REDUCED IMPACT LOGGING GUIDELINES FOR INDONESIA

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FOREWORD

By
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Ministry of Forestry

This book, “Reduced Impact Logging Guidelines For Indonesia” has been long awaited by logging practitioners in the field. It is designed as a guide to environmentally sound logging operations in Indonesia. Reduced Impact Logging (RIL), as many forest practitioners perceive, is part of the effort to attain sustainable forest management.

To meet the needs of users, the book uses simple language to make it easy to understand, and is presented in a unique and handy format, making it easy to carry in the field.

It is our pleasure to acknowledge the contribution of the ITTO, through ITTO Project PD 12/97 Rev 1 (F), and to offer our thanks to CIFOR and FORDA for their collaboration in the project’s implementation, to PT INHUTANI II for its contribution to research and testing the adoption of RIL techniques, and to the many people who helped at various stages in the writing of this book.

It is our hope that this book will provide a useful reference that will enhance the performance of forest management in Indonesia.

December 2001

Reduced Impact logging guidelines for Indonesia
FOREWORD

By
Dr. Mafa Chipeta
Deputy Director General of CIFOR

The world has committed itself to achieving sustainable forest management (SFM), which balances production goals with environmental and social ones. In the field of harvesting, achieving SFM requires environmentally responsible logging, hence the growing interest in reduced impact logging (RIL). The Center for International Forestry Research (CIFOR) is therefore very pleased to have benefited from the financial support of the International Tropical Timber Organization (ITTO) and the strong cooperation of the Forestry Research and Development Organization (FORDA) of the Government of Indonesia to do practical research on RIL in the tropical rain forest of Kalimantan, Indonesia. Unlike common research that is based on small plots, the CIFOR investigations were conducted on a commercial scale on the concessions of PT INHUTANI II, a state-owned timber company.

Central to the successful adoption of the RIL study findings is a clear set of guidelines that define the actions necessary to achieve it. These guidelines, which were adopted by the project, conform to TPTI regulations—the Indonesian silviculture system for dryland natural forest. They also reflect close attention to the ITTO Guidelines...
for the sustainable management of natural tropical forests and the FAO Model Code of forest harvesting practice.

In preparing these Guidelines, CIFOR has been motivated by the real shortage of simple, easy to understand, and practical guidelines on RIL that field operators would find convenient to apply. There is a multitude of regulations and other guidelines on how to harvest forests in a sustainable manner, but few offer the easy format and handy presentation of the present book. In recommending these Guidelines to the industry, CIFOR also invites practitioners to provide feedback on how well their application goes in the field so that continuing improvements can be made. CIFOR commits itself to continue working towards the progressive improvement of RIL practice, in partnership with the Government of Indonesia, industry and others that have an interest in responsible logging.

For making possible the development of these Guidelines as an important achievement of the project, I take this opportunity to express, on behalf of CIFOR, my sincere thanks to the ITTO for funding the project, to PT INHUTANI II for collaborating in the research and in testing the adoption of RIL techniques; and to FORDA for working together with us to make the project a success.

December 2001
FOREWORD

By
Dr. Untung Iskandar
Director General
Directorate General of Production Forest Ministry of Forestry

Forests, as a national development resource, have a very real function for human life, helping to achieve a dynamic balance of ecological, economic and socio-cultural benefits. For this reason, forests must be managed, protected and utilized in a sustainable manner for the prosperity of all Indonesians, not only current but also future generations.

Logging is one means of utilizing forest located in production forest zones. In practical terms, logging still entails many problems, such as damage to residual stands and the environment from field activities that focus on logging and pay insufficient attention to regeneration and rehabilitation. Environmental damage caused by logging activities includes land opening, soil damage and erosion, residual stand damage and logging waste.

Despite the negative impacts of logging on forests, logging is necessary in order to realize the full economic value of the forest; it also provides a source of funding for forest management. What is needed is a logging method that has a low negative impact.
One such method is Reduced Impact Logging (RIL). With regard to this, the Directorate General of Production Forest has issued an official memo (No. 274 VI-PHA/2001 dated 23 February 2001) concerning Reduced Impact Logging (RIL). The memo consists of technical guidance for natural forest operation units that intend to implement an environmentally sound logging system.

In anticipation of the successful implementation of RIL, we appreciate the efforts of the ITTO, FORDA CIFOR and INHTANI II in producing these RIL Guidelines.

We hope this book will be of benefit to all.

Jakarta, December 2001
The importance of forest values for people is unarguable; forests have a role as a source of support for life. Forests provide multi-benefits—environmental, social and economic. Therefore we have to ensure their sustainability.

Looking at the current situation of severe forest degradation, especially degradation of natural tropical forest, it appears that a common perspective on the forest itself is needed. We should see the forest as a process of natural production, using the sun’s energy to process and produce raw materials such as water, minerals, and air in a sustainable manner; these benefits are not a commodity in the form of deposits which can be mined, for example.

We welcome the publication of the book on RIL Guidelines by CIFOR as the result of their collaboration with PT INHUTANI II. We hope that the book will support attempts to maintain sustainability and to enhance the quality of natural forest production processes that will yield optimal and sustainable benefits for human life.
We also hope that our collaboration can continue, and carry on giving maximal support to the development of forest science and forest management.

