

Capacity Building of the State Environmental
Conservation Department Project, Sabah,
Malaysia

EIA for logging and forest
conversion activities

Background Paper

April 2000

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Abbreviations

ECD	Environmental Conservation Department (State of Sabah)
ECD-CAB	Capacity Building of the Environmental Conservation Department Project
EIA	Environmental Impact Assessment
GIS	Geographical Information System
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
LRDMOD	Land Resources Division, Ministry of Overseas Development (United Kingdom)
MYR	Malaysian Ringgit
SAFODA	Sabah Forestry Development Authority
SCS	Sabah Conservation Strategy
SFI	Sabah Forest Industries
SPOT	Systeme Pour l'Observation de la Terre
SSSB	Sabah Softwoods Sendirian Berhad
TOL	Temporary Occupation License
TOR	Terms of Reference

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1 Introduction

In Sabah it is a mandatory requirement for all forestry and related agricultural activities that fall under the *Conservation of Environment (Prescribed Activities) Order 1999*, to produce an Environmental Impact Assessment (EIA). The purpose of this paper is to briefly introduce the EIA procedure in Sabah and define the main forest altering activities and associated environmental impacts of concern.

Given the complex nature of forest and land ownership in Sabah and the range of forest altering activities that may occur, proposed specific Terms of Reference (TOR) for EIA procedures are provided for the two main types of activity:

- (i) **Annex 2** – proposed TOR for Forestry projects on Premanent Forest Estate, Forest Management Units and State Forest intended to remain commercially productive
- (ii) **Annex 3** - proposed TOR for forest conversion projects.

Annex 1 provides the list of contents for the scoping note. The TOR will be based on the results of the scoping activities as documented in the scoping note.

1.1 Legal requirements

1.1.1 Conservation of Environment Enactment (1996)

In 1996 the State assembly passed the Conservation of Environment Enactment (1996). The Enactment outlines the matters of concern for the Director of the newly formed Environmental Conservation Department. Within the Enactment the following points have direct relevance for forestry and related activities:

Part II, Section 3, (2), Conservation and Improvement of Natural Resources, the Director of ECD, if he considers, may order in writing the owner or occupier to undertake or adopt such measures as he may deem necessary for the conservation of natural resources or the protection and enhancement of the environment in such conservation area or other land. Such an order may relate to -

- (a) the use to which the conservation area or land may be put and the manner thereof;

(b) the prohibition, restriction or control of the firing, clearing or destruction of vegetation, or the breaking up or clearing of conservation area or land for any purpose;

(c) the prohibition, restriction or control of cultivation of any part of the conservation area or land;

(d) the method of the cultivation of the conservation area or land;

(f) the preservation and protection of the source, course and banks of streams

Under Section 5, (1), The Director may, subject to such rules as may be made under section 22, by order published in the Gazette, require any person undertaking the following activities:

(a) development of agricultural estates or plantation or an area exceeding the dimension specified in the said order;

(b) clearing of forest areas for the establishment of agricultural estates or plantation;

(c) carrying out of logging operations on State land, alienated land or Forest Reserve under the provisions of the Forest Enactment 1968 of an area exceeding the dimensions in the said order.

to submit to the Director a report from such expert or authority and in such form as may be approved by the Director, on the impact of such activities on the natural resources and environment and any other particulars or information as may be required by the Director.

1.1.2 Conservation of Environment (Prescribed Activities) Order 1999

In 1999 an amended order of Prescribed Activities was gazetted. The Order provides ample legal power for the Director of the Environmental Conservation Department to intervene and request a report from a broad range of activities that may threaten the environmental quality in Sabah.

Forest harvesting or logging activities may be subject to an EIA under the Conservation of Environment (Prescribed Activities) Order 1999. The activities listed under the First Schedule are:

1. Agricultural development:

(i) Development of agricultural estates or plantations covering as area of 500 hectares or more-

(a) from land under secondary or primary forests;

(b) which would involve the resettlement of 100 families or more; or

(c) which would involve modification in the use of land;

(ii) Conversion of mangrove swamps and other wetland areas into agricultural estates having an area of 50 hectares or more; or

(iii) Development of agricultural area adjacent to any conservation area, park or sanctuary declared under any written law.

2. Forestry:

(i) Extraction or felling of timber covering an area of 500 hectares or more-

(ii) Extraction or felling of timber within or adjacent to any water catchment area whether it has or has not been declared under any written law; or

(iii) Development of forest plantation having an area of 500 hectares or more

1.2 Administrative requirements

The administrative requirements for implementing an EIA in Sabah are described in detail in the Handbook for EIA (Environmental Conservation Department, 2000). The main steps in the procedure are outlined in Table 1. The project proponent is responsible for steps 1, 2 and 7, while the EIA consultant is responsible for steps 3-6.

