFM arrangements are challenged now with the problem of how to implement these sophisticated concepts and to facilitate the vertical and horizontal integration into national decentralized and transparent formal forestry systems (e.g. Philippines). At the national level multi-sectoral fora and committees – indispensable for broad consensual decision-making – often have limited success because there is a lack of small operational working teams with an adequate skill mix who would ensure that specific priority issues are addressed in time and continuity. However, bridging the gap between national CBFM planning and local socio-economic and ecological realities remains problematic.

- Moreover in most countries fiscal and budgetary constraints slow down the restructuring and institution-building process towards CBFM. In many cases this prevents the mobilization and effective use of human resources and new technologies, which are required to improve information and knowledge management as well as monitoring and evaluation. Severe budgetary constraints of local governments and inadequate resource mobilization for required funding and other incentives necessary to ensure collaborators' motivation do not allow complying efficiently with the high and labour-intensive leadership requirements of a decentralized multi-stakeholder CBFM policy implementation.

- **Inadequate security of land tenure for local communities**

- Security in forest land and resource tenure is the central issue affecting CBFM in most Southeast Asian countries. Institutionalized effective tenure instruments which would be based on benefit-sharing, would recognize rights of traditional users or local communities as well as secure access and incentives to protect, manage and use forest and forest lands are still not adequately developed. Indonesia, and to a certain extent Thailand and Cambodia, are still aiming to anchor land use and tenure arrangements conducive for CBFM into legal, institutional and administrative structures. In the Philippines various forms of long term land use and tenure arrangements with accredited communities (People's Organizations) and property regimes with indigenous people are issued. Due to a slow paradigm shift to service-oriented assistance as well as inadequate skills and capacities of government units, inconsistencies exist in the timely awarding of various tenure arrangements to local communities and lead to partnership conflicts.

- **Inadequate capacity-building in particular at local level**

- Many countries have made considerable progress in decentralizing or devolving responsibilities for the delivery of cross-sectoral services to an integrated landscape-based CBFM approach. However, most of them have yet to develop site- and situation-specific multi-stakeholder collaboration arrangements and mechanisms at local levels to allow for more effective planning and management of, and better services for integrated CBFM programmes. The expansion and implementation of a broad-based CBFM approach is severely hampered by a shortage of financial means, in-country institutional capacities as well as mobilized personnel with an adequate skill mix, especially in the field of organizational and social change processes (e.g. Philippines, Viet Nam, Cambodia).

☛ A critical issue for the successful implementation of CBFM in the region is the lack of in-country capacities for related training with appropriate training contents and materials capable of reaching large numbers of participants from a variety of target groups at reasonable cost.

☛ Despite this inadequate environment, a number of countries started, often in collaboration with NGOs and other agencies, decentralized hands-on training programmes to capacitate forest-dependent communities to manage their natural resources based on sustainability standards and lessons learnt (e.g. Viet Nam, Philippines). However, support to CBFM communities remains in general too fragmented and often does not incorporate communities' or indigenous peoples' vital needs, perceptions and potentials with regard to land use planning and integrated forest ecosystem management.

- **Outdated and inadequate techniques and technologies unsuitable for sustainable integrated CBFM implementation**

☛ In practice, adequate techniques are mainly developed and applied at project level (model areas). However, a wide range of manuals, handouts, technical handbooks and publications exist but are not used or made available. In most countries technical constraints to a successful implementation of CBFM can be summarized under the following categories: inadequate integrated community land use and management planning techniques, poor technical quality of multiple-use forest ecosystem management and protection, lack of effective techniques and technologies to farming and livelihood alternatives. In most countries awareness increased that the enhanced use of blended traditional and modern technologies is an essential prerequisite to facilitate progressively a broader implementation of the complex CBFM approach.

☛ On the one hand, sustainable traditional methods and communities' perceptions and potentials are often not taken adequately into consideration. On the other hand modern technologies, vital for multiple-use community forest ecosystem management, are still seldom applied or available. Community forest planning and implementation techniques frequently focus primarily on wood production and timber products. However, due to a lack of means and capacities of the communities, the methods and procedures applied are outdated and/or impractical. This results in poor technical quality of forestry operations. Financial investment analyses for CBFM sites with naturally regenerated production forest are rare.

☛ Inadequate techniques also prevail in community land use classification, planning, implementation and monitoring. In some countries GIS and satellite images are used to integrate and monitor community land use and management plans in the overall watershed, municipal and provincial land use planning and database management (e.g. Philippines, Thailand). Participatory community land use mapping and functional zoning are increasingly applied and sponsored but only in rare cases adequately integrated into national land use and other planning maps. Sustainability appraisals of community land use plans are exceptions.

- Farm and livelihood development of communities on forest lands in the frame of community land use plans is still largely neglected. Site-specific, alternative sustainable farming systems and techniques for upland settlers as well as programmes to promote and maintain existing environmentally-friendly farming elements of indigenous people are only occasionally developed and applied. In some CBFM areas participatory financial analysis and monitoring tools are tested. Effective livelihood programmes and tools for value-added production are scarce even if in exceptional cases a large number of livelihood options for upland ecosystems have been analyzed and compiled on a national basis.

- There is a serious gap in micro-financing, marketing and small-scale business development. CBFM communities have rarely access to competitive credit facilities and lack marketing as well as business management tools and linkages. In some CBFM areas, small community-owned saving banks are set up and linkages to rural banks established, mainly with the assistance of NGOs and donor organizations. The process of promoting enterprise development of small producers is ongoing. However the transfer of adequate tools and skills to community members and organizations for small-scale business remains still marginal.

- Community and public sector operations to jointly improve and coordinate the rural infrastructure on forest lands are rare. Existing guidelines for construction and maintenance of environmentally friendly access roads are often not complied with, mostly due to lack of means and capacity.

Common Strategies and Approaches

The following overview of common community forestry strategies of Southeast Asian countries in different CBFM development stages is grouped into several categories ranging from macro to micro levels. At least in theory, these community forestry strategies are generally regarded by most of the Southeast Asian countries as guiding principles and concepts to attain and secure long-term CBFM policy objectives and provide a basis for generating new opportunities. The status of implementation, however, varies from country to country.

- **Strengthening national CBFM framework and implementation mechanisms**

- develop and promote legal and regulatory – minimum rules – frameworks that provide an unequivocal and encouraging basis for CBFM

- strengthen and institutionalize dialogue and partnerships between various levels of government, communities and other stakeholders on devolved CBFM functions and outline roles and responsibilities of cross-sectoral, multi-stakeholder central and decentralized structures
- promote comprehensive capacity-building concepts to re-orient key-personnel on CBFM, good governance and quality management principles
- set up priority frameworks and operational action plans to promote and facilitate vertical and horizontal coordination and integration of site- and situation-specific multi-stakeholder CBFM programmes into national decentralized forestry systems
- design strategies to mobilize and make effective use of human, financial and institutional resources and facilities for CBFM
- improve information and knowledge management as well as monitoring and evaluation in combination with the enhanced use of advanced technologies.

❑ **Providing tenure and resource security on forest lands for local communities**

- promote practical approaches providing CBFM land tenure and resource use security to traditional users and local communities
- review land and resource tenure arrangements to make them more conducive to conservation and implementation of sustainable management systems
- develop and institutionalize effective benefit-sharing and minimum rules tenure instruments recognizing rights of traditional users or local communities as well as sanctions for non-compliance with regulations
- anchor adequate land use and tenure arrangements within local institutional and administrative structures.

❑ **Promoting capacity-building at provincial and local level**

- prioritize strengthening and development of institutionalized and decentralized multi-stakeholder collaboration arrangements, mechanisms and structures with clearly defined roles and functions to allow for more effective planning, management and cross-sectoral services for an integrated landscape-based CBFM approach
- promote and develop co-financing mechanisms to improve and sustain coordinated funding for local service delivery to CBFM communities by government agencies, private stakeholders and assisting organizations
- enhance decentralized hands-on training including trainers' training in collaboration with NGOs to re-orient service providers in participatory CBFM processes and adapted techniques
- intensify and prioritize capacity development assistance to indigenous people and communities on forest land to support their development and, by means of CBFM programme measures, contribute to prevent environmental degradation.

- **Developing adapted CBFM techniques**

Land use

- promote integration of cross-sector community land use planning into watershed management and landscape approaches to facilitate improved forest lands and natural resources management with support of GIS and satellite images
- expand participatory community land use planning and functional zoning including delineation as well as adequate integration of land use zones into maps
- intensify the application of user-friendly simulation models to appraise sustainability of community land use plans and monitor implementation.

Forest management

- advance and improve technical quality of community forestry operations vital for multiple-use ecosystem management and protection, taking into consideration communities' perceptions, potentials and sustainable traditional methods as well as adequate modern technologies
- promote investment analyses of naturally regenerated and plantation forests on CBFM sites.

Farm, livelihood and business development, off-farm employment

- enhance and develop site-specific sustainable farming systems integrating existing environmentally-friendly traditional elements
- develop and use participatory financial analysis and monitoring tools for individual farm development
- increase livelihood options and tools through value-added local production schemes
- promote micro-financing and access to competitive credit facilities, provision of business management tools as well as marketing and market linkages.

Infrastructure

- facilitate coordination of public sector rural infrastructure development with CBFM operations.

Impact of approaches

The package of common CBFM strategies and approaches provides a long-term frame for a meaningful empowerment of the region's communities to establish sustainable natural resources management and environmental protection on forest lands and to secure rural poverty reduction. Yet a wide-spread implementation still calls for country and site-specific evaluations and use of success factors to build up adequate local networks.

Precise information on CBFM impacts on various levels of intervention ranging from micro to macro levels is scarce. Notwithstanding, the summarized effects – as listed below – mainly from CBFM programme or project level interventions are promising, in particular if land tenure security and a decentralized community empowerment approach is assured, which adequately addresses complex site-specific conditions and local communities' needs and obligations within the frame of cross-sectoral federalized local networks and partnerships.

Beneficiary local village communities/indigenous people and decentralized multi-stakeholder partnerships

- The participatory process of community forest land and resource use planning, assisted by local service providers (local government units, NGOs, other assisting agencies)…

  - settles boundary conflicts between neighbouring populations as well as internal utilization divergence of communities,
  - provides security of tenure and incentives to protect, manage and use forests and forest land, once the community has obtained land tenure and resource utilization instruments,
  - puts an end to an open access and utilization regime of forest lands (migration influx),
  - conciliates and clarifies roles and functions for interactive decentralized collaboration and partnership arrangements between communities, local government units and assisting organizations,
  - promotes in most cases, if applied from the very beginning at grass-root levels by cross-sectoral and multi-stakeholder collaboration, good forest governance and avoids emergence of breeding grounds for violent conflicts.

- The communities and their committees are capacitated in essential components of organizational development and management techniques for a sustainable cross-sectoral CBFM implementation through institutionalized regular support of local service providers. This enables them to…

  - make active use of available service systems and support mechanisms from government agencies and other collaborating organizations according to priority needs in sustainable utilization, management and protection of forest and forest lands,
  - recognize ecological impacts and benefits of an integrated multiple-forest use and environmental protection concept,
  - define in consultation with the village authorities and local service providers modalities to manage and protect forest and agricultural land use zones in line with public rules and regulations and dispose of guidelines and procedures on utilization and marketing of forest products, on administration of funds and forest revenues including compensation of labour, reinvestment and profit sharing as well as of mechanisms on supervision and internal sanctions for non-compliance with the terms of the community agreement,
  - set up micro-financing schemes and links to competitive credit facilities of rural banks,

- establish access to domestic and/or international markets and market forest and livelihood products for fair prices,
- harmonize public sector rural infrastructure development with sustainability prerequisites of CBFM planning and operations,
- contribute by improved, environmentally-friendly forest land use and forest management systems as well as value-added production and revenues of forest products to the sustainable development and livelihood needs of the village district.

Capacity development on provincial level

- Institutionalized and decentralized CBFM multi-stakeholder collaboration with clearly defined roles and functions accompanied by inter-agency capacity development and training for quality management and technical measures…

- gradually builds confidence and trust, improves information delivery, transparent decision-making processes, leadership and management capabilities as well as good governance principles,
- uses synergies from interfaces with various collaborating government units and other agencies and in particular improves resource utilization of personnel, budget and equipment,
- streamlines coordinated cross-sectoral planning, implementation and monitoring of multi-stakeholder CBFM measures and service provision.

Summarized major ecological, social and economical impacts in CBFM programme areas with an integrated landscape approach

- Overall cross-sectoral CBFM implementation based on a functional horizontally and vertically integrated partnership approach between communities, government and assisting agencies on provincial level…

- reduces rates of deforestation, provides forest protection, improves the condition and functioning of forest ecosystems, enhances biodiversity conservation, increases tree cover and productivity of forest lands,
- promotes the social status, provides legal security and empowerment of forest-dependent indigenous peoples and communities,
- creates and increases income from sustainable management of naturally regenerated production and plantation forests as well as from improved farm development, value-added production and marketing,
- enhances livelihoods and provides food security.

National CBFM framework and coordination mechanisms

- An institutionalized national multi-stakeholder CBFM dialogue platform involving relevant government departments and research institutions, NGO-CBFM networks, field teams with practical experience and community federations, organized in a manner that permits a structured dialogue of various committees (e.g.: round table for policy and thematic reconciliation of interest, convergence desk and operational working teams for the development of thematic priority modules and action plans as well as public participation by means of fora, internet and media)…

- provides a framework for national CBFM coordination and multi-stakeholder collaboration and links up with the regional/provincial levels on devolved CBFM functions,
- influences the legislative framework and provides minimum rules and regulations conducive to CBFM,
- defines and develops priority modules[2] and action plans and promotes CBFM implementation based on good governance and quality management principles.

In several countries like in the Philippines, Viet Nam, Cambodia and to a certain degree Indonesia a national CBFM dialogue is underway and brings forth successively and in varying degrees the above-mentioned effects, often within the frame of national forestry programmes (nfp).

Community-Based Forest Management in Southeast Asia and its Impact on Poverty Reduction

A broad and flexible CBFM strategy – based on good governance principles, ensuring cross-sectoral and multi-stakeholder partnerships, rural livelihoods and incomes for poor local communities and indigenous people on forest lands, while maintaining biodiversity and forests – is the key to sustainable poverty reduction within the frame of sustainable forest management.

GTZ-assisted programmes and projects in the field of sustainable natural resources and forest management prioritize and address self help-oriented poverty reduction. They focus on ensuring livelihoods and income for forest-dependent communities and indigenous people. A number of international agencies, for Southeast Asia in particular the Asian Development Bank (ADB), as well as acknowledged NGOs, have integrated poverty reduction primarily through community-based forest management in their forest sector development goals.

For the rural poor in Southeast Asia forest lands and forests provide a crucial resource and safety net in achieving food and livelihood security. Forest-dependent communities rely on forest land and forests not only for food production and collection but also for medicine, fodder, hunting, gathering and wood utilization as a ready source of cash. For example, in many rural communities in Laos virtually all food except rice is derived from forests, and non-wood forest products provide an average of 55% of family cash income of villages near forests.[3]

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[2] Philippines 2003, priority themes in the frame of the national CBFM dialogue platform are: best practices in collaborative management, improved info processing and delivery, adjustment of rules and regulations, internal resource mobilization.
[3] ADB, 2003: Asian Development Bank, Forest Policy (Working Paper), June 2003.

Continuing forest loss and degradation and poverty are directly linked and mutually reinforce each other. The vast majority of the poor live in rural areas especially in exploited forest uplands designated as a domain of the state with difficult access, steep slopes and poor soils unfavourable for the development of sustainable agricultural systems. In contrary to more favourable agricultural areas where poverty has declined in recent years, poverty has been persistent in forest lands with fragile environment. Consequently it leads to further forest and environmental destruction by increasing dependence on forest resources and conversion into unsustainable farming crop patterns thus destabilizing forest ecosystems and forest services for environmental security. This process of deforestation in water catchments undermines not only the livelihood basis of the forest-dependent rural poor in the uplands but is also linked to disastrous floods (e.g. degradation of catchments and floods contribution: 1992/93Leyte Islands/ Philippine, 1999: eight provinces in central Viet Nam), with serious negative effects for the downstream population ranging from irregular and poor quality water supply for people and sustainable agriculture as well as fisheries.

The adoption and implementation of an integrated broad CBFM approach based on good governance that puts priority on poverty reduction, social development and environmental protection through:

- provision of unambiguous legal and minimum rules, CBFM framework and national cross-sectoral coordination mechanisms linked to the regional/ provincial levels on devolved CBFM functions
- security of forest land tenure and resource use
- decentralized local communities' government capacity-building and multi-stakeholder partnerships including active service provision to communities
- adapted CBFM techniques in land use planning, sustainable multiple-use forest management and protection, sustainable individual farm development, livelihood improvement, value-added production and small-scale business promotion, micro-credit arrangements, marketing and environmentally-friendly infrastructure development on forest lands

improves significantly food security and livelihoods, increases incomes and provides additional jobs for the poor target population on forest lands. On village district, municipality and provincial level the provision of legally harvested timber and non-wood forest products for processing enterprises as well as the increased and diversified offer of agricultural goods contributes to the sustainable development of the region.

GTZ projects’ contribution to poverty reduction – a case study

The GTZ/KfW-assisted CFPQ programme in Quirino Province/Philippines demonstrates that CBFM plays an important role in achieving poverty reduction, environmental protection and sustainable development in an integrated manner. All in all the application of the previously mentioned principles and strategies of a broad-based and integrated CBFM approach brought forth the following results and effects with regard to poverty reduction:

25 upland communities with CBFM agreements on forest lands now cover around one third of the province area of 315,000 ha and more than half of the logged over forests of 123,000 ha. In 2002/ 2003 three communities with resource use permits realized annual net revenues of around € 15,000 through sustainable selective logging with water buffalos (‘carabao’) and generated 30 full time jobs. Presently, according to conservative estimates for all sites with an actual CBFM agreement and adequately sized naturally regenerated production forests (> 700 ha) **internal rates of return range from 13% to 43% and 143%. Annual net revenues of around € 60,000** (**€ 100-130 per community household**) can be expected **from ‘carabao’ logging** and around **110-120 full time jobs** will be created. Growth of established community or individual **reforestation** on 2240 ha and actual lumber prices allow to forecast an **average 40% internal rate of return**. Rough estimates expect net revenues from € 7.7-12.8 mio from the final cut of those plantations after 10-15 years. In the sector development of **sustainable upland farming systems**, **food security** has been achieved and the beneficiaries in **agricultural production zones on forest lands with irrigated and dryland crops** in average realize an **increased income** of around € 300 per year in comparison to farmers who do not apply improved practices. Theoretically the aggregated annual revenue increment of all 365 participating beneficiary households (around 15% of the population of the CBFM project areas) amounts to around € 106,800, still excluding 150 additional farmers of the intervention areas who apply propagated improved farming methods (‘multiplier effect’) without direct support of the established financial intermediaries (people-owned saving banks). From the **extended agroforestry plantations** the projected **internal rates of return of 48%** are promising. They considerably exceed the interest rates of credits from rural banks. Further direct effects on poverty reduction have been achieved (but are not yet quantified) by joint and coordinated CBFM communities and public sector operations to construct, rehabilitate and maintain environmentally-friendly access and farm to market roads (42 km). Additional gains from **improved market linkages** have been realized.

At the same time the integrated CBFM measures generated positive environmental and sustainable development impacts.

The closed forest cover loss in the project and province was reduced between 2000 and 2003 to minimal areas. According to successive satellite photo analysis, it amounted to a mere 70 ha. Illegal logging was brought down to occasional small-scale timber poaching. The internal land use boundaries between protection and production forest and agricultural zones of the community land use plans were adhered to (one exception). Forest protection and utilization standards were applied and sustainable agricultural practices increased steadily. Migration influx was brought down to zero by the communities and nowhere the CBFM agreements were overruled by mining applications and industrial forest management agreements. Horizontally and vertically integrated service provision for the communities is presently assured by an institutionalized multi-sectoral collaboration, and a newly created foundation continues to coordinate and harness local multi-stakeholder CBFM efforts in the province.

Part 2

Synthesis of German Technical Assistance Projects

Introduction

In Southeast Asia GTZ has more than 25 years of experience in the field of community-based forest management (CBFM). The lessons learnt are summarized in the section below. Table 1 provides an overview of projects with CBFM components, their general approaches and strategies towards CBFM. Box 1 gives a more detailed synthesis of the implementation of CBFM approaches by GTZ-assisted projects. GTZ-assisted projects promote and support the ongoing shift from state-dominated to decentralized governance of forests and forest land management by local communities. GTZ typically uses a two-level approach: On the one hand, a horizontal integration encouraging partnerships, collaborative management, collaborative learning and implementation, strengthening local and community organizations as well as institutionalizing mechanisms and arrangements for harnessing multi-stakeholder CBFM efforts. In parallel to this horizontal integration, a vertical integration of site- and situation-specific local CBFM programmes into national forestry systems is promoted and set within a framework of national coordination and operational action plans. Project approaches aim to link different scales of policy decision-making, institutional change and organizational learning as well as to consider participatory field-based practical experience and methods. To a great extend, the GTZ-supported CBFM project strategies in Southeast Asia aim to cover with their concepts and core methods the summarized common process approaches envisioned and partially applied in the region as outlined in Part 1.

Lessons learnt

This section summarizes experiences of GTZ-assisted CBFM projects in the region which proved significant with respect to a successful implementation of CBFM strategies.

- It has to be recognized that CBFM is one tool to solve land use problems and achieve a more sustainable management of forest resources. However, a consistent and stable regulatory framework is needed to establish the procedure, rights and obligations. Otherwise, CBFM will only become a playground for brokers and illegal loggers (example Indonesia).

- Since CBFM encompasses two major objectives, namely poverty reduction and sustainable management and conservation of natural resources, it needs to be viewed in a broader context, e.g. in the context of watershed management. This provides a more holistic concept by which to bring together livelihoods and natural resources management. It also means that CBFM projects' approaches and methodologies have to go beyond the forest sector and include rural development schemes, improved agricultural techniques, capacity development, land use rights, conflict management etc. This is in line with and supports the countries' endeavours in the development of decentralized policy frameworks as well as the implementation of approaches towards rural poverty reduction under conflicting conditions (examples: Cambodia, Lao PDR, Viet Nam, Philippines).

- The concept of a multi-level approach at the various administrative levels (from national policy level down to the field level) as well as bottom-up processes of policy advisory services provides a realistic input to national level forest policy development. This way local level conditions and demands can be taken into account. Additionally, the combination of policy advisory and technical advisory functions further allows bridging the gap between the innovations in technical interventions and policy changes. In many Southeast-Asian countries considerable changes currently occur due to decentralization and devolution processes. The project approach at multi-levels, in particular including local levels, allows responding quickly to these changes, including them into the project concept, and thus supporting and using these decentralization processes (examples: Indonesia, Philippines).

- Cooperating with a multitude of stakeholders, including government, private sector, NGOs, universities and local field-level-based organizations is critical for successful and sustainable implementation of CBFM. Projects thus function as intermediaries between the various, often conflicting actors. This helps create and/or consolidate partnerships and set up and support institutions required for the successful promotion, implementation and further development of project achievements. It furthermore puts the projects in a position to ensure that fieldwork is carried out in close coordination with the government institutions and with high transparency towards NGOs (examples: Indonesia, Viet Nam, Philippines).

- Capacity-building approaches prove to be most successful if they are systematically integrated into the project's methodology development and involve a range of partner agencies. This strategy helps strengthen existing capacities and ensures the continuity and sustainability of the projects' achievements (example: Viet Nam).

- Most Southeast Asian countries are faced by limited resources for implementing forest sector development. Thus there is a need to utilize and strengthen existing capacities and to create synergy effects. One crucial element of capacity-building therefore is the development and institutionalization of cross-sectoral partnership and coordination mechanisms clearly specifying roles and functions between legitimized local community organizations, local government units, the forest administration and other partners (example: Philippines).

Table 1 GTZ-assisted projects with CBFM components

Land	Project (duration)	Project purpose	General strategy to CBFM	CBFM approach
Cambodia	Cambodian German Forestry Project (CGFP), Phnom Penh (1996 – 2004)	Relevant institutions and the rural population in the project area increasingly implement the principles of sustainable forest management and promote its dissemination	Back-stopping of national consultation process on the drafting of the Community Forestry Sub-Decree Studies on the status of CF and CF initiatives, opportunities, challenges and constraints	
Indonesia	Social Forestry Development Project (SFDP), West Kalimantan (1989 – 2003)	Welfare of local population in forest areas increases in a sustainable way and the sustainability of the forest resource base is maintained.	Model for CBFM of natural forests in designated test area including all forest related activities inside and outside existing natural forests (i.e. reforestation, land rehabilitation, natural forest management)	Multi-sector, multi-stakeholder approach. CFM model is designed as a self-reliant, self-financing system, which is based on participatory village land use planning, customary land tenure, and simple and profitable silviculture and harvesting techniques.
	Sustainable Forest Management Project (SFMP), East Kalimantan (1991 – 2002)	Sustainable management systems for natural production forests in East Kalimantan are supported by national forest policy and implemented by concessionaires and the local population.	Social forestry schemes as part of overall approach to a sustainable, certifiable forest management system; i.e. development of models for an improved and fair cooperation between local forest based communities and forest concessions; proposals for improved income generation mechanisms for marginalised local population	Proposing various degrees of local participation and partnership patterns between local forest based communities and forest concessions; i.e. participatory land use assessment (social zoning); participatory border demarcation; local people as employers in the industrial timber business (partnership schemes).
Lao PDR	Promotion of Forestry Education Project (PROFEP) (1993 – 2003)	The Faculty of Forestry is qualified to provide academic education in the context of a well-designed forestry education system, according to the demand of the forestry sector and in line with the National Forest Policy.	CBFM as part of the creation of a model forest management in the Training and Model Forest of the Faculty of Forestry (TMF). This is to be replicable in other parts of Lao PDR.	Development and implementation of concepts of forest resource management in TMF: joint forest management in the faculty forest and self-help oriented CBFM on village land. Capacity building, in particular following the concept of 'model farmers'.
Malaysia	Forest Management Information System Sarawak (FOMISS) (1995 – 2001)	Sustainable, environmentally friendly and socially acceptable forest management system is applied in Sarawak	Integration of local forest based people in forest management	Participatory planning process aiming at converging the conflicting interests for sustainable, multi-use forest management (including, participatory multi-disciplinary forest resource assessment, forest zoning, documentation of customary rights, community development programme).

	Sustainable Forest Management Project (SFMP), Sabah (1989 – 2001)	The sustainable forest management system is tested and progressively implemented	Model for CBFM of natural forests in designated test area Integration of local forest based communities in forest management planning	Social baseline studies as part of medium term forest management planning.
Philippines	Community Forestry Project Quirino (CFPQ) (1994 – 2003)	Local communities, with support from the Local Government Units and Department for Environment and Natural Resources, manage their renewable natural resources following the criteria of sustainability	Community Forest Management as core component of sustainable rural development. Additional supplementary measures: participatory land-use planning, promotion of sustainable agriculture and agroforestry, rural finance schemes, community-implemented / income-oriented infrastructure	Multi-stakeholder approach working with government institutions and local community organizations. Components: Strengthening national framework, coordination mechanisms and CBFM techniques; participatory land-use planning as basis for the provision of Land Tenure Instruments; participatory and transparent procedures for the preparation of Resource Use Plans and Annual Work-Plans for sustainable forest utilization; rural finance schemes designed for the purpose of serving "sustainable forest management, sustainable farming systems promotion, and income-oriented infrastructure"; capacity-building on government as well as local level.
Viet Nam	Social Forestry Development Project (SFDP), Song Da (1992 – 2004)	Rural communities in Son La and Lai Chau provinces manage their natural resources in an ecologically, economically and socially sustainable way	CBFM as part of overall land use strategy within watershed management (protection)	User: local forest groups, administrative units (district forest protection unit) Components: Participatory Land Use Planning and forest allocation, forming of forest protection groups, facilitation of the formulation of village forest protection and management regulations. Strengthening village and commune organizations. Setting up experiment and demonstration plots.
Lower Mekong Basin (Cambodia, Lao PDR, Thailand, Viet Nam)	Sustainable Management of Resources in the Lower Mekong Basin (1995 – 2002)	Sector organizations in the Lower Mekong Basin generate and manage collaborative forest management (CFM) - relevant information more effectively	CBFM as part of Participatory natural resources management (PNRM). Inventory and further development of CBFM and LUP concepts, strengthening of implementing and supporting institutions, improved management and exchange of information on CBFM and LUP within the Lower Mekong Basin. Feeding information back into policy / decision-making processes for further improvement of PNRM.	Varied CBFM and LUP model activities in the four countries of the Lower Mekong Basin, adapted to the context of the respective country.

Box 1 Core elements of GTZ's CBFM approach and implementation

National CBFM framework and implementation mechanisms

Providing inputs to draft and revise relevant laws and regulations and/or establishing as well as back stopping respective consultative processes

CGFP Cambodia

SFDP Indonesia

SFMP Indonesia

SFDP Vietnam

Land use planning and settlement of land use rights

Supporting the development of land use planning and land allocation methodologies

CGFP Cambodia

SFDP Indonesia

CFPQ Philippines

SFDP Vietnam

Developing collaborative planning processes between companies and communities

SFMP Indonesia

FOMISS Malaysia

Capacity building

Improving education and training system of forestry staff

CGFP Cambodia

SFDP Indonesia

SFDP Vietnam

Training (incl. Training of Trainers) and extension of communities, usergroups, government staff of line departments on CBFM system, its technical components and participatory methods

SFDP Indonesia

CFPQ Philippines

SFDP Vietnam

Setting up of community institutions

SFDP Indonesia

CFPQ Philippines

SFDP Vietnam

Supporting the institutionalization of the cooperation of involved organizations

CFPQ Philippines

SFDP Vietnam

Adapted CBFM techniques

Developing CBFM adapted Management Systems

SFDP Indonesia

CFPQ Philippines

SFDP Vietnam

Introducing a multi-disciplinary forest resource assessment

FOMISS Malaysia

Developing methodology for cost-benefit analysis of CBFM

CFPQ Philippines

Developing conflict mediation methodologies

SFMP Indonesia

FOMISS Malaysia

Monitoring and Evaluation

Developing a project M&E system; impact monitoring of project activities

SFDP Vietnam

GTZ core competencies

The following approaches and/or methods are common to many of the GTZ CBFM projects in the region. They can be considered as core competencies of the GTZ as they are often unique to GTZ projects, proved to be successful and/or are demanded and/or replicated by other national and international organizations.

Core Competencies

Land use planning
Settlement of land use rights

- clarification of land and resource use rights including conflict mediation,
- land use and integrated natural resource management planning

Capacity Building

Organizational Development

- internal structures and organization of communities (e.g.: on management and utilization of forest and forest land, committee structures and leadership training, guidelines and procedures on administration and management of funds and forest revenues, supervision, sanctions etc.)
- external structures and organization of communities (e.g.: interfaces with village district, neighbouring villages and municipalities, community federations, marketing of forest and non forest products)
- build up of cross-sectoral and multi-stakeholder arrangements and partnerships with government, NGOs and private sector

Training

- participatory appraisal and assessment of development potential of natural resources on forest lands with local communities and other stakeholders
- stakeholder analysis and process oriented development of cross-sectoral collaboration mechanisms and frameworks
- qualification and hands-on training of community actors, government service providers and NGOs in technical aspects of natural resources management (e.g.: land use planning, forest management, farm and livelihood development, value added processing)
- training in general and financial management, small scale business development as well as enhancement of entrepreneurial, leadership, facilitation and mediation qualities

National CBFM framework and mechanisms development

- policy advice from macro to meso and local implementation level (practical bottom-up inputs to national CBFM policies, strategies/ concepts, methods and standards)
- national multi-stakeholder CBFM-dialog platforms (round table, convergence desk, working/action groups, public participation)
- re-orientation concepts on CBFM, good governance and quality management
- national coordination frameworks and action plans between line government departments
- legal and minimum rules and regulations conducive for CBFM

Adapted CBFM techniques

- use of blended technologies (e.g.: participatory community land use planning and integration into landscape approaches with GIS and satellite images)
- assessment of communities priorities and potentials
- incorporation of sustainable traditional forest and land use elements of indigenous people in 'modern' forest management systems
- model supported sustainability analysis of community land use plans
- cost benefit analysis for community forest management and farming systems

TOOLBOX

This toolbox provides a compilation of core methods of GTZ-assisted projects. It highlights the promotion of a broad-based inter-sectoral CBFM approach of GTZ assistance ranging from macro to micro levels. Categorized by five identified key elements of CBFM, core methods are identified and abstracts of respective key documents describing advantages, limitations and challenges of the respective methods are provided. Also, project literature is listed with the respective links to ASEAN's Forest Clearing House Mechanism (CHM), where all documents can be downloaded in full text. In case of downloading problems please contact Mrs. Setia Dewi from the ASEAN Secretariat (setiadewi@aseansec.org) or, for direct contact to projects, GTZ's contact persons Bernhard von der Heyde (bernhard.heyde@gtz.de) and Rolf Krezdorn (rolf.krezdorn@gtz.de).

Content: The toolbox lists documents about the following areas of intervention/countries:

National CBFM framework and implementation mechanisms	
No recorded documents available	
Land Use Planning and Settlement of Land Use Rights	
Harmonization of national law with traditional rights	Indonesia
Participatory boundary identification	Indonesia
Village mapping	Malaysia
Participatory land use planning and land allocation	Viet Nam
Model-supported analysis of land use systems	Philippines
Capacity-Building	
Integration of CBFM in university education and research	Laos
Consultative Process for capacity-building	Philippines
Capacity-building on technical aspects of CBFM	Philippines
Capacity-building on designing village-level forest protection and development regulations	Viet Nam
Capacity-building on technical aspects of land use planning	Viet Nam
CBFM Techniques	
Forest management system for CBFM in natural forests	Indonesia
Forest management planning guidelines for CBFM in natural forests	Indonesia
Forest resource inventory	Philippines
Forest management systems for CBFM	Philippines
Integrated forest management plans and annual work plans	Philippines
Designing technical interventions in community forest management	Viet Nam
Monitoring and Evaluation	
Monitoring project impact	Viet Nam
Financial assessment of CBFM	Philippines
Other key documents	

Land Use Planning and Settlement of Land Use Rights

Harmonization of national law with traditional rights	
Source	Concept for Community Forest Management. Proposal for Replication in Indonesia. Chapter 4.3
Author	SFDP
Project	Social Forestry Development Project, West Kalimantan, Indonesia (SFDP)
Year	2002
Abstract	A four step approach is described for the process on synchronizing and harmonizing of national legislation with traditional rights: 1. Deciding on and defining planning area as administrative village area. 2. Land use planning based on zoning of land resulting in a legal product (official village decree) for the community. 3. Setting-up of regulatory framework for land management based on local customary rights. 4. Defining areas and setting-up organizations for forest utilization.
Advantages	- Multi-stakeholder approach bringing together the various interest groups right from the beginning of planning process - Approach on village level with the support and involvement of district institutions (in line with general decentralization process). - Promoting the sustainability and security of village land use based on regional potentials and the aspirations of the communities
Limitations and Challenges	- Designed for areas with natural forests without conflict with industrial concessions.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000851
Resource person	

Participatory Boundary Identification	
Source	Harmonizing Interests and Reconciling Conflicts between Forest Concessions and Local Community, possible through Participatory Boundary Identification and Demarcation (PBID).
Author	Raharjo, Diah.Y. & Beukeboom, Hans
Project	Promotion of Sustainable Forest Management in East Kalimantan, Indonesia (SFMP)
Year	1999
Abstract	PBID is a tool to address and possibly settle or reduce conflicts among stakeholders (namely industrial concession holders and forest communities) in forest areas. The process includes the following steps: a, Forest use mapping; b, Social zoning using participatory community mapping; c, Evaluation of the identified results based on production, ecological and socio-cultural aspects; d, Socialization of the PBID process; e, Negotiation process resulting in a tentative agreement; f, Identification and fixing of boundaries for commercial use and community use; h, Preparation of legal document and integration in existing regulations
Advantages	- Fulfilment of prerequisite for certification of sustainable forest management - Participatory process involving all stakeholders - Long term legal stabilization of forest area - Legal guarantee of communities' land rights and access to natural resources - Stabilization and security of management area of concession holder - In line with local empowerment and decentralization process in Indonesia
Limitations and Challenges	- Requires reevaluation of existing policy and legal processes - Investment required for PBID process and clarification on the sharing of costs - Training and sensitization required on all levels - Willingness to reach consensus required on all parts
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000852
Resource person	Beukeboom, Hans: hansgtz@druknet.bt

Village Mapping	
Source 1	Assessment And Analysis of Existing Landuse Forms of a Selected Longhouse Community with Regards to Forest Zoning (in German)
Author	Erencin, Zhini
Year	1999
Source 2	An Approach to Village Mapping in the FOMISS-Samling Pilot Area – Inception Report
Author	Basiuk, R.
Year	1999
Project	Forest Management and Information System, Sarawak, Malaysia (FOMISS)
Abstract	Village mapping is proposed as a method to quickly identify and demarcate village lands and land use in areas with conflicting land use right claims. Source 1 provides an example of the implementation of the method. Source 2 describes the prerequisites and conditions for the effective implementation of village mapping within the context of Sarawak
Advantages	- Provides additional information (i.e. on so called “grey areas” such as traditional native land claims) which is not sufficiently considered and recognized under conventional land use mapping exercises. - Contribution to clarify confusion over the extent and boundaries of village land
Limitations and Challenges	- Village mapping is prone to fail and cause even more conflict without the legal status of the land being clarified - Success depends on government willingness to solve land use right issues - Village mapping is one part within an overall approach of conflict resolution
Download	Source 1: http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000853 Source 2: http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000857
Resource person	Zhini Erencin: erencin@aht-group.com Robert Basiuk: robert@pd.jaring.my Borneo Resources Institute (BRIMAS) http://brimas.www1.50megs.com/

Participatory Land Use Planning and Allocation	
Source 1	LUP and LA in Viet Nam with Particular Reference to Improvement of its Process in the Social Forestry Development Project Song Da
Author	Christ, Herbert & Kloss, Dirk
Year	1998
Source 2	Participatory Land Use Planning and Land Allocation in the Song Da Watershed
Author	Poel, P.
Year	1996
Project	Social Forestry Development Project Song Da, Viet Nam (SFDP)
Abstract	Methodology developed by the SFDP builds on existing techniques used and executed by government and adapts them to the current local conditions and demands in the region. The major adjustments comprise: a participatory bottom-up approach at village level and a joint approach combining planning and allocation of all land use forms in one process. The main step of this methodology are: a, Preparation on organizational level, i.e. establishing of organizations at district and commune level; b, Conducting PRA in villages resulting in land use maps; c, Land use planning at village level using a 3-D model; d, Land allocation during village meetings (i.e. agreements) and in the field (i.e. boundary demarcation); e, Administrative procedures for approval of LUP/LA results.
Advantages	- LUP at village level guarantees a more active involvement from the actual land user - Brings together officials and villagers - Decision-making on land use more transparent - Joint approach allows for more efficient and sustainable overall land use management - Land and forest management issues are already addressed during early stages of planning process
Limitations and Challenges	- Expensive and time consuming - Identifying the appropriate social units for intervention in the land use planning and allocation process with regard to CFBM (formal administrative/political units versus "natural" informal forest user groups)

	- Training required, in particular of district officials - This process of LUP/LA most beneficial in more densely populated areas with sedentary agriculture
Downlaod	Source 1: http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000858 Source 2: http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000859
Resource person	Herbert Christ: Hchrist@gmx.de

Model-Supported Analysis of Land Use Systems	
Source	Model Supported Analysis of Land Use Systems of Three Selected Communities in the Quirino Province
Author	Richter, Frank & Sepp, Steve
Project	Community Forestry project Quirino, Philippines (CFPQ)
Year	2003
Abstract	This methodology is a developed as a decision support tool as part of the land use planning process. The report demonstrates the application of the developed simulation model for land use evaluation by using the specific data of three community (Barangay) sites located within the CFP-Q intervention area. The model is being used to support local communities to manage in a sustainable manner their renewable natural resources and aims to bridge the gap between the existing and the impacts of the envisioned land use. The results are discussed and analyzed according to the set sustainability criteria. This report forms part of a handbook which includes the description of the 'Evaluation Model for Sustainable Land Use'.
Advantages	- It allows land managers to ask 'WHAT-IF' questions to explore management alternatives and their possible effects over time.
Limitations and Challenges	- Sophisticated land use planning tool which requires respective expertise - It is not geared to recognise the potential impacts of policy changes, on the decision of farmers and other actors (except for taxes and fees). - It is only looking at the financial feasibility of producing (sawlogs, fruit, crops, etc.) from the farmer's perspective. It does not take into account marketing aspects such as limits to the absorptive capacity of a market at any given point in time and the consequences by changing production targets. - It is taking into account land use changes but is not spatially explicit. -It is not taking into account indirect use values consisting of the functional benefits that sustained ecological management provide (for example, undisturbed hillside forests provide flood control protection).
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000861
Resource persons	Sepp, Steve: Steve.Sepp@eco-consult.com Richter, Frank: Frank.Richter@eco-consult.com Vicente, Fidel: +63-927-4907154, CFFQ-I, Capitol Hill, Cabarroguis, Quirino/Philippines Eniego, Enrile: +63-0920-5622872 Capitol Hill, Cabarroguis, Quirino/Philippines

Capacity-Building

Integration of CBFM in University Education and Research	
Source 1	Forest Resource Development, Capacity-building and Research
Author 1	Braeutigam, D., Muziol, C., Phanvilay, K.
Year 1	2001
Source 2	Management Plan for Forest Resources Development, Training and Research 2001-2010
Author 2	PROFEP
Year 2	2001
Project	Promotion of Forestry Education Project, Lao PDR (PROFEP)
Abstract	Key element of the academic forestry education at the National University of Lao PDR is the Faculty of Forestry's 'Training and Model Forest' (TMF). The TMF's management reflects the socio-economic

	and natural resources conditions of wide areas of the Lao P.D.R. It is based on a multi-stakeholder partnership of local communities, government authorities and the Faculty of Forestry. As such, the establishment and development of the TMF is a long-term process and commitment for all stakeholders involved. It stimulates innovation and best practices through the pooling of human and financial resources, and promotes positive interactions between forest resources development and conservation, human resource development, and research. Refined and innovative practices are promoted for their application under similar socio-economic and environmental conditions at national level, through information exchange, training courses and technology transfer.
Advantages	The TMF facilitates and guides decision-making processes by providing a forum where stakeholders can share their knowledge, gain better understanding for conflicting views, and combine their expertise and resources.
Limitations and Challenges	
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000863&cat=76
Resource person	Khamla Phanvilay: klphanvilay@yahoo.co.uk D. Braeutigam: DietmarBspc@mail.fm

Capacity-building on technical aspects of Land Use Planning	
Source	Training Manual for Participatory Landuse Planning
Author	Christ, Herbert
Year	1999
Project	Social Forestry Development Project Song Da, Viet Nam (SFDP)
Abstract	This training manual is based on “the Guideline on Participatory LUP and LA applied on commune level in Son La Province” prepared by the Sonla Provincial People's Committee. It provides a step-by-step instruction on how to conduct a LUP training course. It is aimed at technical staff at the provincial and district level. The Manual has three main parts: a, General aspects of LUP training, including an overview of training methods for adult learning and general terms and concepts of LUP; b, Detailed instructions on the step-wise procedures for LUP; c, Instructions on how to organize a participatory training course evaluation session.
Advantages	- Covers wide range of elements from general concepts of training to specific procedures for LUP. - Accommodating a trainee batch with a wide range of different backgrounds.
Limitations and Challenges	- This Manual is of a “introductory” nature. Other training materials geared specifically to the needs of LUP training needed. - It does not provide instructions on technical and administrative procedures and methods required for LUP.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000872&cat=76
Resource person	Herbert Christ: Hchrist@gmx.de

Capacity-building on technical aspects of CBFM	
Source 1	Village Forest Manual
Author	De Vletter, J.
Year	2003
Source 2	Forest Resource Inventory - Manual
Author	De Vletter, J.
Year	2002
Project	Community Forestry Project Quirino, Philippines (CFPQ)
Abstract	These two Manuals are part of a training program to upgrade and strengthen Peoples’ Organizations (PO) foresters’ technical know-how (local level) as well as that of DENR and LGU forest technicians (district level). The Village Forest Manual consists of four parts dealing with: a, tree selection for community logging and monitoring of community logging; b, timber stand improvement; c, assisted natural regeneration and forest enrichment; d, forest plantation monitoring.