Jakarta, November 2001
FOREWORD

By
The Authors

The Principles and Practices for Forest Harvesting in Indonesia (2000) have been developed to provide a uniform set of minimum standards for logging practices in the Production and Limited Production Forests in Indonesia. They provide the standard for WHAT is involved in planning and implementing logging activities in natural forest and WHY certain operations should be undertaken. The Reduced Impact Logging (RIL) Guidelines for Indonesia provides the mechanism for HOW the standards will be applied in the field or “how to do the work”.

Tractor skidding – mostly by crawlers and skidders – is the most common system (ca. 90%) used in the Indonesian Selective Cutting and Planting (TPTI) System. Considering the fact that familiarity with more environmentally friendly logging system (such as cable and aerial logging) is still lacking in Indonesia, often due to cost, etc., RIL Guidelines focus on ground-based harvesting which can be implemented in the lowland and hill forests in Indonesia.

This booklet has been prepared for use in the selective cutting silvicultural system of tropical natural forests and based on the Principles and Practices for Forest Harvesting in Indonesia (2000), RIL Pocket Book (Elias, 1999) and Ground Based Reduced-Impact Logging Guidelines for Lowland and Hill Dipterocarp Forest in Indonesia (Sist,
Dykstra and Fimbel, 1998). Other technical inputs are provided from results of the Reduced-Impact Logging Research of the ITTO funded project on Forest Science and Sustainability. Bulungan Model Forest (PD 12/97 Rev. 1(F)) carried out in Malinau, East Kalimantan, the Code of Practice for Forest Harvesting in Asia-Pacific (1999), Indonesian industry and from actual situations and conditions in the Indonesian forests.

Target groups of the guidelines are production supervisors, RIL planners, block inspectors, road network planners, road construction supervisors, road construction foremen, machine operators, chainsaw operators, tractor operators and their assistants.
CONTENTS

FOREWORD ii

INTRODUCTION 1

LOGGING PLANNING 5
  • Pre-logging Planning 6
  • Forest Area Zoning 8
  • Logging Planning 12

LOGGING OPERATIONS 51
  • Supervision of Operations 52
  • Felling Operations 57
  • Skidding and Landing Operations 73

MAINTENANCE, CAMP HYGIENE AND SAFETY 89
  • Maintenance and Servicing 90
  • Camp Hygiene 95
  • Safety 98

POST-LOGGING ACTIVITIES 101
  • Road Closure 102
  • Skidtrail Closure 103
  • Temporary Bridge Closure 104
  • Quarry Closure 106
  • Landing Closure 107
  • Camp and Workshop Closure 108
  • Road Maintenance 109

CITED REFERENCES 113

FURTHER READING 114
INTRODUCTION

Background to the RIL Guidelines for Indonesia

In Indonesia, forest management and logging operations are regulated under the Indonesian Selective Cutting and Planting System (Sistem Tebang Pilih Tanam Indonesia/TPTI). RIL practices are recommended under TPTI; however, these are seldom applied in the field for numerous reasons, including:

1. Lack of regulatory control over harvesting practices.
2. Limited specificity in how to conduct RIL techniques.
3. Lack of understanding of the benefits of RIL.
4. Lack of understanding of the steps necessary to implement RIL and lack of specific technical skills.

There is general recognition that existing logging practices need to be improved to ensure a viable residual stand for the successive cutting cycles. As an International Tropical Timber Organization (ITTO) member, such recognition by Indonesian foresters is linked with ITTO’s “Year 2000 Objectives” of achieving sustainable forest management.

Progress towards sustainable forest management will be promoted by the implementation of RIL techniques, which aim at minimising soil disturbance, impacts on wildlife, and damage to the residual stand.
What is RIL?
RIL is a systematic approach to planning, implementing, monitoring and evaluating logging.
RIL embraces a host of improved road building, felling and skidding practices.
RIL requires forethought and skill, and a policy environment that encourages them.

Why RIL?
Forest managers are increasingly endeavouring to improve their practices and implement higher standards of forest management. One means of doing this to implement RIL techniques.
There are a number of reasons why RIL is recommended for implementing RIL, etc.

- Environmental and social risk reduction
- Economics
- Markets
- Appropriate policy and regulatory framework

Reduced Impact logging guidelines for Indonesia
RIL IMPLEMENTATION AND TPTI

Bt-3
- Arrangement of working area

Bt-2
- Forest inventory
- Topographical survey
- Development of tree locations and contour map
- Road planning

Bt-1
- Logging planning
- Road construction
- Pre-logging field preparation

Bt-0
- Opening up of landings and skidtrails
- Felling and bucking
- Landing and skidtrail construction
- Skidding operation
- Bucking, debarking & piling-up of logs at landing
- Major transportation
- Area rehabilitation after logging
- Inspection and reporting

Bt-O : logging time (year); (-) before logging
PRE-LOGGING PLANNING

Inventory

Undertake a forest inventory, map preparation and stock mapping.