Table 1. The seven EIA steps

Steps	The public	The project proponent and EIA consultant	The ECD
Step 1		Project screening	Consultation
Step 2		Selection of consultants	Consultation
Step 3	Hearing	Preparation of TOR	Approval
Step 4		Conduction of the EIA study	Consultation
Step 5		Preparation of the EIA report	Consultation
Step 6	Hearing	Review of the EIA report	Review
Step 7		Agreement of Environmental Conditions	Approval & audit

1.2.1 Scoping activities (Step 3)

An early screening (scoping) exercise is undertaken once the relevant authorities approve the TOL or Logging License. The EIA consultant is required to consult with the Environmental Conservation Department (ECD) to determine the scope of work for the particular EIA study. Consultation with other related agencies may also be required if the particular project involves other environmental requirements or issues, particularly if the land is intended for conversion to an alternative use, i.e. State land to alienated land. In general, the scale of

concern, status of the issue and geographical area of influence is used to define the scope of a particular study.

Scoping activities undertaken by the EIA consultant determine the scope and focus of the EIA study and the level of assessment necessary. The scoping exercise will identify and highlight the environmental issues of greatest concern, upon which the project and mitigation measures should focus. However, scoping also identifies issues of little or no importance that can thereafter be effectively ignored in the EIA.

The first output of the scoping exercise is the scoping note. See Annex 1 for List of Contents for the scoping note. The second output of the scoping exercise is the Terms of Reference (TOR) for the EIA. See Annex 2 and 3.

While scoping a project for the key environmental concerns, the EIA consultant should bear in mind that the distinct stages of activity may have very different impacts. In particular it should be noted that an EIA required for the conversion of forested land to plantation (both agricultural and industrial tree plantations), should also include the operational i.e. harvesting and replanting phase. The major phases of activity and areas of concern are presented in Tables 3 & 4.

1.2.2 Preparation of TOR

Following the identification of the top environmental issues, a scoping note will be prepared and reviewed of the Department. Based on this review a draft Terms of Reference for the EIA study is formulated by the EIA consultant. The draft TOR will be reviewed by the ECD before final approval.

The TOR should clearly define the scope of work for the project proponent and EIA consultant. The study should investigate in detail the environmental issues, possible mitigation measures and subsequent monitoring programme that will ensure that measures have been put in place and are working. Environmental impacts are generally project and site specific but for forestry projects in Sabah, several of the key environmental issues are common to all projects.

2 Forest altering activities in Sabah

The majority of commercial forestry operations in Sabah may be grouped depending upon forest classification, type of activity and associated environmental impact (Table 2).

Table 2. General forest classification and associated environmental impact of forest altering activities in Sabah

Type of Forest Alteration	Land Classification	Overall Environmental Impact
Selective harvesting of natural forests	Permanent forest estate and Forest Management Units	Low - moderate
Selective harvesting of natural forests	State land	Moderate to severe
Conversion of natural forest cover to plantation forest	Permanent forest estate (currently SAFODA, SFI and SSSB) To include FMUs in the future	Severe
Conversion of natural forest cover to plantation agriculture	State land to alienated Land	Severe to very severe
Conversion of natural forest cover to small scale agriculture	State land to alienated land	Moderate to very severe

Two main classifications in relation to EIA can be made: Forestry projects intended to remain commercially productive (selective harvesting of timber) and forestry projects involving the removal of the original forest cover (land intended for alienation or forest conversion).

2.1 Forestry projects on Permanent Forest Estate, Forest Management Units and State Forests intended to remain commercially productive

Permanent Forest Estate

Permanent Forest Land or Estate may be defined as land permanently reserved by Government for commercial and non-commercial forest services for the continued and overall benefit of the State. It is the intention that such forests *remain* under forest cover.

Logging operations, unless well managed, have a major environmental impact, which in turn affects the long-term sustainability of the timber operations. Therefore factors impacting the environment e.g. soil erosion, impact the regenerative capacity of the forest stand e.g. loss of productive forest area, providing an intimate link between good forest management and good environmental management. If the State is to maintain the capacity to generate revenue from commercial timber operations and maintain the environmental quality in Sabah, practical and wise environmental management procedures must be implemented. In general, the key environmental issues are known, as are the mitigating methods. Research in Sabah has shown that Reduced Impact Logging techniques mitigate most of the environmental impacts as well as minimizing damage to the residual forest stand.

State Land

Forests on State land have been subject to environmental degradation. Reasons for the degradation range from (i) frequency of re-logging, (ii) logging practice leading to environmental degradation, (iii) over-harvesting, and (iv) illegal logging. These activities compound the impacts on both the regenerative capacities of the forest and the environment.