	The Manual on Forest Resource Inventory deals with field instructions for 2 types of FRI (5% and 100%) that provide the basis for CBFM. Furthermore, it gives instructions on how to store independently, process and evaluate field data in the 5% and 100% FRI necessary for the writing of the CBFM- and Resource Use Plans (RUP).
Advantages	These Manuals form an essential part to capacitate POs in community forest management as well as DENR, LGU foresters and other assisting organizations to become efficient and engaged service providers
Limitations and Challenges	
Download	Source 1: http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000865&cat=76 Source 2: http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000866&cat=76
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Capacity-building on Village Level Forest Protection and Development Regulations	
Source	Field Guide – Preparing Forest Protection and Development Regulations at Village Level
Author	Miagostovich, Marco
Year	2000
Project	Social Forestry Development Project Song Da, Viet Nam (SFDP)
Abstract	This document is a facilitator's guide which provides a step-by step methodology to facilitate village members and forest owners in the design of their own Village Level Forest Protection and Development Regulations. The methodology aims to build each farmer's capacity to analyze their forest resources and traditional regulations, eventually identifying and adopting the forest regulations that will best respond to farmers' and government's forest management needs. The methodology uses "non-formal adult learning education" methods, based on experiential learning techniques and participatory decision-making techniques.
Advantages	- The methodology is a flexible approach, which increases people's participation and strengthens communities capacities - It combines government and communities needs
Limitations and Challenges	- Focuses on teaching methods - It does not provide instructions on technical and administrative procedures and methods required for Village Level Forest Protection and Development Regulations
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000873&cat=76
Resource person	

Consultative Process for Capacity Building	
Source 1	A Consultative Process for Capacity Development: Guidelines for Action and Collaboration
Author	DelVecchio, Arthur
Year	2001
Source 2	A Consultative Process for Capacity Development: Multi-Sectoral Collaboration for CBFM Framework Implementation, and the Role of the Foundation for Quirino's Cross-Sectoral Services
Author	DelVecchio, Arthur
Year	2003
Project	Community Forestry Project Quirino, Philippines (CFPQ)
Abstract	The consultative process is part of the project's aims to utilize effectively, strengthen and reduce gaps in capacities of community-based organizations, local government organizations, national organizations and other institutions concerned. This is mainly to promote, support and ensure the continuation of community-based forest management after the phasing-out of the project. The first report provides guidance on how to integrate capacity development within the context of the Project Planning Matrix and the subsequent annual Plans of Operation. The second report describes step-by-step the preparatory tasks to institutionalize collaborative and cross-sectoral implementation of the project. The main conclusions of this process are: a. a Memorandum of Agreement

	supporting further development and validation of multi-sectoral collaborative planning and management of CBFM implementation; b, the creation of a Foundation, which provides cross-sectoral services for CBFM implementation.
Advantages	- This strategy is relevant for situations where there are limited resources and where there is the need to build on what exists - to utilize and strengthen existing capacities and to create synergy effects. - Process to ensure continuation of CBFM activities after phasing-out of project.
Limitations and Challenges	- This multi-sectoral CBFM approach requires a high input and complexity of coordination among the various collaborators. Human (qualitative and quantitative) and financial resources at the collaborating institutions might be limiting factors for this task.
Download	Source 1: http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000870 Source 2: http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000871
Resource person	DelVecchio, Arthur: thinkipm@loxinfo.co.th Paet, Sharon Marie: +63-916-7878062, CFFQ-I, Capitol Hill, Cabarroguis, Quirino/Philippines

CBFM Techniques

Forest Management System for CBFM in natural forests	
Source 1	Forest Management System for Community-based Forest Management (CBFM) in Natural Production Forest
Author	Schindele, Werner & Lux, Martin
Year	2001
Source 2	Forest Management Planning Guidelines for CBFM in Natural Forests
Author	Schindele, Werner & Lux, Martin
Year	2001
Source 3	On-site processing of timber as a key technology for community forestry
Author	Lux, Martin & Schindele, Werner
Year	2002
Project	Social Forestry Development Project, Sanggau, Indonesia (SFDP)
Abstract	These three documents provide a package on general descriptions as well as guidelines on the implementation of a community-based forest management system in Indonesia. The first document aims at a general description as well as an explanation of underlying considerations and the rationale for a forest management system that is applicable to communities managing their forests on their own. The second document is a guideline for establishing forest management plans. The forest management system described has been designed for the management of primary forests through communities with the objective of timber production. The management system is built on two fundamental principles that allow for a drastically simplified forest management planning, monitoring and control system: Firstly, the timber is processed on site with mobile sawmills and secondly, there are very low capital and fixed costs. The management system comprises of a, Silvicultural system, that is based on simple assumptions from experience in Dipterocarp forests and is sustainable on small units; b, Simple area based yield regulation; c, Determination of timber extraction and tree selection. The extraction of timber is determined by tree numbers only, while seven selection criteria will ensure sustainability under different aspects; d, Harvesting, controlling and monitoring system; e, Management planning system.
Advantages	- Characteristics of this management system are: simplicity, very low ecological impact, low input and a very strong involvement of the communities - It complies with the international standards set for certification - Due to the low investment cost for the harvesting equipment the forest management system is profitable even under the distorted market conditions that community-based forest management is facing
Limitations and Challenges	- Labour intensive (but this in turn provides job opportunities) - Frame conditions (clarification of legal rights over land and resources) have to be in place and ensured

	- The forest management system necessitates reconsidering the payment system taxes and fees to the government - Establishment of structures for the provision of technical assistance and for control and monitoring through state forest officials
Download	Source 1: http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000874 Source 2: http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000875 Source 3: http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000876
Resource person	Werner Schindele: gfb-ws@onlinehome.de

CBFM Elements	
Source 1	Forest Resource Inventory
Author	De Vletter, Jaap
Year	2002
Source 2	Village Forest Manual
Author	De Vletter, Jaap
Year	2003
Source 3	Integrated Forest Management Plans for Asaclat and Tucod CBFMA and Annual Work Plans for Asaclat and Tucod CBFMA
Author	De Vletter, Jaap
Year	2002
Project	Community Forestry Project Quirino, Philippines (CFPQ)
Abstract	These documents provide a package for the various steps and management options within CBFM in the Philippine context. Forest Management Plans and Annual Work Plans are provided as examples for CBFM planning. The documents have manual and guideline character and can thus also be used for capacity building. The forest management system options for CBFM are Community Logging, Timber Stand Improvement (TSI), Assisted Natural Regeneration and Forest Enrichment. Forest Resource Inventories are carried out in the production forest areas where community logging is to take place and are based on the two levels of planning (medium-term and annual). The inventory for the medium term planning is a reconnaissance-level forest inventory (5% intensity). A full stock (100% intensity) survey is carried out in the Annual Cutting Areas.
Advantages	- the methods and approaches described here form the core part of the overall concept of CBFM system which aims to be adapted to the local situation and be technically and methodologically as simple as possible.
Limitations and Challenges	
Download	Source 1: http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000878 Source 2: http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000879 Source 3: http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000880
Resource person	Vicente, Fidel: +63-927-4907154, CFFQ-I, Capitol Hill, Cabarroguis, Quirino/Philippines De Vletter, Jaap: JdVletter@cs.com

Designing Technical Interventions in Community Forest Management	
Source	Designing Technical Interventions in Community Forest Management: Experiences from the SFDP
Author	Apel, Ulrich
Year	1998
Project	Social Forestry Development Project, Song Da, Viet Nam
Abstract	This document introduces and exemplifies a methodology to identify appropriate levels of intervention as part of CBFM. Four factors are proposed to be considered when designing adapted CBFM practices: Tenure, Community capacity, Local needs, Local site conditions and silvicultural parameters of forests.
Advantages	- Participatory approach taking into consideration the specific social as well as ecological frame con-

	ditions whereby focusing on communities, their capacities and needs.
Limitations and Challenges	- The designing of technical interventions is only a first step towards the introduction of appropriate management systems
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000887
Resource person	Ulrich Apel

Monitoring and Evaluation

Monitoring Project Impact	
Source	Manual for Impact Monitoring
Author	Christ, H.
Year	1999
Project	Social Forestry Development Project, Song Da, Viet Nam
Abstract	This Manual informs on the rationale, components and data requirements of the Impact Monitoring System (IMS) of the project. It furthermore describes the procedures required to record the IMS data. The IMS is designed to investigate on ecological, economical, social/gender and institutional impacts of project activities. The IMS uses already existing data as well as generates new data from the following sources: Land use and cover maps; village based data and village development plans; commune statistics; annual farmer/household surveys; technology option fact sheets; strategic project documents; commune and village based activities.
Advantages	- The IMS focuses on key indicators in priority areas, mostly using available resources. This allows regular monitoring, preferably integrated into the regular project working routine.
Limitations and Challenges	- Labour intensive - Compromise between scientifically sound and practically flexible observation and quantification procedures - Within timeframe of project long term impacts, in particular with regards to social and ecological changes, cannot be observed
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000747
Resource person	Christ, Herbert Hchrist@gmx.de

Financial Assessment of Community-based Forest Management	
Source	Financial Assessment of Community-based Forest Management
Author	De Vletter, Jaap
Year	2000
Project	Community Forestry Project Quirino, Philippines
Abstract	For three representative CBFM sites of Quirino a standard financial analysis (Internal Rate of Return – IRR) has been carried out. It takes into consideration estimated basic data on cost (cash inputs) and benefits (cash outputs) for a management period of 35 years.
Advantages	- This financial analysis is designed using a user-friendly software program and thus allows for replication - As such this cost-benefit analysis of the CBFM approach can be used to provide the communities with figures about the expected financial returns from their inputs
Limitations and Challenges	- A precondition to come up with a reliable analysis are systematically collected data on labor inputs and other cost for all stages of CBFM, these are not available as of yet
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000889
Resource person	Vicente, Fidel: +63-927-4907154, CFFQ-I, Capitol Hill, Cabarroguis, Quirino/Philippines De Vletter, Jaap: JdVletter@cs.com

Other key documents

Country-wide Assessment of Community-based Forest Management	
Source 1	Community-based Forest Management in Cambodia and Lao PDR – frame conditions, selected examples and implications
Author 1	Braeutigam, Dietmar
Year	2003
Project	Cambodian German Forestry Project
Abstract	This report analyses and compares CBFM in Cambodia and Lao PDR. Because of the national differences, the history and development dynamic of CBFM, concepts and approaches as well as technical interventions show specific characteristics. It provides an overview of the various institutions and projects dealing with CBFM and their approaches. Gaps are identified and recommendations for further actions are made. The importance of regional exchange and cooperation is highlighted.
Advantages	Very comprehensive and accurate analysis of the current situation regarding CBFM in Cambodia and Lao PDR
Limitations and Challenges	
Resource person 1	Braeutigam, Dietmar: DietmarBspc@mail.fm
Source 2	An Assessment of ongoing Community Forestry Initiatives in Cambodia – Implications for the Development of Forestry Extension Strategy
Author 2	Fichtenau, Juergen, Ly Chou Beang, Nup Sothea, Dy Sophy
Year	2002
Project	Cambodian German Forestry Project
Abstract	Ongoing CBFM initiatives in Cambodia are analysed as a baseline study for the development of a national Forestry Extension Strategy. Interview based surveys are conducted in the various CF – initiatives to capture the different conditions under which CBFM activities take place. From that forest extension categories and forest development goals for the respective categories are developed. An approach for the identification of potential CBFM areas is suggested.
Advantages	
Limitations and Challenges	
Download	Source 1: http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000891 Source 2: http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000892
Resource person 2	Fichtenau, Jürgen: yetiforest@aol.com

Annex: List of institutions, organizations and platforms dealing with CBFM in the Region

Country	Institution / organization/ platforms	Field of expertise / activities	Contact address / website
Malaysia	Forest Research Institute Malaysia, Dr. Lim Hin Fui	Socio-economic development of Orang Asli communities in Peninsular Malaysia	Kepong, 52109 Kuala Lumpur 0060/3/62797820, 62797538 Web: http://www.frim.gov.my
Malaysia	Sabah Forestry Department, Mr. Jeflus Sinajin	CBFM of indigenous communities in Sabah	Locked Bag 68, 90009 Sandakan Tel. 0060/89/669170, HP 019-8962777 Email: jeflus.sinajin@sabah.gov.my
Malaysia	Partners of Community Organizations (PACOS), Ms. Claudia Lasimbang	Socio-economic development of indigenous communities in Sabah	Block M, Lot 5, 1st floor, Donggongon, P.O. Box 511, Penampang, 89507 Kota Kinabalu Tel. 0060/88/718669, 712518, 726413 Email: pacos@tm.net.my
Malaysia	Borneo Resources Institute Malaysia (BRIMAS)	Community-based sustainable resource management and sustainable development practices in environmental protection and management	Borneo Resources Institute Malaysia (BRIMAS), Lot 1046, 2nd Floor, Shang Garden, Jalan Bulan Sabit, 98000 Miri, Sarawak, Malaysia Email: snanet@tm.net.my Web: http://brimas.www1.50megs.com
Indonesia	Centre for International Forest Research (CIFOR)	- Community forestry research - Policy analysis, - Capacity-building	P.O.Box 6596 JKPWB Jakarta 10065 Indonesia Tel. +62-251-622 622 Fax +62-251 622 100 Web: http://www.cgiar.org
Philippines	Environmental Science for Social Change (ESSC) (*facilitates the operations of the Philippine Working Group*	- Analysis and Policy development for upland management needs based on extensive field visits - Recommendations for improving the national	1/F Manila Observatory Building Ateneo Campus Loyola Heights, 1108 Quezon City or P.O.Box 244, U.P. Diliman

	(PWG))	community forestry policies and programs - Series of relevant publications of ESSC (i.e. national guidelines and methods manual on community mapping)	1101 Quezon City, Philippines Tel. +63-2-426-5921 Fax + 63-2-426 5958 e-mail: essc@pusit.admin.edu.ph Web: www.essc.org.ph
Regional/ Thailand	Regional Community Forestry Training Center for Asia and the Pacific (RECOFTC)	- Training courses on community forestry - Supporting national community development by supporting training and technical support to national forestry institutes, NGOs, and community forestry projects and programs - Supporting community forestry development in the region by hosting regional and international seminars and workshops on community forestry-related topics	P.O.Box 1111, Kasetsart University Bangkok 10903, Thailand Tel. +66-2-940-5700 Fax +66-2-561-4480, 562-0960 e-mail: contact@recoftc.org Web: http://www.recoftc.org
Regional/ Nepal	International Centre for Integrated Mountain Development (ICIMOD)	Research organization, with focus on CBNRM	GPO Box 3226 Kathmandu, Nepal Tel: (977-1) 5525313 Fax: (977-1) 5524509 / 5536747 Web: http://www.icimod.org
Regional	Community-based natural resource management in Asia Virtual Resource Centre (hosted by IDC)	a web-based interactive information and resource sharing platform for CBNRM researchers and innovators in Asia	Web: http://www.cbnrmasia.org/
Regional	Asia Forest Network (AFN)	Provides a framework for regional exchanges on community involvement in forest management (CIFM): > National, Regional and Global Dialogues; > Mediation Processes and Methods for Enhancing Tenure Security; > Field Research and Communications	2/F Gallares Main Building, Gallares Square Graham Ave./Maria Clara Street Tagbilaran/Bohol, Philippines (Peter Walpole: Field Program Director) or 1345 Milvia Street Berkeley, CA 94709-1934, USA Tel. (510) 524-3084 Fax (510) 524-1615 Contact: Mark Poffenberg

			e-mail: mpoffen@aol.com Web: http://www.asiaforestnetwork.org
International	International Institute of Rural Reconstruction (IIRR)	Sustainable livelihood options for CBFM	Y.C. James Yen Center, Silang/Cavite 4118 Philippines Tel. +63-46-414-2417/19 Fax +63-46-414-2420 Contact: Peter O'Hara e-mail: Information@iirr.org Web: http://www.iirr.org
International	The Community-Based Natural Resource Management Network	Portal for Community-Based Natural Resource Management	Web: http://www.cbnrm.net/
International	Forests and Communities	Network of CBFM financed by Ford Foundation	Web: http://www.forestsandcommunities.org/main.html

Annex

09

Review of Literature on Methodologies for Biodiversity Assessment

and Recommendations for Forest Management in Penninsular Malaysia

gtz

Jabatan Perhutanan
Semenanjung Malaysia

German Technical Cooperation

SFMCP

Sustainable Forest Management and Conservation Project
Malaysian-German Technical Cooperation

Review of Literature on Methodologies for Biodiversity Assessment and Recommendations for Forest Management in Peninsular Malaysia

Anke Camphausen

October 2004

Technical Document 48

Table of Contents

Abbreviations

ABC	Asian Bureau for Conservation
asl	above sea level
ATBI	All Taxa Biodiversity Inventory
BIMS	Biodiversity Information Management
C&I	Criteria and Indicators for sustainable forest management
CAMP	Conservation Assessment Management Plan
CBD	Convention on Biological Diversity
CFI	Continuous Forest Inventory
CIFOR	Centre for International Forestry Research
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CR	compartment register
CSIRO	Commonwealth Scientific and Industrial Research Organisation
FAO	United Nations Food and Agriculture Organization
FMI	forest management inventory
FMPRG	Forest Management Planning Rules and Guidelines
FMU	forest management unit
FRIM	Forest Research Institute Malaysia
FSC	Forest Stewardship Council
GEF	Global Environment Facility
GIS	Geographic Information System
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature and Natural Resources
IUFRO	International Union of Forest Research Organisations
JPSM	Jabatan Perhutanan Semenanjung Malaysia
MC&I	Malaysian Criteria and Indicators
MOSTE	Ministry of Science, Technology and Environment Malaysia
NCR	National Conservation Review
NFI	National Forest Inventory
NGO	non-governmental organization
PFE	permanent forest estate
PHVA	Population and Habitat Viability Assessment
PRF	permanent reserved forest
RAP	rapid assessment programme
RBA	rapid biodiversity assessment
RBI	rapid biological inventories
REA	rapid ecological assessment
RIL	reduced impact logging
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity
SCS	Scientific Certification Systems
SGS	Société Général de Surveillance
SMGP	Sistem Maklumat Geografi Perhutanan
TRT	Tropical Rainforest Trust
UNEP	United Nations Environment Programme
WWF	World Wide Fund for Nature

Introduction

Conservation of biological diversity gains recognition in Malaysia's policy through the signing of International Conventions relevant for biodiversity conservation, most importantly the Convention on Biological Diversity (CBD), and the efforts of their implementation into national policy (i.e. "Malaysia's National Policy on Biological Diversity 1997). These efforts are also reflected in Malaysia's commitment towards a sustainable management of her forest resources *"to conserve biodiversity, protect watersheds and water catchments, improve water quality as well as ensure a sustainable supply of forest products"* (8^{th} Malaysia Plan). Based on ITTO's criteria and indicators as well as the FSC Principles and Criteria for sustainable forest management, Malaysia has developed the Malaysian Criteria and Indicators for Sustainable Forest Management (MC&I 2002). Requirements for biodiversity conservation are spelt out in particular in the MC&I Principles 6 and 9.

Box 1: Malaysian Criteria and Indicators; excerpt from Principle 6

> ***Criteria 6.2:***
> *Safeguards shall exist which protect rare, threatened and endangered species and their habitat (e.g. nesting and feeding areas).*
> *Conservation zones and protection areas shall be established, appropriate to the scale and the uniqueness of the affected resources.*
> *Inappropriate hunting, fishing, trapping and collection shall be controlled.*
>
> ***Indicator 6.2.1:***
> *Availability and implementation of guidelines to identify and protect endangered, rare and threatened species of forest flora and fauna, including features of special biological interest such as seed trees, nesting and feeding areas in the PFE for Peninsular Malaysia and forest management areas for Sabah and Sarawak.*
>
> ***Indicator 6.2.2:***
> *Availability and implementation of management guidelines to establish representative conservation and protection areas, in accordance with existing forest ecosystems, appropriate to the scale and intensity of forest management.*

Thus, it is not a question anymore whether to integrate biodiversity conservation aspects in forest management in Peninsular Malaysia. The critical question now is *how* to do it.

The objective of this report is to provide an overview on current activities and methodologies used in the implementation of biodiversity conservation in the context of forest management. From that suggestions are made for the Malaysian context as a base for further discussion. These suggestions highlight what the author considers the first vital steps or prerequisites towards a successful integration of biodiversity conservation in forest management as well as implementation of the MC&I. Given the complexity of the issue the suggestions focus on practicability and feasibility of measures.

Chapter I – Research

1. Approach

1.1 Resource institutions

Various institutions dealing with biodiversity conservation and forest management were contacted (refer to Annex 1 for the list of institutions contacted and their feedback). Information was requested on case studies and methodologies used to implement biodiversity conservation (i.e. implementation of C&I) and in particular species identification and monitoring within the context of forest management.

1.2 Literature review

The literature research was more or less confined to research on the world wide web and its free-access sources. Additional research was conducted in the libraries of JPSM and FRIM.

2. Responses from resource institutions

The responses from the information request from various institutions suggest that the development and implementation of specific methodologies on biodiversity conservation aspects within forest management, which go beyond general guidelines and recommendations, are still scarce and hard to access. In particular the response from ITTO clearly stated that its member states, who are required to submit reports on the implementation of the C&I to the ITTO, have not developed methodologies as of yet on the implementation of C&I concerning biodiversity conservation.

3. Brief general overview on preconditions and approaches towards biodiversity assessments

Literature provides a vast amount of more or less theoretical and general disquisitions on how to integrate biodiversity conservation in forest management. Real practical solutions or case studies in particular on a local (sub-national to stand or site) level within the tropical forest context are hard to access.

In the following a brief overview is given on the preconditions and approaches taken towards biodiversity assessment. Subsequently, methodologies used to assess and monitor biological diversity on country and sub-country level are described under 4.

In literature the term biodiversity assessment covers a range of methodologies, mainly depending on the overall purpose of the assessment and the temporal and geographical scale at which it is applied. In general, three main purposes can be identified:

Firstly, conducting biodiversity inventories. Biodiversity inventories are carried out either to assess existing biodiversity, in the sense of general stocktaking. This provides information on the biodiversity richness of a country or parts of a country. Or, and this is also the second purpose, to conduct a gap analysis. The objective of a gap analysis is to assess whether the protected area network of a country is sufficient in terms of its representation of the country's biodiversity. And thirdly, the term biodiversity assessment is used for monitoring biodiversity changes. Here the effect of human interventions on biodiversity is assessed. The latter purpose bears most relevance in the context of forest management and the assessment of its sustainability. Most of the C&I developed require to incorporate all three aspects in forest management.

Biodiversity is a broad term. Since the adoption of the Convention of Biological Diversity it is commonly defined in terms of three different components: intraspecific genes (genetic diversity), interspecific species (species diversity) and ecosystems (ecological diversity) (UNEP, 2003). All of which them have structural, compositional and functional attributes. Given this complexity and the lack of knowledge on all three components, identifying, measuring and monitoring all three levels exhaustively proofs to be impossible. An array of international and national initiatives have, therefore, sought to overcome this problem by trying to come up with simplified, yet significant methodologies of biodiversity assessments. One way is the identification of indicators – a subset of attributes that could serve as surrogates for total biodiversity. These were developed for various levels – national, regional and stand level (e.g. Stork et al., 1997).

Indicators of biodiversity can be divided into two broad groups: 1) biological or taxon-based indicators, particularly indicator species and guilds and 2) structure-based indicators – stand and landscape level (spatial) features such as stand structure complexity, plant species composition and connectivity and heterogeneity (e.g. Bell et al., 1991; Weaver, 1995; Lindenmayer et al., 2000).

The various contributors in literature seem to agree on the necessity to simplify biodiversity assessments in order to make them realizable mainly with reference to the limited knowledge on biodiversity and the given capacity constraints. However, the selection of surrogates for biodiversity remains a controversial issue. Lack of scientific evidence as well as political agreement on the practicability, reliability and relevance of indicators in general and of specific indicators in particular are the main points of criticism (e.g. Prabhu et al., 1996; Sheil et al., 2004). However, it is more and more accepted that the legitimacy of an indicator or indicator group cannot be proven by science alone, but requires also socio-political consensus (Sheil et al., 2004).

The selection of indicators differs for biodiversity monitoring and biodiversity inventories. Various criteria have been developed for the selection of indicators taking into account biological as well as logistical aspects (e.g. Noss, 1990; UNEP 1993; Pearson 1994). Relatively well-known taxa such as higher vertebrates (e.g. mammals, birds), certain invertebrate groups (e.g. butterflies, ants, land snails) and higher plants (particularly trees) are commonly used as indicator groups (e.g. Boyle and Boontawee 1995; Hoeven et al. 2000). Threatened species, endemic species, and economically or socially important species are often chosen as priorities for data collection (Groombridge and Jenkins 1996).

As much as it is impossible to assess every single element of biodiversity, it is also impossible in practice to inventory every site. Extrapolation and prediction techniques are used to limit the amount of sites to be assessed. The knowledge of species habitat requirements, coupled with baseline data on climate, altitude, soil type, or vegetation cover, is used to predict their occurrence in areas not inventoried. Geographic information systems (GIS) are commonly used in biodiversity inventory techniques.

Based on these preconditions some selected biodiversity assessment techniques are presented in overview:

4. Biodiversity assessment – methods and case studies

The following table provides an overview on a selection of biodiversity assessment techniques, their purposes and range of applicability.

Table 1: Biodiversity assessment – methods and case studies

Purpose		Method	Scale	Developed by
Baseline studies (collecting general data on biodiversity / identifying and prioritizing areas rich in biodiversity / identifying gaps in the representation of biodiversity within protected area networks)		Rapid Biodiversity Assessment (RBA)	Local: site-specific	MacQuarie University, Australia
		Rapid Assessment Programme (RAP)	Local: site-specific	Conservation International
		Rapid Biological Inventories (RBI)	Local	Field Museum, Chicago, US (used in tropical forests in Latin America)
		Rapid Ecological Assessment (REA)	National / local	The Nature Conservancy
		Rapid Assessment of Biodiversity Priority Areas	National / local	Commonwealth Scientific and Industrial Research Organization CSIRO
		National Conservation Review (NCR)	National	Sri Lanka Forest Department
		Gap Analysis	National / local	e.g. US Fish and Wildlife Service
Biodiversity monitoring	**Modelling**	Biodiversity Information Management System (BIMS)	National	Asian Bureau for Conservation
		DOMAIN: computer modelling system for mapping potential distributions for plants and animals	National / local	CIFOR
		Biolink Modelling: Integrated software for the collection, maintenance, analysis, application and dissemination of taxonomic, biodiversity and environmental information.	National / local	Commonwealth Scientific and Industrial Research Organization (CSIRO)

	Wildlife Assessment & Monitoring	Case study: Biodiversity assessments and conservation planning for sustainable production forestry in high-conservation value forests, PITC, Temengor FR, Perak	Local: site-specific	WWF / TRT
		Case study: Assessment of wildlife and its management in relation to forestry in the KPKKT concession area, Terengganu	Local: site-specific	WWF / GTZ
		Case study: Wildlife monitoring system in Deramakot forest reserve.	Local: site-specific	GTZ
		Recording of wildlife population in context with multi-disciplinary Forest Resource Assessment, Forest Department Sarawak	Local: site-specific	GTZ
		Biodiversity Assessment for Forest Certification (different approaches and practical experiences from a case study in East Kalimantan, Indonesia)	Local: site-specific	GTZ

The Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) of the Convention on Biological Diversity has carried out an assessment of biodiversity assessment methodologies. Some of the methods described here are directly taken from this report. For a more detailed description and assessment of the techniques please refer to Annex 1 of SBSTTA's report (UNEP 1996).

4.1 Baseline studies

The techniques described in this section are used for collecting general data on biodiversity mainly within the frame of national biodiversity conservation planning. They include biodiversity inventories, the identification and prioritization of areas rich in biodiversity as well as gap analyses. The techniques vary from using an advanced and highly technical approach (e.g. REA) to simpler ground-based inventories (e.g. RBA).

4.1.1 Rapid Biodiversity Assessment (RBA)

RBA is a very rapid, cheap and attractive method to **assess the relative biodiversity value of different sites**, provided they are assessed using the same indicator groups of species. RBA is based on the premise that certain aspects of biological diversity can be quantified without knowing the scientific names of the species involved. The main characteristic of RBA is the minimisation of the formal taxonomic content in the classification and identification of organisms.
Data are gathered on certain groups of organisms. Several groups, chosen as good "predictor sets" of biodiversity are needed at each location inventoried. Appropriate groups are ones that are relatively abundant, have a high species richness, contain many specialist species, are easy to sample, and have taxonomic traits amenable to RBA methods.
RBAs focus on invertebrate groups, such as butterflies, ants, termites, certain beetle families, grasshoppers and spiders.

Reference:

- Beattie, A. J., J.D. Majer, and I. Oliver. 1993. Rapid Biodiversity Assessment: A Review. Pp 4-14 in: Rapid Biodiversity Assessment. Proceedings of the Biodiversity Assessment Workshop 3-4 May 1993, Macquarie University, Sydney, Australia. Research Unit for Biodiversity & Bioresources, Macquarie University, Sydney, Australia.
- Kerr, J.T., A. Sugar, L. Packer. 2000. Indicator Taxa, Rapid Biodiversity Assessment, and Nestedness in an endangered Ecosystem. Conservation Biology 14 (6): 1726-1734.
- UNEP. 1996. Assessment of Biological Diversity and Methodologies for Future Assessments. CBD/SBSTTA. Second Meeting [online] URL: http://www.biodiv.org/doc/meeting.aspx?mtg=SBSTTA

4.1.2 Rapid Assessment Programme (RAP)

The RAP **conducts preliminary assessments of the biological value of poorly known areas**. RAP teams usually consist of experts in taxonomically well-known groups such as higher vertebrates (e.g., birds and mammals) and vascular plants, so that the ready identification of organisms to the species level is possible. The biological value of an area can be characterised by species richness, degree of species endemism (i.e., percentage of species that are found nowhere else), the uniqueness of the ecosystem, and the magnitude of the threat of extinction. RAPs are undertaken by identifying potentially rich sites from satellite images/aerial reconnaissance, and then sending in ground teams to conduct field-survey transects. Such field trips last from two to eight weeks, depending on the remoteness of the terrain.

Note: A draft field manual of terrestrial methods was prepared by Conservation International (CI) by 2004. Meanwhile, the methods used by CI's collaborating scientists are described in each RAP report, published in the RAP Bulletin of Biological Assessment series. All RAP reports are available in pdf format on the Conservation International website:
(<http://www.biodiversityscience.org/xp/CABS/publications/cabs_publ_research/rap_bulletins/rapbulletin.xml>). Alternatively, copies of RAP reports as well as of the field manual can be obtained from Leslie Rice at <l.rice@conservation.org>.

<u>Reference:</u>

- http://www.biodiversityscience.org/xp/CABS/publications/cabs_publ_research/rap_bulletins/rapbulletin.xml
- Parker, T.A.P. III., A.H. Gentry, R.B. Foster, L.H. Emmons, and J.V. Remsen, Jr. 1993. *The Lowland Dry Forests of Santa Cruz, Bolivia: A Global Conservation Priority*. Rapid Assessment Program Working Papers No. 4. Conservation International, Washington D.C., USA / Fundación Amigos de la Naturaleza, La Paz, Bolivia. 104 pp.
- http://incres.anu.edu.au/biorap/introtxt.html
- Faith, D.P. et al. 2001. The BioRap Biodiversity Assessment and Planning Study for Papua New Guinea. URL:http://www.amonline.net.au/systematics/faith5.htm
- UNEP. 1996. Assessment of Biological Diversity and Methodologies for Future Assessments. CBD/SBSTTA. Second Meeting [online] URL: http://www.biodiv.org/doc/meeting.aspx?mtg=SBSTTA

4.1.3 Rapid Biological Inventories (RBI)

"The goal of rapid biological inventories is to catalyze effective action for conservation in threatened regions of high biological diversity and uniqueness. During rapid biological inventories, which typically take a month, scientific teams focus primarily on groups of organisms that indicate habitat type and condition and that can be surveyed quickly and accurately. These inventories do not attempt to produce an exhaustive list of species or higher taxa. Rather, the **rapid surveys (1) identify the important biological communities in the site or region of interest and (2) determine whether these communities are of outstanding quality and significance** in a regional or global context."

The rapid biological inventory teams use protocols that are specific to the organism groups under study and which are often modified to meet the demands of a particular expedition.

Examples and field reports of RBI used in tropical forest regions exist from Bolivia, Ecuador and Peru.

<u>Reference:</u>

- http://fm2.fieldmuseum.org/rbi/
- Foster, R.B., N.C. Hernandez E., E.K. Kakudidi, and R.J. Burnham. 1998. Rapid assessment of tropical plant communities using variable transects: an informal and practical guide. URL: http://fm2.fieldmuseum.org/rbi/pdfs/VarTrans.pdf

4.1.4 Rapid Ecological Assessment (REA)

Rapid Ecological Assessment is a technique used to assess biodiversity in large, poorly-studied, or exceptionally bio-diverse areas. The REA process consists of a series of increasingly refined analyses, with each level further **defining sites of high conservation interest**. The levels involved are satellite observation; airborne remote sensing; aerial reconnaissance; and field inventory. Analysis of satellite images is used to produce maps of eco-regions, land cover and priority areas; while integration with data from airborne sensors and aerial reconnaissance produces more detailed maps, extended to cover vegetation types and ecological communities. These are used to direct the cost-effective acquisition of biological and ecological data through stratified field sampling. Such data are used to identify priority sites. Spatially-referenced information is managed by GIS, allowing easy data handling and generation of maps.

<u>Reference:</u>

- Roger, S., Roca, E., Sedaghatk, G. 2000. Nature in focus: Rapid Ecological Assessment. Island Press. Washington, D.C.
- Grossman, D.H., S. Iremonger, and D.M. Muchoney. 1992 Jamaica: A Rapid Ecological Assessment. The Nature Conservancy, Arlington, Virginia, USA.
- UNEP. 1996. Assessment of Biological Diversity and Methodologies for Future Assessments. CBD/SBSTTA. Second Meeting [online] URL: http://www.biodiv.org/doc/meeting.aspx?mtg=SBSTTA

4.1.5 Guidelines for the Rapid Assessment of Biodiversity Priority Areas

The World Bank and the GEF are currently funding CSIRO and other Australian institutions to develop a series of Guidelines for Rapid Assessment of Biodiversity Priority Areas (RAP). These will adapt RAP tools employed in Australia for use in developing countries. The Guidelines are still under development. The basic principle is that priorities need to be set in conservation. The technique used will be to compile a suitable database containing maps of the spatial distribution of the biodiversity surrogate chosen, and then use it systematically to identify a network of areas that collectively represents that surrogate. A complementarity approach will be recommended, in which priority areas are added on the basis of the elements of biodiversity they contain which are different from

those already covered. Application of CSIRO guidelines will enable **assessment of the relative contribution of different areas to overall biodiversity protection**. Conservation initiatives will then be focused on areas that make a high contribution.
These guidelines will provide valuable overall approaches to conducting baseline biodiversity inventories mainly on a national basis.