The following manuals provide details of appropriate methods:

- *Pedoman dan Petunjuk Teknis Pilih Tanam Indonesia (TPTI) pada Hutan Alam Daratan* (Departemen Kehutanan RI, 1993)
- *Petunjuk Dasar dalam Timber Cruising dan Survei Topografi* (Ruslim, 1998)
- *Prosedur Survei Topografi Hutan* (TFF&APHI, 2001)

Map Preparation

Contour and stock mapping at a scale of 1:2,000 - 1:5,000 with contour line intervals of 5-10 m can be produced manually or by using computer-based software, e.g:

- FIEPLP (Forest Inventory and Product Linking Programme) from TROPENBOS Foundation Project
- GENESIS and GENAMAP Programme from SFMP-GTZ Project
- ROADENG Software
- SIPTOP (Sistem Informasi Pohon dan Topografi) from PT. INHUTANI I

Reduced impact logging guidelines for Indonesia
Example of field sheets for data to be recorded as part of the inventory and topographic survey.

### Tally sheet of inventory

<table>
<thead>
<tr>
<th>Tree Position</th>
<th>Station Azim.</th>
<th>Horizontal Distance</th>
<th>Elevation (m)</th>
<th>Elevation Corr.</th>
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</thead>
<tbody>
<tr>
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<td>+13</td>
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</tr>
<tr>
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<td>20.6</td>
<td>+18</td>
<td></td>
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<tr>
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<td>4</td>
<td>33</td>
<td>15.5</td>
<td>+14</td>
<td>698</td>
</tr>
</tbody>
</table>

### Tally sheet of topo-survey

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<th>Elevation (m)</th>
<th>Elevation Corr.</th>
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<td>+13</td>
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<td>+14</td>
<td>698</td>
</tr>
</tbody>
</table>
FOREST AREA ZONING

Exclusion Areas

- Identification of exclusion areas is important for defining and locating the net productive area for timber production
- Timber production zone = total area of a forest management unit - exclusion areas
- The timber production zone forms the basis for the determination of the Annual Allowable Cut (AAC)

Exclusion zones, include the following:
- Cultural areas
- Shorelines, lagoons, lakes and water storage areas
- Landslip areas
- Designated watercourses
  - Conservation and protection zone
  - Community forests and local community zones
  - Biological diversity conservation zone
  - Wildlife conservation zone
  - Scientific research zone
  - Buffer zone, e.g.
Legend:
1. Biological diversity conservation zone
2. 5. Town surrounded by a community use forest zone
3. Scientific studies forest zone
4. Wildlife conservation zone
5. Watershed conservation zone
6. Production forest zone

Production Areas

An example of a forest zoning map
### Buffers for exclusion areas

<table>
<thead>
<tr>
<th>Cultural areas</th>
<th>Minimum Width for Buffer Zones</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 m</td>
<td></td>
</tr>
</tbody>
</table>

| Lakes          | Slope < 17% = 50 m |
|                | Slope > 17% = 100 m |

| Lagoons        | Class 1 stream = 30 m each side |
|                | Class 2 stream = 20 m each side |
| Shorelines     | Class 3 stream = 10 m each side |

| Water storage areas | |
| Waterways         | Catchment area 2 ha, no extraction within 5 m each side |

### Stream buffer exclusion areas

- Stream
- Creek
- 10 m
- 30 m
- 50 m
- 100 m

Reduced Impact logging guidelines for Indonesia
Management of Exclusion Areas

Areas excluded from logging are managed as follows:

- No trees to be felled within exclusion areas and their buffer zones
- Machine access is prohibited, except where watercourse crossings are permitted
- No earthworks or spoil from earthworks is to fall within the exclusion areas
- No logging debris is to be pushed into the exclusion areas
- Trees should be felled away from buffer zones and watercourses
The following references provide details of how to undertake road planning:

- *Pembukaan Wilayah Hutan* (Elias, 1997)
**Collection of engineering data**

Important data to be collected consist of:
- Aerial photographs
- Topographic map at a scale of 1:5000 - 1:25 000
- Forest map at a scale 1:25 000 or 1:50 000
- Soil map
- Geological map
- Forest Opening Up Guidelines and Regulations
- Road construction costs
- Timber harvesting costs and timber prices
- Forest Management Plan

**Demarcation of planning area**

An example of planning area demarcation

- Existing road
- Planning area boundary
**Evaluation of proposed road location**

- Need to identify:
  - Access points to public roads and existing forest roads
  - Proposed road location and logging areas
  - Areas with gentle slopes to assist with location, better alignment and log landings
  - Stream crossing points
  - Gravel deposits (quarries)
  - Steep slopes
  - Swamps
  - Landslides
  - Deep canyons
  - Protected forests

**An example of positive and negative cardinal points/zones**

[Map showing different zones and points]
Road network planning

Parallel road network patterns

Avoid... this random pattern.

Circular road network patterns

Reduced Impact logging guidelines for Indonesia
Road network planning on a contour map (scale 1:5000 up to 1:25 000)

Road planning criteria, maximum road grade:
main road 10%; branch road 15%; feeder road 18%

An example of a road network corridor

Reduced impact logging guidelines for Indonesia
- **Choose!** road alignment on stable areas.

- **Road location** should be at least 100 m from the edge of a stream.

- **Avoid!** areas of cultural importance, steep areas and swamps.