The key factors controlling better environmental management of State forests lie at a policy level and relate to the intended long-term future of these forests. If it is intended for State forests to remain in production or to provide other forest amenity functions, they should be subject to the same environmental guidelines as forests within Forest Management Units and the Permanent Forest Estate. Alternatively it would make sense to incorporate such forests into the Permanent Forest Estate. If there is no intention to retain the forest status or if further useful production is unlikely, then such forests should be assigned for conversion. Thereafter, alienation and conversion activities will be subject to the EIA controls for forest conversion and/or the subsequent development activity.

Environmental impact

Activities that commonly lead to adverse environmental impacts and the phases of project activity are listed in Table 3.

Table 3. List of activities involved in the selective harvesting of timber on Permanent Forest Estates, Forest Management Units and State Forests intended to remain commercially productive.

Phase	Activity and impacts to be considered
Inventory and Site Investigation	<ul style="list-style-type: none"> • New/upgrade access road to concession • Establish base/survey camps • Cutting of rentis/survey lines
Road Construction	<ul style="list-style-type: none"> • Planing road haulage and logistical system • Insertion and construction of forest roads i.e. slope cutting, contouring, stream crossing, cross drains, cut and fill, waste disposal • Camp activities e.g. illegal hunting
Forestry Operations	<ul style="list-style-type: none"> • Implement felling plan • Insert skid trail network (activities as for road) • Clear and utilization of log landing • Disposal of cutting waste • Log transport/hauling • Use of chemical/fuel and other waste disposal activities • Camp activities e. g. hunting
Abandonment & Post Felling Activities	<ul style="list-style-type: none"> • Post-felling inventory • Demolition of camps • Removal of all machinery, vehicles and waste • Forest rehabilitation • Post closure environmental monitoring and audit • Invasion and illegal occupation of secondary forest

Example TOR

An example TOR for an EIA, for the selective harvesting of timber from Permanent Forest Estate, Forest Management Units or State Forest intended to remain commercially productive, is provided in Annex 2.

2.2 Forestry Projects on Permanent Forest Estate, Forest Management Units and State Forests intended for land alienation and forest clearance

As part of land alienation process, land is converted from a primary or remnant natural forest cover to an alternative land-use. To a large extent, the intended land-use determines the severity of the environmental impact. Typically, secondary forest is cleared and the land prepared for either small or large-scale agriculture or tree plantations. The additional activities that continue beyond the extraction of commercial timber include the clearance and removal of the remaining vegetative cover. Although illegal, the final stages of vegetation removal may involve burning. Again depending upon the intended use, the soil is often further prepared by scraping and terracing. It is during this process, that adverse impacts to the environment occur, many of which may persist for years. Better environmental management and planning during the conversion process can significantly mitigate some of the adverse environmental impacts.

Environmental impact Activities that commonly result in adverse environmental impacts and the phases of project activity are listed in Table 4. Although the additional stages are few, it is during these that the greatest impacts to the environment take place.

Table 4. The activities associated with land alienation or forest conversion.

Phase	Activity and impacts to be considered
Pre-conversion	<ul style="list-style-type: none"> • Felling and removal of remaining commercial trees
Conversion	<ul style="list-style-type: none"> • Clearance of remaining vegetation • Bulldozing and piling of vegetation • Burning of waste material
Post-clearance	<ul style="list-style-type: none"> • Construction and insertion of new road network • Preparation of land for planting • Planting • Application of pesticides and fertilizer • Cropping/harvesting • Disposal of old crop trees • Replanting at end of crop cycle

Example TOR

An example TOR for a forest conversion EIA is provided in Annex 3. The planting of Industrial Tree Plantations within Forest Management Units must be considered as a conversion process and is subject to the same TOR.

3 Annex 1: The scoping note

The following scoping note shall be forwarded to ECD in order to prepare the TOR for the EIA study.

Introduction

- Project initiator: Name, contact information
- EIA consultant: Identification of consultant to undertake the study , including detailed Curriculum Vitae for each team member (standard ECD CV to be used).

Background information

- The project: Nature and extent of the project
- Listing all main project activities
- The project site: Description of the project site, including maps (location including longitude and latitude or UTM co-ordinates, habitat, water catchment, nearest protected area, etc.)
- The project status: Approvals, comments, etc. from official authorities received/applied for.

TOR preparations/scoping activities

- Activities: What activities (e.g. site visits, interviews, stakeholders, other departments and authorities) have been undertaking in order to prepare this draft TOR
- Data: What data has been collected in order to prepare this draft TOR.