Reference:

- UNEP. 1996. Assessment of Biological Diversity and Methodologies for Future Assessments. CBD/SBSTTA. Second Meeting [online] URL: http://www.biodiv.org/doc/meeting.aspx?mtg=SBSTTA

4.1.6 National Conservation Review (NCR)

NCR was used in Sri Lanka to **identify an optimal or minimum set of sites which is representative of the national biodiversity**. This is achieved through the collection of data on species distributions and their subsequent analysis. Surveys are conducted to assess these distributions. The sampling procedure involves the following steps: identification of sites, positioning of transects along environmental gradients, inventory of flora and fauna within plots. The NCR also has a hydrological and soil conservation component. An iterative complementarity procedure is being used to define a minimum set of sites necessary to conserve the nation's biodiversity. The biological survey technique employed was **Gradient-directed transect (Gradsect) sampling**. Transects were deliberately selected to traverse the steepest environmental gradients present in an area, while taking into account access routes. This technique is considered appropriate for rapidly assessing species diversity in natural forests, while minimizing cost, since gradsects capture more biological information than randomly-placed transects of similar length. This method is not suitable for first-tranche assessment of biodiversity, but rather for the investigation of, and conservation priority-setting between, pre-identified sites.

Reference:

- Green, M.J.B. & E.R.N. Gunawardena. 1993. Conservation Evaluation of some Natural Forests in Sri Lanka. In: Green, M. J. B & E. R. N. Gunawardena (compilers), Designing an optimum protected areas system for Sri Lanka's natural forests. IUCN – The World Conservation Union, Cambridge. 97 pp. http://rmbr.nus.edu.sg/rbz/biblio/s12/s12rbz023-029.pdf
- UNEP. 1996. Assessment of Biological Diversity and Methodologies for Future Assessments. CBD/SBSTTA. Second Meeting [online] URL: http://www.biodiv.org/doc/meeting.aspx?mtg=SBSTTA
- Wessels, K.J. et al. 1998. An evaluation of the gradsect biological survey method. Biodiversity & Conservation 7(8): 1093-112.

4.1.7 Gap analysis

The technique "Gap Analysis" is essentially a coarse-filter approach to biodiversity conservation. It is used to **identify gaps in the representation of biodiversity** within protected areas. The goal is to ensure that all ecosystems and areas rich in species diversity are adequately represented in protected areas. Gaps in the protection of biodiversity are identified by superimposing three digital layers in a Geographical Information System (GIS), namely maps of vegetation types, species distributions and land management use. A combination of all three layers can be used to identify individual species, species-rich areas and vegetation types that are either not represented at all or are under-represented in existing reserves. In practice, vegetation, common terrestrial vertebrate species, and endangered species are used as surrogates to represent overall biodiversity.

Reference:

- Scott, J.M. et al. 1993. Gap Analysis: A Geographic Approach to the Protection of Biological Diversity. Wildlife Monographs, 123: 1-41.
- UNEP. 1996. Assessment of Biological Diversity and Methodologies for Future Assessments. CBD/SBSTTA. Second Meeting [online] URL: http://www.biodiv.org/doc/meeting.aspx?mtg=SBSTTA

4.2 Biodiversity Monitoring

This chapter firstly introduces extrapolation and prediction techniques (i.e. modelling) used to predict species' occurrence and conservation status in areas not inventoried. Secondly, case studies from Southeast Asia (Malaysia and Indonesia) are presented on the integration of biodiversity monitoring in forest management. The focus here is drawn onto wildlife (fauna) species.

4.2.1 Modelling

4.2.1.1 Biodiversity Information Management System (BIMS)

BIMS is a data management system developed by the Asian Bureau for Conservation (ABC) with support from the World Bank. The software is able **to evaluate the status of species and habitats and evaluate the importance of localities and protected areas**. It consists of an inter-relational database working over a GIS background. Species are coded to the geographical units, habitat types and altitude limits within which they are found. GIS is then able to track in how far such a habitat originally existed, whether it still exists, and how much of it lies within a protected area. The software can create unique distribution maps for each species and overlay all known record points. Habitat maps and maps of protected area systems are also standard outputs.

Some analytical tools accompanying the software can compare the species compositions of different areas, perform gap analyses of protected area coverage and show trend data on census records. The software is already being used to monitor the conservation status of China, Pakistan, India, Bhutan, Nepal, Myanmar, Laos and Vietnam.

Reference:

- Asian Bureau for Conservation website: http://www.conservationgis.org/ctsp/abc/abc.html
- UNEP. 1996. Assessment of Biological Diversity and Methodologies for Future Assessments. CBD/SBSTTA. Second Meeting [online] URL: http://www.biodiv.org/doc/meeting.aspx?mtg=SBSTTA

4.2.1.2 DOMAIN

CIFOR's DOMAIN free software was developed **to generate maps of the potential distribution of plants and animals**. It takes known distribution points for species and uses map layers of environmental factors such as climate, soil, land use etc., to construct an environmental habitat envelope or “domain” for those points. The envelope is then compared with environmental data for the region under study, and a map is produced of similarity ranges of the species’ primary domain.
Another facility allows the investigator to explore how survey transects, (e.g. drawn with the mouse) account for environmental variability within the area. The same transects can be used to examine the degree to which they intercept the domain of specified plant or animal species. This can be a very useful way of generating maps for planning and inventory.

<u>Reference:</u>
- Carpenter, G. Gillison, A.N. and Winter, J. 1993. DOMAIN - A flexible modeling procedure for mapping potential distribution for plants and animals. Biodiversity and Conservation 2: 667-680.
- http://www.cifor.cgiar.org/docs/_ref/research_tools/domain/index.htm

4.2.1.3 BioLink Modelling

BioLink is a free software developed by the Biodiversity Informatics Project of the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Entomology Division. It is used **to estimate or predict the likely range of taxa based on known collection localities**.
BioLink manages taxon-based information such as nomenclature, distribution, classification, ecology, morphology, illustrations, multimedia and literature. Specimen-based information (the “who, what, when and where” information) includes collection sites, collectors and collection dates, museum storage locations, loans and accession and catalogue numbers. It provides a built-in mapping tool (using ESRI) to graphically show the location of individual collection sites as well as all collection sites for a taxon.

<u>Reference:</u>
- http://www.biolink.csiro.au/index.html
- Chapman, A. 2003. BioLink2.0. A preliminary evaluation. http://splink.cria.org.br/docs/appendix_I.pdf in: Report Sistema de Informação Distribuído para Coleções Biológicas: a Integração do Species Analyst e SinBiota (June 2003) http://splink.cria.org.br/reports?criaLANG=en

4.2.2 Wildlife Monitoring – Case studies

4.2.2.1 Biodiversity assessments and conservation planning for sustainable production forestry in high-conservation value forests, PITC, Temengor FR, Perak

This case study provides an example for a biodiversity assessment as part of forest management planning. The objective of the assessment was **to identify high conservation value attributes within the harvestable areas** prior to harvesting. The approach taken was a combination of analysis of existing data and information and rapid field surveys. The field assessment was carried out by a team of external surveyors and forest staff. Following a brief reconnaissance survey two sets of surveys were carried out within a period of two weeks. Aspects looked at included:

- a habitat assessment conducting a qualitative assessment of the forest structure and species composition in selected areas and along walking-transects.
- Faunal assessments focusing on mammals, birds and amphibians.

A rapid assessment of large mammals was conducted, including day and night walks along forest roads and trails using the expertise of local people. The bird assessment used methods such as the Mackinnon List and additionally focused on threatened species, indicator species for forest health, diversity and disturbance, focal species (such as hornbills). Amphibians were assessed by presence/absence inventories.
The results of the study led to general recommendations on harvesting. A proposal is made for a monitoring system of logging impact based on birds as indicators.
Due to limited resources, time and manpower this assessment can be regarded as a snapshot assessment. It provided some qualitative data, but certainly not an exhaustive insight into the presence (or absence) of wildlife species. However, it represents the realistic setting and circumstances of wildlife surveys within the context of forest management, in particular if studies like this are to be integrated into routine forest management planning.

<u>Reference:</u>

- WWF Malaysia. 2002. Biodiversity assessments and conservation planning for sustainable production forestry in high-conservation value forests, PITC, Temengor FR, Perak.

4.2.2.2 Assessment of wildlife and its management in relation to forestry in the KPKKT Concession Area, Terengganu

A wildlife assessment was designed and conducted in the KPKKT Concession Area, Terengganu. The objective was to **investigate the richness and variation in richness of wildlife** in the area in order to derive management recommendations on how **to mitigate potentially adverse impacts** of forest management operations on wildlife and its habitat. The approach taken focuses on selected mammal and bird species as these groups of species are easy to identify. Furthermore, there exists considerable knowledge on these species regarding their taxonomy, but also regarding their relationships and interactions with plant and other wildlife species as well as the impacts of logging on these species. For each of the selected species standardized methods were applied. The survey team comprised staff of World Wide Fund for Nature, the State Forest Department Terengganu, the Department of Wildlife and National Parks, Terengganu and the KPKKT. The study included a brief reconnaissance survey and a six-week main survey. The management recommendations drawn from the results of the study can be summarized as follows:

- Zoning and mapping of areas according to special habitat and topographic features
- Integration of wildlife considerations in harvesting planning and operations

Reference:

- WWF Malaysia. 1998. Assessment of Wildlife and its Management in Relation to Forestry in the KPKKT Concession Area, Terengganu. STC Report No. 23. Malaysian German Sustainable Forest Management and Conservation Project.

4.2.2.3 Wildlife monitoring system in Deramakot Forest Reserve

A practical tool is designed for the forest manager in the Deramakot Forest Reserve (DFR), Sabah, to monitor its wildlife resources in the long-term. Staff of the DFR is trained for that purpose. The monitoring system includes three components:

- Extensive Wildlife Census: every ten years wildlife diversity is measured and the total population sizes for important species (groups) as well as densities in relation to the different forest types are determined. Common survey techniques, such as line-transect walks, mist netting, live trapping and block counts are used. This requires the cooperation with Wildlife Department staff.
- Monitoring Wildlife Population Trends: Using qualitative abundance estimators (i.e. footpath monitoring, night roadside monitoring, riverside monitoring, salt lick monitoring, elephant monitoring, orang utan aerial survey, and opportunistic observations) the changes in abundance and distribution of wildlife species are assessed
- Management Response Survey: The response of wildlife to management inputs is assessed by using qualitative abundance estimators.

This tool is an interesting approach to provide a compromise between data quality, information value and thus usable data and the practical constraints forest managers are facing; i.e. lack of human and financial resources and time.

Reference:

- Lackman-Ancrenaz, I. & Ancrenaz, M. 1999. Wildlife Monitoring System in Deramakot Forest Reserve. Consultancy Report for the Malaysian-German Sustainable Forest management Project, Sandakan, Sabah.

4.2.2.4 Recording of wildlife populations in context with multi-disciplinary forest resource assessment

This report designs a **wildlife assessment approach as part of a multi-disciplinary resource assessment** covering soil and site conditions, vegetation, wildlife and recreational potential for the FOMISS Samling project area in Sarawak. Firstly, a summary of possible general methods to collect data on wildlife is provided. The multi-disciplinary survey team consists of inventory staff (forest rangers) with required knowledge in the various fields. The survey design of the multi-disciplinary resource assessment is following a systematic sampling system using L-shaped grid lines. It is suggested to focus the wildlife survey method on presence/absence scoring and ranking of animals based on their occurrence (i.e. rare to common). No specifications are made on which species to focus the survey on. The report further does not elaborate on how to incorporate the results of the assessment in forest management planning.

<u>Reference:</u>

- Jiwan, D. 1997. Recording of wildlife populations in context with multi-disciplinary forest resource assessment. Development and implementation of a sustainable forest management system on a pilot area under proposed cooperation between Samling Corporation Sdn, Bh. and FOMISS of Forest department, Sarawak. Consultancy Report No. 21 for the GTZ FOMISS project.

4.2.2.5 Assessing biodiversity for forest certification – case study from East Kalimantan

This study investigated practical solutions to the implementation of C&I as set out in the Indonesian context. It was meant to test rapid field methods combined with computer simulation models under rather typical field conditions (i.e. limited time frame and restricted access to field sites due to difficult weather and road conditions). **Bird and mammal richness was used as an indicator for forest biodiversity and changes of biodiversity due to logging**. The technique used for birds was repeated transect walks covering representative parts of the forest. Information on mammals was mainly collected through encounters along the bird transects as well as interviews with village people and forest workers. The final conclusion of the study was that a species-based biodiversity (impact) assessment is not very practical, since the requirements regarding human resources, time demand and funds most often go beyond the possibilities of the forest managing agency. An approach whereby analyzing forest landscape and habitat structures is suggested and described as being a more practical solution to biodiversity assessment. It is recommended to base this approach on three indicators: landscape indicators, production indicators and conservation indicators. The methods used would be a mix of map and satellite image interpretation, analysis of forest inventory data and ground truthing.

<u>Reference:</u>

- Goenner, C. 1998. Assessing biodiversity for forest certification. Different approaches and practical experiences from a case study in East Kalimantan. GTZ-SFMP Document No. 13. Promotion of Sustainable Forest Management Systems Project, East Kalimantan, Indonesia.

References and further readings (Chapter I)

Beattie, A. J., J.D. Majer, and I. Oliver. 1993. Rapid Biodiversity Assessment: A Review. Pp 4-14 in: *Rapid Biodiversity Assessment. Proceedings of the Biodiversity Assessment Workshop 3-4 May 1993, Macquarie University, Sydney, Australia.* Research Unit for Biodiversity & Bioresources, Macquarie University, Sydney, Australia.

Bell, S.S., E.D. Mc Koy & H.R. Mushinsky (eds.). 1991. Habitat structure: the physical arrangement of objects in space. Chapman&Hall, London.

Boyle, T.J.B. and B. Boontawee. (eds.). 1995. Measuring and monitoring biodiversity in tropical and temperate forests. Proceedings. IUFRO Symposium, Chiang Mai, Thailand.

Boyle, T.J.B. and J.A. Sayer. 1995. Measuring, monitoring and conserving biodiversity in managed tropical forests. Commonwealth Forestry Review. Vol. 74 (1): 20-25.

Carpenter, G. Gillison, A.N. and Winter, J. 1993. DOMAIN - A flexible modeling procedure for mapping potential distribution for plants and animals. Biodiversity and Conservation 2: 667-680.

Chapman, A. 2003. BioLink2.0. A preliminary evaluation. http://splink.cria.org.br/docs/appendix_I.pdf in: Report Sistema de Informação Distribuído para Coleções Biológicas: a Integração do Species Analyst e SinBiota (June 2003) URL: http://splink.cria.org.br/reports?criaLANG=en

Faith, D.P. et al. 2001. The BioRap Biodiversity Assessment and Planning Study for Papua New Guinea. URL: http://www.amonline.net.au/systematics/faith5.htm
Foster, R.B., N.C. Hernandez E., E.K. Kakudidi, and R.J. Burnham. 1998. Rapid assessment of tropical plant communities using variable transects: an informal and practical guide. URL: http://fm2.fieldmuseum.org/rbi/pdfs/VarTrans.pdf

Goenner, C. 1998. Assessing biodiversity for forest certification. Different approaches and practical experiences from a case study in East Kalimantan. GTZ-SFMP Document No. 13. East Kalimantan

Green, M.J.B. & E.R.N. Gunawardena. 1993. Conservation Evaluation of some Natural Forest in Sri Lanka. UNDP, FAO and IUCN. Unpublished report. 163 pp.

Groombridge, B. & M.D. Jenkins (eds.). 1996. Assessing Biodiversity Status and Sustainability. WCMC Biodiversity Series No. 5. World Conservation Monitoring Centre. World Conservation Press, Cambridge, UK.

Grossman, D.H., S. Iremonger, and D.M. Muchoney. 1992 Jamaica: A Rapid Ecological Assessment. The Nature Conservancy, Arlington, Virginia, USA.

Hoeven, C van der, H.H. de Iongh, V. Nijman & B. van Balen. 2000. Biodiversity in disturbed ecosystems. A literature review of the use of fauna indicators for the assessment and monitoring of the levels of human disturbance in Bornean tropical lowland forests. Tropenbos Documents 16. Tropenbos International, Wageningen, The Netherlands.

Lackman-Ancrenaz, I. & Ancrenaz, M. 1999. Wildlife Monitoring System in Deramakot Forest Reserve. Consultancy Report for the Malaysian-German Sustainable Forest management Project, Sandakan, Sabah.

Lindenmayer, D.B., C.R. Margules, & D.B. Botkin. 2000. Indicators of

Biodiversity for Ecologically Sustainable Forest Management. Conservation Biology 14(4): 941-950.

Kerr, J.T., A. Sugar, L. Packer. 2000. Indicator Taxa, Rapid Biodiversity Assessment, and Nestedness in an endangered Ecosystem. Conservation Biology 14 (6): 1726-1734.

Noss, R.F. 1990. Indicators for monitoring biodiversity: a hierarchical approach. Conservation Biology, 4: 355-364.

Parker, T.A.P. III., A.H. Gentry, R.B. Foster, L.H. Emmons, and J.V. Remsen, Jr. 1993. *The Lowland Dry Forests of Santa Cruz, Bolivia: A Global Conservation Priority*. Rapid Assessment Program Working Papers No. 4. Conservation International, Washington D.C., USA / Fundación Amigos de la Naturaleza, La Paz, Bolivia. 104 pp.

Pearson, D.L. 1994. Selecting indicator taxa for the quantitative assessment of biodiversity. Philosophical Transactions of the Royal Society of London: Biological Sciences, 345: 75-79.

Prabhu, R., C.J.P. Colfer, P. Venkarteswarlu, L.C. Tan, R. Soekmadi & E. Wollenberg. 1996. Testing Criteria and Indicators for the Sustainable Management of Forests: Phase 1 Final Report. CIFOR Special Publication, Bogor, Indonesia.

Raison, R.J., A.G. Brown, D.W. Flinn. (ed.). 2001. Criteria and Indicators for Sustainable Forest Management. IUFRO. CAB International, UK.

Roger, S., Roca, E., Sedaghatk, G. 2000. Nature in focus: Rapid Ecological Assessment. Island Press. Washington, D.C.

Scott, J.M. et al. 1993. Gap Analysis: A Geographic Approach to the Protection of Biological Diversity. Wildlife Monographs, 123: 1-41.

Sheil, D., R. Nasi, & B. Johnson. 2004. Ecological criteria and indicators for tropical forest landscapes: challenges in the search for progress. Ecology and Society 9(1):7. [online] URL: http://www.ecologyandsociety.org/vol9/iss1/art7

Stork, N.E., T.J.B. Boyle, V. Dale, H. Eeley, B. Finegan, M. Lawes, N. Manokaran, R. Prabhu & J. Soberon. 1997. Criteria and Indicators for Assessing the Sustainability of Forest Management: Conservation of Biodiversity. Working Paper No.17. CIFOR, Bogor, Indonesia.

UNEP. 1993. Guidelines for Country Studies on Biological Diversity, UNEP, Nairobi, Kenya.

UNEP. 1996. Assessment of Biological Diversity and Methodologies for Future Assessments. CBD/SBSTTA. Second Meeting [online] URL: http://www.biodiv.org/doc/meeting.aspx?mtg=SBSTTA-02

UNEP. 2003. Handbook of the Convention on Biological Diversity, 2nd edition, Secretariat of the Convention on Biological Diversity, Montreal

Watt, A.D. 1998. Measuring disturbance in tropical forests: a critique of the use of species-abundance models and indicator measures in general. Journal of Applied Ecology Vol. 35 (3): 467.

Weaver, J.C. 1995 Indicator species and scale of observation. Conservation Biology 9 (4): 939-942.

Wessels, K.J. et al. 1998. An evaluation of the gradsect biological survey method. Biodiversity & Conservation 7(8): 1093-112.

WWF Malaysia. 2002. Biodiversity assessments and conservation planning for sustainable production forestry in high-conservation value forests, PITC, Temengor FR, Perak.

Chapter II – Biodiversity conservation in managed forests in Peninsular Malaysia

The JPSM's chief approach to biodiversity conservation in managed forests is the zoning of the *permanent reserved forests (PRF)* into various functional classes. Firstly, as the National Forestry Act (1984) requires, the PRF is divided into the following eleven functional classes; i.e. productive and protective zones:

1. Timber production under sustained yield
2. Soil protection forest
3. Soil reclamation forest
4. Flood control forest
5. Water catchment forest
6. Forest sanctuary for wildlife
7. Virgin jungle reserve forest
8. Amenity forest
9. Education forest
10. Research forest
11. Forest for federal purposes

Secondly, according to the Forest Management Planning Rules and Guidelines (JPSM 2004 *final draft*), *within the timber production zones* further multifunctional zoning is carried out: areas with various additional forest functions which are not or only conditionally compatible with timber production are further differentiated into:

- Soil protection
- Soil conservation
- Soil reclamation
- Water catchment protection
- Water catchment conservation
- Flood control protection
- Riparian buffer protection
- Wildlife protection
- Rare ecosystem protection
- Cultural sites protection
- Production of non-timber forest products

Conservation of biodiversity is explicitly considered in the functional class "forest sanctuaries for wildlife" as well as in the zones "wildlife protection" and "rare ecosystem protection" within the timber production forests. Zones for wildlife protection refer to "areas where endangered, rare and threatened wildlife species occur (…) this includes corridors for their movement to other wildlife protection zones" (JPSM 2004 *final draft*). Since a variety of other functional classes are not compatible with timber production and are therefore also fully protected (e.g. soil protection, riparian reserve protection etc.), these can also be considered areas for biodiversity conservation.

The zoning approach is fully in line with the MC&I. As of now, however, no systematic assessment and identification of threatened species and their habitats exists within the forest management planning and implementation process. This, however, is a prerequisite for the zoning exercise.

In the following two chapters a two-way approach is suggested. On the one hand, more information is required on threatened species. Prerequisites and methods for their identification and integration into the existing system are proposed in Section 1. On the other hand, for the protective zones to be effective in particular in terms of biodiversity conservation their status, distribution and connectivity needs to be known and monitored. A system for the effective planning and implementation of forest management (including production and protection) on a landscape scale needs to be set up. An approach is suggested in Section 2.

1. Safeguarding threatened species in managed forests

1.1 Status quo

Protecting threatened[1] species requires the knowledge on the threat status of species occurring in the forest. However, to date there does not exist a nationally accepted list of threatened (plant) species of Malaysia.
In general, data on ecology, population status and viability of species in Malaysia is scattered and incomplete. Certain species are better assessed than others, such as timber trees and palms as well as big mammals and birds.
Information on species' threat or protection status in Malaysia can be gained from various sources:

a. **Legislation**: Malaysia protects various species through national legislation. Most of it refers to faunal species: Protection of Wildlife Act, 1972 for Peninsular Malaysia; Fauna Conservation Ordinance, 1963 for Sabah; Wildlife Protection Ordinance, 1990 for Sarawak.
   Flora: The protection of plants is currently not provided for in Peninsular Malaysia legislation. Plant species of Sabah are protected under the Wildlife Conservation Enactment (1997) of Sabah. In the case of Sarawak, four species of trees are totally prohibited and protected from felling by legislation: *Casuarina equiselifolia* for the control of coastal *erosion, dipterocarpus oblongifolius* for the control of river bank erosion, *Shorea macrophylla and S. splendida* for the production of the valuable illipe-nuts. In recent years, an additional 42 plants are also being protected under an amendment to the Wildlife Protection Ordinance, 1990.
b. **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)**: Currently, the following tree species and genera native to Malaysia are listed in the CITES Appendices II and III respectively: Appendix II: *Gyrinops spp*. and *Aquilaria spp.* (Agarwood), *Gonystylys spp*. (Ramin); Appendix III: *Podocarpus neriifolius* (Yellow Wood)) (CITES 2004, Traffic 2004a, Traffic 2004b). For a complete list of fauna and flora species listed in the CITES appendices refer to the CITES website.
c. **"Endemic Trees of the Malay Peninsular"** (Ng et al., 1990) identifies 746 endemic trees (or 26.4% of total number of tree species) of which 511 are classified as endangered. 30 dipterocarp species are listed as

[1] The term "threatened" in this report is considered an overall term for the variety of threat categories including rare and endemic; i.e. IUCN threat categories.

endemic to Malaysia of which 9 are considered endangered. Criteria for this classification are: rarity (not more than 5 specimens ever collected) or geographical restriction to 1 or 2 states only, or endangered swamp (wetland) habitat.

d. **IUCN Global Red List of threatened species**: This is a comprehensive information source on the *global* threat status of species in Malaysia. According to the IUCN Red List 689 plant species are threatened (Categories Extinct in the Wild, Critically Endangered, Endangered and Vulnerable) in Malaysia. Within the Categories ‘Critically Endangered’ and ‘Endangered’ 184 species are tree species of which 158 belong to the dipterocarp family. (IUCN 2003). Annex 2 provides an overview of the IUCN threat categories.

The “Assessment of Biological Diversity in Malaysia” carried out and published by MOSTE in 1997, calls for a “national red data book for Malaysia patterned after the global IUCN Red Data Books and Red Lists” (MOSTE 1997).

In 1999 Malaysian delegates participated in a regional consultation workshop held in Sri Lanka on “Using the IUCN Red List Criteria at the National Level”. The status of threatened species listing in Malaysia was presented, and general constraints and priority needs identified (Perumal and Sharma 1999). This process was never followed up since (Sharma, pers com.).

FRIM is currently in the process of developing threat assessment criteria and categories for Malaysian plant species, in particular for threatened dipterocarp species. In a first classification, the 161 dipterocarp species in Malaysia were ranked by its degree of rareness. The investigation is further focused on the 80 rarest species. Common species are not considered in the assessment. Each single species – starting with seven – will be assessed in terms of its ecology, biology and biogeography as well as genetic aspects using herbarium records and conducting field studies. The criteria and categories for threatened species assessment should have been developed by 2004. The species listing under the IUCN Global Red List, which mainly focuses on tree species, is regarded as being not representative of the actual situation in Malaysia, since the lowland dipterocarp species were automatically listed as “critically endangered” or “endangered” due to habitat destruction. No ground proofing or verification took place whether these species occur anywhere else in Malaysia.
Another project providing valuable information on threatened species and which is to be completed by the year 2005 is FRIM’s project on plant geography of dipterocarps and palms. Species distribution is mapped using GIS. (Chua, FRIM; personal communication)

There are a variety of other individual research projects at FRIM and Universities each focusing on specific taxonomic groups. The objectives of these research projects, however, differ and the determination of the threat status of the taxa under question is mostly a by-product of the overall research. No concerted process of all the stakeholders exists as of now for the systematic assessment of species’ threat status.

Recently, first steps towards a national process for the establishment of a national threatened species list were taken. A technical committee was formed consisting of the three Forestry Departments (Peninsular, Sabah, Sarawak), FRIM, the Wildlife Department and the Ministry of Natural Resources and Environment. This committee is currently developing an “Action Plan” and “Conservation Strategy”, which will set the frame for the development and agreement on the actual criteria on how to assess threatened species status. Additionally, a consultative committee will be formed which includes other institutions, such as NGOs and other research institutions (Chua, FRIM; personal communication).

1.2 A proposed practical approach

1.2.1 Establishing a preliminary list of threatened species in forests

Evaluating the threat status of taxa is a difficult task. It is a long, tedious and costly process, which furthermore requires the collaboration and cooperation of a variety of government as well as non-government institutions. FRIM is currently working on the development of threat assessment criteria and categories for Malaysian plant species. The process should have produced first results by 2004. But only a fraction of those species prone to be assessed, will be assessed by then (and this only refers to dipterocarps). Information on the threat status of the eighty dipterocarp species FRIM focuses on, will be not available before some years, not to mention non-dipterocarp species.

Since there is a discrepancy between the immediate call for action in particular for institutions like the Forestry Department to undertake measures regarding biodiversity conservation and the time required to gain more profound knowledge on species and biodiversity in general in Malaysia’s forest, a compromise has to be sought. This would allow the forest manager to take immediate action. For a start intermediate measures based on the current (fragmented) knowledge have to be developed. These then need to be adjusted or expanded once more accurate knowledge becomes available.

As outlined above, there are data available on the threat status in particular of tree species, but also of fauna species. These could serve to establish a *preliminary working list of threatened species* within the context of forest management. It would most probably contain threatened endemic tree species and a list of the rarest and threatened (tree) species as identified by FRIM (or any other institution for that matter) as well as a list of fauna species.

A multi-disciplinary process is required to establish this list, to confirm the data and reach consensus on the species listed. The Technical Committee and its Consultative Committee might already provide an adequate forum for such a process.

Listing a species under a certain category of threat simply provides an assessment of the extinction risk under current circumstances. It does not per se make any statement on priorities for conservation action. These would need to be developed subsequently for each single species. Hence, even if the list of threatened species consisted of a considerable number of species, this does not automatically imply that all these species need complete protection. It is to decide in a multi-disciplinary process which of these species need protection, monitoring or any other management action.

1.2.2 Identification of threatened species and habitats in the forest

Which survey or inventory technique are to be chosen first of all depends on the species to be inventoried; secondly, on the overall objective of the inventory, i.e. what the data are needed for. Thirdly, it depends on the frame conditions, namely the financial and technical means as well as the availability of manpower and expertise.

Different approaches are proposed for the different planning levels, i.e. medium-and short-term planning or state and compartment level.

Medium-term planning on state level:
The FMPRG require a rapid biodiversity assessment as part of the medium-term planning (JPSM 2004 *final draft*, section 3). The results of the assessment are used in the multifunctional zoning process to ascertain wildlife protection and ecosystem protection function at state level.

Various methods for a rapid assessment of biodiversity have been briefly introduced in Chapter I. Which method is most applicable for the Forestry Department's purpose depends on the focus of the assessment: identification of suitable habitats of threatened species; identification of areas which are the richest in biodiversity (e.g. Rapid Biological Inventories, Rapid Ecological Assessment). Another way of identifying potential areas in particular of threatened species' habitats is to use extrapolation methods. They give an estimation of the habitats and (potential) occurrence of the species in question. In order to pool resources and synchronize activities related to biodiversity conservation, it would be most effective to use extrapolation methods which are already used by the Wildlife Department (fauna) and/or FRIM (flora) (if any available). Otherwise, the potential of modelling systems, such as the Biodiversity Information Management System (BIMS) (see Chapter I, 4.2.1.1) or BioLink Modeling (See Chapter I, 4.2.1.3) and their compatibility with existing mapping and GIS systems (i.e. FRIM's plant geography project, Forestry Department's SMGP etc.) need to be explored. These modelling systems estimate and map the likely range of taxa based on known collection localities. Ground truthing of some of the high potential areas identified by modelling is required to get a more complete picture of the species' actual status. This requires the cooperation of the Forestry Department with other departments and research institutions (i.e. Wildlife, FRIM, universities).

The Forestry Department as well as other institutions carry out scientific expeditions ("ekspedisi saintifik") in more or less regular intervals. It would also be worth exploring the potential of these scientific expeditions for the systematic collection of field data on threatened species in specific areas.

Short-term planning on compartment level:
As a first step of operational planning on compartment level, the forest functions as identified during the macro-level planning are verified and further dif-

ferentiated on a micro-level during field surveys. At this stage biodiversity field surveys need to be carried out. Since a 100% inventory of the entire area is impractical, an efficient sampling method needs to be employed. The Gradient-directed transect (Gradsect) sampling as briefly described in Chapter I, 4.1.6, is an effective method to rapidly detect the maximum number of species in an area (or threatened species). Transects would be positioned within the compartment to follow the major physiographical characteristics, traversing the steepest environmental gradients present in the area, while taking into account logistical aspects, such as access routes. A multidisciplinary survey team is required again to cover the threatened fauna as well as flora species.

Alternatively, the biodiversity assessment conducted in the PITC, Temengor FR, Perak (see Chapter I, 4.2.2.1) needs to be reviewed with regard to its applicability of its methods for threatened species identification and its suitability as a routine survey system.

1.2.3 Threatened species monitoring in the timber production zones

Apart from identifying areas of high concern for biodiversity conservation (i.e. in this context areas that harbour habitats/sites of threatened species), identification and in particular monitoring of threatened species needs to be incorporated in forest management planning within the timber production zone. The current forest management planning system provides two monitoring instruments:

- ***Continuous forest inventory*** on state level: The continuous forest inventory (CFI) is a medium term planning instrument for conducting a forest management inventory (FMI) on a State's forest resource within the timber production zones. This is to be repeated every ten years. The sampling design consists of permanent sample units of square shape with one sample plot in each corner, altogether four. Each sample plot consists of a 4m-circle for small size trees and a point sample for big trees. The CFIs of the respective states combined provide the information for the National Forest Inventory.
- ***Pre- and post-harvest assessment*** on compartment level: Pre- and post-F inventories are forest resources assessments within the timber production zones with a 2.5% sampling density (i.e. 1 plot of 0.1 ha per 4 ha). Pre-F inventories are conducted a year prior to forest harvesting. The same plots are re-measured two years after forest harvesting in the post-F inventories. This allows for an assessment of (immediate) logging impacts on the residual stand.
- ***Timber cruising*** (i.e. timber enumeration and mapping) is not designed as a monitoring instrument. But it is included here as it is carried out simultaneously with the pre-F inventory and can provide additional substantial information on species occurrence, distribution and status. The timber cruising is a 100% inventory of all trees above 40 cm dbh within the timber production zone. Following the cruising lines the cruising team measures and marks all trees above 40 cm dbh, whereby it is distinguished between protected and non-protected trees.

These inventory systems in conjunction with the existing information system (i.e. CR, SMGP, GIS) in forest management already provide a system, which will allow monitoring of tree species' distribution, regeneration, specimen numbers etc. However, they are not sufficient for the identification and monitoring of threatened species in managed forests.

The main constraint is that they do not truly identify all tree species, but only a list of species. In the case of the tree enumeration and the pre/post-F inventories tree species to be inventoried are listed in the "Manual Kerja Luar" (Jabatan Perhutanan Semenanjung Malaysia, 1997), some trees are only recorded to genus level. All other species are combined under one common code that does not allow for further differentiation. A list of selected species is also established for the FMI. This means that under the current forest inventory system, threatened tree species are not surveyed if they are not listed in the Manual Kerja Luar. Since these inventories focus on timber production, all this refers to tree species (and some palm and bamboo species) only.

The least adjustment, which needs to be done, is the integration of threatened tree species (including bamboos, rattan, palms, if relevant, as well as other plants which are relatively easy to identify, e.g. Tonkat ali or *Nepenthes* species) in the inventory list. Furthermore, specimens of threatened tree species need to be inventoried to the lowest size possible within the entire sample plots (i.e. identify threatened species from seedling to tree size within the 50mx20m-plot of the pre/post-F plots). This would allow for a more complete inventory of threatened tree species.

The identification of other threatened plant species than trees as well as fauna species goes for most of the cases beyond the capacities of the Forestry Departments' staff. The cooperation with other institutions, namely the Wildlife Department, is required, and options for a multidisciplinary inventory team need to be explored. Furthermore, local people are a valuable source of information on wildlife. Interviews with local people and/or their participation in the inventories would be a locally specific, rapid, cost-effective and efficient way of gaining data on threatened fauna species in the respective forest areas (timber production and non-production classes and zones).

As described in Chapter I, 4.2.2, a variety of biodiversity assessments within forest management mainly focusing on wildlife were carried out already in Malaysia. These studies provide a valuable input for the designing of a general monitoring strategy for the Forestry Department. A critical assessment of these studies would need to be carried out with regard to the applicability of these methods on a wider scale and their feasibility in terms of financial and human resources.

2. A coarse filter approach to biodiversity conservation

The previous paragraphs have shown that taking a species based approach to biodiversity conservation in Malaysia's forests has its limitations as there is a considerable knowledge gap on species, their habitat and site requirements, their threat status, the impact of logging on species etc. Furthermore, with regard to the requirements of expertise, time demand and funds, extensive species-based assessment and monitoring techniques seem impractical as routine exercises within the context of forest management planning and implementation.

A more practical solution is a coarse filter approach to biodiversity conservation focusing on habitats (i.e. parts of ecosystems) at a landscape level. It works on the assumption that if the integrity of a representative part of the country's forest ecosystems and thus habitats is maintained at all times, negative impacts on biodiversity are kept to a minimum. The zoning concept of the Forestry Department in conjunction with the protected areas of the Wildlife Department is already a vital step in this direction.

2.1 Status quo in Peninsular Malaysia

In total, 2.6 million ha of the Peninsular's forest area are protected. Tables 2 and 3 below give an overview of the various categories of set aside areas.

Table 2: Forestry Department Forests set aside for protective functions	
'Protection' forest functional classes within PRFs (1.9 mio ha)	
	Soil protection and reclamation forest
	Water catchment forest
	Flood control forest
	Forest sanctuary for wildlife
	Virgin jungle reserves
Areas unsuitable for timber production within Timber Production Forest (multifunctional zoning)	
	Soil protection
	Water catchment protection
	Flood control protection
	Riparian buffer protection
	Wildlife protection
	Rare ecosystem protection
	Cultural sites protection

Sources: National Forestry Act 1984; JPSM 2000; URL: http://www.forestry.gov.my (Aug. 2004).

Table 3: Wildlife Department Protected Areas (768,994 ha)[2]
National Parks
State Parks
Wildlife Reserves
Nature Parks

Source: URL: http://www.wildlife.gov.my/tablepa.htm, May 2004

Forests fulfilling protective functions within the PRFs are estimated to cover about 1.9 million ha (http://www.forestry.gov.my, August 2004) or 40 % of the PRFs (this refers to the "protection" forest functional classes within PRFs only, so far no data exist on the multifunctional zones within the timber production forests). This shows that the Forestry Department is responsible for more than two thirds of the protected forest area[3] in the Peninsula. But little is known about the distribution and connectivity of these protected areas and in how far the existing protected area system is representative of the forest ecosystems.

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[2] Figure refers to protected areas within forests (FD Statistic 2002).

[3] In the following the term "protected areas" combines forests set aside for protective functions under the jurisdiction of the Forestry Department and protected areas managed by the Wildlife Department. In their combination, these areas constitute the protected area system of Peninsular Malaysia.

2.2 A proposed practical approach

In order to effectively combine activities related to timber production and biodiversity conservation, an information and decision support system needs to be set up which provides information on the status quo of the protected forest areas (distribution, vegetation types etc.), location of potential relevant habitats of target species, spatial heterogeneity of the forest structure (i.e. seral stages of forests) within the overall forest landscape (i.e. protected forests and production forests).

- Determine status quo:

In a first step, the forested area currently under protection needs to be identified and mapped. This includes forests set aside for protective functions under the jurisdiction of the Forestry Department (see Table 2) (hereby called protected areas under the jurisdiction of the Forestry Department), but also protected areas managed by the Wildlife Department (see Table 3). These data are generated and compiled using GIS.

- Carry out gap analysis 1:

The second step is to combine GIS data on the distribution of these protected areas and forest types (e.g. vegetation classification by Wyatt Smith (1995)). That way information is obtained on the question in how far the respective forest ecosystems are represented under the current protected area system. Additionally, the seral stages of forests need to be mapped (i.e. for practical reasons it is recommended to use the logging status or strata as required in the forest management inventory). This gives an overview of the spatial heterogeneity of the forests and allows to draw conclusions on the suitability of forest areas (within the timber production zones, but also protected areas) as habitats of critical species and/or as corridors.

- Carry out gap analysis 2:

In a further step, the habitat/site requirements of the threatened species identified are compared with the protected areas available. This would reveal gaps in the ecosystem coverage and connectivity of the current protected area system. Cooperation with other institutions is required. E.g. FRIM has extensive data on site requirements in particular of tree species. The Wildlife Department would need to provide data on wildlife species' habitat requirements and distribution.

- Pilot phase:

The compilation of the data as described needs to be seen as a continuous process, since data on many forest areas are not available yet. This is in particular the case for the multifunctional zones. It is therefore suggested to start with a pilot phase in one FMU or PRF. This would provide an insight into data availability and compatibility, workload and feasibility. It also already gives an input to what extent this data is already integrated or can be integrated into existing information systems and management planning.

Conclusion

Since Malaysia's forest ecosystems are very rich in biodiversity and complex and little is known, as of yet, a biodiversity conservation strategy of the Forestry Department needs to be a combination of a variety of different management strategies. A coarse to fine filter approach is suggested. A coarse filter approach on a landscape level ensures adequate representation of all forest ecosystems through a network of set aside forest areas. This way, it is assumed that most species are taken care of. A fine filter approach (on species level) is only used for some selected species (i.e. selected threatened species), which need special attention and monitoring and which might not be taken care of adequately in the coarse filter approach.