- **Avoid!** sensitive landslide areas.
Road location

- **Contour/slope road**

- **Ridge road**

- **Valley road**

Reduced Impact logging guidelines for Indonesia
<table>
<thead>
<tr>
<th>Degrees</th>
<th>Percent</th>
<th>Distance (m)</th>
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<td>49</td>
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</table>

Reduced Impact logging guidelines for Indonesia
### Road marking

<table>
<thead>
<tr>
<th>Category</th>
<th>Field Marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main road</td>
<td>Centrefine with 1 vertical stripe as high as possible on two sides aligned with the road direction (red colour)</td>
</tr>
<tr>
<td>Branch road and feeder</td>
<td>Centrefine with 1 vertical stripe as high as possible on two sides aligned with the road direction (red colour)</td>
</tr>
<tr>
<td>Log landing</td>
<td>Marked with L and number as per harvesting plan on tree at location (red colour)</td>
</tr>
<tr>
<td>Stream crossing (bridges)</td>
<td>Marked on trees with B (red colour)</td>
</tr>
<tr>
<td>Stream crossing (culverts)</td>
<td>Marked on trees with C (red colour)</td>
</tr>
</tbody>
</table>

### Marking of zero line on the ground

The zero line is determined using a clinometer and is marked on the ground with stakes
An example of a forest road network

- Block boundary
- Existing forest road
- Planned forest road
Logging Plan Development

1. Identify log landing locations
2. Identify skidtrail network
3. Identify felling and skidding direction
Identify log landing locations

Preferred landings are:
1. Large, flat area with slope of up to 6°
2. Top of hills
3. Not located in Protected Areas
4. Not near streams or watercourses
Identify skidtrail network

1. Skidtrails are designed as straight as possible following the contours.
2. Skidtrails should avoid steep areas, ravines, swamps and unstable ground.
3. Skidtrails should minimise the number of stream crossings. If a skidtrail crosses a stream, a small bridge should be constructed.
4. Skidtrails are designed to be used as intensively as possible.
5. Slopes of skidtrails must not exceed 45%.
6. Skidtrail network must avoid exclusion areas.
7. Skidding distances should be minimised.
8. Maximum width of skidtrails is 4 m.
- Identify felling and skidding direction

: Possible felling direction
: The best possible felling direction

Reduced Impact logging guidelines for Indonesia
An example a Logging Plan
Pre-Logging Operation

Road specifications
↓
Road construction
↓
Watercourse crossings
1. Steeper grades (up to 20%) for short sections (maximum 500 m) would be acceptable if it reduces soil disturbance from road construction

2. Any two sections of road at absolute maximum gradient should be separated by 100 m of level, or lower-gradient road
## Road grade specification

<table>
<thead>
<tr>
<th>Road Class</th>
<th>Maximum Allowable Grade (%)</th>
<th>Maximum Adverse Grade (%)</th>
<th>Length at Maximum Grade (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main road</td>
<td>10</td>
<td>9</td>
<td>1000</td>
</tr>
<tr>
<td>Branch</td>
<td>15</td>
<td>10</td>
<td>750</td>
</tr>
<tr>
<td>Feeder road</td>
<td>18</td>
<td>12</td>
<td>600</td>
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</tbody>
</table>

## Road width specification

<table>
<thead>
<tr>
<th>Road Class</th>
<th>Maximum Road Width (m)</th>
<th>Gravel Surface (m)</th>
<th>Compacted Clay Surface (m)</th>
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</thead>
<tbody>
<tr>
<td>Main road (2-way)</td>
<td>10.0</td>
<td>15.0</td>
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<tr>
<td>Main road (1-way)</td>
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<tr>
<td>Branch road</td>
<td>6.0</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>Feeder road</td>
<td>5.0</td>
<td>6.0</td>
<td></td>
</tr>
</tbody>
</table>
- Curve widening will be required on corners to allow for off-trailing of trailers
- Off-trailing on curves based on a vehicle with overall length of 14 m
- Additional width is required in each lane, i.e. a two-lane road requires a total widening of the roadway width to twice the tabulated value

<table>
<thead>
<tr>
<th>Radius (m)</th>
<th>Off-Trailing (m)</th>
<th>Radius (m)</th>
<th>Off-Trailing (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>1.65</td>
<td>75</td>
<td>0.55</td>
</tr>
<tr>
<td>30</td>
<td>1.20</td>
<td>100</td>
<td>0.40</td>
</tr>
<tr>
<td>40</td>
<td>0.95</td>
<td>150</td>
<td>0.35</td>
</tr>
<tr>
<td>50</td>
<td>0.80</td>
<td>200</td>
<td>0.20</td>
</tr>
<tr>
<td>60</td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
- Road curves

<table>
<thead>
<tr>
<th>Minimum radius (use may require signs)</th>
<th>Design Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 kph</td>
</tr>
<tr>
<td>Minimum radius</td>
<td>25 m</td>
</tr>
<tr>
<td>Desirable minimum radius</td>
<td>35 m</td>
</tr>
<tr>
<td>Minimum sight distance required</td>
<td>30 m</td>
</tr>
<tr>
<td>Meeting sight distance</td>
<td>50 m</td>
</tr>
</tbody>
</table>

- The minimum radius of the curve is related to visibility and speed of vehicles travelling on the road.

- Road drain spacing

<table>
<thead>
<tr>
<th>Centerline Gradient (%)</th>
<th>Maximum Drain Spacing (m)</th>
<th>Unstable Soil</th>
<th>Stable Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-15</td>
<td>40</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>16-20</td>
<td>20</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>21-25</td>
<td>10</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

- Drain all roads to minimize sediment production.
- Road drains should be constructed as follows:
  - At changes of slope
  - Within 50 metres of watercourse crossings
  - Additional drains to meet the maximum spacing requirement

Reduced Impact logging guidelines for Indonesia
Drain out-flow should be diverted into surrounding vegetation at least 50 m before a watercourse.
Salt traps on drains

Sediment traps around cross-drain outlets
Measures to minimize erosion on batter slope

☑️  Do .......