Results of the scoping activities

- Presentation of the EIA long list matrix (see ECD EIA Handbook), including listing and scoring of all main environmental issues that will be affected by the project

- Appraisal of potential impacts from each project activity or resource use.

Proposed scope of work for the EIA study

- Proposed key environmental issues to be studied (priority list), including description of issues and arguments for priority setting
- List of possible key mitigation measures to be studied
- List of possible key monitoring programmes to be studied
- Proposed schedule and methods for impact, mitigation measures and monitoring programmes, including data to be collected and how (primary and/or secondary data collection).
- Proposed list of authorities to be consulted in the EIA study

Work schedule with tentative and final completion dates

An overview of expected work schedule and timing of the EIA study.

4 Annex 2: Example TOR for forestry projects intended to remain commercially productive

The following instruction to EIA consultants covers the preparation of Terms of Reference for proposed forestry projects on Permanent Forest Estate, Forest Management Units and State Forests intended to remain commercially productive.

It is intended that the EIA Terms of Reference form a subdocument and should not normally exceed 20 sides of printed text. The TOR must include the following sections:

Background information

A short general description of the project including the objectives and major components planned.

The section should include the following sentence: *The (name of project) is a Prescribed Activity (state number of prescribed activity) under the Conservation of Environment (Prescribed Activities) Order 1999. In compliance with the above requirements, a report on the impacts of the proposed project on the environment is to be prepared for the approval of the Environmental Conservation Department. The (name of project) EIA study and report shall be undertaken in accordance to the guidelines issued by the ECD.*

The section should furthermore provide information on:

- The project proponent including contact person, contact details and license number
- Details and reference to similar or related projects undertaken by the proponent
- Information on the EIA consultant including ongoing work that may be of relevance
- Provide information on the study team staff including Curriculum Vitae for all key personnel (standard ECD CV format to be used).

Specific

For proposed **forestry projects on Permanent Forest Estate, Forest Management Units and State Forests intended to remain commercially productive** the following information is required:

- The type of project/activity
- The components of the project and the major activities
- The Forest Management Unit number, reference to Forest Management Unit Plan (if already submitted) and details of license agreements and plan
- Size and schedule of area to be felled, existing status of forest i.e. primary or logged over. If logged over, provide information on previous forest management, concession history, *brief* summary of volumes of timber extracted and details of silvicultural treatment, if any. If the forest has been logged over, the summary should clearly describe the condition of the forest to be harvested.

For a proposed forestry project on Permanent Forest Estate, Forest Management Units and State Forests intended to remain commercially productive, the following staff are required:

- Remote sensing specialist: Map and interpret remotely sensed image of the project area
- GIS/mapping specialist: Procure/produce topographic map of the project area at a scale of 1:12,500 or larger. Classification of land by slope
- Civil engineer/hydrologist: Planning and design of logging roads, skid trails, bridges, culverts and drains. Design erosion control measures
- Wildlife ecologist/protected area management specialist: Classification and zoning of habit within project area with some reference to surrounding land. Classification and zoning of habitat within project area, paying special attention to the surrounding land. Recommendation for the incorporation of buffer zones within and around the margins of the project area
- A sociologist may be needed in order to liaise with and determine the needs and concerns of local communities that utilise the forest.

Scope of work for the EIA study

This section should include the following:

Prediction and evaluation of environmental impacts

General

Based on the initial scoping, this section outlines and describes what has been assessed and predicted to be the most important adverse environmental impacts, focussing on the key impacts i.e. "the priority list " which normally only includes a limited number. The methods intended to investigate and evaluate each of the impacts should be identified and the procedures outlined.

Specific

For proposed **forestry projects on Permanent Forest Estate, Forest Management Units and State Forests intended to remain commercially productive**, the following major impacts should be considered:

ACTIVITY	POTENTIAL IMPACTS
1. Construction and insertion of logging roads into previously undisturbed forest	<ul style="list-style-type: none"> • Soil erosion and subsequent sediment pollution in river systems • Intrusion of poachers
2. Construction and insertion of skidding trails for log extraction	<ul style="list-style-type: none"> • Soil erosion and subsequent sediment pollution in river systems • Intrusion of poachers
3. Forestry Operations 4. Log extraction	<ul style="list-style-type: none"> • Soil erosion and subsequent sediment pollution in river systems • Loss of cover/food supply for most species • Loss of species due to environmental stress • Large mammals forced to seek refuge in adjacent forest and agricultural areas • Intrusion of poachers • Haulage road passing through and nearby populated areas • Intrusion of poachers
5. Recovery/regeneration period	<ul style="list-style-type: none"> • Intrusion of poachers • Illegal settlement within concession area

Recommended mitigation measures

This section should identify the intended mitigation measures and include the following statement: *'The consultant will explore the full range of possible mitigation measures for each of the adverse environmental impacts and the findings will be included in the EIA recommendations.'*

Specific

For proposed **forestry projects on Permanent Forest Estate, Forest Management Units and State Forests intended to remain commercially productive** a major step towards across the board mitigation is the implementation of Reduced Impact Logging Techniques as recommended by the Forest Department. However, the following mitigation measures must also be investigated in detail:

- Detailed topographic map indicating the full range of riparian reserves for all permanent watercourses
- Detailed haulage road plan and intended skid trail network
- Details of all erosion control techniques.