In Peninsular Malaysia a substantial amount of the forest area is protected already through the Forestry Department's zoning exercises and the protected areas of the Wildlife Department. These, however, need to be combined to a network of protected forest areas. This requires first of all a thorough understanding of the *status quo* of the existing protected area system. To successfully (i.e. economically efficient and ecologically effective) set up and manage Peninsular's network of protected areas, cooperation between the forestry and the Wildlife Department as well as other relevant stakeholders is required. Furthermore, the integration of the various protected forest areas and zones as well as threatened species' distribution and habitat requirements into the Forestry Department's existing information system facilitates multi-purpose forest management planning and implementation and sets the ground for a landscape approach to multi-purpose forest management.

An approach on a landscape level is not only a biodiversity measure, but also a basis for the planning and implementation of activities related to both production and conservation. Apart from setting aside areas for protection (zoning), this includes management measures in timber production zones, such as the implementation of strict RIL practices and the identification and monitoring of the most critical (fauna and flora) species. Forest management planning and implementation tools need to be adjusted accordingly; e.g. there is a need to adapt existing forest inventory systems to adequately integrate biodiversity survey and monitoring systems. This first and foremost requires additional expertise, which cannot be solely provided by Forest Department staff – at least not in the short term and most probably not in the long-term either. New ways of collaboration with other government, but also non-government institutions need to be explored. The consolidation of the two departments – the Forestry Department and the Wildlife Department - under the Ministry of Natural Resources and the Environment, provides a promising basis for a constructive cooperation on common matters such as biodiversity conservation. The approximation and increasing cooperation between the public and private sector is also a crucial prerequisite for a successful implementation of biodiversity conservation.

References (Chapter II)

CITES. 2004. CITES listed species database. URL: http://www.cites.org/eng/resources/species.html

Fauna Conservation Ordinance, 1963 for Sabah Forestry Department Headquarters Peninsular Malaysia. Forestry Statistics, Peninsular Malaysia 2002.

IUCN. 2003. IUCN Red List of Threatened Species.[online] URL: <www.redlist.org>. Downloaded on 8 April 2004.

Jabatan Perhutanan Semenanjung Malaysia. 1997. Manual Kerja Luar. Sistem Pengurusan Memilih.

JPSM (Jabatan Perhutanan Semenanjung Malaysia). 2004. Forest Management Planning Rules and Guidelines (final draft); yet to be published.

MOSTE (Ministry of Science, Technology and the Environment). 1997. Assessment of Biological Diversity in Malaysia. Country study on Biological Diversity. Kuala Lumpur, Malaysia National Forestry Act. 1984. Peninsular Malaysia.

Ng, F.S.P., C.M. Low, Mat Asri Ngah Sanah. 1990. Endemic Trees of the Malay Peninsular. FRIM Research Pamphlet 106. Forest Research Institute, Kepong, Malaysia.

Perumal ,B & D.S.K. Sharma. 1999. The Status of Threatened Species Listing in Malaysia: Lessons learned, key constraints and priority needs. In: IUCN. Using the IUCN Red List Criteria at National Level: A regional consultative workshop for South and Southeast Asia. 13-17 September 1999. Sri Lanka [online] URL: http://www.biodiversityasia.org/ebooks.html

Protection of Wildlife Act, 1972 for Peninsular Malaysia

Traffic. 2004a. International conference highlights regional action to combat illegal wildlife trade. [online] URL: http://www.traffic.org/news/combat.html

Traffic. 2004b. CITES backs sustainable management of high-value fragrant wood. [online] URL: http://www.traffic.org/news/press-releases/wood.html

Wildlife Conservation Enactment (1997) of Sabah.

Wildlife Protection Ordinance 1990 for Sarawak.

WWF Malaysia. 2002. Biodiversity assessments and conservation planning for sustainable production forestry in high-conservation value forests, PITC, Temengor FR, Perak.

Wyatt-Smith, J. 1995. Manual of Malayan Silviculture for Inland Forest. Malayan Forest Records No. 23, FRIM, Malaysia.

Annex 1:

List of institutions contacted by email

Institution	Relevance	Response
International Tropical Timber Organization (ITTO)	Examples of implementation of ITTO_C&I (i.e. 5.3)	Negative response
Forest Stewardship Council (FSC)	Examples of implementation of FSC C&I (i.e. 6.2)	No response
Smartwood		No response
Société Général de Surveillance (SGS)		No response
Scientific Certification Systems (SCS)		General information
Soil Association		No response
Secretariat of the Convention on Biological Diversity (CBD)	Case studies on implementation of CBD	No response
International Model Forest Network	Case studies on implementation of biodiversity conservation in managed forests	No response
IUCN Conservation Breeding Specialist Group	Methodologies on threatened species identification and classification	Information on Conservation Assessment Management Plan (CAMP) and Population and Habitat Viability Assessment (PHVA)
IUCN Species Survival Commission		
Fauna&Flora International - Global Trees Campaign (FFI)	Case studies and methodologies used for species assessment and monitoring	No specific information provided on implementation level
Conservation International (CI)	- Implementation species conservation - Request for field manual of rapid assessment programme standard methods for biodiversity assessment	- No response - Field manual being developed and will be available by fall 2004
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH	Case studies on incorporating biodiversity conservation aspects in forest management in other projects	See examples given below

Annex 2:

Threat Categories according to the IUCN Global Red List

The IUCN Red List

The IUCN Red List is the world's most comprehensive and regularly up-dated inventory of the global conservation status of plants and animals. It uses a set of globally applicable criteria to evaluate the extinction risk of species and sub-species globally.
There are nine categories in the IUCN Red List system:

Extinct	EX
Extinct in the Wild	EW
Critically Endangered	**CR**
Endangered	**EN**
Vulnerable	**VU**
Near Threatened	NT
Least Concern	LC
Data Deficient	DD
Not Evaluated	NE

Classification into the categories for species threatened by extinction (VU, EN, CR) is through a set of five quantitative criteria that lie at the heart of the system. These criteria are based on biological factors related to extinction risk. They include: *rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation*. The decision rules defining criteria for the three threatened categories (VU, EN, CR) were designed to be applicable to species from the full taxonomic spectrum, except for micro-organisms. The other six categories (NE, DD, LC, NT, EW, EX) are defined in the form of qualitative decision rules.
Note: The category of threat simply provides an assessment of the extinction risk under current circumstances. It is not necessarily sufficient to determine priorities for conservation action (IUCN. 2003. Guidelines for Using the IUCN Red List Categories and Criteria).

Annex

10

Practitioners Guide:
Curriculum / Syllabus Development

gtz

Practitioners Guide
on
Curriculum/ Syllabus Development

Nikolaus Schall

2003

A practical guide on the development of curriculum and syllabi, which gives a brief introduction into the method before it describes in detail principles and general procedures. It further lists advantages and disadvantages.

Contents

List of Figures:

List of Templates:

Curriculum/ Syllabus Development

Brief description

At the heart of all education and training courses lies the curriculum. Curriculum development is much more than simply listing the content of a course. It takes into consideration the learning that the students achieve, the activities and experiences that bring the learning about, the process of planning and organizing these activities and experiences and the piece of writing which embraces this planning.

The **curriculum** defines the training required for a particular profession/ job position, for example, a foresters' certificate course or land management course. On the other hand, the **syllabus** describes the objectives and contents of subjects that form part of a certificate course; e.g. the subject of land survey.

Nevertheless, major shifts in education and training are difficult to achieve, and they often take years for completion. In comparison with other elements of formal education systems, training institutions and even universities seem particularly resistant to changes in organizational and educational strategies, processes and methodologies, even when they operate in dynamic external environments.

In many countries the training institutions and university sector seems to maintain a safe distance from theorising about teaching and learning. Though changes are to be observed in many training institutions and universities throughout the world, these are often structural rather than conceptual. It is likely that economic imperatives are responsible for the changes rather than a perception of the need to improve the effectiveness of learning. During the late 1980s and the 1990s there has been an increasing interest by many training institutions and universities, often driven by pressure associated with greater external scrutiny, in developing a more systematic approach to change management.

Proposed main users

Trainers, lecturers, training institutions, universities, colleges.

Purpose of the method

The **curriculum** (and therefore also the **syllabus** for the courses) is central to the teaching and learning process. Some authors (for example Miller, Turner and Innis, 1986) have advocated "curriculum-led" institutional development as a vehicle for change. The degree of autonomy conceded to teachers and even institutions in the development of curricula is very variable. In some training institutions, teachers and lecturers are able to take quite wide-ranging decisions on the development of the curriculum, subject to approval from the institution. In many education institutions, however, overall development of the curriculum often remains the responsibility of a few, an elite group located at the top of a hierarchy. Discussions about curriculum development tend to involve a small number of persons in senior academic and, in some cases, government positions, and usually centre around the content of teaching. There are two serious problems associated with this hierarchical approach:

- Firstly, the assumption is made that a small, privileged group is aware of the reality of the external environment, and that their own theoretical understanding and experience is sufficient to enable them to develop curricula which will bring about effective learning.

- Secondly, as discussed earlier, it is believed that learning will take place through transmission of knowledge, and that the subject-related expertise of teaching staff is sufficient to convey knowledge to the learners. Curricula developed under this approach rarely provide guidance to teachers and learners on how the learning process may be facilitated. Teachers are left to fend for themselves, amidst all the constraints which are present in training institutions or universities (Taylor, 1998b).

Even in those training institutions where teachers have a greater degree of autonomy in the curriculum development process, there is rarely any mechanism or agreed-upon principle for increasing the involvement of other stakeholders. The lecturer is still considered as the expert, and the assumption is made that he or she will deliver the goods as a result of expertise garnered through professional activities such as academic study and research, or through personal linkages with the relevant "industry" in which graduates will be employed. Authority over what will be taught to the majority is vested in the minority.

Advantages

- A curriculum assists training organizations to determine what the students need to know; it sets the standard of training.
- The curriculum defines what students should know and be able to do by the end of the training.
- The curriculum/ syllabus supports trainers and teachers alike in providing high-quality learning experience for all students.
- The curriculum/ syllabus is expected to be up-to-date and provide an insight into how the professions being trained for are in-line with the current practices and future trends.
- The syllabus provides an instrument for effective learning and teaching strategies that could be additionally supported by research and practice.
- The syllabus initiates discussions concerning curriculum integration within and across different subjects.
- The curriculum defines the standard to be set for evaluating student/ trainee performance.
- The curriculum provides "outsiders" (private sector, government agencies) within an insight into the contents and training approach.

Limitations

- Curriculum and syllabus do not necessarily have a legal character and they are not binding, they are indicative.
- The curriculum does not contain a detailed lesson plan; such a plan is usually only included in the subject syllabus.
- The curriculum does not cover everything a student needs to know.
- Once they are developed and approved curricula are usually difficult to modify and revise due to the great efforts attached with the process.
- As a consequence of slow adaption to changes, curricula are not always up to date and in line with current trends and practices.

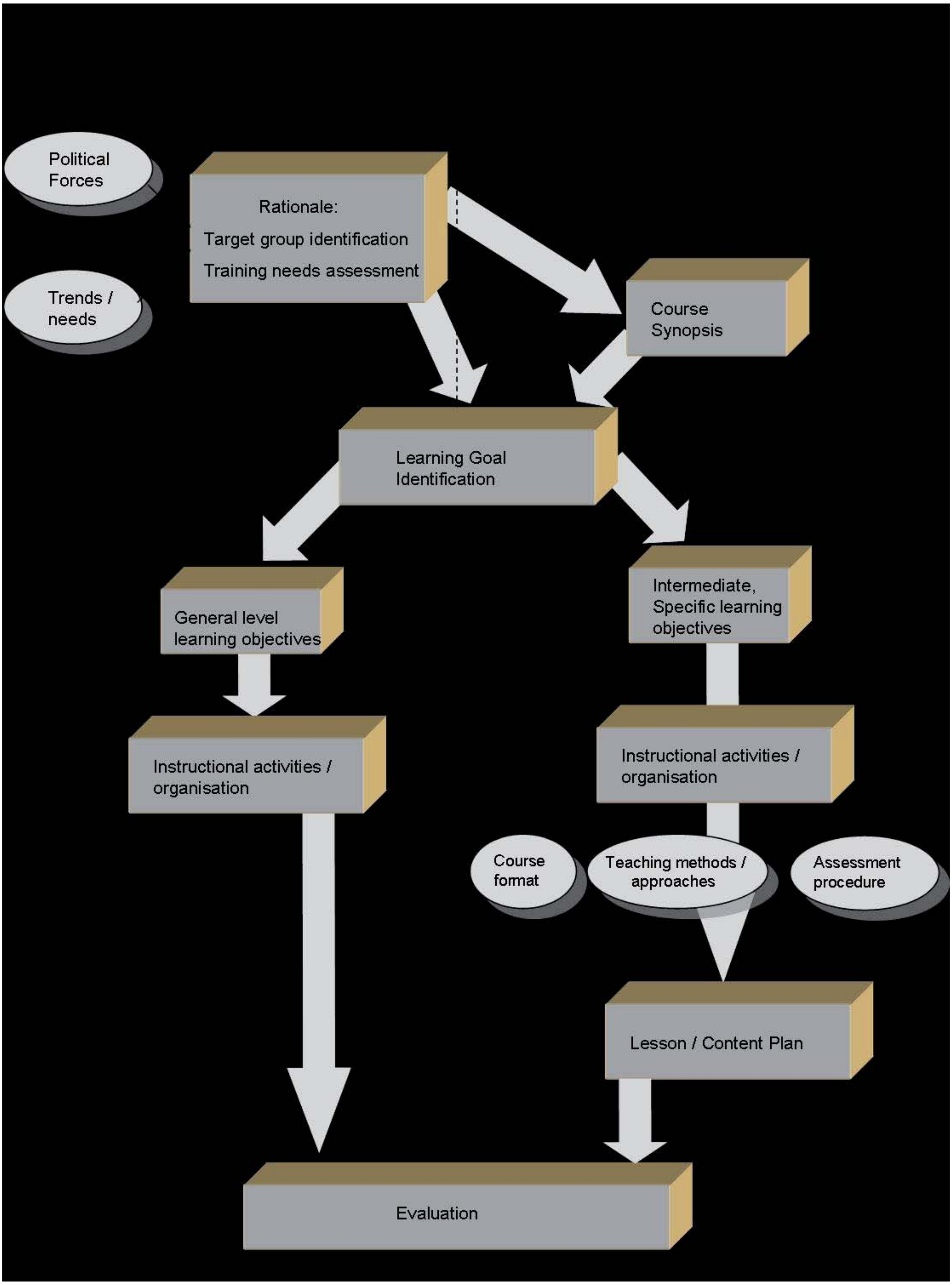
Principles and General Procedures

A basic model for curriculum/ syllabus development

Verduin's model (1980) was developed to document and guide a system of curriculum / syllabus development that was used in urban adult education centres. It recognizes the peculiar needs of adult learners. The model can be applied to different sectors, including the forestry sector. The approach promoted by Verduin includes taking the "learners" from where they are in life to where they need to be according to the organizations and their individual perspectives.

Verduin's model has five major elements: **rationale, outside political forces, goal identification, instructional activities and organization, and evaluation**. All of these contain sub-elements. The description contained in these guidelines depict Verduin's model in terms of how it relates to curriculum/ syllabus development for forestry management.

Figure 1: Inter-relationship: Curriculum/ syllabus and Verduin's five elements



1. Rationale

The first element of curriculum planning is that of the rationale, or explaining why a curriculum is being developed or revised. However, for the subject syllabi the rationale is included in the synopsis. In Forestry, one can take the rationale directly from the people to be trained. One of the core beliefs of a hallmark of good curriculum development is that one develops long-term relationships with “clients” to move them through a training stream. For example, learners may start with the Foresters Certificate and move through Forest Rangers. A successful curriculum takes learners from where they are and moves them to where they need to be to meet their own and the organization’s goals. The rationale has two steps: target group identification and needs assessment of trainees have to be included in a training course.

Target Group Identification. It is critical to identify the primary target group to be reached through the training course. The more one knows about the target group and the more closely a target group has been identified, the better the conditions for designing a curriculum or syllabus that best meets their needs. In Forestry one may have had business relations with foresters in the past, while presently owners of private plantations or other target groups may emerge as a target group. In this case the curriculum/ syllabus needs to be adapted according to the target group’s demands and requirements. The first step that needs to be undertaken is to get to know the target group and to understand their motivation for learning. Often training courses may target two or more diverse target groups. In such cases, understanding the differences between the groups and designing training courses to meet both sets of needs, is of great importance.

Needs Assessment. Needs assessments can be formal or informal. It is advantageous to conduct a formal needs assessment for the forestry sector periodically. When working on a new professional picture of, say, the Forest Rangers that also embraces their role in the private sector, it is mandatory to conduct a formal needs assessment. Informal needs assessments could be done by keeping one’s ear to the ground or visiting potential employers of foresters/Forest Rangers.

2. External Actors

It may also be worthwhile to ponder the effects of external actors. This is particularly relevant in the area of forest management where the identified needs of target groups must be balanced with political and other external circumstances. Three types of external actors impacting on the syllabus/ curriculum development process are government agencies, private organizations and non-governmental organizations.

Government Agencies. Legal acts and regulations relevant for the forestry sector are regularly enacted. The effects that such requirements have (for example privatization efforts) as well as (voluntary) norms and standards such as the ISO 9002 mean that curriculum and syllabus constantly need to be revised.

Private Organizations. Curricula and syllabi contents can be affected by private organizations in a variety of ways. In the timber and non-timber production sector, private enterprises can set technical standards associated with certain sets of skills. For example, private log millers may establish standards on measuring forest products. A training programme in forest measurement needs to take into account these developments. Market mechanisms are also an important factor that require and determine the type of training programmes.

NGOs. Non-governmental organizations such as environmental groups can have significant impact on the demand for continuing training programmes. One example is the development of criteria and indicators for sustainable forest management. NGOs may also be important for the funding of training programmes.

3. Learning Goal Identification

The most important element in a curriculum development model is goal identification. Learning activities are developed as specific responses to goal statements. The process of defining the goal statements determines what will be taught and what will not. It also determines how easy it will be to evaluate what is learned. Goals give curriculum developers targets to shoot for. Learning activities are attempts to hit those targets, and evaluations are measures to see how many targets were hit. Three levels of goals can be set for curricula: general objective, intermediate goals and specific targets. A similar hierarchy can also be set for subject syllabi.

General objective (abstract). The general objective defines what, overall, the training course aims at. For instance, a forestry course may want to achieve strengthened capacities for sustainable forest management.

Intermediate goals (course/ subject level). These goals generally state what subjects participants will learn about in a particular course. It is very important to develop measurable indicators for these goals. This can be done by formulating active imperatives with the learner and making qualitative statements. For example: Learners will be able to estimate the volume of timber in a stand by taking plots to measure height, diameter, and number of trees per acre, using diameter tapes, clinometers, loggers tapes as tools, or using a computer course to perform their calculations and be within 5 percent of the instructor's estimate.

Specific targets (class session level). Specific targets are very task-oriented and relate to small discrete learning milestones towards the achievement of intermediate goals. These goals are often not enumerated in detail. An example of a specific-level goal would be to learn to identify the three particle sizes used in soil classification of sand, silt, and clay.

4. Instructional Activities and Organization

Developing and organizing instructional activities lies at the centre of developing curricula and syllabi. While instructional activities are only broadly defined in the curriculum they will be explained in more detail in the subject syllabus. If trainers and managers are thorough in their goal development, the selection, development, and organization of instructional activities should be a fairly straightforward process.

Develop or use specific learning experiences to achieve goals at all three levels. Like goals, learning experiences are hierarchical. Specific learning experiences that will cover a class session or two constitute the building blocks of a syllabus. They serve specific-level goals. The entirety of specific-level experiences make up the learning experiences of a course or subject; they serve a series of mid-level goals.

Need to recognize hierarchy of knowledge, attitudes, skills, and abilities (KASA). Learning covers different sorts of material. Knowledge learning requires acquisition of knowledge or facts. Knowledge learning is the basis of all learning. Ability learning involves manipulation of knowledge through synthesis and prediction. Ability learning can be called a higher-order learning than knowledge learning since knowledge is a first step to developing abilities. Skills learning is the practical application of knowledge and ability learning. Skills learning is a very hands-on, i.e. practical kind of, learning. Some view it as the basic type of learning at all.

Need to know or assume entry level of KASA performance to design appropriate instruct-ion. Each subject syllabus within a training course needs to assume an entry level of KASA. Knowing or assuming the foresters and Forest Rangers' points of departure allows the trainer to design instructional activities that actually take the students where they need to go.

Use prerequisites to try and assess entry-level KASA performance. In a training, students are not always long-term learners as they would be in a university or college course. Therefore, it is all the more important to define prerequisite classes or skills to ensure entry-level KASA performance.

5. Evaluation

Evaluation is the final step in the model for both designing a curriculum for a whole course and developing a subject syllabus. It can be used to measure achievements of student's and teacher's goals, to provide feedback on learning activities and to determine the effectiveness of educational courses.

Measure goal achievement. Goals that have been well developed and are described in a measureable manner are fairly easy to evaluate. Achievement of these goals by learners can be measured by using pre- and post-tests. The results of the evaluation can be used to improve the courses provide feedback for learners.

Formative evaluation. Formative evaluations are conducted during an educational course with the objective of improving course decisions. Formative evaluations are often used to measure students' intermediate learning achievements.

Summative evaluation. Summative evaluations are more formal. They seek to evaluate course effectiveness, by means of assessing the achievement of course objectives and course impact. Various levels of summative course evaluations are used. They comprise some sort of hierarchy: The higher the level achieved in a summative evaluation, the more information the trainer will have regarding course effectiveness:

1. an **inputs level** evaluation looks at the resources necessary to conduct a course.
2. an **activities level** evaluation consists of listing the activities involved in conducting the course.
3. an **involvement level** evaluation lists the number and type of participants in a course.
4. a **reactions level** evaluation characterizes learners' response or reaction to a course and the instructor.
5. a **KASA change level** evaluation attempts to measure changes in the students' knowledge, attitude, skills and abilities.
6. a **practice change level** evaluation looks at behaviour changes in the learners in the wake of an educational experience.
7. an **end results level** evaluation attempts to assess if the overall programme objectives are met.

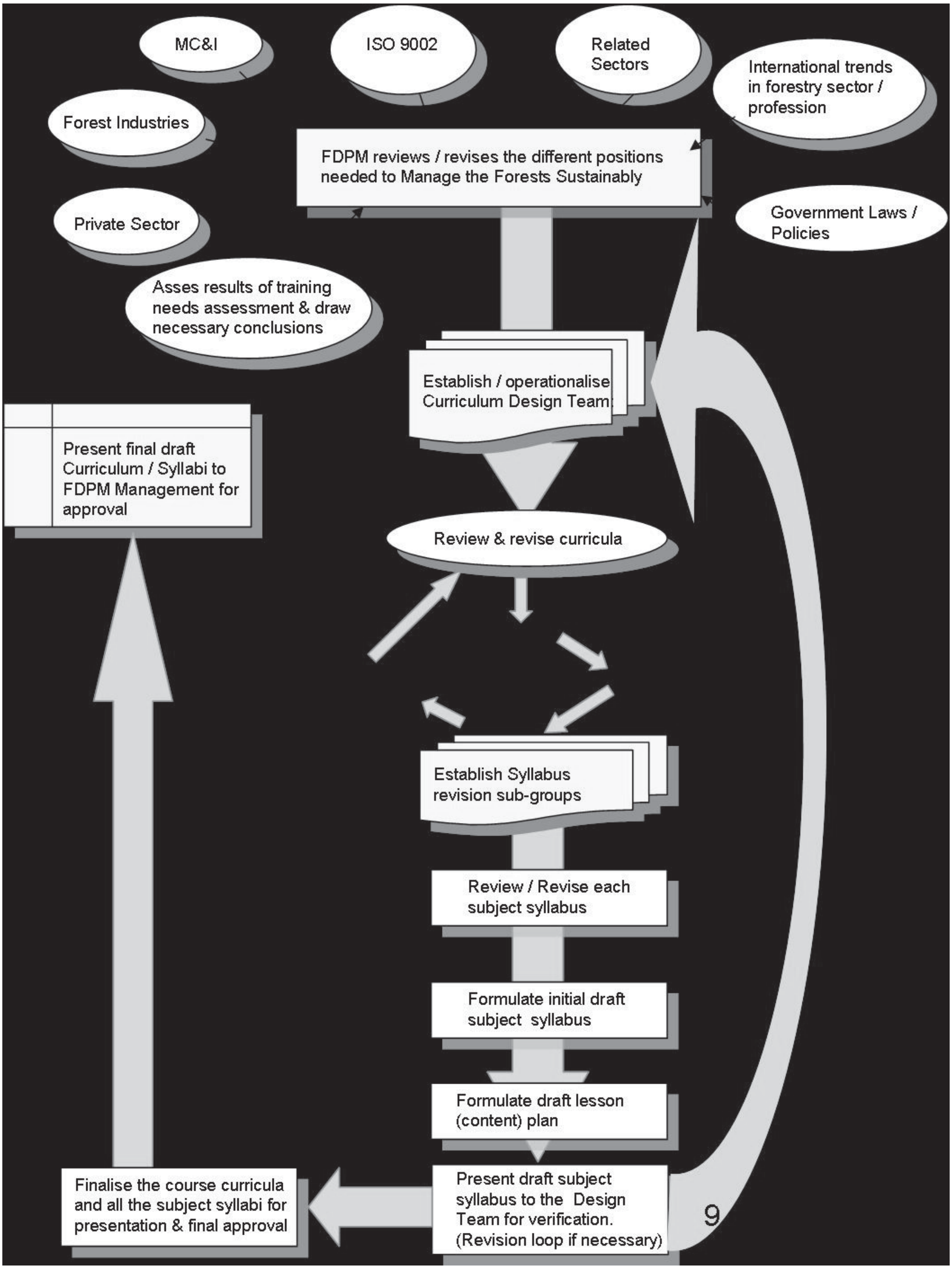
Process approach:

Before planning or reviewing any certificate course, several issues have to be addressed. The development of both the curriculum and the syllabus should be undertaken in a participatory manner. The exercise should not be undertaken merely by the upper management of an organization but should involve the management, the trainers and the professionals working in the field. A step-by-step approach is proposed (cf. Figure 2):

Step 1: Review of positions in the department: The organizational/ institutional management needs to assess and review all job positions in the department with respect to their ability to meet the department's vision and goals. This review will need to consider both internal and external factors, including changes occurring in the profile of professional foresters, the increasing role of the private sector, ISO 9002, results of the training needs assessment and so on.

Step 2: Establish a curriculum design team: A curriculum design team is proposed to be established. It should be composed of members from the training institute, representatives from the industry/ private sector, lecturers and field practitioners. It could be considered to integrate an "independent" forest service provider/ consultant, a representative of the human resources department of the organization and an instructional design expert. This person would be assist to match the best pedagogical approaches with the resources available to the training institution. The team would be the main "working" body, charged by the organization's management to ensure that the whole of curricula are reviewed and revised.

Figure 2: Curriculum/ syllabus stakeholder participation process



Step 3: Review/ revise the curricula:

On the basis of the recommendations made by the senior management of the organization/ institution, the curricula design team would revise and update the course curricula. The team would make use of all available information about the training needs, including any training needs assessment. The team would undertake a systematic review of the curricula for the whole certificate courses, including all the various subjects that would have to be covered in the curriculum. The team will allocate the initial credit hours for each subject. This will only be indicative initially and will be finalized once all the subject syllabi have been completed.

Step 4: Define job descriptions and assign credit hours: The team could also assist in refining the job descriptions for the relevant positions as they are indicated by the management of the organization/ institution. This may also turn out useful in defining the training needs and thus curricula of the course. In addition, the curricula design team could assign the initial credit hours that will be allocated to each of the subjects defined in the curricula.

Step 5: Establish sub-team to elaborate the subject syllabus: Once all the subjects have been defined, sub-teams can be established who receive the task of reviewing and revising the syllabi of all the subjects. The sub-teams will formulate the revised syllabi for each subject.

Steps 6 – 8: Review syllabus, elaborate formulate initial draft subject syllabus and lesson plan: The sub-team made up of professionals and trainers will develop the subject syllabus. The template attached to this guideline may prove useful for this purpose. The sub-teams will also formulate the lesson/ content plans for each subject. Each sub-team will also outline the appropriate techniques for assessing student achievement.

Step 9: Submit initial draft subject syllabus and lesson plan to curricula design team: Each sub-team will then submit the draft syllabus to the curricula design team/ board for verification with the curriculum. A feedback loop between the syllabus sub-teams and the curricula design team would be undertaken in which proposed changes would be integrated into the syllabus and duplications and overlaps removed.

Step 10: Finalize the curricula and syllabi: The curricula design team would be responsible for ensuring that the subjects are in line with the overall course curricula, that duplications and overlaps have been streamlined and that the course is manageable and can be implemented to the desired level in the given time period.

Step 11: Submit revised curricula and syllabus to management for approval: The curricula design team would submit the curricula and all of the subject syllabi to the Senior Management for final approval.

Curricula, syllabus and lesson plan templates

The following templates are designed to guide curricula and syllabus training institutions during the design or revision stage of curricula and syllabi.

Template 1: Curriculum template

COURSE CURRICULUM

Please describe here the exact name of the certificate course for which the curriculum is intended.

RATIONALE	:	*The first element of curriculum planning is that of the rationale, or explaining why a curriculum is being developed or revised. The rationale has two steps: target group identification and needs assessment of trainees has to be included in a training course.* ***Target Group Identification.*** *It is critical to identify the primary target group to be reached through the training course.* ***Needs Assessment.*** *Needs assessments can be formal or informal.*
PRE-CONDITIONS	:	*In some cases the trainees/ students may have to have completed another course or have certain knowledge before they can attend this course.*
MAIN SUBJECTS INCLUDED IN THE COURSE	:	*The main subjects that will be covered in the course should be spelt out here. In defining the main subjects it should also be aspired to make the course relevant for the practical needs of the private and public sectors.*
LEARNING GOALS / OBJECTIVES (General, intermediate learning goals)	:	***General Level (abstract).*** *These goals are the guiding principles behind large-scale training courses. For instance, a Forestry course may have 1-2 general goals.*
COURSE FORMAT	:	*In the course format section it is necessary to describe how this course is structured and how the classes will be carried out. If the course has multiple formats including lectures, practical field training and time in a laboratory these should be carefully spelt out here.*
TEACHING METHODS / APPROACHES	:	*The section on the teaching methods and approaches should give the students/ trainees more information on the pedagogical style of teaching/ training that is going to be applied throughout the course.*
EVALUATION PROCEDURES	:	*Summative evaluations are more formal and seek to evaluate course effectiveness. The evaluations are undertaken by assessing achievement of course objectives and course impact.* 1. ***Inputs level****: resources necessary to conduct a course.* 2. ***Activities level*** *listing activities involved in course.* 3. ***Involvement level*** *lists the number / type of participants* 4. ***Reactions level*** *characterizes the response or reaction of learners to a course and the instructor.* 5. ***KASA change level*** *attempts to measure changes in the knowledge, attitude, skills, and abilities of the students.* 6. ***Practice change level*** *looks at behaviour changes in the learners because of an educational experience.* 7. ***End results level*** *attempts to see if the overall broadest course objectives are met.*
REFERENCES	:	*Literature, books, articles and other relevant works that should be read by the students/ trainees should be listed in this section of the syllabus.*

Template 2: Syllabus template

SUBJECT SYLLABUS

Please describe here the subject which the following syllabus is intended for.

COURSE TITLE	:	*Write down the exact title of the course for which this is one subject. For example it could be the Forest Ranger Certificate Course*
SUBJECT	:	*The subject title should clearly define the subject to be addressed in the course.*
SUBJECT SYNOPSIS	:	*The subject synopsis is to be structured comparably to an executive summary. It describes why the subject has been chosen and how it fits in with the rest of the course.*
SUBJECT CODE	:	*The subject code is usually defined by the training institution (e.g. the Forestry Training Unit of the FDPM)*
CREDIT HOURS	:	*The institution is responsible for defining the way in which the credit hours are calculated. The total number of credit hours available for the whole course also has to be assigned by it.*
SEMESTER	:	*In this section the semester in which the course will be undertaken has to be defined. In other words, it could be the 3rd Semester of the 2 year Forest Rangers Certificate.*
PRE-CONDITIONS	:	*In some cases the trainees/ students may need to have completed another subject or have certain knowledge before they can attend this course.*
LEARNING GOALS / OBJECTIVES (Intermediate and specific learning goals)	:	***Intermediate Level (Subject Level / Measurable Objectives).*** *These goals are generally responsible for driving the training course and subjects. They are generally simple statements of what course participants can expect to learn.* ***Specific Level (Class Session Level / Measurable Objectives).*** *These are very task-oriented goals. They relate to small discrete pieces of learning that must take place to achieve mid-level goals.*
SUBJECT FORMAT	:	*In the subject format section it is necessary to describe how this subject is structured and how the classes will be carried out. If the subject has multiple formats including lectures, practical field training and time in a laboratory these should be carefully spelt out here.*
TEACHING METHODS / APPROACHES	:	*The section on the teaching methods and approaches should give the students / trainees more information on the pedagogical style of teaching/ training that will be resorted to.*
ASSESSMENT PROCEDURE	:	*The exact grading / assessment procedure should be detailed for the students / trainees. In this section it is important to describe the percentage allocation for the tests, assignments, practical work, attendance and final examination.*
STUDENTS RESPONSIBILITIES	:	*The students / trainees also have a number of responsibilities. Some of these are defined e.g. in the FTU rules and regulations – while others may not be as explicit. In this section it would be important to define the exact responsibilities of the students.*
REFERENCES	:	*Literature, books, articles and other relevant works that should be read by the students / trainees should be listed in this section of the syllabus.*

Template 3: Course content/ lesson plan template

COURSE SCHEDULE / CONTENT **COURSE TITLE:** Insert the name of the course as it appears on the syllabus of the course

Nr.	Main Topic	Sub-Topic	Teaching Method	Learning Objectives	Instruments / Equipment	Estimated Time (Hours)		
						Theory	Practical	Total
Insert the number of the course here	Give the exact title of the main topic which forms part of the overall course	The topic being handled in the respective class maybe a sub-topic. In this case define the name of the sub-topic here.	Describe the type of teaching methods that will be used, this may include lectures, group work, field trips, etc reference can also be made to the fact whether visual aids material will be used, powerpoint presentations and son on.	The specific learning objective of this part of the course should be clearly spelled out here. It can be derived from the overall syllabus documents.	In some cases specific instruments or equipment will be sued for the training. For example, the use of GPS, maps, charts etc. These should be noted here..	The number of hours that will be devoted to the theory in this section needs to be noted here	The number of hours that will be devoted to the theory in this section needs to be noted here	The total numb er of hours to be spent on the theory and practi cal is summ ed

References and sources used:

Cloughesy, M; A. Scott Reed, *Training Managers for 21st Century Flexible Learning Pathways:* A Forestry Extension Perspective on Curriculum Development. Fisheries Queenstown, NZ, 12.2001.

Freire, P., (1972), *The Pedagogy of the Oppressed*. New York: Herder and Herder.

Helvetas, (1997) *Social Forestry Support Programme Project Document*. Hanoi: Swiss Agency for Development and Co-operation and Ministry of Agriculture and Rural Development of the S.R. of Vietnam, September 1997.

Hobbs, S.D., A.S. Reed, and B.B. Hobbs. 1993. *Technology transfer: putting research into practice*. Journal of Forestry 91(10):12-14.

Reed, A.S., J.J. Garland, and L.E. Biles. 1996. *Extension forestry organizational processes, programs, and policies.* Presented at International Union of Forestry Research Organizations Extension Working Party, 1996, Freising, Germany.

Rowntree, D., (1981), *Educational Technology in Curriculum Development.* London: Harper and Row.

Senge, P., (1990), *The Fifth Discipline*. London: Falmer Press.

Taylor, P. (1998b), *Participatory Curriculum Development - Some Experiences from Vietnam and South Africa*, in Training for Agricultural Development, 1996-98. Rome: FAO.

Verduin, J.R. 1980. *Curriculum building for adult learning*. Southern Illinois University Press/Carbondale and Edwardsville.

Annex

11

Self-Scoping Handbook for Sustainable Natural Forest Management Certification in Indonesia

gtz

Indonesian-German Technical Co-operation
Ministry of Forestry
in co-operation with
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)

Self-Scoping Handbook

for
Sustainable Natural Forest Management Certification
in Indonesia

Ferdinandus Agung PMW
Alexander Hinrichs

With contributions by:
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and Members of the East Kalimantan Certification Working Group (KKS*)*

SFMP Document No.6a (2000)
ISBN : 979-606-063-9

Promotion of Sustainable Forest Management Systems
In East Kalimantan (SFMP)

November 2000

Foreword

Activities in natural production forest management outside the island of Java are now heading into the fourth decade. Over this time timber company practices have lead to severe changes in the condition of forests within Indonesia. The reality in the field shows that forest management practices are still far from what we would expect, private concessions practices and local community activities are still causes of forest degradation. Also the matter of forest fire has contributed to the destruction of forest in Indonesia.

Forestry problems in Indonesia are so complex and difficult that they have gained the attention of several national agencies, through MoF as well as other initiatives. International assistance has been provided through relevant organizations that are concerned about the future of Indonesian forests. NGOs and forestry practitioners are making a combined effort to decrease the degradation of forests in Indonesia.

Sustainable forest management certification is one instrument for achieving this goal. Initially certification was voluntary for concession holders. However, given the increasing amount of criticism from consumers it can soon become compulsory. Consumers have shown an increasing commitment towards purchasing forest products (especially timber) that are environmentally friendly. This is cause for thought and will be a challenge for forestry practitioners that wish to continue to fulfill market demands and maintain a strategic position in future sustainable development.

Self-scoping is one step that should be undertaken by a forest management unit in response to global developments relating to utilization of forest products as well as the actual condition of the global timber industry.

Therefore, self-scoping is an instrument that should be used by all Indonesian forest management units to prepare for entering the era of sustainable forest management certification. It is hoped that this Self-Scoping Handbook will be accepted as a practical reference for forestry practitioners undertaking initial steps and for those wishing to improve performance generally. This guide should help to achieve sustainable forest management certification more quickly and easily.

Jakarta, 15 September 2000

Director General of Production Forest Management
Ministry of Agriculture and Forestry

Ir. H. Soegeng Widodo
NIP 080 026 696

TABLE OF CONTENTS

LIST OF TABLES, BOXES AND FIGURES

INTRODUCTION

Globalization and its effects on forest utilization have created a new paradigm for sustainable development within the forestry sector of developing countries. Issues related to the utilization of forest resources and the role of the local community as a part of the management system have gained significant world attention.

Realistically, we have to acknowledge that sustainable forest management (SFM) certification is a new challenge for forestry practitioners in Indonesia. To date forest management procedures and mechanisms have been tied to rigid mandatory governmental regulations, technical guidelines, and practical procedures. Recent global developments mean that nowadays concessionaires are faced with a new reality, that is, the existence of a third party showing interest in a management unit's performance. This has influenced the way a Forest Management Unit (FMU) evaluates its performance. This third party, the buyer, has indirectly, through certification organizations, pushed the producer to prove that their performance standards meet with SFM standards. The consequence of not fulfilling such expectations is that the FMU's export market share will fall, especially in countries with an eco-sensitive market (Europe, USA).

We have to admit that the socialization of SFM in Indonesia through certification has not proceeded well. Obstacles of both a technical and non-technical nature have caused this. Non-technical obstacles arise out of the non-conducive atmosphere existing under the current framework conditions in the current era of change. At this point it is absolutely necessary that all macro and micro political initiatives concerning the utilization of natural resources are successfully completed.