- Planted vegetation on batter slope
- Sediment trap at roadside drain
Road construction

- Timing
  - Opening and clearing
    - Grading and forming
      - Surfacing
        - Compacting
          - Finishing
Timing

Road construction should be conducted one year before logging and should not take place during the wet season.
Opening and clearing

Removal of trees, stumps, roots and organic matter from the road construction area.

Opening

Clearing

Reduced Impact logging guidelines for Indonesia
Grading and forming

Grading and forming of the road is undertaken after area has been opened and cleared. Earthmoving is done by bulldozers over short distances. Dump trucks and loaders are used for longer distances. Bulldozers and motor graders are the basic equipment used for grading and forming.

Surfacing

All-weather forest roads require a surface application of rock, gravel or acceptable surface material. This material is usually brought from local quarries. The material is hauled by dump trucks and spread with motor graders.
Compacting

Compacting the road is important. The vibration roller is the basic equipment needed to compact the soil and roading material.

Finishing

The final step in road construction is the crowning, sloping of shoulders and slopes and ditching. This is usually accomplished with a motor grader.
Watercourse crossings

Steel bridge

Steel and wooden bridge

Wooden bridge
### Wooden bridge

![Wooden bridge image](image)

### Timber species for bridge construction

<table>
<thead>
<tr>
<th>In fresh water</th>
<th>In salt or brackish water</th>
<th>Above water level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baku (Diptercarpus munda V.S.)</td>
<td>Baler (Fusidicoryn zwageri Loef.)</td>
<td>Baku (Diptercarpus munda V.S.)</td>
</tr>
<tr>
<td>Bangkirai (Shorea toona Roxb.)</td>
<td>Resak (Vatica spp.)</td>
<td>Bangkirai (Shorea toona Roxb.)</td>
</tr>
<tr>
<td>Balian (Fusidicoryn zwageri Loef.)</td>
<td>Kerang-ji (Diakum spp.)</td>
<td>Balian (Fusidicoryn zwageri Loef.)</td>
</tr>
<tr>
<td>Chengal (Himalaya spp.)</td>
<td>Chengal (Himalaya spp.)</td>
<td>Chengal (Himalaya spp.)</td>
</tr>
<tr>
<td>Glam (Vatica revoluta V.S.)</td>
<td>Glam (Vatica revoluta V.S.)</td>
<td>Glam (Vatica revoluta V.S.)</td>
</tr>
<tr>
<td>Kerang-ji (Diakum spp.)</td>
<td>Kerang-ji (Diakum spp.)</td>
<td>Kerang-ji (Diakum spp.)</td>
</tr>
<tr>
<td>Kampong (Koompassia malaccensis Merr.)</td>
<td>Kampong (Koompassia malaccensis Merr.)</td>
<td>Kampong (Koompassia malaccensis Merr.)</td>
</tr>
<tr>
<td>Merbau (Intisia bijuga [Cavaleri])</td>
<td>Merbau (Intisia bijuga [Cavaleri])</td>
<td>Merbau (Intisia bijuga [Cavaleri])</td>
</tr>
</tbody>
</table>

Reduced Impact logging guidelines for Indonesia
### Marking of exclusion areas

![Illustration of exclusion area marking]

### Buffer zone marking

<table>
<thead>
<tr>
<th>Category</th>
<th>Field Marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffer zones</td>
<td>Perimeter with an &quot;inverted T&quot; as high as possible on one side facing the logging area</td>
</tr>
</tbody>
</table>
### Marking of landings and skidtrails

<table>
<thead>
<tr>
<th>Category</th>
<th>Field Marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major skidtrail</td>
<td>Central line with 1 vertical stripe as high as possible, front and back of trees, spaced at approx. 10 m intervals.</td>
</tr>
<tr>
<td>Major skidtrail ends</td>
<td>Marked with 2 parallel stripes as high as possible facing the track.</td>
</tr>
<tr>
<td>Minor skidtrail</td>
<td>Central line with 1 vertical stripe as high as possible, front and back of trees, spaced at approx. 10 m intervals.</td>
</tr>
<tr>
<td>Temporary stream crossings</td>
<td>Marked with 8 on the trees on either side of stream.</td>
</tr>
</tbody>
</table>

### Cutting of lianas

![Image of cutting lianas]
**Marking of trees with felling direction**

**Tree marking decision chart**

1. **Diameter greater than minimum cutting limit or tree is dead, dying, defective or in area to be cleared for road/landing according to Silvicultural Prescriptions**
   - NO
   - YES → Specified prohibited from felling

2. **Specified prohibited from felling**
   - NO
   - YES → Distance to watercourse as per RI, Specification

3. **Distance to watercourse as per RI, Specification**
   - NO
   - YES
   - YES → Tree is seed source as per Silvicultural Prescriptions

4. **Tree is seed source as per Silvicultural Prescriptions**
   - NO
   - YES

**MARK TREE FOR FELLING**
SUPERVISION OF OPERATIONS

- Organization Structure
  - Supervisor
  - Foreman
  - Feller
  - Tractor operator
  - Helper