Recommended monitoring programme

This section should identify and outline a recommended monitoring programme and should include the following statement: *'The consultant will explore the full*

range of possible programmes for monitoring compliance to recommended mitigation measures and for monitoring residual impacts on the environment.'

Specific

For proposed forestry **projects on Permanent Forest Estate, Forest Management Units and State Forests intended to remain commercially productive**, the following monitoring technique has to be included:

- The ECD require that at two-year intervals during felling operations, a remotely sensed image (preferably a multispectral SPOT scene) be purchased, georeferenced and classified. One image should be purchased and processed before operational activities begin. A copy of each image should be submitted to the ECD along with a map abstracted from the image showing all disturbance scars.

Work schedule and final completion dates

General

This section should outline the planned work schedule (project implementation plan) for the EIA study. An estimated completion date should also be stated.

Additional information

General

Additional information on the proposed study should be listed here.

5 Annex 3: Example TOR for forest conversion projects

The following instructions to EIA consultants covers the preparation of Terms of Reference for forest clearance and proposed forestry conversion projects on State Forest Land, Permanent Forest Estate and Forest Management Units (conversion to industrial tree plantation).

It is intended that the EIA Terms of Reference form a subdocument, should not normally exceed 20 sides of printed text, and include the following sections:

Background information

A short description of the project incl. objectives & major components planned.

The section should include the following sentence: *The (name of project) is a Prescribed Activity (state number of prescribed activity) under the Conservation of Environment (Prescribed Activities) Order 1999. In compliance with the above requirements, a report on the impacts of the proposed project on the environment is to be prepared for the approval of the Environmental Conservation Department. The (name of project) EIA study and report shall be undertaken in accordance to the guidelines issued by the ECD.*

The section should furthermore provide information on:

- The project proponent incl. contact person & details and license number
- Details & reference to similar/related projects undertaken by the proponent
- Information on the EIA consultant
- Provide information on the study team including Curriculum Vitae for all key personnel (standard ECD CV format to be used).

Specific

For proposed **forest conversion projects** this specifically includes:

- The type of project/activity
- The components of the project and the major activities
- For industrial tree plantations within Forest Management Units, state the Forest Management Unit number, reference to Forest Management Unit Plan (if already submitted) and details of license agreements and plan
- Size and schedule of area to be converted, existing status of forest i.e. primary or logged over. If logged over, provide information on previous for-

est management, concession history, *brief* summary of volumes of timber extracted and details of silvicultural treatment, if any. If the forest has been logged over, the summary should clearly state the condition of the forest to be converted but should exclude detailed information on annual cuts.

For a proposed **forest conversion projects** the following staff are required:

- Remote sensing specialist: Map and interpret remotely sensed image of the project area
- GIS/mapping specialist: Procure/produce topographic map of the project area at a scale of 1:12,500 or larger. Classification of land by slope
- Civil Engineer/hydrologist/agriculturist: Planning and design of all roads and planned earthworks including planting and replanting procedure. Design erosion control measures including bridges, culverts and drains.
- Wildlife ecologist/protected area management specialist: Classification and zoning of habitat within project area paying special attention to the surrounding land. Recommendation for the incorporation of buffer zones around the margins of the project area.

Scope of work for the EIA study

This section should include the following:

Prediction and evaluation of environmental impacts

Based on the initial scoping, this section outlines and describes what has been assessed and predicted to be the most important adverse environmental impacts, focussing on the key impacts i.e. "the priority list " which normally only includes a limited number. The methods intended to investigate and evaluate each of the impacts should be identified and the procedures outlined.