Technical obstacles to the socialization of SFM have arisen because SFM techniques have not enough been clarified to the forestry sector (for example, *TPTI* as one instrument of SFM). In the field, certification standards are viewed as difficult for an FMU to fulfill. It needs to be demonstrated that most of the certification standards are not actually something new but already part of an FMU's everyday activities. The publication of this **Self-Scoping Handbook** is intended to support this socialization process. It is meant to provide a simple guidance to SFM certification standards and procedures. We hope this publication will become a tool that assists each FMU/HPH to view and reflect upon their performance according to the Indonesian certification standards.

To date it has been agreed that SFM performance evaluation for certification in Indonesia is based on **LEI Document -01.** These standards (Criteria and Indicators) were produced through a long process of discussion involving many parties or stakeholders as well as field trials. The process was related to the development of certification standards at the international and regional level.

A. Development of SFM Criteria and Indicators

Development of certification standards for sustainable forest management at the national and international level has been proceeding for the past decade. Important initiatives that have assisted with the development of SFM principles, criteria and indicators are:

A.1 International Initiatives

The **International Tropical Timber Organization (ITTO)** conference held in Bali in 1990 resulted in an agreement and commitment by its member nations to implement SFM by the year 2000. This commitment was strengthened by the "Earth Summit" held in Rio de Janeiro, Brazil in 1992. The summit resulted in an agreement to develop SFM Principles, Criteria and Indicators. In 1992, ITTO took the initiative to formulate Criteria and Indicators. The aim was to assist its member countries with relevant tools to observe the development of their forest management systems at the national and field level. By identifying the main elements of Sustainable Forest Management the ITTO mission "to increase the capacity of members in implementing strategies for achieving exports of sustainably managed Natural Tropical Production Forest" was to be achieved by the year 2000 (see ITTO Policy Development series No. 7).

The **Forest Stewardship Council (FSC)** was established by NGOs and the private sector. This organization gives full authority to its members to carry out its mission and vision. Membership is open to experts in the fields of economics, environment and social affairs. In 1994, nine FSC principles were released, consisting of SFM principles and related criteria. [Box.1)] These were extended to 10 principles in 1995. FSC criteria and principles are oriented to evaluate the performance of an FMU (performance standards), (see Document No. 1.1, FSC Statutes). The role played by FSC is that of an accreditation organization for certification bodies. So far Smartwood (Rain Forest Alliance), SGS, Woodmark, Forest Conservation Programme, SKAL, SCS, IMO, and LUSO have been approved to work in accordance with the FSC principles. Around 18 million ha of forest in the world have received a FSC certificate (FSC, 2000). To date there is only one FMU in Southeast Asia (Deramakot Forest Reserve in Sabah, Malaysia[1]), which has passed the FSC certification.

The **International Standardization Organization** or as is it better known ISO, through implementation of the ISO 14000 series, has created a certification framework called the Environmental Management System (EMS). This system is oriented towards the management process within an FMU. The ISO technical working group has also prepared information and documents on performance standards for forest management according to the EMS. ISO standards do not yet cover all aspects of SFM.

[1] See also annex 8 of this publication: "Biodiversity Conservation in Managed Forests: Review of Literature on Methodologies for Biodiversity Assessments and Recommendations for Forest Management in Peninsular Malaysia", p. 17.

A.2 National/ Regional Initiatives

National initiatives have also begun in other countries such as: Sweden, where both the FSC and ISO approaches are combined, Malaysia, Norway, Canada (*Canadian Standards Association, CSA*), Finland, Indonesia (*Lembaga Ekolabel Indonesia - LEI*), Ghana, and PEFC in Europe. The emergence of such national/regional initiatives has increased cooperation between countries, in an effort to find a system suitable for all.

A.3 Indonesian Ecolabeling Organization

The **Indonesian Ecolabeling Organization (LEI)** was formed in 1994, and in the beginning took the form of an independent working group. In close coordination with the forestry sector, LEI prepared a set of national criteria and indicators for SFM certification (LEI standard). These criteria and indicators were developed by referring to standards set by ITTO and FSC as well as the environmental management system set by ISO. **LEI** has developed a complete certification system that includes SFM criteria and indicators for natural forest management to be used as the national certification procedure. LEI achievements to date include certification efforts in several HPH's in Indonesia and the establishment of a network aimed at improving the criteria and indicators.

Until the year 2000, LEI played a dual role as the national certification system developer and future accreditation organization as well as being a national certification body themselves. Since recently, LEI only works as national system developer and accreditation organization, the same role as FSC plays to its certification bodies. LEI has so far accredited 4 certification bodies (CBs). An address list of all CBs (LEI-CBs and FSC CBs) currently operating in Indonesia is included in the appendix.

Through a **Memorandum of Understanding to develop a Mutual Recognition Agreement** (MRA) between LEI and FSC in Rome on March, 1998, LEI's international position increased.

Follow-up from the MRA efforts, ongoing improvement of LEI's criteria and indicators as well as periodic field trials took place. This has resulted in an agreement to undertake **joint certification** between LEI and FSC in Indonesia. This process has been supported by GTZ and WWF (see MoU *YLEI* and FSC September, 1999). It was agreed that under joint certification, the standards from the LEI Document -01 (SFM criteria and indicators) should be used in all certification activities in the natural production forest in Indonesia. Future steps for joint certification were discussed at a meeting in London in June 2000. Here it was agreed that the joint certification should continue in Indonesia using the LEI-01 criteria and indicators plus whatever needed to meet FSC requirements and that an FMU, which has successfully passed joint certification, would achieve two certificates, one LEI and one FSC certificate. Finally, the detailed process for joint certification between LEI-CBs and FSC-CBs was developed during a seminar in Bogor in September 2000 (see appendix for procedure).

B. Certification Process on the Management Unit level

There are two important steps to be undertaken by an FMU when proceeding with the certification process:

B.1 Preparation Process for Certification (internal; or with a consultant)

To avoid failure when proceeding with the certification process, there needs to be a set of well planned and structured preparation activities. The certification system works based on a clear standard for SFM, which must be understood and internalized well for all management activities. Certification is also a learning process that will allow for much internal reflection and will lead to corrective actions concerning the encountered weak points. The certification process will be more efficient if an FMU is able to prepare itself thoroughly prior to signing a contract for SFM certification.
Preparation activities include:

a.	**Preparing staff**:	Establishment of a certification working group at the FMU level
b.	**Self-Scoping**:	Identification of FMU macro conditions (strong and weak points)
c.	**Corrective Action**:	Action plan to irradiate major problems (gaps) that may delay the SFM certification process
d.	**Self-Scoping follow-up**:	Evaluation and monitoring of progress (improvement of existing weaknesses)

e. **Registration for Certification at LEI/FSC certifier.**

B.2 Certification Mechanism (external; by the certification org.)

An FMU that has undertaken the preparational steps and has eradicated major obstacles can then undertake the certification process by using one of the certification organizations that have been accredited by LEI or FSC. The certification mechanism begins by:

a.	**Registration for Cert.**:	Registration and fulfilment of all registration requirements
b.	**Scoping Visit (optional)**:	Pre-assessment activity undertaken by a certification organization. Scoping is optional and depends on the amount of preparation done by the FMU. A scoping report indicates the position of the FMU and comments on the possibility of continuing to the main assessment.
c.	**Main Assessment**:	Field evaluation and main report
d.	**Certification Decision**:	Certificate granted or improvements suggested, jointly by LEI & FSC certifier (both systems to be passed).

C. Self-Scoping

C.1 Definition

Self-scoping is an initial identification process that an FMU can undertake to prepare for a certification request. It uses a simplified set of the Indonesian SFM criteria and indicators and can be performed internally by the FMU or by an external consultant. The results of this initial investigation can be used to determine the current position of the FMU and to evaluate the needed steps to achieve SFM certification.

C.2 Scope

Self-scoping activities include determining the type (*Typology*) of an FMU and the **identification of its overall performance,** based on the certification standards.

C.3 Aim of Self-Scoping

The self-scoping technique developed by SFMP-GTZ aims to make understanding of the concept and objectives of LEI criteria and indicators easier, as these are the standards jointly used by LEI/FSC in Indonesia. The technique consists of activities that can be fully performed by an FMU in the field. It must be understood that the LEI criteria and indicators are arranged based on a log-frame with outcomes listed in a hierarchical way. A matrix is given showing both the management dimension and the results dimension [Box 2)]. In this matrix system each indicator is related to the others so that to get the most accurate information about the requirements of one indicator, each section of the whole dimension needs to be understood. There are several indicators that appear repeatedly, which may make it seem more complex than it is.

C.4 Principles of Self-Scoping

Self-scoping shall be performed by an FMU using the following principles:

1. Internal process; not based on legal requirements and only relevant to the internal needs of the FMU.
2. Implemented with internal staff or consultant; if a consultant/advisor is used this person must have a lot of experience in the field of forest management and certification. The results are only for use within the FMU itself.
3. Internal familiarization process; undertaking self-scoping means that all FMU staff involved in the process must be informed about the approach and procedure. There needs to be a transfer of information and training concerning eco-labeling and certification.
4. Initial evaluation; the process is rough and dirty, therefore does not require a complete assessment.

Box 1. FSC statutes: 10 Principles of Sustainable Forest Management

1. **Compliance with Laws and FSC Principles.** Forest management shall respect all applicable laws of the country in which they occur, international treaties and agreements to which country is a signatory, and comply with all FSC Principles and Criteria.
2. **Tenure and Use Rights and Responsibilities.** Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established.
3. **Indigenous Peoples' Rights.** The legal and customary rights of indigenous peoples to own, use and manage their lands, territories, and resources shall be recognized and respected.
4. **Community Relations and worker's rights.** Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.
5. **Benefit from the Forest.** Forest management operations shall encourage the efficient use of the forest multiple products and services to ensure economic viability and wide range of environmental and social benefits.
6. **Environmental Impact.** Forest management shall conserve biological diversity and its associated values, water, resources, soils, and unique and fragile ecosystems and landscapes, and, by doing, maintain the ecological functions and integrity of the forest.
7. **Management Plan.** A management plan – appropriate to scale and intensity of the operations — shall be written, implemented, and keep up to date. The long-term objectives of management, and the means of achieving them, shall be clearly stated.
8. **Monitoring and Assessment.** Monitoring shall be conducted — appropriate scale and intensity of forest management – to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.
9. **Maintenance of High Conservation Value Forest.** Management activities in high conservation value forest shall maintain or enhance the attributes, which define such forests. Decisions regarding high conservation value forest shall always be considered in the context of a precautionary approach.
10. **Plantations.** Plantations shall be planned and managed in accordance with Principle and Criteria 1-9, and Principle 10 and its Criteria. While plantations can provide an array of social and economic benefits.

Box 2. Separation of Management and Performance Dimensions (LEI Standards)

Management Dimension:
- a. Area Management : Area Demarcation (Compulsory Requirements)
- b. Production Management : Performance (Core Activities)
- c. Organizational Management : Managerial Quality (Desired Requirements)

Performance Dimension:
1. Production Sustainability
2. Environment Sustainability
3. Social Sustainability

The matrix shows how the management and production dimensions are combined and that each indicator represents an combination of dimensions.

Matrix Showing the Management and Production Dimensions

Management Dimension (Strategies for Achieving Results)	**Production Dimension (Principles)**		
	Production Sustainability	**Environment Sustainability**	**Social Sustainability**
1. Area Management ***(Compulsory Requirements)***	INDICATOR	INDICATOR	INDICATOR
2. Forest Management 2.1 Production M'ment 2.2 Environmental M'ment 2.3 Social M'ment ***(Core activities)***	INDICATOR	INDICATOR	INDICATOR
3. Organizational Management ***(Desirable)***	INDICATOR	INDICATOR	INDICATOR

Source : LEI 5000 Standards

II. PRECONDITIONS FOR UNDERTAKING CERTIFICATION

In this report preconditions means all efforts taken to prepare an environment conducive to undertake Sustainable Forest Management certification [Box3)]. This includes self-scoping and corrective actions. These shall be done before the official certification process begins. There are several important factors required to engender an environment conducive to certification preparation including:

A. Vision and Mission and a Corporate Statement on SFM

Commitment by the FMU's top management is the most fundamental cornerstone to achieve SFM. This commitment triggers many consequences including changes to the corporate culture from focusing on timber extraction to shifting to "resource-oriented management". Concrete changes include changes to management structure policies with more emphasis on the 3 important aspects of SFM – production, environment, and social. So far, it has been rather common for the last two aspects to be left out under the current system of "timber extraction".

Certification is an "investment". Changing the management style to SFM practices has major economic impacts. Investments include the certification cost, which are about ± Rp. 4.000/Ha for the overall process under the Joint Certification Protocol (JCP) and the cost for performance improvements, especially regarding environmental and social aspects. Depending on the initial condition of the FMU there may also be major costs for improvements made to the production technique as well as to workers' health and safety.

B. Technical Preparation

The second step under the preconditions for certification preparation is technical/ organizational preparation including:

B.1 Formation of an Internal SFM Team / Task Force

For SFM activities to be truly effective within an FMU, it is necessary to have an internal team that can handle all certification preparations. The structure of this task force should be based on the 3 main SFM sections; for example 4 team members for production, 2 for social, and another 2 people for environmental aspects could be chosen. The composition and membership of the team should be needs-based, according to the criteria and indicators that will be evaluated. Members should be placed according to their expertise and experience, see Figure II-1. This task force should be maintained on an ongoing basis, remembering that the certification system includes a follow-up surveillance process.

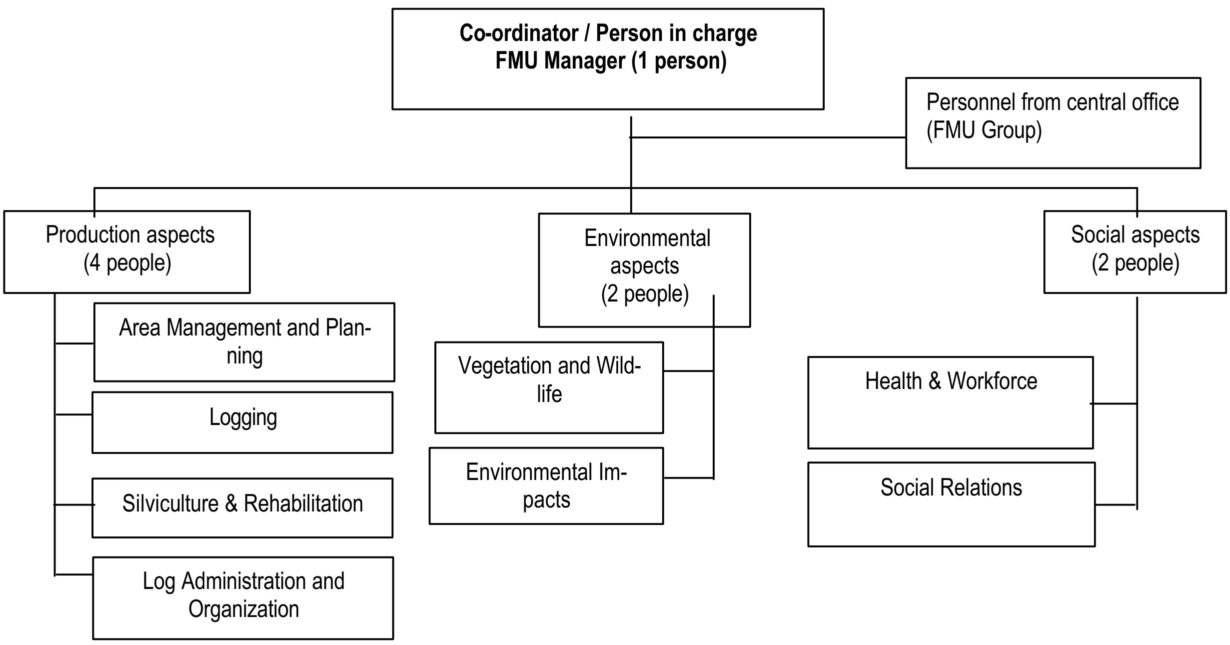


Figure II-1. Example of an Internal Team to prepare SFM implementation on FMU level

Box 3. **Prerequisites to Achieve SFM**

1. Certainty of the area: The area of an FMU must be free from conflict in the long term. This is strongly connected with problems of government policy and local interests. The history and legal aspects of the management area must be clear.

2. The ability of the FMU to maintain production stability: This is important because forests are limited resources.The harvesting and silvicultural system must ensure that the forest will continue to be productive every year for the long term.

3. Forests do not only serve production targets but also fulfill ecological functions that are tightly connected to endemic species and the environment at large. The FMU management must be able to guarantee that the forest management system used is environmentally acceptable.

4. Forest utilization must be guaranteed for communities living in/near the forest. This can be a cause of conflict for the FMU in the long term if not adequately dealt with.

B.2 Evaluation of the Certification System and Standards

The **Indonesian Ecolabelling Organization (LEI)** has developed several certification mechanisms and procedures, including: certification working mechanism (SNI 5000) and performance evaluation standard (LEI-01 and LEI-02). These mechanisms and procedures should be fully understood by the FMU management.

Certification Standards [Box4)] are determined according to the certification activities. LEI 5000 Standards are based on a SFM system framework. Criteria, indicators and verifiers are discussed in more detail in LEI-01 standards, while the FMU performance values are determined using the LEI-02 document.

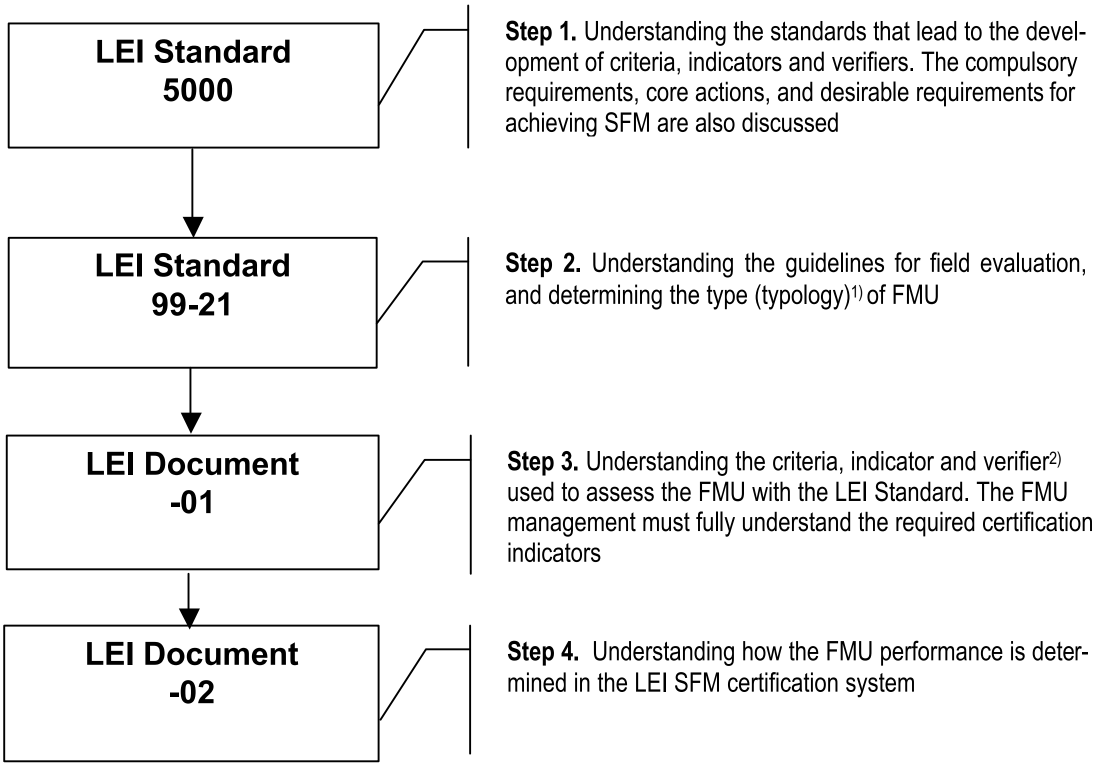
Box 4. **Documents and Standards of the LEI Certification System**

The LEI certification system works based on sustainable production forest management standards, including:

No.	Certification Guide/Doc.	Contents of Document/Guidelines	Target
1.	LEI 5000 Standard	Sustainable Natural Forest Management System Framework	FMU Performance
2.	LEI 5001 Standard	Sustainable Natural Forest Management System	FMU Performance
3.	LEI 5005 Standard	Terminology and Meaning related to Sustainable Natural Forest Management certification	FMU Performance
4.	**LEI Document-01**	**Criteria, Indicators, Verifier and Methodology for field evaluation**	FMU Performance
5.	**LEI Document -02**	**Intensity scale for each indicator**	FMU Performance
6.	LEI Guide 99	Certification of Sustainable Natural Forest Management	FMU Performance
7.	LEI Guide 99-21	Guidelines for performing field evaluation for Sustainable Natural Forest Management certification	FMU Performance
8.	LEI Guide 99-23	Guidelines for Sustainable Natural Forest Management certification rejection	FMU Performance

9.	LEI Guide 99-24	Guidelines for making Sustainable Natural Forest Management certification decisions	FMU Performance
10.	LEI Guide 99-01	General Requirements for a Certification Organization	Certification Organization
11.	LEI Guide 99-02	General requirements for field evaluation under Sustainable Natural Forest Management Certification	Cert. Organization and Assessor
12.	LEI Guide 99-03	General requirements for a Sustainable Natural Forest Management Certification Expert Panel	Expert Panel
13.	LEI Guide 99-22	Guidelines for report writing on field evaluation results for Sustainable Natural Forest Management Certification	Cert. Organization and Assessor
14.	LEI Guide 55	Guidelines for Solving Problems following a Certification Decision	FMU, others (local population)
15.	LEI Guide 25	Guidelines for Preparing a Certification Decision	Cert. Organization Expert Panel Assessor
16.	LEI Guide 26	Guidelines for Surveillance and Extension of Certification under the Certification Program	Cert. Organization and Assessor

Figure II.2. Schematic process for reviewing LEIs SFM certification documents



[1] *Typology*: A classification for FMU's related to their social and environmental conditions.
[2] *Verifier* : A tool for verifying/clarifying indicators so that the indicator is measured correctly.

FSC accredited international certification bodies like Smartwood or SGS also work in accordance with LEI Document –01, but do not follow the performance grading system outlined in LEI Document -02. The FSC certification bodies name in an assessment areas of improvements (major or minor corrective action requests), before the certificate can be granted. This procedure is similar to the concept used in the self-scoping handbook.

B.3 Other Supporting Factors

There are other factors that will support self-scoping activities, including:

1. **Time**
   Some of the FMU's work time will be taken up by self-scoping activities, especially in production management. The internal FMU assessor will have to travel to undertake reviews of field performance.

2. **Funding**
   Some funding is necessary for fieldwork and collection of secondary data related to the certification preparation process. Funding may also be required for mapping equipment and logistics.

3. **Complete Secondary Data**
   The availability of complete secondary data is important for the fluency of the self-scoping process. To gather this data can be the task of a specific section within the organization of the FMU.

Based on the experience of SFMP-GTZ and the members of the producer group "Certification Work Group East Kalimantan", if the preconditions are fulfilled, the self-scoping process will only take approximately two weeks.

III. Determining the Main Conditions and the Key Indicators of a Management Unit Performance

AN FMU is a profit-oriented entity, which is managed and controlled by a legal body/individual/community group, which has the right to manage production forests. The activities of an FMU include: Pre-Production (forest planning), Production (felling, skidding, scaling/grading, hauling, timber documentation = timber reporting/*TUK*), Post Production (tending/thinning, rehabilitation) as well as Monitoring and Evaluation and support to the local communities (social affairs).

Based on observations and experience from several certification field trails one can determine a handful of FMU main activities that already indicate well the strength and weaknesses of each FMU. These activities or referring to their output dimension, conditions, directly or indirectly contribute to whether or not

SFM certification will be achieved. They are called **Main Conditions** and are each measured by one or several **Key Indicators.**

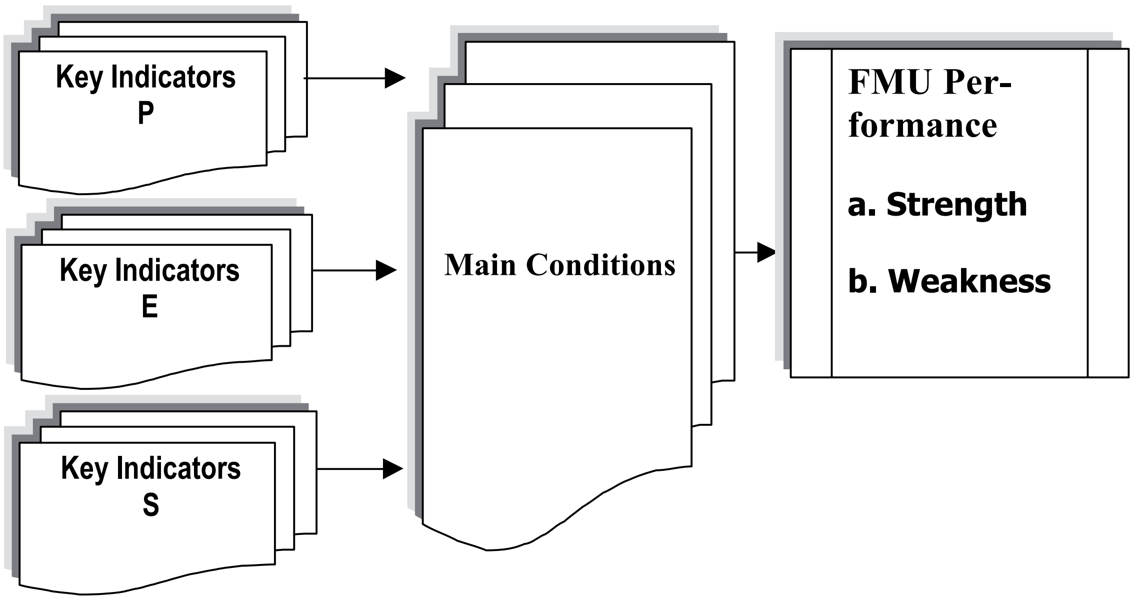


Figure III.1 The Relationship between Key Indicators, Main Conditions and FMU Performance

A Main Conditions

Each main condition is an output of management activities, indicating the position of the FMU against the forest certification standards. The main conditions are determined based on secondary data and the operational field situation, assessed with the LEI-01 standard. Evaluation results identifying FMU strengths and weaknesses from a SFM viewpoint along with the activities regularly performed by the FMU are considered to determine the performance under each main condition. They can be recapitulated as follows: 5 under the production aspect, 3 under environment and 5 under social affairs.

A.1 Main Conditions under the PRODUCTION Aspect

Under production there are 5 main conditions that need to be evaluated by the FMU: 1) Area status and security, 2) Planning and harvesting technique, 3) Silvicultural system and rehabilitation, 4) Timber management and reporting, 5) Organization and administration.

1. **Area status and security**: Reflects on the legal status of the FMU area. It also includes future predictions on the security of the area from land use conflict (claims of traditional ownership and other land users).
2. **Planning and harvesting techniques**: Reflects on the FMU performance in long and short term planning and details of harvesting, including; compartmentalization and blocking; preparation of infrastructure according to standards (roads, log landings, bridges); detailed planning for AAC and harvest

preparations (contour map, tree position map, skid trail planning); harvesting using RIL (directional felling, skidding with winching, avoiding felling into protected areas, rivers, springs, lakes, difficult terrain, heath forests etc.) [2].

3. **Silvicultural system and rehabilitation**: Reflects on the FMU performance in selecting and implementing a silvicultural system that is suitable to the forest type and the post harvesting conditions (tending and rehabilitation). Post harvesting activities often have low priority for an FMU.
4. **Timber management and reporting**: Reflects on the flow of the timber from the felling location to the logpond. Performance is evaluated by the use of a tree location map, labeling of timber at the stump and base of the log as well as the accuracy of reporting.
5. **Organization and administration**: Reflects on the professionalism of the FMU in forest management. There should be work continuity within the organization between the different sections; planning, production, silviculture, administration as well as monitoring and evaluation.

A.2 Main Conditions under the ENVIRONMENTAL Aspect

There are three main conditions that need to be evaluated by the FMU: 1) Condition of the vegetation, 2) Condition of the wildlife, 3) Soil and water conservation.

1. **Condition of the vegetation**: Reflects on the condition of the forest after logging. This is indicated by a comparison to an allocated part of the forest as **protected virgin forest area**. Concession activities, especially harvesting should not cause drastic changes to the original stand structure and composition.
2. **Condition of wildlife**: Reflects on the efforts undertaken to protect the wildlife and their habitats from disturbances caused directly by timber harvesting or other activities.
3. **Soil and water conservation**: Reflects on the use of a timber harvesting system that does not cause major erosion or water pollution. During harvesting a method that is environmentally friendly should be used (Reduced Impact Logging – RIL). A post-harvest evaluation and monitoring system for environmental impacts should be in place.

A.3 Main Conditions under the SOCIAL Aspect[3)]

There are 5 main conditions to be considered under the social aspect: 1) Community-based forest tenure system, 2) Economic Development of the local community, 3) Social and cultural integrity, 4) Community health, 5) Workers' rights.

1. **Community-based forest tenure system** means that there is a system of rights and responsibilities in place that regulates the relationship between

[2] For further information about RIL see SFMP-GTZ Documents 1/2000 and 10/1999.

[3] The main conditions of the social aspect are compatible with LEI-01 criteria for social aspects.

public control and use of the forest. This system should be based on the traditional laws of the local community and guarantee that the lifestyle of the community will not be lost due to the existence of the FMU. This should be indicated by clear boundaries that have been agreed to by all relevant parties.
2. **Economic development of local community** means that the community should be able to use forest products optimally. If the existence of the FMU disturbs the community's access to the forest then either adequate compensation should be paid or the community should be involved in the FMU profit distribution and/or management (joint management). The process for determining the compensation/ joint management relationship must be fair and legal.
3. **Guarantee of social and cultural integrity** means equitable relations are maintained towards the local community and workforce.
4. **State of community nutrition and health** means that the FMU must be aware of and treat health conditions in the community that are caused directly or indirectly by the existence/activities of the FMU. The FMU must keep records on the condition of health in the community, especially when there has been a direct impact from FMU activities.
5. **Guarantee of workers' rights** means that government policies covering workers rights are followed.

Table III. 1 Clarification of the main conditions for the social, environmental and production aspects.

No.	ASPECT	MAIN COND.	Clarification
I.	SOCIAL	1. Tenure system	Land claims by local communities based on traditional ownership must be acknowledged.
		2. Economic development of local community	If the local community relies on the forest for their livelihoods, their activities should not be disturbed by the existence of the FMU.
		3. Guarantee of social/ cultural integrity	No use of force (physical and non-physical) to solve problems with the workforce or the local community occurs.
		4. Guarantee of community nutrition and health	The FMU must be sensitive to the impact of its activities on the local community's health.
		5. Guarantee of workers' rights	No unjust contract termination, health and safety should be provided, workers' unions must be allowed, and salaries should be adapted to the local conditions.
II.	ENVIRON-MENT	1. Condition of the vegetation	The structural composition of the forest stands should not change drastically, both within protected areas and other areas.
		2. Condition of the wildlife	Logging activities should not disturb the biodiversity of animals and their habitats.
		3. Soil and water conservation	The level of erosion and water quality should not change as a result of forest exploitation. The FMU must have equipment for monitoring and evaluating its environmental impact.

III.	PRODUC-TION	1. Area status and security	The area managed by the FMU must be free of land use conflicts in the long term. Both horizontal conflict with the local community (traditional land) and vertical conflicts due to inconsistent policies for land use allocation must be addressed. The FMU must be active in resolving conflicts.
		2. Planning and harvesting techniques	Harvesting should be well planned especially the yield schedule, and preparation of infrastructure must follow a set standard. Timber harvesting is done emphasizing environmentally friendly methods (RIL)
		Silvicultural system and rehabilitation	The FMU must implement post-harvesting activities in a realistic manner. The silvicultural system used should guarantee continuous production for the long-term in accordance with the forest condition
		3. Timber management and reporting	Any logs at the felling site, log landing or logpond are clearly identifiable
		4. Organization and administration	The FMU operations are supported by a professional organization and Standard Operating Procedures (SOP) are prepared, especially in forest fire management

B. Key Indicators

Key indicators is the term used to denote certain indicators that are viewed as important or influential to evaluate the **Main Conditions.** The key indicators have been selected from LEI Document-01, without being changed in meaning or order (S 1.5 = Social criteria no. 1 & Social indicator no. 5). In Figures III.2, III.3, III.4 the connection between the main conditions and the key indicators is shown.

B.1 Key Indicators for the PRODUCTION Aspect

14 key indicators have been selected from the 21 production indicators in LEI–01. These 14 are influential to the 5 main conditions for the production aspect.

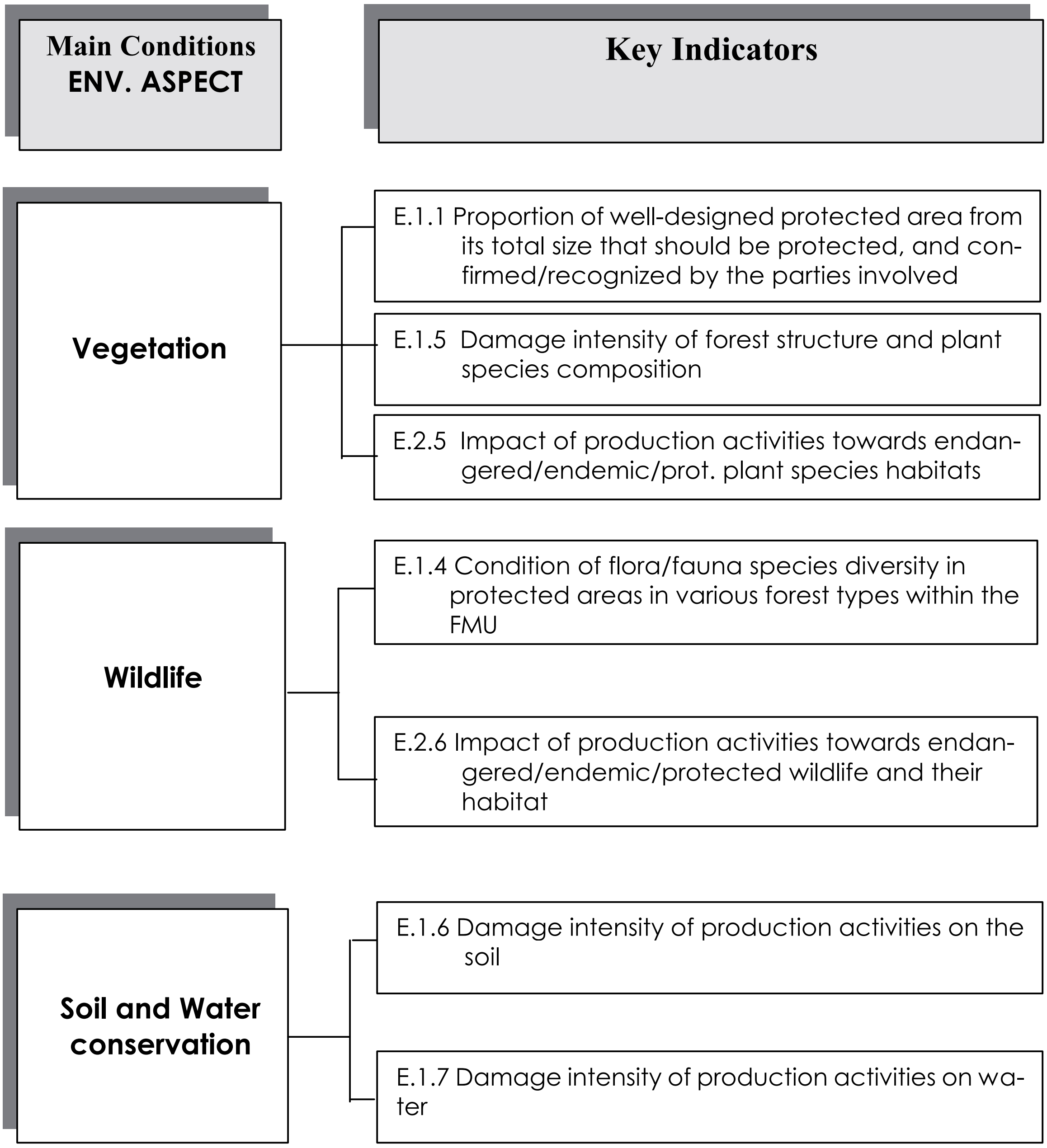
Figure III.2. Key Indicators for the PRODUCTION Aspect.

Main Conditions PROD. ASPECT	Key Indicators
Area Status and Security	P 1.1 Guarantee of land utilization as a forested area
	P1.3 Size of change in the closure of land due to encroachment and conversion of forest area, fire and other impediments
Planning and Harvesting	P1.2 Planning and implementation of forest demarcation based on functions and types according to the type and forest function
	P2.3 Annual production is in accordance with forest productivity
	P2.7 Suitable infrastructure/water management in entire FMU
	P2.8 Implementation of Reduced Impact Logging
Silviculture, and Rehabilitation	P1.5 Selection and implementation of silvicultural sys-tem in compliance with the local forest ecosystem
	P2.2 Implementation of permanent observation plots for stand growth and yield (PSP)
	P2.5 Condition of residual stand
Timber reporting	P2.6 Validity of timber tracking system in the forest
Organization and Administration	P3.1 Financial condition of the company
	P3.4 Availability of professional staff for planning, protection, production, and management of forest and business
	P3.5 Investment & reinvestment for forest mana'ment
	P1.4 Existence of forest fire management system

B.2 Key Indicators for the ENVIRONMENTAL Aspect

7 key indicators were selected from 19 environmental indicators in LEI–01. These are influential to the 3 main conditions of the environmental aspect.

Figure III.3. Key Indicators for the ENVIRONMENTAL Aspect.



B.3 Key Indicators for the SOCIAL Aspect

7 key indicators were selected from the 15 social indicators in LEI –01. These indicators are influential to the 5 main conditions of the social aspect.

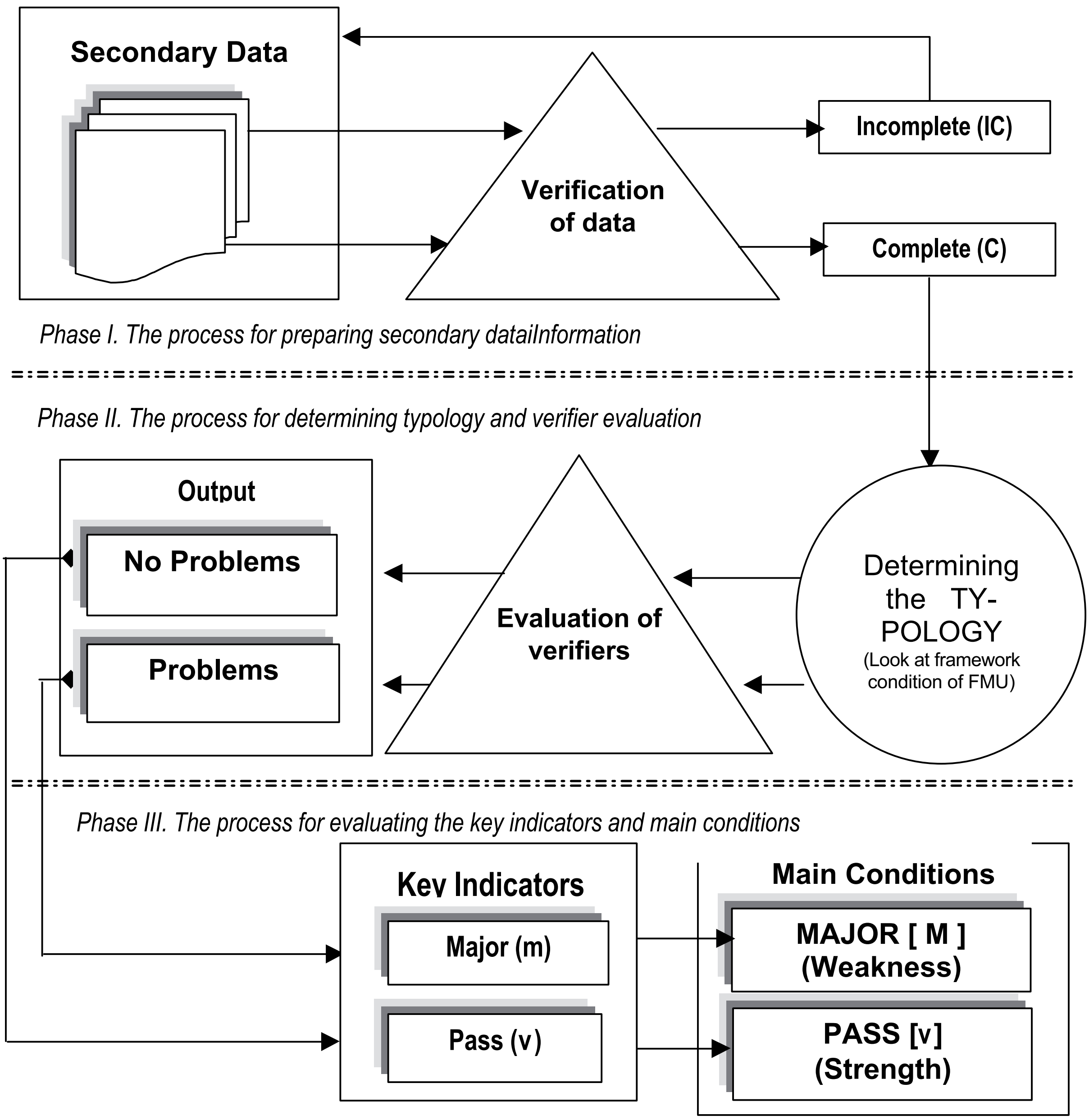
Figure III.4. Key Indicators for the SOCIAL Aspect.