- Job Descriptions
  - Production Supervisor
    - Direct involvement in pre-logging planning
    - Train and familiarise staff with the operational and safety requirements
    - Coordinate logging operations
    - Direct supervision of logging operations
    - Maintain and submit accurate records as required by the company
    - Render first aid as required
    - Arrange rapid evacuation to hospital of any injured worker as required

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## Block inspectors

- Direct involvement in pre-logging planning
- Monitor progress of felling and skidding activities (incl. providing guidance)
- Check and evaluate results of felling, skidding and post-logging activities
- Report result of the evaluation and appraisal by felling compartment to the Base Camp Manager, Timber Production Division and Forest Planning Division
- Calculate and prepare payment/salary proposal based on tariffs for felling and skidding, to be submitted to the Base Camp Manager

## Felling and skidding foremen

- Ensure that only authorized and adequately trained workers operate machines and equipment
- Coordinate, improve and provide guidance in skidtrail construction, felling and skidding operations
- Control and monitor production process in order to achieve the targeted quality and quantity
- Ensure that all equipment and facilities are properly inspected and maintained
**Feller**

- Maintain chainsaws in a safe operational condition
- Be responsible for felling activities
- Fell each harvestable tree according to the planned or proper felling direction
- Buck the felled trees according to cross-cutting rules and procedures
- Open skid trail and winching path

---

**Helper for felling**

- Assist feller, especially in informing him about the location of harvestable trees
- Assist in checking whether all trees to be cut have been felled
- Construct safety or escape lines for the feller
- Assist in removing branches from the felled trees and in measuring log lengths for bucking at the felling site
- Mark stumps left by the felled trees with tree number as well as logs produced with log numbers
- Carry chainsaw bars and chains, maintenance tools and lubricating oil
- Carry food and drinking water
- Clean chainsaw and all other tools
Tractor Operator

- Be responsible for the tractor and its accessories
- Construct landings and skidrails
- Adhere to technical standards of skidding as planned
- Conduct preventive measures against post-harvest damage to residual stands and the environment
- Be responsible for skidding activities

Helper for Skidding

- Assist the tractor operator in the maintenance of tractor
- Be responsible for choker/hooks and cables
- Locate logs to be skidded
- Install chokers/hooks for winching
- Direct the tractor operator to the location of logs to be skidded
- Pull winch cable towards logs to be winched and attach it to the chokers/hooks
- Signal the tractor operator to start winching
- Assist the tractor operator in taking measures to prevent further post-harvest damage
All crew members involved should know their duties and responsibilities, expected work procedure and standards.

'Morning Talk':
Meeting of skidding/felling foremen, chainsaw operators and tractor operators

'Weekly Meeting':
Meeting of production supervisors, block inspectors, skidding/felling foremen, chainsaw operators and tractor operators
FELLING OPERATIONS

Chainsaw Maintenance

Operations of Landings and Skinheads

Felling

Choice of felling direction
Preparation of work area
Directional felling techniques
Log preparation
Winch trail preparation
Chainsaw Maintenance

The following parts of chainsaw are to be checked daily:

- Saw chain
- Guide bar
- Gears
- Oil filter and fuel filter
- Spark plugs
- Exhaust system
- Chain brake and front handle guard

✅ Keep the saw chain sharp before felling and sharpen regularly!

Reduced Impact logging guidelines for Indonesia
Opening of Landing and Skidtrails

- Landing and skidtrail openings should be set up prior to felling
- Tools to be used: logging plan and chainsaw

1. Landing and skidtrail network map

2. Felling to open the landing and skidtrails (Et-0)

* Et = Time of logging (year); () = Before logging
Skidtrail opening procedure

1. The team required for opening landings and skidtrails consists of a chainsaw operator and a helper.
2. Chainsaw operators open landing areas and skidtrails by cutting all trees with $\varnothing \geq 15$ cm within these areas.
3. The felling begins from the end of the prospective skidtrail to the landing with felling direction away from the landing.
4. Undercuts and backcuts are made as low as possible, with felling directions coinciding with the skidtrail direction or right on the skidtrail.
Felling

1. The Felling commences according to the felling pattern on the map
2. Check felling condition, determine felling direction, prepare work site, open escape routes and caution all persons in vicinity of felling area (danger zone)
3. Make the notch and the backcut on the stump as low as possible
4. Top and limb the fallen tree
5. Clear buttresses from the stem
6. Measure and buck stem according to specifications
7. Place tree number on stump and on the bottom of each log section
8. Open winch trail
9. Proceed to other harvestable trees

AVOID......

- Trees falling across rivers or in Protected Areas
- Damage to potential crop trees and protected trees

Reduced Impact logging guidelines for Indonesia 61
Procedures:

1. The best felling direction is towards or away from skidtrails at an angle of 30° - 45° (herringbone pattern), or the tree should fall in a parallel position on the skidtrail away from the skidding direction.
2. If possible, the felled tree should be directed to an open site. Preferably other trees should be felled into the same gap (maximum 3).
3. On steep areas, the felling direction should be towards the side of the slope (along the contour).
Directional felling techniques

The use of felling wedges is recommended to give additional control over felling direction.