Specific

For proposed **forest conversion projects** the following major impacts should be considered and included:

ACTIVITY	IMPACT
Construction & insertion of roads into the conversion area	<ul style="list-style-type: none"> • Soil erosion and subsequent sediment pollution in river systems • impact on wildlife and subsequent effect on surrounding area • national and international significance of species loss/extinction
Removal of remnant vegetation	<ul style="list-style-type: none"> • Soil erosion and subsequent sediment pollution in river systems • Fire hazard associated with wood debris
Preparation of land for planting	<ul style="list-style-type: none"> • Soil erosion and subsequent sediment pollution in river systems
Operational period	<ul style="list-style-type: none"> • Invasion of exotic species into nearby habitat • Use of pesticides and fertilisers • Soil erosion and subsequent sediment pollution in river systems

Harvesting and replanting	<ul style="list-style-type: none"> • Product processing effluent and debris • Soil erosion and subsequent sediment pollution in river systems
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Recommended mitigation measures

This section should identify the intended mitigation measures and include the following statement: *'The consultant will explore the full range of possible mitigation measures for each of the adverse environmental impacts and the findings will be included in the EIA recommendations.'*

Specific

For proposed **forest conversion projects** the following mitigation measures must be investigated in detail:

- Detailed topographic map, slope map and drainage map indicating the full range of riparian reserves for all permanent watercourses
- Identification of steep lands to be left under natural forest cover
- Detailed haulage road plan
- Details of fire hazard control
- Detail of buffer zones and exotic species control
- Details of all erosion control techniques for *all* phases of project activity.

Recommended monitoring programmes

This section should identify and outline a recommended monitoring programme and should include the following statement: *'The consultant will explore the full range of possible programmes for monitoring compliance of mitigation measures and for monitoring residual impacts on the environment, depending of the findings of the study.'*

Specific

For proposed **forest conversion projects**, the following monitoring technique has to be included:

- The ECD require that a remotely sensed image (preferably a multispectral SPOT scene) be purchased and classified. One image should be purchased and processed before operational activities begin. Subsequent images should be purchased at two-year periods during planting or any subsequent replanting - or after the final planting phase. Copies of the images should be submitted to the ECD with accompanying interpretations.

Work schedule and final completion dates

This section should outline the planned work schedule (project implementation plan) for the EIA study and provide an estimated completion date.

Additional information

Additional information on the proposed study should be listed here.

6 Annex 4: Note on forestry operations and land conversion in Sabah

The link between sustaining the yield of timber and good environmental management is such that if careful stewardship of forested land can be achieved, many of the related environmental problems can be solved. To understand the complex set of issues controlling forest cover alteration and land use change in Sabah, the history of land development and the subsequent classification of forested lands needs to be understood. A variety of forest alteration activities can take place and each activity will have specific environmental impacts. Who cuts and for what reason also needs to be understood, for it is often the shortcomings associated with the award of logging licenses that leads to adverse environmental impacts. Some generalizations may be made as to the environmental impact of each type of activity (Table 1). The process is often sequential with selective cutting being the first step.

Table 1. Types of forest alteration and classification of commercial forests in Sabah

Type of Forest Alteration	Land Classification	Overall Environmental Impact
Selective harvesting of natural forests	Permanent forest estate and Forest Management Units	Low - moderate
Selective harvesting of natural forests	State land	Moderate to severe
Conversion of natural forest cover to plantation forest	Permanent forest estate (currently SAFODA, SFI and SSSB) To include FMUs in the future	Severe
Conversion of natural forest cover to plantation agriculture	State land to alienated Land	Severe to very severe
Conversion of natural forest cover to small scale agriculture	State land to alienated land	Moderate to very severe

In Sabah forests are the property of the State on all categories of land except land that has been alienated. The Federal Government may introduce legislation for the purpose of achieving uniformity, however, such legislation has no legal standing unless adopted by State legislature and gazetted.

Since pre-independence times, natural forests in Sabah have been the greatest source of revenue for the State Government and have provided an important source of wealth to fuel development in general. From the mid 1970's onwards, Sabah has come to rely on harvesting of natural forests to supply revenue in the region of MYR 717.5 million per annum and in the absence of alternative sources of revenue, it has become difficult to rapidly reduce harvesting levels (percentage of state income). Timber harvesting levels began to exceed the likely maximum long-term annual sustainable yield during the 1960's. A policy of gradual reduction in annual harvest was recommended in 1980 but was not achieved. In primary dipterocarp forest, the greatest volume of timber is derived from the first cut. In Sabah, annual recorded production averaged 10,000,000 m³ during the two decades 1971-90. During this period the commercial productive forest reserves were decreased by 90%. This provides a dilemma for the State, as it is clear that the primary resource is now on the verge of exhaustion, as is the traditional source of revenue.

Today, large areas of Sabah has been alienated and is now privately owned, the majority of which is dedicated to oil palm agriculture. Eastern Sabah currently forms the hub of the oil palm industry in the state and by 1995 an estimated 785,000 hectares of oil palm were planted, generating an income for the private sector of MYR 2.3 billion for that year. Forest converted for this use is likely to increase significantly in the near future.