Main Conditions SOCIAL ASPECT	Key Indicators
Tenure System	S 1.1 Boundaries between the concession area and local community area are clearly marked and approved by the relevant parties
	S1.2 Communities' intergenerational full access and control towards guaranteed traditional forest areas
	S1.3 Communities' intergenerational full access to forest product utilization is guaranteed for the future generations
Economic Development of the Local Community	S 2.1 Economic resources of the community should at least be able to support the continuation of intergeneration livelihood
Guarantee of Social-Cultural Integrity	S 3.1 Human rights are guaranteed
State of Community Nutrition and Health	S4.1 Impact of FMU activities on community health is minimized
Guarantee of Workers Rights	S5.1 Mutual work agreements exist and are implemented

IV. PERFORMING SELF-SCOPING

The instruments used for measuring the position of an FMU within SFM certification standards are: main conditions, key indicators, verifiers, verification methods, verification support data and *Typology*. A complete flow chart of the process for undertaking self-scoping is given below:

Figure IV. I. The Self-Scoping Evaluation Process



A. Process for Preparing the Data

There are two types of secondary data required during the self-scoping process. The first is base data (according to forestry regulations). The second is supporting data, which is intended to provide a clearer picture of the field conditions. Generally the data are required from:

a. Documents :

Forestry agreement (FA), 20-year-management plan (RKPH), 5-year-management plan (RKL), annual plan (RKT), environmental impact study (AMDAL), 5-year-environmental plan (also named RKL), yearly environmental monitoring plan (RPL), diagnostic study, boundary reports, the most recent forest function change document and all legal decrees (SKs) that indicate the legal status of the concession.

b. Maps/information :

Maps on: regional land use (RTRWP), local land use, vegetation cover (if available a Landsat image time series covering at least the past three years), topography, slope, soil, climate, rainfall measurements form separate locations, tree location map, concession boundaries.

To run the self-scoping process smoothly and efficiently, the data directly related to the key indicators (requirements) must be prepared in full (see the key indicator reference matrix; Table IV.3). The self-scoping process will not be completed prior to the secondary data being complete.

B. Determining the *Typology*

The technique for determining the FMU ***Typology*** is based on LEI Guideline 99-21. In the context of self-scoping, determining the *typology* is intended to show the specific framework of the FMU that may influence the environmental and social conditions. By understanding the *typology* the FMU can know and compare itself better and can create a priority plan for handling problems.

B.1 Management Unit *Typology* according to the Environmental aspect

Typology of the environment aspect is determined by:

Degrees of Habitat Fragmentation

The degree of habitat fragmentation[Box5)] influences the genetic movement (distribution, flow) from one genetic population to another:

a. Fragmented :	There is no connection between the FMU area and other natural forest ecosystems.
b. Semi-fragmented :	Less than 50 % of the FMU boundary is directly connected with another natural forest ecosystem.
c. Connected :	More than 50 % of the FMU boundary is directly connected with another natural forest ecosystem.

Box 5. Sensitivity Scale for Degrees of Fragmentation

Degree of Fragmentation	Sensitivity Scale
Fragmented	3
Semi-fragmented	2
Connected	1

NB : The higher the ordinal number the more sensitive the forest is to disturbances

Physical environment and **biological aspects** further influence the typology of an FMU area.

a. The **physical environment**[Box 6)] is influenced by the sensitivity of some elements of the physical environment (soil condition, rain fall, topography, location up river or down river).

- **Endangered physically** : If the forest is located in a physical environment that is sensitive to disturbances (for ex. large rainfalls, sensitive soils, steep slopes).
- **Safe physically** : If the forest is located in a physical environment that is not sensitive to disturbance.

b. The biological condition is influenced by a the availability of conservation areas near to the FMU.

- **Biologically sensitive :** Where the forest area of the FMU is not near or adjacent to protected forest (located far from conservation areas)
- **Biologically safe :** Where the forest area of the FMU is connected with other areas of protected forests, especially one that requires biological protection (located near conservation areas)

Box 6. Sensitivity Scale by FMU Location

Location	Biologically Sensitive	Biologically Safe
Physically Sensitive	3	2
Physically Safe	2	1

NB:
The greater the ordinal scale the more sensitive the forest ecosystem is to disturbances.

***Typology* of Forest Management Unit Ecology aspect**

Location	Fragmented	Semi fragmented	Connected
Bio-Phys sensitive	**03**	**02**	**02**
Biologically sensitive-Physically safe or Bio safe-Phys sensitive	**02**	**02**	**01**
Bio-Phys safe	**02**	**01**	**01**

NB:
The greater the ordinal scale the more sensitive the forest ecosystem is to disturbances.

B.2 Determining Social *Typology*

Within the LEI certification scheme, determining the FMU social *typology* is done in two phases; initial social *typology* determination and final social *typology* determination.

Initial *Typology* Determination for the Social aspect

There are 4 variables to be classified under the social aspect; (1) **Production technique**, (2) **Utilization zones**, (3) **Level of agrarian intensity** and (4) **Production motive**. The variables, verification and data needed to determine the initial *typology* for the social aspect can be inferred from Table IV.1.

Table IV.1 Variables, verification and data sources to determine the initial social typology

Variable Evaluated	Verification	Data Source
(1) Production Technique - **Hunter-gatherer** : The majority of the community fulfill their daily needs by hunting wild animals and gathering	• Place of residence and its function • Planting cycle	• Long-term forest management plan (RKPH)

Variable Evaluated	Verification	Data Source
forest products. They do not farm or produce their food requirements and they do not settle in one place. - **Shifting cultivation** : The majority of the community conducts slash and burn farming and stays in one place only for a certain amount of time. - **Settled dry field farmers:** The majority of the community farm on a permanent plot of land and grow annual crops. - **Intensive Agriculture:** A community where the majority of people farm on irrigated land in a permanent location.	• Irrigation system • Commodity produced • Production technique	• Diagnostic Study • Social/Economical survey of surrounding communities • Environmental Impact Study (AMDAL)
(2) Land Use Zones - **External to concession:** If the local community has claimed / works on land outside the concession area. - **Connected:** If the local community has claimed /works on some land within the concession area. - **Internal/enclave**: If the total area of land claimed / worked by the local community is within the concession area.	• Area of economic, social, cultural and religious activities • Location of farm land • Area of Harvesting/Gathering • Timber and non-timber forest products	• Report on Forest Security Activities • Diagnostic Study • AMDAL • Social Map of the FMU • Legal Status of boundaries
(3) Agricultural Density: land required per household Size of the area currently used divided by the land required by the relevant community (calculated as: Total Population x Hectare required per household/person according to the farming technology used). The land required per household/person can be taken from the diagnostic study, i.e. population per village and portion of their livelihood. - High: <1 Agricultural Density - Medium: between 1 and 1.5 Agricultural Density - Low : > 1.5 Agricultural Density	• Population growth • Population density • Rotational cycle • Immigrants and regional occupations • Population mobility • Livelihood	• District in figures • Sub-district in figures • List of villages • Diagnostic and AMDAL
(4) Motivations for Production - **Subsistence** : To fulfill daily needs - **Commercial** : Production/Farming is also aimed at accumulating capital.	• Life style • Production orientation • Secondary services sector • Trade system	• Social/Economic Survey • AMDAL and monitoring • Diagnostic study and reports

After reviewing and comparing the four variables above the social *typology* of the FMU can be identified (table IV.2). The next step is to group the values in a classification scale as shown in **Box 7.**

Table IV.2 Values for Identifying Community Sensitivity to FMU Activities in Indonesia

Production Technique	(2) Land Use Zone																	
	External						Overlapping						Internal					
	(3) Density Level																	
	Low		Medium		High		Low		Medium		High		Low		High		High	
	(4) Main Motive for Production																	
	S	C	S	C	S	C	S	C	S	C	S	C	S	C	S	C	S	C
Hunt. & Gath'er	19	20	21	22	23	24	43	44	45	46	47	48	67	68	69	70	71	72
Shifting Cultiv'n.	13	14	15	16	17	18	37	38	39	40	41	42	61	62	63	64	65	66
Dry land farming	07	08	09	10	11	12	31	32	33	34	35	36	55	56	57	58	59	60
Irrigated farming	01	02	03	04	05	06	25	26	27	28	29	30	49	50	51	52	53	54

S : Subsistence C : Commercial

Box. 7 Classification of social condition

Degree of Sensitivity	*Typology (social condition)*
01 - 18	01
19 - 36	02
37 - 54	03
55 - 72	04

Explanation of the evaluation scale:

01 = Fully safe
02 = Safe
03 = Unsafe
04 = Very unsafe

Further clarification on the technique for determining the social *typology* is illustrated in the example below:

Observations within one FMU indicated that the local community used the following:

- *Production technique: a hunter-gatherer community*
- *Utilization Zone : within the FMU forest area*
- *Agricultural density level : low*
- *Production motive : subsistence.*

If these results are formulated in accordance with Table IV.2 we get the number 67. To make the conversion into a Social Typology Classification, the social condition of the FMU Box 7 is rated at the degree of sensitivity. The results of Table IV.2 give the number **67,** lying between **55-72;** the social condition is therefore rated very unsafe (category **04).**

To sharpen these typology results, a further analysis is necessary to determine the final social FMU typology performance.

Determining the Final Social *Typology*

We realize that there are many other social factors that are not included within the four initial *typology* variables. Therefore it is possible to include new variables that may help to control the initial variables. Within the LEI system these variables are called control variables. The LEI scheme includes the following control variables:

(1) Complexity and potential of conflicts connected to the land tenure system,
(2) Actual land conflicts,
(3) Diversity of livelihood,
(4) Time-span of FMU operation/ health of the company and *rentability*,
(5) Other matters thought to be relevant field values, which can be held accountable and are significant to determining this final *typology* evaluation.

Example-1 :
The initial social *typology* based on the evidence mentioned in **Table IV.2 and Box 7** is "*typology* 4". However, the production technique used in the community is relatively uniform and/or there is no tendency towards conflict as the FMU is proactive and can anticipate the possibility of social problems arising. In this case it is possible that the social *typology* could change to "*typology* 2".

Example-2 :
On the other hand, for example the indicators from **Table IV.2 and Box 7** show "*typology* 2", but there is an indication that conflicts between the FMU and the community frequently occur, are long lasting or do not have a end point. In this case the final FMU social *typology* could change to "4".

Example-3 :
The initial social *typology* based on the evidence mentioned in **Table IV.2 and Box 7 is** "*Typology* 1". However, the production technique used by the community is quite diverse and/or a high tendency for reoccurring conflict exists, which have never been solved. In this case the FMU *typology* could change to become "*typology* 2" or even "*typology* 3".

B.3 Determining a *Typology* Summary for the FMU

After analyzing both *typology* aspects stated above, finally the FMU can gain a summary *typology* by combining the results from the environmental *typology* and the social *typology*.

In **Box 8** the FMU summary *typology* is given. In the vertical columns the Social *Typology* is shown and in the horizontal rows the Environment *Typology* is given. The FMU *typology* is determined by meeting of coordinates between the two *typologies*.

Box 8. Management Unit *Typology* Summary

Typology Social	Environment aspect *Typology* (Environment)		
	01	**02**	**03**
01	1 safe	3 unsafe	5 unsafe
02	2 safe	4 unsafe	6 unsafe
03	7 unsafe	9 in danger	11 in danger
04	8 unsafe	10 in danger	12 in danger

Note:

- Safe condition (1-2)
- The physical environment is unsafe (3-6)
- The social conditions are unsafe (7-8)
- Both environmental and social conditions are unsafe (9-12)

The summary of these *typology* conditions should become material for consideration by the FMU management when deciding the priority scale for handling problems. For example, if the FMU *typology* is unsafe in the biophysical area, then the self-scoping should be focused on the effects of production on the environment. If the results show that the social aspect is unsafe, the self-scoping should focus on the social aspect.

C. Verifier Evaluation Process

A verifier is the tool used to measure the indicators. If an indicator is formulated in a way that it is difficult to answer directly, then it is necessary to use a verifier for more clarification.

Several verifiers are provided in this Self-Scoping Handbook, which helps to find answers to the key indicators quickly. The used verifiers are a simplification of the verifiers given in LEI Document–01, to allow a quick – 'rough and dirty'– evaluation of the relevant key indicators. The simplification is based on our field experience. As an illustration of the role of verifiers an example is given:

To answer the key indicator Reduced Impact Logging Implementation (P.2.6) several verifiers are used, including:
(a) The FMU plans the skid trails on a tree location and topographic map
(b) The FMU has marked and opened the skid trails before felling
(c) The FMU developed and follows a Standard Operating Procedure for tree felling
(d) The FMU applies measures to mitigate erosion and sedimentation from skidding (for example: the tractor stays on the planned skid trail, winching is used, closing up after logging takes place).

By looking at these verifiers we can easily evaluate the indicator P2.6 concerning the application of Reduced Impact Logging (RIL) in the FMU.

D. Process for Determining the Key Indicator Status and the Main Conditions

The next phase of self-scoping is to assess every verifier, key indicator and main condition. During this assessment the status of every key indicator is given as follows:

a. Major :	Strong weakness in the FMU's readiness to face SFM certification occurred in this field
b. Pass :	No serious problems to the FMU's readiness to face SFM certification occurred in this field.

To decide the status of the key indicator (Major/Pass), several references are needed, like those shown in **Table IV.3:** Reference matrix for determining the status of the key indicators.

Clarification of the Reference Matrix Tables

The **second column [2]** of the tables gives a description of the **main conditions** for each aspect; there are 5 main conditions for the production aspect, 3 for the environment aspect and 5 for the social aspect.

In the **third column [3]** of the tables the **status** of the main conditions is shown as **MAJOR (M)** or **PASS (v).** The status of MAJOR or PASS for each of the main conditions is determined by the status of the key indicators. Each main condition comprises of several key indicators, if **one of** the key indicators has the **major (m)** status the main condition will automatically become **MAJOR (M).**

In the **fourth column [4]** of the tables a description of the **key indicators** is given. The key indicators were selected from the indicators given in the LEI standard (in the LEI -01 final document; the English translation used was printed in September 2000 and partly adjusted by the author). The indicators selected are believed to provide the greatest contribution to the status of the relevant main condition.

The **fifth column [5]** shows the **status** of the key indicator as either **major** or **pass.** This status is determined by the results of each **verifier.** The verifiers are the reference used to measure the indicators in a structured way. The verifiers chosen for the Self-Scoping Handbook are a simple, practical interpretation of LEI verifiers in the LEI -01 Document. They can be supplemented if needed (toolbox approach). If one of the used verifiers shows a **major problem** the status of the key indicator is automatically **major**.

The **sixth column [6]** of the tables refers to the selected verifier.

The **seventh column [7]** provides the data that need to be prepared by the FMU in order to assess the specific key indicator.

The **eighth column [8]** gives examples of when to evaluate the specific key indicator as status **major**. Also, some cases in which the verifier needs to receive the status **major** are given, without attempting completeness.

Table IV.3 Reference Matrix for Determining the Status of the Key Indicators in the Production Aspect

No.	Analysis of Main Cond.	STATUS	Key Indicator	STATUS	Verifier	Data	EXAMPLES for Key Indicator STATUS With relevant Verifier Status of Indicator is Major (m) if:
A.	**PRODUCTION ASPECT**		**P1.1** Guarantee of land utilization as a forest area	m/p	- Agreement of FMU area with regional land use planning (RTRWP) - Legal aspect of the FMU existence - Process for demarcating the FMU outer boundaries	- FMU base map /Landsat image (not older than 2 yr.) - Regional land use planning map (RTRWP) - Map of Functional Changes - Boundary map - 20-year-management plan (RKPH), 5-year-plan (RKL), annual plan (RKT), license document (SK HPH)	- The formal legal aspects of the existence of the concession are not fulfilled - Results of overlaying the FMU base map with the regional land use planning shows that much of the forest area is within conversion areas (KBNK) - A claim has been made by a local community but there has been no effort to resolve this claim - The FMU has deliberately not marked its boundaries
A.1	**Area status and Security**	**M/P**	**P1.3** Size of changes to closure of land due to encroachment and conversion of forest area, fire and other impediments/disturbances	m/p	- Chronological changes to the area since the beginning of the FMU - Changes of Land Forest Function to other land use (HTI, Plantations, Resetlement/Transmigration) - Intensity of disturbances i.e., forest clearing and forest fire	- FMU base map - RTRWP - Map of Functional Changes - Boundary map - RKPH, RKL, RKT, SK HPH - Forest function conversion documents - Delineation of areas affected by forest fire (if relevant)	- The frequency of changes to the forest to other uses (conversion) is quite high and covers a rather large area - A lot of illegal logging is occurring within the FMU - Previous forest fires have caused the FMU area to be greatly reduced (>10 % of the area has been burnt) and there has been no effort to take follow up action (adjustment to the AAC, rehabilitation)
A.2	**Planning and Harvesting**	**M/P**	**P1.2** Planning and Implementation of forest demarcation based on functions and types	m/p	- Felling block/compartment demarcation, protected areas, conservation areas - Yearly production plan has a net harvesting area	- FMU base map - RKT - Soil map - Topographic map - Field information - Env. impact report (AMDAL)	- When marking the block and compartment boundaries, the FMU did not take the environmental functions into consideration, as recommended in the environmental impact study (rivers, springs, sharp slopes, easily eroded areas, unfertile area, genetic resources)

A.2	**Planning and Harvesting**		**P 2.3** Annual production is in accordance with forest productivity	m/p	- Suitability and stability of annual allowable cut (*JPT*) - Methods to determine the AAC	- Production statistics - RKL/RKT - Block & compartment map - Landsat image	- There has been repeated felling after a block has been closed for felling and the AAC was reached (*cuci mang-kok*) - The legal AAC is not reflecting the true forest condition (encroachment, fire or illegal logging are not taken into account) - Location of the cutting blocks and compartments are not the same on the map and in the field
			P 2.7 Infrastructure / water management is suitable	m/p	- Quality of roads, bridges and log landings - Quality of water manage-ment (drainage system) - Road density	- Road network map - Standard of road quality (technical guide) - Field information	- Quality standards are not met at all - High erosion due to lack of water management (drains, bridges) - Ratio of road length to FMU area is very low (indicates lack of area control)
			P2.8 Implementation of Re-duced Impact Logging (RIL)	m/p	- Planning of skid trails - Opening up of skid trails prior to felling - SOP felling/harvesting - Measures to mitigate skid-ding effects (tractor stays on skid trail, winching, clos-ing up)	- Topo map - Tree location map - Standard Operating Proce-dure (SOP) for fell-ing/harvesting - Field information - Monitoring system	- There is no planning process for the skid trails, neither on the map nor in the field - No SOP for felling/harvesting exists - The chainsaw operator does not perform directional felling - The tractor operator does not use low-impact skidding methods
A.3	**Silviculture, and Rehabilita-tion**	**M/ P**	**P1.5** Selection and implemen-tation of a silvicultural system in compliance to the local forest ecosystem	m/p	- Suitability of the silvicultural system used to the local conditions - Yearly implementation of the silvicultural system	- Data on stand structure and composition - Annual planning - Data on forest type within the FMU	- The silvicultural system used is not suitable to the forest conditions (a high erosion area under clear cutting, steep areas under line felling and planting, etc.) - FMU does not perform the suggested silvicultural system correctly
			P2.2 Implementation of perma-nent observations plots for growth and yield (*PSP*)	m/p	- Existence of PSP (Perma-nent Sample Plot) - Mechanism for measuring and managing PSP data	- PSP location map - Measurement data - Field information	- PSP are not well established by the FMU or are not or-ganized well - Growth measurements are not taken

A.3	**Silviculture and Rehabilitation**	**M/ P**	**P2.5** Condition of the residual stands	m/p	- Timber harvesting technique - Stand structure and composition - Fire disasters	- Env. impact report - Data on the stand structure and composition, post harvest inventory - Work map (Compartment and Block) - Field information	- Stand structure and composition shows large past changes (time series analysis) - After fire damage there has been no rehabilitation process to increase the availability of local species
A.4	**Timber Management/ Administration**	**M/ P**	**P2.6** Validity of the timber tracking system in the forest	m/p	- Standard Operating Procedure (SOP) for timber management - Filing system of flow of timber - Flow of timber - Block inspections	- Tree location map - Data on inventory and production	- Timber at the logpond does not come from the expected felling location - Timber is not labeled at the stump and the log - The tree location map is not accurate
A.5	**Organization and Administration**	**M/ P**	**P3.1** Financial condition of the company	m/p	- Rentability - Liquidity - Solvability	- Data from financial reports and a public accountant audit	- Financially unhealthy company
			P3.4 Availability of professional staff for planning, protection, and management of forest and business	m/p	- Number and qualification of the work force - Qualifications of the Camp Manager - Training and HRD	- Structure of the organization - Work force data - Record of HRD training	- Unprofessional staff - Staff is not placed according to their expertise - There has been no effort on the part of the FMU to increase the performance ability of its employees
			P3.5 Investment and reinvestment for forest management	m/p	- Allocation of funds for increasing stand quality	- Financial report (silvicultural activities)	- The FMU does not allocate some of its profits for improving stand quality/ performing silviculture
			P1.4 Existence of forest fire management system	m/p	- Early warning system - Existence of a plan, tools and SOP for fire suppression	- Fire index map - Hot spot map - Tool lists	- The FMU has no equipment or network for reviewing fire danger - There is no SOP for fire management and suppression

Table IV.4 Reference Matrix for Determining the Key Indicator Status for the Environment Aspect

No.	Analysis of Main Conditions	STATUS	Key Indicator	STATUS	Verifier	Data	EXAMPLES for Key Indicator STATUS With relevant Verifier Status of Indicator is Major (m) if:
B.	**ENVIRONMENTAL ASPECT**						
B.1	**Condition of the vegetation**	**M/P**	**E 1.1** Proportion of the well-designed protected area from its total size that should be protected and recognized by the parties involved	m/p	- Size, position and condition of the boundaries of protection areas (rivers, dams, beaches etc.); buffer zone, *KPPN* - Condition of the protected vegetation	- Protected area maps - Information of protected area from the field - List of protected flora species - AMDAL, Environmental Monitoring Plan Report *(RPL)* - Agreements made with other parties	- The FMU has not allocated an area to be protected as "*kawasan lindung (KL)*" - There is a protected area but the flora has been severely disturbed due to FMU operations
			E 1.5 Damage intensity of forest structure and plant species composition	m/p	- Stand structure and composition (S&C) within the LoA, V*F*, protected area (*KL*) - Level of similarity between the logged over (LoA) and virgin (VF) stands	- Data on the stand structure & composition: RKPH, RKL, RKT, production report (LHP),post inventory *(ITT*) - AMDAL (chap.), *SEL*/Environmental plan *(RKL)*	- There is a drastic difference in stand structure between LoA and VF (over exploitation of certain species) - There is a big difference between the vegetation in the VF and LoA (assessed by the similarity index)
			E 2.5 Impact of production activities on endangered /endemic/protected plant species and their habitat	m/p	- Protected vegetation within the FMU - Degree of habitat fragmentation	- AMDAL report (chap.), RKL - Latest Landsat image - Information on field conditions - Data on protected trees/flora	- Felling of protected species - Felling of trees within a protected area - FMU is not aware of occurrence of species which are protected
B.2	**Condition of the wildlife**	**M/P**	**E 1.4** Condition of flora/fauna species diversity in protected areas in various forest types within the FMU	m/p	- Flora/fauna biodiversity within the protected areas in all forest types - Flora/fauna biodiversity in virgin and logged over forest	- Env. Impact report (Chap. V), RKL env. planning - Landsat image - Other relevant reports	- Protected fauna and their habitats are disturbed - Harvesting occurs within the protected area

B.2	**Condition of the wildlife**	**M/P**	**E 2.6** Impact of production activities towards endangered/ endemic/protected wildlifeand their habitat	m/p	- Protected animal species that live within the FMU area - Condition of the protected animals' habitats - Degree of habitat fragmentation	- Map of animal distribution - List of protected animals, AMDAL (Chap.V), RKL	- Timber harvesting has a strong effect on the protected animals and their habitat
B.3	**Soil and Water Conservation**	**M/P**	**E 1.6** Damage intensity of production activities on the soil	m/p	- Soil erosion - Incidents of erosion in the field - Sedimentation	- AMDAL (Chap. V), *RKL* - Field information	- High soil erosion levels - Incidents of erosion in the field indicate high erosion levels
			E 1.7 Damage intensity of production activities on the water	m/p	- Fluctuation of water levels (flood/drought) - Water pollution levels	- AMDAL (Chap. V), five-year planning - *SPAS* report (if available) - Field information	- Water quality has decreased below set levels - Fluctuation of water levels is caused by the FMU operations - Evidence in the field suggests heavy flooding and sedimentation

Table IV.5 Reference Matrix for Determining the Key Indicator Status for the Social Aspect

No.	Analysis of Main Conditions	STATUS	Key Indicator	STATUS	Verifier	Data	EXAMPLES for Key Indicator STATUS With relevant Verifier Status of Indicator is Major (m) if:
C.1	**SOCIAL ASPECTS** **TENURE SYSTEM**	M/P	**S 1.1** Boundaries between the concession area and the local community area are clearly marked and approved by the relevant parties	m/p	- Certainty of the management area through acknowledgement of the boundary by the local community	- *BAP* Boundaries with local communities - FMU work map - Map of community land use within the FMU - Evaluation results of the boundary demarcation process	- Results of an evaluation of the FMU show that the boundary demarcation process was very one sided or involved the use of force (repressive action)
			S1.2 Communities' intergenerational full access and control towards guaranteed traditional forest areas	m/p	- Acknowledgement of a local community's traditional territory (*adat*)	- Documentation of community claims - Documentary evidence of agreement to community claims	- The community has made an *adat* claim for land but the FMU has done nothing to resolve the problem - The FMU does not have the capacity or capability for conflict resolution
			S1.3 Communities' intergenerational full access to forest product utilization is guaranteed	m/p	- Acknowledgement of community access to (non timber) forest products	- Distribution map of non timber products within the FMU - Documentation of procedures for the concept and capacity of the FMU for conflict resolution	- The FMU management forbids the local communities to access the FMU for using (non-timber) forest products
C.2	**Development of the local community's economy**	M/P	**S 2.1** Economic resources of the community should at least be able to support the continuation of intergeneration livelihood	m/p	- Level of food shortages - Availability of non-timber forest products - Access to work opportunities	- Data on the types of food for the local community - Information on causes of food shortages - Report on realization of community dev. activities - Types of non-timber forest products utilized by the community	- Food shortages have occurred and the FMU was not active to help overcome the situation - FMU operations are destroying the non-timber forest products but no compensation has been provided to the community - FMU does not offer work opportunities to local people

C.3	**Social Cultural Integration is Guaranteed**	**M/P**	**S 3.1** Human rights are guaranteed	m/p	- The level of force used on the local community by the management unit - Freedom for the workers to form a union	- Frequency with which force and criminal action is used - Existence of a workers' union - Cases of breaking/ignoring traditions - Report on mechanisms used for conflict resolution	- There are cases in which the FMU has used force either directly or indirectly towards the community - Formation of unions is forbidden within the FMU
C.4	**Status of the community's nutrition and health**	**M/P**	**S4.1** Impact of FMU activities on community's health is minimized	m/p	- Pollution levels and mechanisms for prevention of pollution - Community nutrition and health status - Health service unit - Programming and allocation of funding for nutrition and health	- Waste Management - Data on chemical products used - Allocation of funding for increasing community health	- There are no health facilities (clinic) - There is no funding allocated for staff health - Local community is not allowed to use FMU health facilities - The staff do not understand about waste management
C.5	**Guarantee of Workers Rights**	**M/P**	**S5.1** Mutual work agreements are in existence and implemented	m/p	- Work Co-operation Agreements - Level of labor conflicts - Fair wages and salary structure (local standards and ILO) - Level of work accidents - Implementation of safety standards - Availability of a company health services unit	- Work regulations and agreements - Documentation of conflicts with workers and resolutions - Organizational structure - SOP - List of staff salaries	- There is evidence of conflict between the FMU and its staff as well as among the staff themselves - There are no health and safety guidelines and no socialization about it for the staff - There is no career security and wage structures are not suitable for local conditions - Pollution levels are high (especially at workshop)

E. How to fill in the Self-Scoping Checklist

AN FMU performance **checklist** [box9] is offered in the appendix. This table has been provided to assist with identification of each SFM self-scoping component, from the secondary data to each verifier. In Box 9 the technique for filling in the self-scoping checklist is explained.

Box 9. Clarification and Example on how to fill in the Checklist

Self-Scoping Checklist for Forest Management Unit Performance According to SFM Standards (LEI Doc-01) and simplified verifiers

- **FMU** : PT. Prospek Abadi Timber
- ***Aspect*** : Production
- ***Main Condition*** : Land Certainty
- ***Status*** : [M]

Filled in according to the results of the key indicator analysis. If one of the key indicators related to the corresponding main condition is major (m) then automatically the main condition becomes MAJOR (M).

Clarification and Recommendations (example): P 1.1: FMU area not compatible with regional land use planning. A larger part of the area is located inside the conversion forest KBNK,; the planning section of the company should get further clarification before proceeding to certification.

No.	Key Indicator	Data and Info C = Complete IC= Incomplete		Verifier (✓) : No problem (x) : Problems		STATUS Major (m) Pass (✓)	Notes
	P 1.1	• Landsat	C	• Congruity with regional land planning	✓	m	The boundary is not yet definite
		• Regional land planning	IC	• Legal Aspect	✓		
				• Boundary	x		

Key Indicator No. (LEI-01)

Data (complete (C) or incomplete (IC)

If one of the verifiers has a problem then the key indicator will be major.

Bibliography

Anonymous, ITTO Policy Development series No., 1998.

Ruslim Y, Hinrichs A, Sulistioadi B, Study on Implementation of Reduced Impact Tractor Logging. SFMP Documents No. 01a (2000).

Ruslim Y, Hinrichs A, Ulbricht R, Technical Guidelines for Reduced Impact Tractor Logging). SFMP Documents No 10a (1999).

___________, Document No.1.1 FSC Statutes (Ratified),September 1994.

___________, FSC Publication 2000, FSC website www.FSCOAX.org

___________, Dokumen LEI-01, Lembaga Ekolabel Indonesia, 1999.

___________, Standar LEI - 5000, Lembaga Ekolabel Indonesia, 1999.

___________, Standar LEI 99-21, Lembaga Ekolabel Indonesia, 1999.

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- **SmartWood**
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Joint Certification Protocol (JCP) between LEI-accredited Certification Bodies and FSC-accredited Certification Bodies

September 2000

(following five pages)

This protocol refers to a joint certification programme between FSC-accredited Certification Bodies (FSC-CBs) and LEI-accredited Certification Bodies (LEI-CBs) for natural forest management in Indonesia. All FSC- and LEI-accredited certification bodies currently working in Indonesia will be bound by this protocol for the period of its validity. The JCP is intended to operate for one year or until revised or renewed. Any revision before one year will need agreement of all parties. This protocol is part of the Memorandum of Understanding between FSC and LEI dated 3 September,1999.

1. LEI-CBs and the FSC-CBs agree that the process of joint certification should be open, transparent and co-operative and that all parties will benefit from the process.

2. The JCP among LEI-CB's, and FSC-CB's will cover co-operation through out all stages of the certification process to gain experience in working together and understanding each other's systems.

3. FSC, LEI, and the accredited certification bodies agree that the JCP will meet all requirements under both FSC and LEI certification systems.

4. Under the JCP all parties agreed that criteria and indicators of LEI will be used by all certification bodies operating in Indonesia. This means that FSC-CB's will use all LEI C&I, including those exceeding the requirements of the FSC, as well as any additional FSC requirements, not included in the LEI C&I.

5. Only FMU that passes both LEI and FSC system requirements will be certified. The FMU will receive both an LEI certificate and an FSC certificate. The FMU will be allowed to use both LEI and FSC logos.

6. At the application stage, the FMU will be sent a document prepared jointly by the LEI-CB and FSC-CB explaining the certification process under the JCP.

7. Contractual arrangements will be determined by the FMU and the collaborating LEI CB and FSC CB on a case by case basis.

8. Under the JCP, an FSC scoping is not compulsory. Past experience indicates that typically a scoping is required. Prior to signing a contract between an FSC- or an LEI-CB and an FMU, a document completeness review shall be performed by the LEI-CB, and the need for an FSC scoping visit shall be determined by the FSC-CB.

9. The FSC-CBs and LEI-CBs agree to use a single team
   in the case of a joint LEI screening and FSC scoping process,
   in field assessment.

10. Public consultation is a fundamental component of the JCP. It starts with a joint public announcement a minimum of 30 days before a field assessment takes place.

11. Public summaries of certification decision will be made available in both Bahasa Indonesia and English and will include a full description of the joint certification process.

12. A surveillance visit will be done according to each system's requirements; a joint surveillance is preferable. Results shall be shared between both the LEI-CB and FSC-CB. Suspension or termination of the certificate will follow the procedures laid out in Table 1 or table 2, point 17.

13. Appeal process will follow each system's requirements. Suspension or termination of the certificate will follow the procedures laid out in Table 1 or Table 2, point 17.

14. LEI and FSC may send observers to monitor implementation of the JCP. Provided that the FMU agrees full report of each CB can be made available to LEI 1 FSC.

15. The details of the certification steps under the JCP are described in Table 1 and Table 2.

Table 1. Certification Process Under JCP When Scoping by FSC-CB is Needed.

No	Action Step	Responsible parties/person
1	FMU sends application and delivers all required documents to LEI CBs and/or FSC CBs. CBs communicate with respective partner CB.	FMU and LEI CBs and/or FSC CBs
2	a. Document Completeness review by LEI CB	LEI CB
	b. Decision about scooping by FSC CB FSC CB	FSC CB
3	Contracting between FMU and CB(s) FMU and LEI CBs and/or FSC CBs	FMU and LEI CBs and/or FSC CBs
4	CBs put together work plan and teams for LEI screening process and FSC scoping process.	LEI CB and FSC CB
5	Screening/ scoping step 1: document review and clarification of corporate statement	LEI CB and FSC CB
6	Screening/ scoping step 2: Joint Field Visit (Single team) and there may be LEI-CB facilitator	LEI CB/EP 1 and FSC CB
7	Screening/ scoping step 3: EP 1 decision (LEI CB) and separate report Bs	LEI CB/EP 1 and FSC CB
8	a. If EP 1 decision: fail- back to (1) application/process restarts, FSC b. EP 1 decision: pass- proceed to field assessment	LEI CB FMU
9	Notification to proceed: the FMU contacts LEI/FSC-CB.CBs communicate with respective partner CB.	FMU - FSC/LEI CBs
10	Contracting for field assessment	FMU - FSC/LEI CBs
11	CBs develop work plan and put team together based on LEI and FSC system requirements. A minimum of 3 assessors is required.	LE]/FSC-CBs
12	Joint public announcement (minimum 30 days before field assessment) in Bahasa Indonesia and English.	LEI/FSC-CBs
13	Joint Field assessment, including public consultation. The FKD (regional consultation forum) needs to be involved.	LEI/FSC-CBs
14	Joint fieldwork (including briefing/ debriefing) of FMU	FMU – LEI/FSC-CBs
15	Separate reporting a. LEI CB Assessor to EP 11 b. FSC CB Assessor to FSC-CB	 LEI-CBs FSC-CBs
16	Separate decision-making process	LEI-CBs/EPII - FSC-CB
17	Combined decision and notification to FMU: • Situation 1: FMU passes in LEI and FSC system. Joint notification to FMU. • Situation 2: FMU passes in LEI system but does not pass FSC system . LE[-CB notifies FMU that it has 6 months to meet FSC requirements. • Situation 3: FMU passes FSC system but does not pass LEI system. FSC-CB notifies FMU that it has 6 months to meet LEI requirements (see note below). • Situation 4: FMU does not pass either system. LEI-CB and FSC-CB notify that it has 6 months to meet both LEI and FSC requirements (see note below). Note: Under LEI system, an FMU that does not pass LEI system is required to re-apply for field assessment within 6 months after the decision of certification. Otherwise, FMU will be required to return to the screening process Under FSC system, an FMU that does not pass FSC system is required to inform FSC CB when it is ready for preconditions or major CAR audit.	LEI-CBs and FSC-CBs
1 8	FMU completes administrative requirement to receive certificates (Certification contract, fees).	LEI-CBs and FSC-CBs
1 9	a. Handing over LEI and FSC certificates and other mandatory documentation b.Public summary posted by CB's c.Public announcement according to each CB-system	LEI-CBs and FSC-CBs

Table 2. Certification Process Under JCP When Scoping by FSC-CB is Not Needed

No	Action Step	Responsible parties/person
1.	FMU sends application and delivers all required documents to LEI CBs and/or FSC CBs. CBs communicate with respective partner CB.	FMU and LEI CBs and/or FSC CBs
2	c. Document Completeness review by LEI CB	LEI CB
	d. Decision about no need for scoping by FSC CB	FSC CB
3	Contracting between FMU and CB	FMU and LEI CB
4	CB put together workplan and team for LEI screening process	LEI CB
5.	Screening step I: document review and clarification of corporate statement	LEI CB
6	Screening step II: Field Visit and there may be LEI-CB facilitator	LEI CB/EP I
7	Screening step III: EP I decision (LEI CB) and report writing by LEI-CB	LEI CB/EP I
8	c. If EP I decision: fail- back to (1) application/process restarts, FSC CB awaits EP I approval d. EP I decision: pass- proceed to field assessment	LEI CB FMU
9	Notification to proceed: the FMU contacts LEI/FSC-CB. CBs communicate with respective partner CB.	FMU – FSC/LEI CBs
10	Contracting for field assessment	FMU – FSC/LEI CBs
11	CBs develop workplan and put team together based on LEI and FSC system requirements. A minimum of 3 assessors is required.	LEI/FSC-CBs
12	Joint public announcement (minimum 30 days before field assessment) in Bahasa Indonesia and English.	LEI/FSC-CBs
13	Joint Field assessment, including public consultation. The FKD (regional consultation forum) needs to be involved.	LEI/FSC-CBs
14	Joint fieldwork (including briefing/ de-briefing) of FMU	FMU – LEI/FSC-CBs
15	Separate reporting c. LEI CB Assessor to EP II d. FSC CB Assessor to FSC-CB	 LEI-CBs FSC-CBs
16	Separate Decision making process	LEI-CBs/EPII – FSC-CB
17	Combined decision and notification to FMU: • Situation I: FMU passes in LEI and FSC system. Joint notification to FMU. • Situation II: FMU passes in LEI system but does not pass FSC system . LEI-CB notifies FMU that it has 6 months to meet FSC requirements. • Situation III: FMU passes FSC system but does not pass LEI system. FSC-CB notifies FMU that it has 6 months to meet LEI requirements (see note below). • Situation IV: FMU does not pass either system. LEI-CB and FSC-CB notify that it has 6 months to meet both LEI and FSC requirements (see note below). Note: Under LEI system, an FMU that does not pass LEI system is required to re-apply for field assessment within 6 months after the decision of certification. Otherwise, FMU will be required to return to the screening process. • Under FSC system, an FMU that does not pass FSC system is required to inform FSC CB when it is ready for pre-conditions or major CAR audit.	LEI-CBs & FSC-CBs
18	FMU completes administrative requirement to receive certificates (Certification contract, fees)	LEI-CBs & FSC-CBs
19	a. . Handing over LEI and FSC certificates and other mandatory documentation. b. Public summary posted by CB's c. Public announcement according to each CB-system	LEI-CBs & FSC-CBs

Bogor, September 20th 2000

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Self-Scoping Checklist for Forest Management Unit Performance according to SFM Standards (LEI Doc. - 01)

Self-Scoping Checklist for FMU Performance According to SFM Standards (LEI Document-01)

- FMU Name :
- Aspect : **PRODUCTION**
- Main Condition : **Area status and security**
- Status : [.........] **[MAJOR (M) or PASS (v)]**

Clarification and Recommendations :

....