Diagram: Felling technique for leaning trees

- **a**: Tree leaning direction
- **b**: Felling direction
- **c**: Undercut
- **d**: Backcut
- **e**: Wedge
- **f**: Hinge

Directional felling for leaning tree:

- Notch is cut according to expected felling direction
- Create asymmetric hinge, stronger end opposite the leaning direction
- Use of felling wedges to give additional control over felling direction
Set up of notch, backcut and hinge

- Wrong
- Correct

Cutting technique of backcut

- Small tree
- Big tree
Work steps:

1. The first cut is a horizontal cut as deep as 1/4-1/3 of tree $\phi$ at a maximum height of 50 cm.
2. The second cut is a slanting cut, making an angle of 45° towards the end of the horizontal cut.
3. The third cut is a backcut. It is made about 5—10 cm above and on the opposite side of the horizontal cut.
4. Leave a hinge of 1/10 to 1/6 of the tree $\phi$. 

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1. Create notch
2. Make hole at the center
3. Backcut 10–20 cm above the undercut of the notch

Clean the buttresses after tree is felled
Large buttresses are cut before felling the tree
Small tree

Work steps:
1. Create notch
2. Create backcut by cutting from left and right side of the backcut
3. Cut from the front of backcut

Large tree

Work steps:
1. Create notch
2. Create backcut by cutting from left side of backcut
3. Cut from right side of backcut
4. Cut from the holding wood
**Felling technique for trees with buttresses**

1. undercut
2. Removal of lateral buttresses
3. Backcut

**Work steps:**
1. Create notch
2. Remove buttresses on the right and left side of backcut
3. Create backcut

---

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69
a. The tree is leaning in the felling direction
b. The tree has to be felled against the lean
c. The tree has to be felled slanting to the direction of lean

Numbers 1, 2, 3, 4 indicate sequence of work
(prepare notch, remove the lateral buttresses, backcut and cut the supporting buttress)
1. Stem should be measured and its log sections should be determined before cutting the stem. Cross-cuts are no more than 10° from vertical.

2. Cutting of tension stems
   a. Cut on the compression side
   b. Cut on the tension side

3. Stem cutting technique
   a. Vertical cut
   b. Compression zone
Winch trail preparation
Tractor Maintenance

Tractor maintenance should be undertaken by the tractor operator and his helper every morning before operating and every afternoon.

**Before operating:**
- Check lubrication oil at:
  - Engine
  - Steering
  - Master clutch
- Check radiator water
- Check all:
  - Wheels and tyres
  - Propeller shaft
  - Spring/U-bolt
  - Battery

**During warming up:**
- Check function of:
  - Water temperature gauge
  - Fuel pressure gauge
  - Air pressure gauge
  - Ampere meter
- Check engine smoke
- Check engine sound
- Discard water in tank
- Check all transmission and transfer functions

**Check Mounting at:**
- Engine
- Radiator
- Transmission
- Transfer

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After operating:

- Fill fuel tank on level ground
- Park the tractor
- Switch off machine after 5 minutes
- Clean up inside cabin
- Clean dirt off wheels and tyres
- Clean dirt off lamps
- Ensure cab doors are securely closed
- Size of landing: 900 m²
- Drains should be constructed and must empty on to stable vegetated areas
Steps for skidtrail construction:

\[ \text{Et-1}^* \quad \rightarrow \quad \text{Et-1} \]

Skidtrail network map

\[ \text{Et-0} \quad \rightarrow \quad \text{Et-0} \]

Skidtrail marking

Skidtrail construction

Skidtrail opening

* Et = Time of logging (year); ( ) = Before logging
Steps for skidtrail construction

- Skidtrail construction begins with skidding team and tractor after completion of skidtrail opening and felling activities.
- To finish up the skidtrail construction simply remove trees already cut (surface is not to be disturbed).
- Avoid cutting and filling.
- Small stems and branches are to remain on skidtrail surface to help soil protection.

Skidding Operations

- Skidding operations commence after the construction of the skidtrail.
- The helper sets the choker cable/hook on the log.
- The helper gives signals to the tractor operator to assist winching operation.
- The helper pulls the winch cable out and hooks the choker cable on the log to be winched.
- The helper moves to a safe place and gives the signal to start winching.
- During winching the tractor should remain on the skidtrail.
- After winching, the log is skidded along the skidtrail to the landing.
- The helper looks for other log(s) consulting the Logging Map.
AVOID ..!

1. Skidding during rain and when soil is still wet
2. The tractor moving off the skidrail looking for logs to be skidded
3. The blade contacting the soil surface and standing trees during skidding activities
4. The tractor moving into protected areas (exclusion zones)

- Logging plan map from felling team
- Tractor equipped with winch, blade < 4 meter (wide)
- 2–4 cable chokers/hooks
- 1 block
- 2 pairs of boots/shoes
- 2 helmets
- 2 pairs of gloves
- 2 sets of work clothing
- 2 food caterers and 5 litres of drinking water
Use of choker

- Types of cable choker

- Technique for setting chokers on log

Wrong

Correct

Reduced Impact logging guidelines for Indonesia
1. Tractor reverses down hill, then pulls the log(s) (tractor remains in stationary position)

2. After the winched log(s) come near the tractor, the winch cable is released

3. Tractor moves ahead to the landing (without pulling the log(s))

4. After the tractor has arrived at the landing, winching of log(s) continues until the log(s) reach the landing
Skidding

- Tractor blade should be raised when skidding
- Use arch to lift the end of the log off the ground

Raise the tractor blade when skidding (± 0.5 m)

Use arch to lift the end of the log
Hand signals for skidding

a. Slacken the winch cable!
b. Winching
c. Stop winching and hold!
d. Stop tractor!
e. Tractor may start winching
f. Back up tractor!
g. Drop chokers here!
h. Use upper winch!
i. Go back inside tractor!
j. Move forward!
Use shunt skidding method for turning logs

The shunt skidding method is applied to reduce disturbance of the residual stand and soil.