6.1 Forest Allocation and Classification

The decision as to which category of Forest Reserve may be used for timber production lies with State Governments, throughout Malaysia.

6.1.1 Permanent Forest Estate

In an effort to sustain sufficient forest for timber production, traditional community use and environmental services, the concept of Permanent Forest Estate was developed and implemented in Sabah. 'Permanent Forest Estate or Reserve' is defined as land reserved by Government for forestry and forest conservation purposes, and includes Forest Reserves, Parks and other land allocated by Government specifically for permanent timber production and in some cases for Industrial Plantation Forests (currently SAFODA, SFI and SSSB). 'Permanent Forest Reserve' is used in Sabah to refer to the existing array of Forest Reserves legislated under the Forests (Amendment) Enactment 1984 and it is the intention that they will remain permanently as Forest Reserves.

By 1984, approximately half of Sabah's land area was established as Permanent Forest Estate - which can be divided into two categories, Production Forests

and Protection Forests. Protection Forests are preserved undisturbed while Production Forests are primarily utilized for timber production. Timber harvesting does not involve the clear felling of forests and therefore does not significantly contribute to forest loss, nor if well managed, does it lead to severe environmental degradation.

At about one half of the State's total land area, the present array of Permanent Forest Land in Sabah is large in comparison to that of many other Malaysian States, and very large in a world context. However, no more than 30 per cent of Sabah, including some remote areas, and some of the existing Permanent Forest Land, has been classified as being suitable for permanent agriculture, and only 7.6 per cent of the State is regarded as ideally suited to agriculture (LRDMOD, 1976). It has been estimated that in practice, given the constraints of climate, and terrain, it is unlikely that more than 25 per cent of Sabah can ever be used productively for agriculture (World Wide Fnd for Nature, Malaysia, 1992). Much land unsuitable for agriculture but suitable for wood production lies outside the Permanent Forest Estate. Conversely, there are forest areas that are potentially important for conservation that remain outside the existing Permanent Forest Estate.

6.1.2 Forests on State land and alienated land

Forests outside of the reserve system largely occupy State land, with very little remaining on alienated land. Reliable data on recent forest cover on State land and alienated land are not available, however, it is possible that 485,000 ha of forests (including logged and secondary) with the potential to produce wood of commercial value still remain in Sabah outside the Forest Reserves. However, it is often in these forests the most severe adverse environmental impacts have been seen, for example due to multiple logging within a period of few years, which under the present forest management policy is permissible, because it is based on a minimum size limit for cutting, not a minimum period between cuts. This practice appears to have become normal and increases the extent and intensity of direct and indirect damage to regenerating forests and the environment. There is neither a policy nor mechanism that promotes sustainable management of forests outside Forest Reserves.

6.1.3 Alienated Land

Outside urban areas most land is either alienated with a 99-year lease or has a Native title in perpetuity. Before 1930, land was typically alienated on a 999-year lease. The purpose of alienating land is to give rights to specific individuals or companies or other organizations, in order to develop the land for specific purposes. From the government perspective, it has been assumed that once alienated, i.e. once a title has been issued, forested land will be converted to an alternative use. The process of converting State land to alienated land has been ongoing for more than a century. Eventually it is likely that all land will have been alienated or reserved.

A key period was from 1976-1984, when the present pattern of Forest Reserves and State Parks was finalized. Large areas of land, particularly in eastern Sabah, much of which had previously been Forest Reserve, was de-reserved and made available for alienation for agriculture. Since that period, land use and ownership outside reserves has seemingly evolved primarily on the basis of individual applications.

From the point of view of the new landowner, there is no incentive and no requirement to maintain land under forest or partial forest, and there appears to be the following channels by which alienated land might conceivably be retained under forest:

- Using section 26(2) of the Land Ordinance, specific areas may be shown on land titles as reserves, however, such areas may only be watercourses or along the seashore or on ridges of hills. The implication of these reserves is that they should be retained under forest. However, the law does not make riverine reserves obligatory, nor does the law specify the size of such reserves, nor the criteria or reasons for selecting them, nor does the law explicitly state that these reserves have to be kept under natural vegetation. In practice, section 26(2) of the Land Ordinance appears to be used very rarely, except for the case of larger watercourses
- Under conditions written on land titles, it is usual that directives of the Director of Agriculture have to be followed. It is possible that this option could be used to retain forest for reasons of preventing soil erosion and or water protection
- Voluntarily by the landowner.
- The State Government may reserve ridge tops and riverbanks under natural forest. However, this appears to not often occur in practice. With few exceptions, most agricultural landowners clear all land under their ownership, partly to maximize the area under crops and partly on the assumption that this will minimize potential pest problems.