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No.:	KEY INDICATOR	DATA & INFORMATION C : Complete IC : Incomplete		VERIFIER (v) : No Problems (x) : Problems		STATUS : Major (M) Pass (v)	Notes
1.	P1.1	• Work area map/Landsat TM images (max. 2 years old)		• FMU area compatibility with regional use land planning (RTRWP)			
		• Regional land use planning map (RTRWP)		• Legal aspects of the FMU			
		• Map of changes to FMU function and legal release forms		• Outer boundary determination and demar-cation process			
		• Boundary map					
		• RKPH (20-year plan), RKL (5-year plan), RKT (annual plan), SK HPH (license document)					
2.	P1.3	• Concession work map		• Chronological list of changes to the area since the beginning of the FMU			
		• Regional land use planning map (RTRWP)		• Changes to forest function and provision to others (transfer of rights)			
		• Map of conversion activities within the FMU area		• Intensity of disturbance to forest (clearing, fire)			
		• Boundary map, RKPH, RKL, RKT, SK HPH					
		• Map indicating areas of previous forest fires (if relevant)					

Self-Scoping Checklist for FMU Performance According to SFM Standards (LEI Document-01)

- FMU Name :
- Aspect : **PRODUCTION**
- Main Conditions : **Forest planning and harvesting**
- Status : [............] [MAJOR (M) or PASS (v)]

Clarification and Recommendations :

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No :	KEY INDI-CATOR	DATA & INFORMATION C : Complete IC : Incomplete		VERIFIER (v) : No Problems (x) : Problems		STATUS : Major (M) Pass (v)	Notes
1.	**P1.2**	• FMU work map		• Demarcation of felling block/compartments, protected areas, conservation areas			
		• RKT		• Blocks planned for production = the net harvesting area (buffers, etc. are set aside)			
		• Field information					
		• Soil map					
		• Topographical map					
		• Environmental impact report (AMDAL)					
2.	**P2.3**	• Production statistics		• Suitability of annual allowable cut (AAC)			
		• Five-year planning/annual planning		• Method of AAC determination			
		• Block and compartment map/ work map					
		• Landsat image					
3.	**P2.7**	• Road network map		• Road, bridge and log landing quality			
		• Data on road quality standards (*TPTI* guide)		• Quality of water management (drainage) • Road density			
		• Field information					
4.	**P2.8**	• Topographical map		• Skid trail planning on the map			
		• Tree location map		• Opening up of skid trails prior to felling			
		• Felling/harvesting Standard Operating Procedures (SOP)		• SOP felling/harvesting			
		• Field information		• Measures to mitigate skidding effects			

Self-Scoping Checklist for Management Unit Performance according to SFM Standards (LEI Document-01)

- FMU Name :
- Aspect : **PRODUCTION**
- Main Conditions : **Silviculture ad rehabilitation**
- Status : [..........] MAJOR (M) or PASS (v)

Clarification and Recommendations :

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No :	KEY INDI-CATOR	DATA & INFORMATION C : Complete IC : Incomplete		VERIFIER (v) : No Problems (x) : Problems		STATUS : Major (M) Pass (v)	Notes
1.	P1.5	• Data on stand structure and composition		• Suitability of silvicultural system used now			
		• Annual plan (RKT)		• Yearly implementation of each step of the silvicultural system			
		• Data on forest type within the FMU		• Suitability of the silvicultural system for the local conditions			
2.	P2.2	• PSP (PUP) location map		• Existence of PSP (PUP)			
		• Measurement data from PUP		• Mechanism for gathering and managing PSP data			
		• Field information					
3.	P2.5	• Vegetation map (Landsat image)		• Timber harvesting techniques			
		• Data on stand structure and composition		• Condition of the stand structure and com-position			
		• Environmental impact report (AMDAL)					
		• Work map (block and compartment)		• Impact of fire disasters			

Self-Scoping Checklist for Management Unit Performance According to SFM Standards (LEI Document-01)

- FMU Name :
- Aspect : **PRODUCTION**
- Main Condition : **Timber management and reporting**
- Status : [.........] [MAJOR (M) or PASS (v)]

Clarifications and Recommendations :
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No :	KEY INDI-CATOR	DATA & INFORMATION C : Complete IC : Incomplete		VERIFIER (v) : No Problems (x) : Problems		STATUS : Major (M) Pass (v)	Notes
1.	**P 2.6**	• Tree location map		• SOP of timber administration/reporting			
		• Inventory report/production report data		• Filing system for *TUK*			
				• Flow of timber *(TUK)*			
				• Block inspections			

Self-Scoping Checklist for Management Unit Performance According to SFM Standards (LEI Document-01)

- FMU Name :
- Aspect : **PRODUCTION**
- Main Conditions : **Organization and administration**
- Status : [...........] [MAJOR (M) or PASS (v)]

Clarification and Recommendations : ....
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No :	**KEY INDI-CATOR**	**DATA & INFORMATION** C : Complete IC : Incomplete		**VERIFIER** (**v**) : No Problems (**x**) : Problems		**STATUS :** **Major (M)** **Pass (v)**	**Notes**
1.	**P 3.1**	• Financial audit report by public accountant		• Rentability			
				• Liquidity			
				• Solvability			
2.	**P 3.4**	• Organizational structure		• No. and qualifications of the workforce			
		• Data on the workforce		• Qualification of the Manager Camp			
		• Record of HRD training activities		• HRD training and curricula (*diklat*)			
3.	**P 3.5**	• Financial records (tending activities and environmental management)		• Allocation of investment funds for increasing forest stand quality (silviculture)			
4.	**P 1.4**	• Map of fire danger rating indexes		• Early warning system for fire dangers			
		• Hot spot map		• Availability of tools, network and SOP			
		• Tool lists					

Self-Scoping Checklist for Management Unit Performance according to SFM Standards (LEI Document- 01)

- FMU Name :
- Aspect : **ENVIRONMENT**
- Main Condition : **Condition of the vegetation**
- Status : [...........] [MAJOR (M) or PASS (v)]

Clarification and Recommendation :

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No :	KEY INDI-CATOR	DATA & INFORMATION C : Complete IC : Incomplete		VERIFIER (v) : No Problems (x) : Problems		STATUS : Major (M) Pass (v)	Notes
1.	**E 1.1**	• Map of protected areas		• Size, position and condition of water sources (rivers, dams, beaches, etc); Buffer zone, *KPPN*.			
		• Documentation on agreements with other parties					
		• Information on protected areas in the field		• Condition of protected flora/vegetation			
		• List of protected flora					
		• Env. impact report: AMDAL/ 5-year environmental plan: RKL/ annual environmental plan: RPL					
2.	**E 1.5**	• Data on stand structure and composition (long-term forest management plan/RKPH, RKL/RKT, prod. report, post harvest inventory: ITT)		• Stand structure and composition (S&K) in LoA, VF, protected areas			
		• AMDAL (Chap. V), SEL/RKL/RKT		• Level of similarity (species, structure) between LoA and VF			
3.	**E 2.5**	• AMDAL(Chap. V),Environment plan, RPL		• Protected vegetation species within the FMU			
		• Latest Landsat image		• Degree of habitat fragmentation			
		• Data on protected trees/flora					
		• Information on field conditions					

Self-Scoping Checklist for Management Unit Performance according to SFM Standards (LEI Document 01)

- FMU Name :
- Aspect : **ENVIRONMENT**
- Main Condition : **Condition of wildlife**
- Status : [........] [MAJOR (M) or PASS (v)]

Clarification and Recommendation :

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No :	KEY INDI-CATOR	DATA & INFORMATION C : Complete IC : Incomplete		VERIFIER (v) : No Problems (x) : Problems		STATUS : Major (M) Pass (v)	Notes
1.	**E 1.4**	• AMDAL (Chap. V), RKL/RPL		• Biodiversity of flora/fauna in virgin for-est/LoA			
		• Landsat image		• Biodiversity of flora/fauna in protected ar-eas			
		• Other relevant reports					
2.	**E 2.6**	• Animal distribution map		• List of protected animals species within the FMU			
		• List of protected animals living within the FMU, AMDAL (Chap. V), RKL/RPL		• Condition of the protected animals' habi-tats			
				• Degree of habitat fragmentation			

Self-Scoping Checklist for Management Unit Performance according to SFM Standards (LEI Document 01)

- FMU Name :
- Aspect : **ENVIRONMENT**
- Main Conditions : **Soil and water conservation**
- Status : [........] **[MAJOR (M) or PASS (v)]**

Clarification and Recommendation :

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No :	**KEY INDI-CATOR**	**DATA & INFORMATION** C : Complete IC : Incomplete		**VERIFIER** (v) : No Problems (x) : Problems		**STATUS :** **Major (M)** **Pass (v)**	**Notes**
1.	**E 1.6**	• AMDAL (Chap. V), RKL/RPL		• Soil erosion			
		• Field information		• Indications of erosion in the field			
				• Sedimentation level			
2.	**E 1.7**	• AMDAL (Chap. V), RKL/RPL		• Fluctuation of water level (flood/ drought)			
		• *SPAS* report (if available)		• Water pollution levels			
		• Field information					

Self-Scoping Checklist for Management Unit Performance according to SFM Standards (LEI Document 0-1)

- FMU Name :
- Aspect : **SOCIAL**
- Main Condition : **Tenure System**
- Status : [.........] [MAJOR (M) or PASS (v)]

Clarification and Recommendation :
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No :	KEY INDI-CATOR	DATA & INFORMATION C : Complete IC : Incomplete		VERIFIER (v) : No Problems (x) : Problems		STATUS : Major (M) Pass (v)	Notes
1.	**S 1.1**	• Documentation of boundary agreements with local communities (BAP)		• Certainty of the FMU area through acknowledgment of FMU boundaries by local communities			
		• Results of the boundary evaluation process					
		• FMU work map					
		• Map of community land use within the FMU					
2.	**S 1.2**	• Documentation of community claims		• Acknowledgement of local communities' traditional territories (adat)			
		• Documentation on acknowledgement of traditional laws					
3.	**S 1.3**	• Distribution map for NTFP within the FMU		• Acknowledgement of local community access to NTFP			
		• Documentation on the procedures and capacity of the FMU in conflict resolution					

Self-Scoping Checklist for Management Unit Performance according to SFM Standards (LEI Document 01)

- FMU Name :
- Aspect : **SOCIAL**
- Main Condition : **Economic development of local community**
- Status : [........] [MAJOR (M) or PASS (v)]

Clarification and Recommendation :
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....

No :	KEY INDI-CATOR	DATA & INFORMATION C : Complete IC : Incomplete		VERIFIER (v) : No Problems (x) : Problems		STATUS : Major (M) Pass (v)	Notes
1.	**S 2.1**	• Data on the food species used by the local communities		• Level of food shortages			
		• Information on causes of food shortages		• Availability of a minimal level of NTFP			
		• Report on realization of community development activities		• Fair access to employment opportunities			
		• Types of NTFP utilized by the community					

Self-Scoping Checklist for Management Unit Performance according to SFM Standards (LEI Document 01)

- FMU Name :
- Aspect : SOCIAL
- Main Condition : **Guarantee of social cultural integrity**
- Status : [.........] [MAJOR (M) or PASS (v)]

Clarification and Recommendation :
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No :	KEY INDI-CATOR	DATA & INFORMATION C : Complete IC : Incomplete		VERIFIER (v) : No Problems (x) : Problems		STATUS : Major (M) Pass (v)	Notes
1.	**S 3.1**	• Frequency of forceful and/or criminal action		• The level of force used by the FMU towards the community			
		• Existence of a workers' organization		• Freedom of the workers to form a union			
		• Cases of breaking of tradition laws					
		• Reports on mechanisms for conflict resolution					

Self-Scoping Checklist for Management Unit Performance according to SFM Standards (LEI Documentation 01)

- FMU Name :
- Aspect : SOCIAL
- Main condition : **Status of the community's nutrition and health**
- Status : [.........] [MAJOR (M) or PASS (v)]

Clarification and Recommendation :

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No :	KEY INDI-CATOR	DATA & INFORMATION C : Complete IC : Incomplete		VERIFIER (v) : No Problems (x) : Problems		STATUS : Major (M) Pass (v)	Notes
1.	**S 4.1**	• SOP Waste Management		• Pollution levels and mechanisms for pollution prevention			
		• Data on chemical products used in the FMU		• Community nutrition and health status			
		• Allocation of funding for increasing community health		• Health services unit			
				• Programme and fund allocation for nutrition and health			

Self-Scoping Checklist for Management Unit Performance according to SFM Standards (LEI Document 01)

- FMU Name :
- Aspect : SOCIAL
- Main Condition : **Guarantee of workers' rights**
- Status : [.........] [MAJOR (M) or PASS (v)]

Clarification and Recommendation :
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....

No :	KEY INDI-CATOR	DATA & INFORMATION C : Complete IC : Incomplete		VERIFIER (v) : No Problems (x) : Problems		STATUS : Major (M) Pass (v)	Notes
1.	**S 5.1**	• Work agreements and regulations		• Work co-operation agreements			
		• Documentation on labor conflicts and resolutions		• Level of labor conflicts			
		• Organization structure		• Fair salary and wage structure (local and ILO standards)			
		• SOP		• Level of work accidents			
		• List of employee salaries		• Safety standards			
				• Availability of a company health services unit			

Cover page

Information and Knowledge Management (IKM) Systems in the Context of Natural Resources Management in Southeast Asia

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Information and Knowledge Management (IKM) Systems in the Context of Natural Resources Management in Southeast Asia

Toolkit

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Anke Camphausen
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April 2005

Sector Network Rural Development Asia

Preface

German Technical Cooperation – namely the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH – has supported the forest sector in Southeast Asia for nearly 30 years. Sustainable Forest Management (SFM) has been the subject of at least 20 projects supported through GTZ. Although much of the knowledge gained has been documented within these projects, a systematic and comprehensive assessment, analysis and documentation of the entire knowledge has not been undertaken. In order to enable future German Technical Cooperation projects in the sector as well as partner organizations and other beneficiaries to share the knowledge, expertise and lessons learnt of previous SFM projects, a knowledge management process was initiated in the forestry sector in Southeast Asia.

Its general objective was to

- systematically assess and analyze existing knowledge with reference to future demand
- make available the experience, lessons learnt and knowledge of relevant SFM projects for users
- identify and provide access to resource persons and institutions.

Five core topics in the context of SFM were identified on which documented experiences and knowledge exist and which are considered to have a current and future demand:

Community-Based Forest Management
Best Management Practices
Capacity Building
Information Management
Land Use Planning.

This document covers the fourth topic, information management. It intends to systematically document, assess, and analyse the experience made and the knowledge gained with development of information and knowledge management systems in the context of German Technical Cooperation projects in the forestry/ natural resources management Sector in Southeast Asia. The intention is to provide a toolkit which allows quick and easy access to relevant information and documents on this topic and respective projects in the region.

Abbreviations

ASEAN	Association of Southeast Asian Nations
FMIS	Forest Management Information System
GIS	Geographic Information System
IKM	information and knowledge management
IT	Information technology
MDG	Millennium Development Goals
MRC	Mekong River Commission
NRM	natural resources management
SFM	sustainable forest management
Indo	Indonesia
MY	Malaysia
PM	Peninsular Malaysia
Phil	Philippines
CFPQ	Community Forestry Project Quirino
FCMP	Forest Cover Monitoring Project
FOMISS	Forest Management Information Systems Sarawak
IFFM	Integrated Forest Fire Management Project
WMSP	Mekong River Commission GTZ Cooperation Programme - Watershed Management Component
ReFOP	Regional Forest Programme (ASEAN)
SFMCP	Sustainable Forest Management and Conservation Project
SFMP	Sustainable Forest Management Project
SMRP	Sustainable Management of Resources (Lower Mekong) Project

Definitions

In this document the key terms below are used as follows:

Information
- Facts, data or instructions in any medium or form.

Spatial Information
- Information (as defined above) that is geographically referenced.

Knowledge
- Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms.[1]

Information and Knowledge Management
- Conscious strategy of getting the right information and knowledge to the right people at the right time, and helping people share and put information and knowledge into action.

Information and Knowledge Management System
- A system, whether automated or manual, that comprises people, machines (hardware), and methods (software) organized to manage (collect, store, process, disseminate) information and knowledge and thus assist in monitoring, further developing and controlling an institution's organization, resources, activities and results.

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[1] T. H. Davenport and L. Prusak, *Working Knowledge: How Organizations Manage What They Know,* Harvard Business School Press, Boston, MA (1998).

Contents

Part 1

General Analysis of IKM approaches in the context of NRM in Southeast Asia

1.1 Background

Over the last two decades, decision-making in the global information society has become more and more complex. This is due to the increased amount and the often conflicting information available as well as due to a more complex organizational landscape, in which new stakeholders from the civil society demand to be taken into consideration. This holds true for natural resources management (hereafter NRM) just as for any other field that requires decision-making in situations characterized by high levels of complexity and uncertainty. Natural resources managers in the emerging economies of Southeast Asia and elsewhere, when attempting to decide in a factual and rational manner, have to base their decisions on huge amounts of spatial and non-spatial information and knowledge originating from various sources. To support decision-making processes, information and knowledge management (hereafter IKM) and related information and knowledge management systems (hereafter IKM systems) are recognized as essential tools. They are vital for planning, operation, monitoring and evaluation of NRM processes.

More recently, rising awareness of the cross-border environmental dimensions of NRM has fostered networking between organizations as an approach to share information and knowledge and to embark on national as well as regional policy dialogues. Networks within and between organizations and nations rapidly become essential in supporting holistic decision-making processes. IKM[2] systems that facilitate the information and knowledge sharing through networking between organizations or nations play an important role in this context.

Thus IKM approaches in general need to be seen at least on two levels:

- On the one hand, IKM approaches aim at the establishment of IKM systems within organizations. This would for instance include GIS-based forest information management systems or collaborative information technology tools to capture internal knowledge.
- On the other hand, IKM refers to the establishment of information and knowledge exchange fora *between* nations and/or organizations as well as the development of tools and mechanisms to facilitate policy or cross-organizational dialogues.

[2] This document addresses the management of “explicit” knowledge as indicated above. We do recognize and value the importance of “tacit” knowledge (such knowledge that can not be readily articulated or codified), but managing tacit knowledge is beyond the scope of this paper.

The role of information technology (IT) to support informed decision-making processes and thereby aiming towards sustainable development in general is increasingly recognized. Appropriately designed and implemented IKM systems reduce the cost and thus improve the efficiency of organizations, increase the quality of their services, while also contributing to increased transparency and accountability. With the evolution in capacity and speed of modern computers and the ever increasing availability of telecommunication facilities, increasing deployment of computerized IKM systems supporting natural resources management in Southeast Asia can be observed.

1.2 Common framework conditions

Information and knowledge management in Southeast Asia needs to be regarded in the context of general attitudes towards information and knowledge, the roots of which may lie in culture to a significant extent. Additionally it has to be acknowledged that the framework conditions vary greatly between countries as far as IT literacy and communications infrastructure are concerned.

The general framework conditions prevalent in the region, or broad attitudes towards information and knowledge, have been very concisely summarized by Dr. F. Ng (2001), a renowned Malaysian academic in a recent publication[3], from which we quote here:

- Knowledge transfer tends to be conservative, with “the teacher” playing a central role, and taught knowledge being valued as the basis of qualification and advancement, presupposing that it has an indefinite useful life. The idea of knowledge being subjected to continuous testing, questioning, revision, improvement or obsolescence has not fully sunk in.
- The anticipated applications determine which information and knowledge should be managed. There may be high reluctance to manage information and knowledge for which no clear application is readily envisaged. Envisaging clear applications may be particularly challenging in complex situations characterized by high levels of uncertainty, such as NRM.
- There is in general considerable secretiveness and reluctance to share or publish. Sharing of information and knowledge goes deeply against the tendency to keep secrets in order to maintain competitive advantage. To overcome this issue, many countries have established legal systems for the protection of intellectual property rights, e.g. through copyright regulations. However, actual protection of intellectual property (enacted regulations and their enforcement) greatly varies in strength between various Southeast Asian countries.

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[3] Ng, F.S.P. (2001) Biodiversity and Asian Attitudes on Knowledge. In: Chua Teck Kheng and Eileen Yen Ee Lee (eds.), Biodiversity 2000: Proceedings of Intern. Conference on Prudent Biodiversity Management and Sustainable Development Sarawak Biodiversity Centre, pp.169-176.

- The aforementioned points constitute strong motivations even for public sector institutions to try and “corporatize” information and knowledge and keep them under wrap, instead of managing them transparently. Moreover, under the cover of corporate secrecy, individuals are tempted to hoard not only for their institutions, but also for themselves. Hence, ownership of information and knowledge is compartmentalized, and individuals tend to keep secrets. Experience shows that this is an obstacle especially with such information and knowledge that can readily or with little additional modification be used in the work of the recipient (such as high quality GIS data).
- In some Southeast Asian countries, as in many other countries of the world, the issue is further complicated to varying degrees by the fact that numerous individuals in public services who possess knowledge simultaneously draw substantial portions of their income from (part-time) work as advisors to the private and/ or development sectors. This makes the information and knowledge they hold even more valuable and may further boost tendencies to hoard it.

Other assets and constraints related to IKM and IKM systems development in Southeast Asia, which are more specifically related to **human resources development** are:

- Initial enthusiasm for high-tech approaches and support from top management. However gradual loss of interest (a) due to long system development phase, (b) because for lack of a clear definition of objectives IKM and its IT applications are seen as an end in itself and not as means to an end, (c) because over-emphasis is put on the technical side and too little attention paid to human resources development, (d) due to lacking prior awareness of institutional adjustment requirements.
- Responsibility for IKM System operation is often entirely transferred to technical staff, with the management level not being able to properly oversee and direct their work or assess their performance. Operators often lack understanding for requirements of decision making, and tend to operate the system as they see fit or even consider it as their personal domain, which negatively impacts the overall usefulness of the system.
- Resulting insufficient capacity and/or interest of government institutions to manage IKM systems in the long run
- Twisting and hijacking of needs and the use of IKM for other purposes (e.g. IT set-ups, personal laptops, mobile phones)
- Incentive systems are not geared towards rewarding open and transparent handling of data and information.

Finally, there are numerous aspects of IKM systems development related to **technical proficiency and infrastructure**:

- General IT literacy of staff in public institutions (varies from country to country, but with existing gaps closing fast).

- Availability of specialized IT staff in public institutions (varies greatly from country to country).
- Internal IT infrastructure in place (varies greatly from country to country country).
- External telecommunication sufficient for connection to internet and e-mail (in nearly all major urban centres).
- Imbalance of technical infrastructure between rural and urban areas.
- Availability of raw data (e.g. spatial data) as a constituent for (spatial) information systems (varies greatly from country to country regarding quantity and quality).

The following table summarizes a "Readiness Assessment" [4] and thus some general framework conditions for IKM implementation in six ASEAN countries[5]:

Country	Basic infrastructure	Access to services	Internet use	Promotion and facilitation	Skills and human resources	Positioning	Average
Indonesia	0.54 (5)	0.54 (3)	0.34 (6)	0.49 (5)	0.23 (5)	0.58 (5)	0.45 (5)
Malaysia	0.60 (4)	0.48 (5)	0.61 (2)	0.67 (4)	0.37 (2)	0.82 (1)	0.59 (2)
Philippines	0.63 (3)	0.64 (1)	0.59 (3)	0.70 (3)	0.33 (3)	0.61 (4)	0.58 (3)
Singapore	0.82 (1)	0.56 (2)	0.66 (1)	0.82 (1)	0.45 (1)	0.63 (2)	0.65 (1)
Thailand	0.68 (2)	0.53 (4)	0.51 (4)	0.72 (2)	0.29 (4)	0.62 (3)	0.56 (4)
Vietnam	0.45 (6)	0.37 (6)	0.38 (5)	0.39 (6)	0.23 (6)	0.42 (6)	0.37 (6)
Average ASEAN 6	0.62	0.52	0.52	0.63	0.32	0.61	0.53

Legend:

Basic infrastructure:	covers access to basic infrastructure, speed and functionality of the infrastructure.
Access to services:	is measured by capacity of access to internet services.
Internet use:	is assessed on the use of internet technologies by the public and private sector.
Promotion and facilitation:	include public awareness and promotion and facilitation activities by the government.
Skills and human resources:	are assessed on education system, skill formation, and training.
Positioning:	covers an assessment on government policies such as taxation, legal framework, security, and encryption.

(0=least ready, 1=most ready; figures in brackets indicate the rankings scored by the countries on each factor, 1 being the highest rank)

[4] This Readiness Assessment refers to E-Commerce Readiness, but also applies to IT and IKM readiness in general.
[5] Electronic Commerce Resource Centre. 2000.

Summarizing the above, much still remains to be done to ensure the long-term use and operationalisation of IKM systems in the region. Furthermore, a gap still persists between the expressed desire for change, and the actual incorporation of IT in decision-making processes. In particular constraints such as:

- organizational culture
- insufficient communication in the system development phase
- limited IT infrastructure
- shortage of skilled human resources
- shortage of operational funding

remain challenges for the sustainable implementation of IKM systems in the NRM sector in Southeast Asia. In many cases the finding applies that “rather than thinking of IT [information systems] projects, the public sector needs to to think in terms of projects to change the way government works, of which IT is an important part”.[6]

1.3 Common strategies and approaches

In general, the GTZ strategy is to offer an integrated approach for IKM systems development, including the organizational set-up and capacity-building rather than focussing primarily on software development, offering off-the-shelf packages or turnkey solutions. The partner organization, throughout the entire development process, plays an essential role in developing the IKM strategy, and in designing the architecture and customizing the functions of an IKM system. This enables the partner organization to independently use and further develop the established IKM system and further extensions thereof in the future.

A sequential approach, consisting of modular elements, is used to implement this strategy. The approach reflects internationally accepted guiding principles and concepts to attain and secure long-term institutionalization of an IKM system within the business processes of an organization or network.

This sequential approach towards client-centred implementation of IKM systems in partner organizations can be outlined as follows:

1. Clarification of preconditions for IKM system introduction: Clarification of preconditions for successful IKM system implementation and advice on creation of an environment conducive to IKM system introduction.
2. Situation analysis: thorough assessment of business processes, related current information and knowledge flows and needs, and of IT readiness and capacities of partner organizations.

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[6] Malcolm Wheatley, quoting from a British government report on the issue: "Her Majesty's Flying IT Circus." In: CIO – Business Technology Leadership (04 September, 2000). http://www.cio.com.au/index.php/id;170149485

3. IKM strategy development: joint development and agreement on an IKM strategy reflecting the identified needs and capacities of the partner organization.
4. IKM system development: development of an IKM system guided by the agreed IKM strategy.
5. IKM and IT capacity-building: capacity building in general IKM and IT skills as well as maintenance and utilization of the IKM system and adjustments of organizational structure.
6. Planning, monitoring and evaluation of IKM system: intense process monitoring with abundant feedback loops throughout the entire development process as well as monitoring of actual system utilisation and its impact on business processes and related information and knowledge flows.

The approach would ideally be implemented in the sequence indicated. Yet in practice certain deviations from this sequence are likely to occur.

Part 2 lists GTZ's activities and competencies related to the individual steps.

1.4 Impact of approaches

Expected benefits from the use and implementation of information and knowledge management (IKM) systems are:

- The internal business operation of the partner organizations is optimized, the partner organization reduces costs and thus works more efficiently.
- The partner organization's quality of service delivery is improved.
- The partner organization reaches a higher level of transparency and accountability and thus overall corporate governance.
- Governmental organizations achieve higher qualification in monitoring and evaluation processes.
- The establishment of information and knowledge platforms allows the partner organization to integrate its organization and administration into the international information and knowledge exchange.
- An intergovernmental exchange of information and knowledge through international information and knowledge systems such as a clearing house mechanism facilitates the international policy dialogue.

Part 2

Synthesis of German Technical Assistance Projects

2.1 Introduction

In Southeast Asia GTZ has more than 10 years of experience in the field of information and knowledge management (IKM) systems developed and implemented within the context of natural resources management. The development and implementation of IKM systems in GTZ assisted projects is typically an integral part of an overall strategy towards a sustainable management of forests and natural resources, both on national and regional levels. Chapter 2.2 provides an overview of projects with IKM components and their general strategies and approaches towards IKM. Chapter 2.3 gives a more detailed synthesis of the implementation of IKM approaches by GTZ-assisted projects. “Lessons learnt” is a synthesis of the experiences made by GTZ-assisted projects with IKM components.

2.2 GTZ-assisted projects with IKM components

Country	Project (duration)	Project purpose	General strategy towards IKM	IKM approach
ASEAN	Regional Forest Programme (ReFOP) (2002-2006)	Facilitate communication and cooperation between ASEAN member institutions and the ASEAN Secretariat to implement the Strategic Forestry Action Plan	Development of needs-based information and knowledge exchange mechanism to facilitate the ASEAN forest policy approach	Establishment of an ASEAN Forest Clearing House Mechanism as a tool, along with data exchange protocols. Implementation of E-discussions to create needs-based mechanisms for information and knowledge exchange, such as good practices, lessons learnt
Indonesia	Integrated Forest Fire Management Project (IFFM) (1993-2004)	Contribute to reduce damage caused by fire to mankind and the environment in East Kalimantan and to an improved fire management system in Indonesia	Establishment of a computer-supported Forest Fire Management system for effective implementation of fire prevention and preparedness measures	Integrating fire-related data and information such as monitoring and detection, to determine fire danger criteria as well as data analysis and information dissemination to support fire management prevention, suppression and policy decisions
Malaysia	Forest Management Information Systems Sarawak (FOMISS) (1995-2001)	A sustainable, environmentally friendly and socially acceptable forest management system is applied in Sarawak	Establishment of a Forest Management Information System supported by GIS with the Forestry Department	Improving and developing spatial information technology and application at the Forestry Department headquarters as well as in the regional offices through institutionalization, capacity-building, database development and application development
	Sustainable Forest Management Project, Sabah (SFMP) (1989-2001)	The sustainable forest management system is tested and progressively implemented	Establishment of Forest Management Information System at the Forestry Department	Establishing a GIS-based information system at the Forestry Department through institutionalization, capacity-building, database development and application development
	Forest Planting Material Procurement Programme (FPMPP) (1994-2001)	Sufficient forestry seed and planting material of indigenous species is available	Establishment of a computer-supported Forest Genetic Resources Information System	Establishing an information system which allows centralized and decentralized information management pertaining to forest seed and plant procurement among all relevant parties in Malaysia. This includes database and application development as well as institutionalization and capacity-building
	Sustainable Forest Management and Conservation Project (SFMCP) (1994-2005)	Key elements of sustainable forest management are further refined and applied by the Forestry Department Peninsuar Malaysia on a larger scale in selected forest management units (states)	Establishment of a Forest Management Information System with the Forestry Department	Establishment of an information system supporting all management processes involved in timber harvesting, including spatial information and all compartment-related information

Country	Project (duration)	Project purpose	General strategy towards IKM	IKM approach
Mekong River Commission (MRC) – Lower Mekong Basin (Cambodia, Lao PDR, Thailand, Viet Nam)	Forest Cover Monitoring Project (MRC – FCMP) (1992-1999)	Human resources and technical capacities of the NRM planning authorities in the Lower Mekong Basin countries are improved and are utilized for land use planning	Support the establishment of NRM related information such as GIS databases, maps, statistics, and promote their use in forest and other environmental policy-making processes in the Lower Mekong Basin	Create a regional natural resources information system including a forest cover monitoring and trend analysis system. Enhance cooperation related to standardization of data generation and exchange between and within riparian countries. Related capacity-building in the line agencies of the Mekong River Commission member countries as well as in its regional office
	Sustainable Management of Resources in the Lower Mekong Basin Project (MRC – SMRP) (1995 – 2002)	Sector organizations in the Lower Mekong Basin generate and manage information which is relevant to collaborative forest management (CFM) more effectively	IKM as the methodological focus within the overall thematic umrella NRM (land use planning, collaborative forest management). IKM activities focussed on two main strategic elements: (a) user orientation and (b) information / communication technology orientation	Application of the "information cycle" concept to NRM: Agree on the priority issues demanding information, determine the information needs of decision-making groups, design strategic and operational information products, agree on stakeholder roles and responsibilities for information production, enable stakeholders to deliver the required information products
	Sustainable Watershed Management in the Lower Mekong Basin (MRC – WSMP) (2002-2012)	Relevant institutions in the riparian countries of the Lower Mekong Basin use regional cooperation, information and data exchange and improved concepts for the sustainable management of watersheds	Facilitate access to and promote use of relevant information / knowledge on management of water-related terrestrial natural resources by relevant policy makers and leading institutional developers in the Lower Mekong Basin countries	Assess and analyze data and information needs with partner organizations. Collect, summarize and valuate data and information accordingly. Promote dissemination of data and information to government officials and the public through web based information systems, conferences, etc. Strengthen capacities of partner organizations for data and information management
Philippines	Community Forest Project Quirino (CFPQ) (1994-2003)	Local communities, with support from the local government units and the Department for Environment and Natural Resources, manage their renewable natural resources along sustainability criteria	Supporting land use planning at municipal level by using spatial information systems	Establishment of a GIS service centre at local government level

2.3 Core elements of GTZ's IKM approach and project implementation

Clarification of preconditions for IKM system introdcution	Situation analysis	IKM strategy development	IKM system development	Capacity-building	Process-monitoring
Promote high-level commitment to IKM system initiative ReFOP MRC MY_SFMCP MY_FOMISS Phil_CFPQ	Conduct assess-ment of business processes (data quality and availability, information and training needs etc.) ReFOP MRC SMRP FCMP MY_SFMCP MY_FOMISS	Development of IKM strategy ReFOP MRC	Development of regional IKM system ReFOP MRC	Development of training modules Phil_CFPQ	Usage and impact assessment MRC
			Development of national forest management infor-mation system MY_SFMCP MY_FOMISS MY_SFMP	Development of training material MY_SFMCP MY_SFMP	
			Development of Fire Man-agement Information Sys-tem Indo_IFFM	Organization of training and workshops ReFOP MRC Indo_IFFM MY_SFMCP MY_FOMISS MY_SFMP Phil_CFPQ	
			Development of forest genetic resource information system MY_FPMPP	Organizational set-up Phil_CFPQ	
			Development of land use planning information system Phil_CFPQ		

2.4 GTZ core competencies

Clarification of preconditions for IKM system introduction

Coordination with partners in high administrative/ policy-making positions to directly reach decision-making level and obtain high-level commitment to IKM system initiative.

Analysis of overall attitude towards IKM and of current incentive systems.

Advice to management on appropriateness of incentive systems to motivate staff involved in IKM systems establishment.

Clarification of legal aspects and organizational mandate pertaining to IKM.

Continuous reporting to top management.

Analysis of institutional set-up.

Situation analysis

Analysis of existing internal and external organizational communication.

Analysis of organizational mandate and current/ planned future activities that may require IKM support.

Inventory of existing systems that handle data and information, including existing IT systems.

Inventory of availability, quality and usability of existing data (e.g. spatial data).

User information needs assessments.

Assessment of IT training needs.

IKM strategy development

Development of IKM strategy in consultative process with all relevant parties (top management as well as operators) within the partner organization (based on the results of the first two steps).

Advice on cost (budget/ manpower requirements) and schedule for implementation of IKM strategy, and on cost of alternative solutions.

IKM system development

Design of issues- and needs-based IKM system architecture, adapted to existing and projected IKM and IT skills, based on agreements reached in IKM strategy.

Technical assistance with technical setup of required IS infrastructure.

Assessment of locally available IKM technical and software development support.

Selection of generic software platforms, organization, monitoring, supervision of prototyping and development of customized software.

Technical assistance with data generation/ capture, quality assurance and meta documentation.

IKM and IT capacity-building

Awareness creation for the benefits of IKM at both management (decision-making) and operator (technical) levels.

Development of training modules.

Development of training materials such as self-learning and e-learning tools.

Organization of trainings, workshops, and other human resources development activities supporting development and implementation of the IKM system.

Assistance in the re-designing of organizational structure

Planning, monitoring and evaluation of IKM systems

Documentation of IKM system development process for future use.

Evaluation of changes in organizational performance (impact) triggered or influenced by the IKM system.

2.5 Lessons Learnt

This section summarizes experiences of GTZ-assisted IKM projects in the region which proved significant with respect to a successful implementation of IKM strategies and approaches.

- IKM systems provide an indispensable tool to support national NRM systems. However, this tool can only be effective in its overall purpose if it is implemented along with the realization of the NRM system.

- GTZ takes an integrative and comprehensive approach to IKM system development: the development of the IKM system has to be part of an overall natural resources management strategy promoting and supporting the shift towards sustainable management of natural resources (i.e. it includes the implementation of SFM, creation of awareness at political level and capacity-building). This guarantees compatibility with the SFM system and facilitates the implementation of such an SFM system.

- The system has to be tightly integrated into the business processes and has to ease the work of the involved personnel. They have to experience personal gain through the implementation of the IKM system; otherwise resistance to implementation will occur.

- As for regional IKM systems, GTZ is not only positioned within the regional institutions, but also based at the member countries and organizations. This multi-level approach aims to promote and facilitate sustainable NRM and corresponding policy making at the national level, provide access of this information on the regional level and thus allow cooperation as well as decision-making and consensus-building on the regional level. At the same time, it facilitates the implementation of regional processes and decisions made on the national level. It is essential to incorporate national focal points right from the beginning of the development to ensure ownership not only on the regional but also on the national level.

- Setting up and implementing an efficient IKM system is not only a technical issue, but also challenges the organizational as well as the communication culture of an institution. Therefore the managerial and policy-making levels need to be integrated at all stages of development and implementation. Integrating organizational set-up and capacity-building into methodology development of IKM systems right from the beginning helps strengthen existing capacities and enables the partner organization to independently use and further develop the established IKM system and further extensions thereof in the future.

- The higher the level of implementation of the IKM system (i.e. national, regional), the greater the number of stakeholders with individual, at times conflicting interests. To gain broad acceptance and participation in the IKM system, these need to be integrated into the system development and implementation process at an early stage. The challenge is, however, not to provoke resistance among the superior authority which might fear a loss of power.

- IT infrastructure and IT literacy are often deficient, in particular at the lower administrative levels. The complexity and sophistication of an IKM system need to be adapted to the resources available to ensure the long-term sustainability of the system. This requires a thorough assessment of the existing capacities for IKM system operations prior to defining the IKM project design. Realistic concepts might conflict with a partner's demands for prestigious modern high-tech solutions.