Correct

Wrong
Use temporary bridges to cross streams/creeks
Landing Operations

- Putting S-nail on log

Use log nail or S-nail on log ends to avoid splitting

- Debarking

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Log storage

Loading

Reduced Impact logging guidelines for Indonesia
MAINTENANCE AND SERVICING

Moving Equipment

- All equipment is to be washed thoroughly before it is moved to a new operational area
- Locate in a well-drained area and not less than 100 m from village areas and 50 m from watercourses
- When they must be located on the wharf, they should be:
  - Located as far away from the sea as the fuel pumping lines permit
  - Fitted with a proper, leak-proof bund, which in the event of a spill can be pumped to a disposal pit
Fuel Servicing and Maintenance

- Field fuel tank, refuelled points and maintenance areas are to be located:
  - In well-drained areas such as on landings or road junctions
  - Outside areas excluded from logging

- Sump oil is not to be dumped in the logging areas, but should be collected and removed to the main disposal facility
Refuse and Toxic Waste Disposal

- Refuse pits should be located at least 100 m from areas subject to inundation by water and at least 1 m above maximum ground water height.
- The refuse pit location should be clearly indicated (including signs in all the local languages) and the pit securely fenced.
- Toxic materials are to be collected in containers and sealed securely.
- All solid waste should be placed in refuse pits and buried as soon as harvesting in the coupe has been completed.
Camp should be supplied with clean water obtained from running streams, rainwater or wells.

Water storage tanks should be properly screened.
- Camp areas should be well-drained, to avoid water impoundment that creates mosquito breeding areas.

[Diagram showing camp area with well-drained land and absence of water impoundment.]

Rubbish and water pond
Additional facilities in camps should include:
- Medical
- Educational
- Recreational, and
- Spiritual facilities
## SAFETY

### Protective Clothing and Safety Equipment

#### Guide to protective clothing

<table>
<thead>
<tr>
<th>Logging Case</th>
<th>Safety Boots</th>
<th>Safety Vests</th>
<th>Cut-Resistant Clothing</th>
<th>High Visibility Clothing</th>
<th>Gloves</th>
<th>Safety Helmet</th>
<th>Ear Muffs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chain saw Operator</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tree Surgeon Operator</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Leader Operator</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Trimmer</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

#### Equipment Safety Requirement

**Chainsaw:**
- Clearly marked positive on-off switch
- Safety throttle catch
- Chainsaw cutter and chain brake guard
- Exhaust system to direct fumes away from the operator
- Tool kit

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Legend:

a = Hard helmet  e = Gloves
b = Goggles      f = Safety trousers
c = Ear muff    g = Safety boots
d = High visibility vest
Tractor:
- Roll Over Protection Structure (ROPS)
- Falling Object Protection Structure (FOPS)
- Securely mounted seat and seat belt
- Rear of cab or frame fitted with protective wire mesh
- Reverse alarms
- Securely guarded pulleys, shafts, belts and fan blades
- Positive, non-returning engine stopping devices
- Suitable fire extinguisher firmly fixed and easily retrievable
- Exhaust system fitted with a spark arrestor
- First aid
POST-LOGGING ACTIVITIES

- ROAD CLOSURE
- SKIDTRAIL CLOSURE
- TEMPORARY BRIDGE CLOSURE
- QUARRY CLOSURE
- LANDING CLOSURE
- CAMP AND WORKSHOP CLOSURE
- ROUTINE MAINTENANCE
SKIDTRAIL CLOSURE

- Skidtrail cross-drain construction with interval of 20–30 m

Cross-drains should be directed towards the undisturbed part of the forest

Cross section of skidtrail cross-drain
TEMPORARY BRIDGE CLOSURE

- Removal of logs from watercourse
- All crossing material should be removed, so the water in the stream can flow again.

- Turn the drainage from the skid trail to the forest before it reaches the stream.
LANDING CLOSURE
CAMP AND WORKSHOP CLOSURE

- Remove all refuse from camp and workshop areas
- All solid waste should be placed in a refuse pit and buried
ROAD MAINTENANCE

- Road maintenance

- Toward permanent road and bridges

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- Road drainage maintenance
- All roads should be graded on a regular basis.
- Additional construction equipment such as rollers and watercarts may be used in conjunction with the grader to recompact the road surface.
- Road maintenance may require periodic addition of surfacing materials.
- Bridge maintenance

- Bridges should be inspected at least twice yearly, to confirm that:
  - Waterway is clear of debris
  - Substructure and superstructure are stable
  - Wingwall protection is functional and that no erosion has occurred
  - Scour has not occurred adjacent to abutments
  - Deck surface is in good condition
  - Bridge approaches provide smooth access
Culvert should be inspected and maintained regularly
CITED REFERENCES


FURTHER READING


Reduced impact logging guidelines for indonesia