6.2 Conditions of Forest Tenure

The State has sole rights in controlling the harvesting for sale commercial timber in all forests except on alienated land. The Chief Minister, as Minister in charge of natural resources, has discretionary rights to the allocation of specific areas of forests to individuals, organisations or companies, under license for a temporary period, to harvest timber.

The following types of license may be issued for commercial logging in Forest Reserves:

- Concessions: - Concessions are issued for long periods (usually 21 to 25 years). Current exceptions are Yayasan Sabah which has a concession of

100 years and SFI which has been allocated exclusive rights to forest land for an unspecified period to support its paper mill

- Special licenses: are issued for a period of 5 years subject to the renewal for another 1-5 years
- Annual license: Annual ("form 1") licenses are issued annually and are renewable.

It is now widely-believed that tropical forests are likely to be well-managed not so much through attempting to enforce precise details of harvesting rules, but through one or more of several ways which provide an automatic incentive for loggers to harvest sustainably. Under the existing conditions of forest tenure, neither logging license-holders nor contractors have any incentive to minimise logging damage or to maximise future timber yields. Amongst the ways that have been suggested are:

- Alienation of land under natural forest with an obligation in the title to manage that forest in perpetuity for timber production subject to fulfillment of prescribed activities (this has been permitted in the case of a part of the SFI mill concession area)
- Private ownership of land under natural forest accompanied by incentives and/or penalties that favour retention under natural tree cover. This has not occurred because a condition of title for most alienated land is agricultural or plantation forest development.

A study in Deramakot Commercial Forest Reserve conducted jointly by GTZ and SFD collected information to generate a management plan for the Reserve, with the intention that the plan be the first in a series of plans for all Forest Reserves in Sabah. The overall objective was to achieve sustainable forest management; i.e. the management of forest in accordance with the sustainable yield principles for the maximisation of social, economic and environmental benefits to the nation. The project adopted a holistic approach to forest resource management including an accurate stock inventory and the employment of eco-friendly harvesting systems such as Reduced Impact Logging.

The management plan has in part provided a working solution as to how to manage long term, the Permanent Forest Estate in Sabah. The Forest Management Plans, which have or are currently being formulated for the 27 Forest management units, each cover approximately 100,000 hectares of Class II (Commercial Forest Reserve). Each unit consists of amalgamated blocks of forest to be managed on a 100-year concession basis. The idea is to enable private sector participation in the business of sustainable forest development and to provide stewardship for the area. The 100-year license provides security of tenure - a vital consideration for investors - and the period covers at least two harvest or investment cycles. During the recovery period premature re-entry will not be allowed in order to protect the forest from being over-logged or degraded.

Yayasan Sabah operates a model logging concession and has been identified as one of the few operations in the world where logging of tropical forests has the potential to be sustainable in the long term (Burgess, 1989). However, the logging contractors of Yayasan Sabah use the same extraction methods as contractors elsewhere in Sabah, so damage to the residual stand and the environment remain high. Yayasan Sabah has recently decided not to adopt Reduced Impact Logging techniques.

6.3 Environmental Problems - Overview

Various forms of damage occur and are inevitable when large trees are felled and extracted from the forest. The greatest logging damage occurs when the natural density of commercial trees is high. However, all forms of damage can be reduced by such measures as carefully planned and constructed logging roads, careful skidding of logs, cutting of climbing plants and felling of trees in preplanned directions.

Careful logging need not add to costs. For example, experiments in Sarawak indicated that a 22% reduction in skid trail density not only reduced damage but also resulted in a 20% reduction in logging costs (Jonsson & Lindgren, 1990).

The severity of the major environmental impacts below will depend upon the nature of the activity. Well-managed and supervised logging operations will have a relatively light impact whereas forest conversion will have more severe impacts.

The environmental impacts associated with the alteration of forest cover may be grouped into the following:

- **Erosion.** Net loss of topsoil through erosion significantly reduces the rate of wood/crop production after logging. The removal of eroded soil *via* the drainage network to the coastal zone is a significant externality, polluting rivers almost statewide and impacting both freshwater and coastal ecosystems
- **Compaction** Occurring wherever heavy machinery has been used, retarding the reformation of topsoil and suppressing seedling emergence which retards the growth of timber trees. If regeneration of dipterocarp trees is delayed say 50 years on compacted soils the potential timber royalty foregone Statewide must be enormous
- **Damage to residual stand.** Logging methods used in Sabah typically causes partial or fatal damage to between 20% and 50% of residual trees (Jonsson & Lindgren, 1990)
- **Impacted terrestrial ecosystems.** Depletion or extinction of local species
- **Increased risk of forest fire.** Logging forests or clear felling forest significantly increases the risk of fire - risk extends to nearby forest stands

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