- The quality of the data and information used for the system is often deficient. As a result the outputs (e.g. maps) are disappointing, but the system is made responsible for it. Care needs to be taken to not only build an (empty) system shell, but to pay sufficient attention to the amount and quality of data forming the core of the system, e.g. to develop mechanisms for data quality management; to develop protocols for data exchange.

- The Project Management Unit needs to be aware that software development as well as the entire development process of an IKM system is a complex task. Enough resources (financial as well as human) have to be allocated within the team to plan and supervise the development. In summary critical elements for IKM system planning are:

  - Precise IKM project definition as a result of an initial assessment and analysis phase. This phase also needs to include a self reflection process of the partner organization (i.e. identification of strengths and weaknesses) out of which the IKM strategy is formulated
  - Sufficient and long term secured budget for the IKM system development
  - Experts with thorough experience in IKM implementation
  - Sufficient resources for the "socialization" of the system, i.e. this includes on the one hand training of users and system administrators, on the other hand familiarization of decision-makers
  - System development should be pursued via Rapid Application Development. Ample time needs to be allocated within the project concept to accompany the operational phase of the IKM system. The initial phase of operation is the most crucial one and without direct support can be detrimental for the system
  - As the sustainability of an IKM system might not be guaranteed due to a high staff turn over at the partner organization, local experts need to be integrated at an early stage. The preferred way i.e. in form of consultants (outsourcing) or development of respective positions within the partner organization, needs to be clarified with the partner organization at an early stage. They then ensure development and maintenance of the IKM system once the project has terminated. Ownership of the system is enhanced if the partner bears the costs for the local IT experts right from the beginning
  - The system needs to be developed in short, clearly defined design stages. This allows an early, stepwise implementation of the system as well as monitoring and evaluation of the entire process.

IKM in natural resources management in Southeast Asia and the Millennium Development Goals (MDG)

IKM systems in the context of NRM (IKM/NRM) as described in the previous chapters directly contribute to the achievement of the MDGs, in particular MDG 7 Target 9 and MDG 8 Target 6 (see box below).

MD Goal 7:	***Ensure Environmental Sustainability***
Target 9:	*Integrate the principles of sustainable development into country policies and programmes and reverse the losses of environmental resources.*
MD Goal 8:	***Develop a global partnership for development***
Target 6:	*In cooperation with the private sector, make available the benefits of new technologies – especially information and communications technologies.*

IKM obviously cannot offer a panacea for all problems and challenges related to sustainable natural resources management and protection, let alone for the achievement of the MDGs. It rather needs to be seen as a powerful tool when used appropriately as part of an overall strategy on sustainable natural resources management.

IKM can help to increase efficiency, e.g. by providing new and more efficient methods of production, improving the delivery of government services and facilitating management as well as transfer of knowledge as Jayasuriya and Wordon[7] state: "In order to reach the targets set by the MDGs, countries can either increase the resources allocated to these objectives, or increase the efficiency with which valuable resources are used".

Last but not least, IKM/NRM systems facilitate monitoring and reporting of the status quo of the achievement of the MDGs (e.g. MDG 7 Target 9 Indicator 25 and 26).

[7] Jayasuriya, R. and Wodon, Q. (2003). "Efficiency in Reaching the Millennium Development Goals", World Bank Working Paper No. 9, The World Bank.

TOOLBOX

This toolbox provides a compilation of core methods and concepts of GTZ-assisted projects. It highlights the German technical cooperation's integrated approach towards IKM systems within NRM in the region. Categorized by the six identified elements of IKM, documented core methods are identified and abstracts of respective key documents describing advantages, limitations and challenges of the respective methods are provided. The annotated bibliography lists each document title with an executive summary and hints as to usability and applicability of the document in different contexts. Also, a link to ASEAN's Forest Clearing House Mechanism (CHM) website (http://forest-chm.aseansec.org) is provided, where the documents are available for download. You may also contact an ASEAN resource person for a CD-ROM which contains all full-text documents with respective links in the bibliography.

Some of the activities within the elements listed below do not lend themselves for easy codification in the shape of a manual or concept paper. In particular activities in the element "Clarification and advice on preconditions for IKM systems introduction" can hardly be moulded into technical guidelines (i.e. activities such as "coordination with partners in high administrative/ policy making positions"). In listing these elements nevertheless, we intend to underline the importance of tacit knowledge and its communication in the process of IKM systems development.

Content: The toolbox lists documents about the following areas of intervention/countries:

<table>
<tr><th colspan="3">Clarification and advice on preconditions for IKM systems introduction</th></tr>
<tr><td colspan="2"></td><td></td></tr>
<tr><th colspan="3">Assessment of IKM system demand and readiness</th></tr>
<tr><td colspan="2">ASEAN - Information Needs Assessment: Forest Clearing House Mechanism</td><td>ASEAN</td></tr>
<tr><td colspan="2">Mekong River Commission (MRC) - Information Needs Assessment Questionnaire</td><td>Lower Mekong Basin</td></tr>
<tr><td colspan="2">Assessment of demand and readiness for a FMIS</td><td>Malaysia (Sabah)</td></tr>
<tr><td colspan="2">Review of current Forest Management Information System (FMIS) set up</td><td>Malaysia (Sarawak)</td></tr>
<tr><th colspan="3">Development of IKM strategy</th></tr>
<tr><td colspan="2">ASEAN – Regional Forestry Communication Strategy</td><td>ASEAN</td></tr>
<tr><td rowspan="3">MRC – IKM Strategy</td><td>IKM Strategy and Concept</td><td rowspan="3">Lower Mekong Basin</td></tr>
<tr><td>Support Strategy for National Information Management Units</td></tr>
<tr><td>Summary SMRP strategy and activities in IKM (German)</td></tr>
<tr><th colspan="3">Development of adapted IKM systems</th></tr>
<tr><td colspan="2">ASEAN Forest Clearing House Concept Paper</td><td>ASEAN</td></tr>
<tr><td colspan="2">Development of a Forest Fire Information System</td><td>Indonesia</td></tr>
<tr><td rowspan="2">MRC - Development of a Regional IKM system</td><td>Regional Forest Cover Monitoring</td><td rowspan="2">Lower Mekong Basin</td></tr>
<tr><td>Development of MekongInfo</td></tr>
<tr><td colspan="2">Concept – Forest Management Information System</td><td>Malaysia (PM)</td></tr>
<tr><td colspan="2">Concept – Forest Genetic Resources Information System (FORGRIS)</td><td>Malaysia</td></tr>
<tr><th colspan="3">Capacity-building</th></tr>
<tr><td colspan="2">ASEAN Clearing House Mechanism Toolkit</td><td>ASEAN</td></tr>
<tr><td colspan="2">Technical Notes on aspects of setting up a regional forest cover monitoring system</td><td>Lower Mekong Basin</td></tr>
<tr><td colspan="2">MRC – Guidelines Information Needs Assessment</td><td>Lower Mekong Basin</td></tr>
<tr><td colspan="2">User Manuals for a Forest Management Information System</td><td>Malaysia (PM)</td></tr>
<tr><td colspan="2">User Manual for the Forest Genetic Resources Information System (FORGRIS)</td><td>Malaysia</td></tr>
<tr><td colspan="2">Organizational set up of GIS Unit</td><td>Philippines</td></tr>
<tr><th colspan="3">Process and usage monitoring</th></tr>
<tr><td colspan="2">Process analysis of the Clearing House Mechanism development</td><td>ASEAN</td></tr>
<tr><td colspan="2">Summary report of the 4th workshop on networking and IKM by regional organizations in the field of NRM</td><td>ASEAN</td></tr>
<tr><td colspan="2">Monitoring of Mekong Info Usage</td><td>Lower Mekong Basin</td></tr>
</table>

Assessment of IKM system demand and readiness

ASEAN – Information Needs Assessment	
Source	INFORMATION NEEDS ASSESSMENT IN ASEAN COUNTRIES: FOREST CLEARING HOUSE MECHANISM
Author	Bernhard von der Heyde, Prabianto M.Wibowo
Project	ASEAN-German Regional Forest Programme
Year	2004
Abstract	The needs assessment was conducted by the ReFOP national focal points. interviews and recording of data were performed by the national focal points through a jointly developed questionnaire and supported by the GTZ project on "IKM of Regional Organizations in the Field of Natural Resources Management" and ReFOP. The results were presented at an ASEAN-wide reach-out workshop highlighting the benefits of inter-organizational IKM within ASEAN and lead to the development of the ASEAN Forest Clearing House Mechanism
Advantages	As the involved organizations conducted the needs assessment themselves (and not a team of external consultants) a learning process could be initiated within the organization. This resulted in an awareness of the benefits of IKM and ownership for the whole process.
Limitations and Challenges	Since the process could not be continuously monitored the quality of the results vary greatly between member countries.
Download	http://forest-chm.aseansec.org//refop/php/doc/doc_detail.php?id=DOC-000903
Resource person	Bernhard von der Heyde: bernhard.heyde@gtz.de

Mekong River Commission - Information Needs Assessment	
Source	INFORMATION NEEDS ASSESSMENT FOR SUSTAINABLE WATERSHED MANAGEMENT. QUESTIONNAIRE
Author	WSMC Information Management Team
Project	MRC GTZ Cooperation Programme Watershed Management Component (WSMP)
Year	2004
Abstract	This document contains a questionnaire, which was developed and used by the Watershed Management Component (WSMC) of the Mekong River Commission (MRC) GTZ Cooperation Programme as part of the Information Needs Assessment for Watershed Management. The aim was to identify the information needs of people and organizations working in Watershed Management or related fields in the Region in order to improve the regional management and sharing of information.
Advantages	Despite its thematic focus on Watershed Management, the questionnaire covers multiple facets of information needs / flows / dissemination mechanisms, and can easily be adapted to other thematic areas.
Limitations and Challenges	The questionnaire does not focus on specific (technical) IT or Information System related issues.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000909
Resource person	Christoph Feldkoetter: christoph.feldkoetter@gtz.de or cfeldko@gmx.net

Assessment of demand and readiness for a FMIS	
Source	**DESIGN OF A CONCEPT FOR A MANAGEMENT INFORMATION SYSTEM FOR THE FORESTRY SECTOR IN SABAH**
Author	Eller, E.
Project	Sustainable Forest Management Project, Sabah, Malaysia
Year	1996
Abstract	Consultancy report. Prior to designing a concept for a forest management information system that

	supports a forest management system at the forestry department (FD) in Sabah a needs assessment was conducted. During consultative meetings, interviews and workshops the following elements were assessed: the data and information structure at the FD, i.e. the suitability of exisiting databases; the organizational and personnel structure. Shortcomings are identified, recommendations made and a logical framework and action plan developed.
Advantages	At the end of the report job descriptions for MIS related staff members are provided which give examples of clear definitions of MIS related activities for the respective positions.
Limitations and Challenges	
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	

Review of current FMIS set-up	
Source	**CONSULTANCY REPORT ON THE DEVELOPMENT OF THE FOREST MANAGEMENT INFORMATION SYSTEM**
Author	Hoesli, T.
Project	Forest Management Information System Sarawak, Malaysia
Year	1999
Abstract	This consultancy was part of the Sarawak Forest Department's process to introduce a concept of digital GIS. Consistent pre-established procedures for data conversion were required. Within this context, this consultancy report undertakes a review of the current FMIS set up, focusing on data conversion specifications and database management procedures at the GIS Unit of the Forest Department Sarawak.
Advantages	
Limitations and Challenges	Focus of assessment on system set up and data management
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000911
Resource person	

Development of IKM strategy

ASEAN - Regional Forestry Communication Strategy	
Source	**MAINSTREAMING SUSTAINABLE FOREST MANAGEMENT. REGIONAL COMMUNICATION STRATEGY: AN INCEPTION STUDY**
Author	Buchholz, G.;
Project	ASEAN German Regional Forest Programme ReFOP
Year	2005
Abstract	This communication strategy serves as an input for the future forest policy activities of the Natural Resource Unit at the ASEAN Secretariat. It distinguishes between two goals and two levels: - The external goal is to broker a consensus between relevant stakeholders that forest utilization and protection are complementary and contribute to sustainable development and poverty reduction. - Secondly, the internal goal is to build a common understanding for decision-makers on the benefits for sharing knowledge among ASEAN Member countries in order to achieve ASEAN Vision 2020 namely, to promote sustainable forest management as a model in sustainable development. The greatest challenge for ASEAN is to mobilize the necessary financial and human resources for a sector that persistently fails to generate enough public awareness, political attention and the necessary support to securing the indispensable functions of forests for sustainable development. The new Clearing House Mechanism (CHM) as well as the fact sheets and policy briefs serve as

	the main tools for the communication strategy. Both "channels' complement each other in terms of timeliness and depth of communication. Considering the challenge, further tools such as press briefings are suggested to be employed. The importance of focal points is underscored. The main proposed ASEAN Forest policy activities of the Natural Resource Unit at the ASEAN Secretariat are described. Irrespective of which tool or mix to use, it is essential not to communicate the entire SFM-package, but only parts of it such as illegal logging and its impact on national economies or rural livelihoods. Such details are easier to market than the three dimensions of sustainable development and their permutations in forestry. The strategy at hand is not be construed as being final. Shaping a regional communication strategy for SFM is an open-ended process that requires dialogue among Member Countries and with all walks of society. Next steps are briefly described to this end.
Advantages	Discusses the role of the Natural resources management Unit as information broker within the overall context of SFM, the ASEAN Clearing House Mechanism is highlighted as one tool to achieve the communication goal. The development of a communication strategy can be seen as a process where the personnel involved in drafting the strategy intensively discuss their roles and the goals they want to achieve
Limitations and Challenges	It is more valuable as a process than a paper, thereby when new staff enters the unit a way have to be shown how the strategy can be revised to ensure socialisation and ownership
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000914
Resource person	Georg Buchholz: georg.buchholz@gtz.de

Mekong River Commission - IKM strategy	
Source	**INFORMATION AND KNOWLEDGE MANAGEMENT STRATEGY AND CONCEPT**
Author	MRC GTZ WSMP
Project	MRC GTZ Cooperation Programme Watershed Management Component (WSMP)
Year	2005
Abstract	This document contains a combined IKM Strategy and Concept within the context of sustainable watershed management in the Lower Mekong Basin. It is mainly targeted towards policy makers and leading institutional developers in the MRC member countries, but also towards researchers, representatives of the civil society and capacity builders. While the strategy lays out guiding principles for effective information and knowledge management, the concept provides a brief inventory of data and IKM activities in the MRC secretariat. Actions required to achieve the objectives are identified and their appropriateness is evaluated. The concept further outlines the risks and assumptions relevant for IKM in the regional context and suggests approaches for risk mitigation.
Advantages	Outlines generic aspects of IKM as well as the specific role of IKM and its associated risks and assumptions within the setup of a regional governmental Southeast Asian organization. Much of this may be relevant for other, especially regional, organizations as well.
Limitations and Challenges	Reflects the somewhat rigid environment of a public river basin organization, and may hence be of less immediate relevance for IKM in NGO or private sector environments.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000916
Resource person	Christoph Feldkoetter: christoph.feldkoetter@gtz.de or cfeldko@gmx.net

Source	**STRATEGY TO SUPPORT INFORMATION MANAGEMENT UNITS IN SECTOR ORGANIZATIONS**
Author	
Project	Sustainable Management of Resources in the Lower Mekong Basin Project (SMRP)
Year	2001
Abstract	This document describes SMRP's approach to establish and/or strenghten information management units in the four partner countries Cambodia, Thailand, Vietnam and Lao PDR. The aim is to generate and manage information related to collaborative forest management (CFM) for more effective decision-making. Information Management Units (IMU) can serve the following functions:

	• Produce and disseminate relevant information products and services (e.g. in-house newsletters, inventories, metadata lists, etc.) based on demand. • Increase access to relevant sector information from internal and external sources. • Strengthen internal capacity to manage and maintain systems for sectoral information and knowledge management and improve information flows. SMRP has developed clear principles for the selection process of suitable organizations as well as for the establishment of cooperation and implementation of activities of the IMUs.
Advantages	Discusses in detail the principles, particularities, and steps of an IKM setup, at the core of which are Information Management Units (IMUs) being established within government organizations, and in which the TC component is gradually being phased out, while the partner(s) gradually take full ownership of and responsibility for operating the IMU.
Limitations and Challenges	In practice, IMUs have rarely lasted much longer than their TC support. This may however be particular to the Lower Mekong Basin Countries, and the prospects for sustainability of the IMU concept may be better elsewhere,
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000918
Resource person	Michael Glueck: michael.glueck@gtz.de, Christoph Feldkoetter: christoph.feldkoetter@gtz.de or cfeldko@gmx.net

Source	**DIE ROLLE UND AKTIVITÄTEN VON INFORMATIONS MANAGEMENT IM PROJEKT „NACHHALTIGE BEWIRTSCHAFTUNG VON WASSEREINZUGSGEBIETEN IM UNTEREN MEKONG BECKEN (SMRP).**
Author	
Project	Sustainable Management of Resources in the Lower Mekong Basin Project (SMRP)
Year	2003
Abstract	This document (in German) describes the overall approach of the Sustainable Management of Resources in the Lower Mekong Basin Project (SMRP) with regard to IKM. The SMRP based its activities, which are briefly outlined, on two main strategies: a human resource/social oriented component and a communication technology component. SMRP is a good example of the implementation of the step wise, intergated apporach as described in chapter 1.3.
Advantages Limitations and Challenges	This paper is not so much a concept or methodological paper, but a summary paper describing project activities and results. As such it gives a good overview over SMRP's approach towards IKM and its implementation.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000920
Resource person	Michael Glueck: michael.glueck@gtz.de, Christoph Feldkoetter: christoph.feldkoetter@gtz.de or cfeldko@gmx.net

Development of adapted IKM systems

ASEAN Forest Clearing House Concept Paper	
Source	**ASEAN FOREST CLEARING HOUSE CONCEPT PAPER**
Author	Buchholz, G.
Project	ASEAN ReFOP
Year	2004
Abstract	
Advantages	
Limitations and Challenges	
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000921
Resource person	Georg Buchholz: georg.buchholz@gtz.de

Development of a Forest Fire Information System	
Source	**ASPECTS OF A FIRE INFORMATION SYSTEM FOR EAST KALIMANTAN, INDONESIA**
Author	Hoffmann A.; Schindler L.; Goldammer J.
Year	1999
Abstract	The FIS developed by the IFFM in East Kalimantan is a system that manages spatial fire-related data and information in an integrated manner integrating it to policy decision making. It is a computer supported system based on the principles of a Geographic Information System (GIS). This helps to acquire geographical and other data, to manipulate, transform, analyse and finally display them. Fire information components are fire monitoring and detection, determining fire danger criteria, data analysis and efficient information dissemination.
Advantages	An important innovation of the project is the concept of community based fire management (CBFiM), which is a promising model to establish sustainable structures for fire management by involving the local population.
Limitations and Challenges	The FIS can only be effective and successful if it is integrated into a strong implementation process which includes: fire prevention on the base of a participatory approach including all stakeholders, effective lwa enforcement, improvement of fire management skills at all levels of fire users and supervising authorities and consistent land use policy.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000923
Resource person	

Source	**DEVELOPMENT AND EXTENSION OF A FIRE DANGER RATING SYSTEM FOR THE PROVINCE EAST KALIMANTAN, INDONESIA**
Author	Weidemann D.
Year	2002
Abstract	This document deals with one aspect of the Forest Fire Information System, namely the Fire Danger Rating System (FDRS). The FDRS is an early warning system indicating the fire danger and drought situation for a variety of meteorological conditions. The system is based on the Keetch / Byram Dryness Index using the moisture deficieny levels in the upper soil.
Advantages	The system rates fire in a simple way, without highly sophistivated technical and financial requirements and it is easily adaptable to Kalimantan's natural conditions. The document gives a comparison of various Fire Danger Rating methods
Limitations and Challenges	The described system is an Early Warning system and not a Fire Prediction system (since most fires in Kalimantan are human induced).
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000927
Resource person	
Project	Integrated Forest Fire Management Project (IFFM)

MRC – Development of a regional IKM system	
Source	**MEKONGINFO – A REGIONAL APPROACH FOR INFORMATION MANAGEMENT**
Author	Glück, M.
Project	Sustainable Management of Resources in the Lower Mekong Basin Project (SMRP)
Year	2001
Abstract	MekongInfo is an interactive and dynamic Web-based system for sharing information and knowledge about participatory natural resources management (PNRM) in Cambodia, Laos, Thailand and Vietnam. It provides an electronic gateway to PNRM in the Lower Mekong Basin. This paper describes (a) the conceptual and technical characteristics of MekongInfo; (b) the target groups and their role in its development and (c) the attempt to apply state-of-the-art conceptual and strategic experiences based on organizational knowledge management, to a sectoral approach.
Advantages	Interested organizations are offered a platform to present their work and resulting documentation.

	These shared and joint efforts not only provide participating organizations with the possibility to present their findings and results to a wider audience but also act as multiplicators to stimulate the use of the system.
Limitations and Challenges	Challgenges to the system are mainly of an organizational, institutional as well as technical nature: The culture of freely sharing information or even knowledge which is a number one requirement for the functioning of such a platform is not well established yet in the region. Furthermore, technological constraints occur as it is only recently that modern communication technologies are implemented in the region.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000929
Resource person	http://www.MekongInfo.org, Michael Glueck: michael.glueck@gtz.de, Christoph Feldkoetter: christoph.feldkoetter@gtz.de or cfeldko@gmx.net

Development of a Forest Management Information System	
Source	**THE FORESTRY GEOGRAPHIC INFORMATION SYSTEM – A DECISION SUPPORT TOOL FOR SUSTAINABLE FOREST MANAGEMENT IN PENINSULAR MALAYSIA**
Author	Buchholz, G.; Wan Abd. Hamid Shukri bin Wan Abdul
Project	Sustainable Forest Management and Conservation Project, Peninsular Malaysia
Year	2003
Abstract	Forest Managers in Peninsular Malaysia require detailed spatial information to manage forest resources sustainably. This includes information on logging areas such as boundaries, topography, accessibility and the location of harvestable trees. Using data management systems like Geographical Information Systems (GIS) and Management Information Systems (MIS), the forester can easily capture, store and analyze spatial and non-spatial information. With the information gathered, the Forest Manager is in a position to plan, implement, monitor and evaluate all forest operations required for a multiple-use sustainable forest management. In the spirit of Vision 2020, the Forestry Department Peninsular Malaysia is in the process of developing high-tech solutions like GIS and MIS for the sustainable use of forest resources in Peninsular Malaysia. Various projects are being implemented to ensure the use of up-to-date technologies on the ground. One of these projects is the Forestry Geographic Information System, or "Sistem Maklumat Geographi Perhutanan" (SMGP). The objective of this GIS application is to enable the State Forestry Departments to systematically and rapidly produce operational maps such as license maps, forest inventory maps, timber harvesting maps and other maps relevant for forestry operations. Additional to the cartographic output, with the new linkage to the Compartment Register as the newly developed core model of the MIS spatial analysis for planning and monitoring is possible.
Advantages	
Limitations and Challenges	
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000931
Resource person	Wan Abd. Hamid Shukri bin Wan Abdul

Concept – Forest Genetic Resources Information System	
Source	**FOREST GENETIC RESOURCES INFORMATION SYSTEM (FORGRIS) - CONCEPT**
Author	Thai See Kiam; Abdul Rahman Abdul Jalil; Mansor M.; Schmalen W.
Project	Forest Planting Material Procurement Programme, Malaysia
Year	1999
Abstract	FORGRIS is an information system, which allows centralized and decentralized information management pertaining to forest seed and plant procurement among all relevant parties in Malaysia.
Advantages	The information system saves important and relevant data about the approved forest reproductive material (FRM) on different levels. This includes data about resource types, selected plus trees, monthly phenological monitoring as well as seed collection, seed storage and nursery management. An unchangeable Resource-ID, which assigned all data to a specific resource, allows a reflection from the planted reproductive material to the basic material. The recording of the regular monthly phenological monitoring improves the knowledge about development, cycle and frequency of

	ering and fruiting of the monitored tree species. The information about the basic material will be digitized and linked to the Forestry Department's *Forest Management Information System* (MIS) so that all FORGRIS-data are available in forest management.
Limitations/ Chall.	
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000933
Resource person	

Capacity-building

ASEAN Forest Clearing House Mechanism Toolkit	
Source	**ASEAN Forest Clearing House Mechanism Toolkit (collection of relevant documents for capacity-building in the operational use of the CHM)**
Author	Georg Buchholz
Project	ASEAN-German Regional Forest Programme
Year	2005
Abstract	Due to the vast geographical area ASEAN faces the following challenges: limited resources for training, difficulties in reaching the end user and high staff turn-over in the CHM member countries. Therefore, the remote e-learning approach was chosen. The tool kit consists of a mini-CD Rom were all documents including concept paper, fact sheets, as well as manuals are included. Furthermore an Flashplayer animation describes the use of the CHM in an e-learning module.
Advantages	A CD rom with the animated e-learning module ensures that the basic functioning are explained and operational use is possible also without face-to-face training. This is in many cases the only possibility to reach users when working on a regional level
Limitations and Challenges	No interaction with the potential user is possible, it follows the idea of self-learning.
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Georg Buchholz Georg.buchholz@gtz.de; asean-forest@aseansec.org

Technical notes on aspects of regional forest cover monitoring	
Source	**Forest Cover Monitoring Technical Notes** [(1) Interpretation, Mapping, Digitising, Database, Monitoring, (2) Interpretation and Delineation from Satellite Images, (3) GIS, Data Input, Standards, Projection, Transformation, Tiling, (4) Establishment of a Relational Database for Forest Inventory and Socio-economic Data, (5) Processing of 1996/97 and 1975/76 Satellite Images]
Author	Stibig, H-J. (1) to (4) and Feldkoetter, C. (5)
Project	Forest Cover Monitoring Project, Lower Mekong Basin (Cambodia, Laos, Thailand, Vietnam)
Year	1997/98
Abstract	This series of technical notes covers the various aspects of forest cover mapping and monitoring, such as raw data selection and procurement, data base structures, data standards, technical (interpretation and digitising) procedures, etc.
Advantages	A very comprehensive package of detailed yet simple and robust technical guidelines. Of "historical" interest, and possibly still usable when establishing mapping and monitoring activities in technologically challenged environments.
Limitations and Challenges	Technically representing the standard of the mid 1990s, thus far outdated when measured by todays standards.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000936 http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000937 http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000938 http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000939 http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000940
Resource person	Christoph Feldkoetter: christoph.feldkoetter@gtz.de or cfeldko@gmx.net

MRC – Guidelines Information Needs Assessment	
Source	**HOW TO PLAN AND CONDUCT AN INFORMATION MANAGEMENT SUPPORT ASSESSMENT**
Author	SMRP
Project	Sustainable Management of Resources in the Lower Mekong Basin Project (SMRP)
Year	2000
Abstract	This guide offers a framework for planning and implementing the process for an information management support assessment and acting upon the findings. It is a guide to a process rather than an output. The process should involve key people in the partner organizations/departments. Therefore implementation of the process also puts in place the means by which it is to be implemented.
Advantages	This assessment was designed to jointly identify concrete areas in which the project can provide information management support to its partners. At the same time, it was supposed to help to create a picture of internal and external organizational information patterns and flows, which are of use to the partners.
Limitations and Challenges	The assessment does not cover the respective organization's management information system (MIS) used for financial or administrative purposes.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000944
Resource person	Michael Glueck: michael.glueck@gtz.de, Christoph Feldkoetter: christoph.feldkoetter@gtz.de or cfeldko@gmx.net

User Manuals for a Forest Management Information System	
Source	**SMGP (FORESTRY GEOGRAPHIC INFORMATION SYSTEM) – USER MANUAL**
Author	Buchholz G.
Year	2003
Abstract	Using data management systems like Geographical Information Systems (GIS) and Management Information Systems (MIS), the forester can easily capture, store and analyze spatial and non-spatial information. With the information gathered, the Forest Manager is in a position to plan, implement, monitor and evaluate all forest operations required for a multiple-use sustainable forest management. In the spirit of Vision 2020, the Forestry Department Peninsular Malaysia is in the process of developing high-tech solutions like GIS and MIS for the sustainable use of forest resources in Peninsular Malaysia. One of these projects is the Forestry Geographic Information System, or "Sistem Maklumat Geographi Perhutanan" (SMGP). The objective of this GIS application is to enable the State Forestry Departments to systematically and rapidly produce operational maps such as license maps, forest inventory maps, timber harvesting maps and other maps relevant for forestry operations. Additional to the cartographic output, with the new linkage to the Compartment Register as the newly developed core model of the MIS spatial analysis for planning and monitoring is possible.
Advantages	
Limitations and Challenges	
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Georg Buchholz: georg.buchholz@gtz.de

Source	**COMPARTMENT REGISTER– USER MANUAL**
Author	Barth, Henry
Year	2003
Abstract	The objective of the Compartment Register (CR) ist to collect and store all information available at compartment level. The CR is designed as the core of the Peninsular Malaysia Forestry Department's MIS and is directly linked to the SMGP (Forestry Geographic Information System).
Advantages	The electronic storage of compartment realted data facilitates data linkages and analysis for the purpose of planning, monitoring and control of forest operations. The Compartment Record Book enables the printout of the information relevant for compartment level planning, monitoring and evaluation. It provides the manager on the spot information relevant to the specific compartment. As

	all management activites implemented are recorded, the CRB contains the whole management history. The knowledge of the stand history allows silvicultural decisions tailored to the conditions of the stand.
Limitations and Challenges	For this system to function diligent data entry and management is of utmost importance.
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Henry Barth
Source	**HOW TO…. SERIES**
Author	Buchholz G.
Year	2003
Abstract	The How to… Series describe step-by-step the procedure to produce the working results
Advantages	These small documents support the production of working maps necessary for the internal business processes. Through the step-by step approach the user is guided to generate fast working results
Limitations and Challenges	Only parts of the system is explained
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000953 http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000954
Resource person	Georg Buchholz: Georg.buchholz@gtz.de
Project	Sustainable Forest Management and Conservation Project

User Manual – Forest Genetic Resources Information System	
Source	**FOREST GENETIC RESOURCES INFORMATION SYSTEM (FORGRIS) – TECHNICAL DOCUMENTATION**
Author	Krebs F. & Barth H.
Project	Forest Planting Material Procurement Programme, Malaysia
Year	2002
Abstract	FORGRIS is an information system, which allows centralized and decentralized information management pertaining to forest seed and plant procurement among all relevant parties in Malaysia.
Advantages	The information system saves important and relevant data about the approved forest reproductive material (FRM) on different levels. This includes data about resource types, selected plus trees, monthly phenological monitoring as well as seed collection, seed storage and nursery management. An unchangeable Resource-ID, which assigned all data to a specific resource, allows a reflection from the planted reproductive material to the basic material. The recording of the regular monthly phenological monitoring improves the knowledge about development, cycle and frequency of flowering and fruiting of the monitored tree species. The information about the basic material will be digitized and linked to the Forestry Department's *Forest Management Information System* (MIS) so that all FORGRIS-data are available in forest management.
Limitations and Challenges	
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Henry Barth

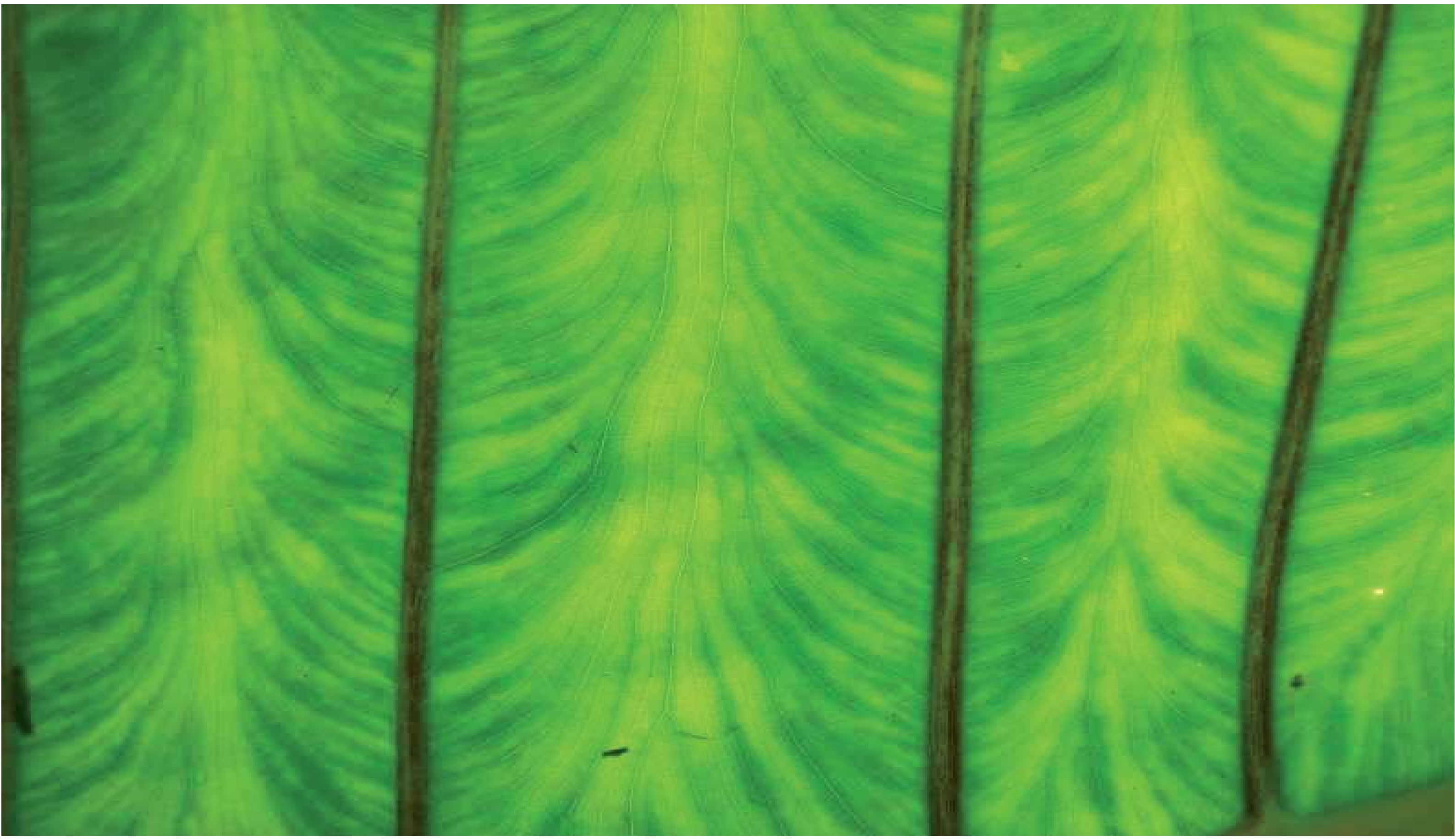
Organizational set-up	
Source	**REPORT ON CONSULTING MISSION ON GIS IMPLEMENTATION (2 REPORTS)**
Author	Schweter, M.
Project	Community Forestry Project Quirino, Philippines
Year	2002 /2003
Abstract	The reports highlight the latest developments and achievements of the CFPQ Geographic Informa-

	tion System (GIS) unit but also some of the still prevailing difficulties, that may affect the future of the GIS Service Center. The evaluation of the current situation in terms of personnel and equipment, cost and revenues, satellite image analysis, municipal GIS and land use planning from the PO and Barangay to the Municipal and Provincial level is followed by consideration on the future role of the GIS Service Center and its continuous integration into Local Government Units (LGUs) and Department of Environment and Natural Resources (DENR) structures. An annual work plan for the future GIS Service Center has been drafted and basic job descriptions for the personnel have been set up. The work plan will help the GIS personnel to schedule permanent and recurrent GIS work and to assess the necessary budget. General recommendations are presented that address some of the potential future difficulties. The report is accompanied by the final version of a power-point presentation on the concepts, methods and achievements of the CFPQ GIS implementation.
Advantages	The major success of the CFPQ GIS implementation is the comparatively rapid creation of a functioning GIS unit, starting virtually from scratch. There was no experience or competence in GIS available in Quirino when the CFPQ started the selection of personnel in 2000. Offering substantial training input and providing the necessary equipment created the basis for the successful development of the unit.
Limitations and Challenges	As the external contirbutions in terms of funding and in particular in terms of organizational (management) input from the project are no longer available, a strong and continuous commitment on part of the local and national government is indispensable.
Download	http://forest-chm.aseansec.org/refop/php/doc/doc_detail.php?id=DOC-000958
Resource person	

Process and usage monitoring

Process analysis of the CHM development	
Source	**ASEAN GUIDELINES FOR THE ESTABLISHMENT OF A FOREST CLEARING HOUSE MECHANISM**
Author	Georg Buchholz, ASEAN development group IKM
Project	ASEAN-German Regional Forest Programm / Networking and Knowledge Management of Regional Organizations NeRO
Year	2005
Abstract	This guide is geared towards non-technical staff that is responsible or involved in setting up a Clearing House Mechanism (CHM). The guide explains what a Clearing House Mechanism is, how it is planned, developed and gives suggestions how to maintain it, once it is online. The content is based on lessons learned and best practices of existing CHM. It is a product of the project "Networking and Knowledge Management of Regional Organizations working in Natural resources management (NeRO)" a joint initiative between the German Agency of Technical Cooperation (GTZ), Bellanet, ICIMOD, Mekong River Commission and ASEAN. Under this umbrella the ASEAN-German Regional Forest Programme (ReFOP) documented the result of a learning exercise and process analysis while establishing the ASEAN Forest CHM. Thereby the leading example presented in this guide is the development of the ASEAN Forest CHM. The steps taken in establishing this CHM are explained and compared with other initiatives. The guide embodies the experiences of the practitioners involved in this process. This guide is a practical tool that wants to support the assigned project manager in setting up a Clearing House Mechanism. The way to a CHM is explained step-by-step and practical examples from various CHM initiatives are given for illustration. Checklists for planning up to managing CHMs are provided in the Annexes, to help work in a structured way.
Advantages	Analyzing and documenting the steps taken in the development of the CHM resulted in a joint learning experience. Reflecting the process and identifying the lessons learnt was considered a very valuable experience for the participants involved in the process.
Limitations and Challenges	Documenting such a process takes a lot of resources and time and is only feasible if the results can be used internally for replication of the process
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	Georg Buchholz: georg.buchholz@gtz.de

Monitoring of MekongInfo Usage	
Source	**MEKONGINFO – REGIONAL INFORMATION SYSTEM FOR PARTICIPATORY NATURAL RESOURCES MANAGEMENT IN THE LOWER MEKONG BASIN. STATUS QUO AND OPTIONS FOR INTEGRATION INTO MRC INFORMATION MANAGEMENT STRATEGIES**
Author	WSMP
Project	MRC GTZ Cooperation Programme Watershed Management Component (WSMP)
Year	2003
Abstract	This document describes in detail the process of MekongInfo (MI) development as well as its elements and functions. It further gives an analysis of MI usage: trends of utilization and contributions to the system. Finally, it provides the rational for the integration of MI into MRC.
Advantages	MekongInfo provides an example for a tested, fully operational, and comprehensively monitored Internet Based Information System. It has more than 8,500 (status March 2005) registered users interested in natural resources management issues in the Lower Mekong Basin. User demand on the system is high.
Limitations and Challenges	MekongInfo somewhat less successful as a recipient of information – there would by significantly fewer documents being posted without active „information hunting“ by the system operators. The system is also only moderately successful as a means for dialogue and discussion. It is still questionable whether MekongInfo would function sustainably without TC subsidies, fully and independently managed by the partner organization.
Download	Soon to be obtained via CHM; or contact asean-forest@aseansec.org
Resource person	http://www.MekongInfo.org, Michael Glueck: michael.glueck@gtz.de, Christoph Feldkoetter: christoph.feldkoetter@gtz.de or cfeldko@gmx.net



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