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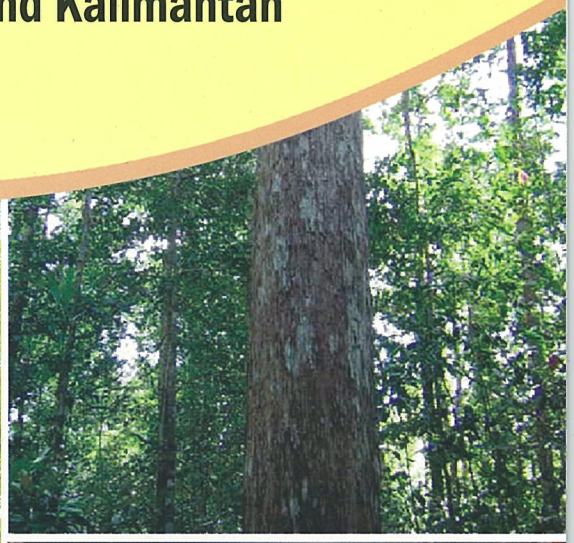

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FORESTRY RESEARCH AND DEVELOPMENT AGENCY
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INTERNATIONAL TROPICAL TIMBER ORGANITATION

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Preface

Gonystylus bancanus (ramin) is one of the most valuable timber species in Indonesia. Population of this species sharply decreases in last several years along with deforestation and degradation of its habitats. Deforestation is the worst condition for ramin causing not only population depletion but also permanent loss of habitat. On the other hand, the rehabilitation-restoration of the habitats and field plantation of this species are limited and slow progress. The causes of population decrease, habitat loss and degradation are caused by many factors. The significant reduction of population and growing stocks, especially commercial species, is mainly due to over exploitation, unsustainable methods of its harvesting and insufficient regeneration in its natural habitats. The slow progressing in habitat rehabilitation-restoration is mainly due to lack of scheme and driving force. Lack of artificial plantation, in addition to lack of scheme and driving force, is also due to scarcity of ramin planting materials. Lack of planting materials are due to lack of seed sources and limited seed production since 2004-2005. Therefore, the efforts toward the sustainable management of ramin are critical importance. At least two aspects need to be considered in order to achieve sustainable management, 1). Improving silvicultural techniques along with its field application and 2). Improve capacity to enhance conservation of population and habitat. Current silvicultural system, if applied properly, could enable to maintain sustainability of forest resources. On the other hand, enhancing restoration of ramin population still face barrier in the provision of planting material. Various measures to ensure sustainable management of forest resource and conservation have also been identified such as empowering rules and regulation as well as conservation and plantation activities.

Bogor, July 2012

Authors

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All photograph provided in this publication were taken by and for the ITTO project PD 426/06 Rev. 1 (F).

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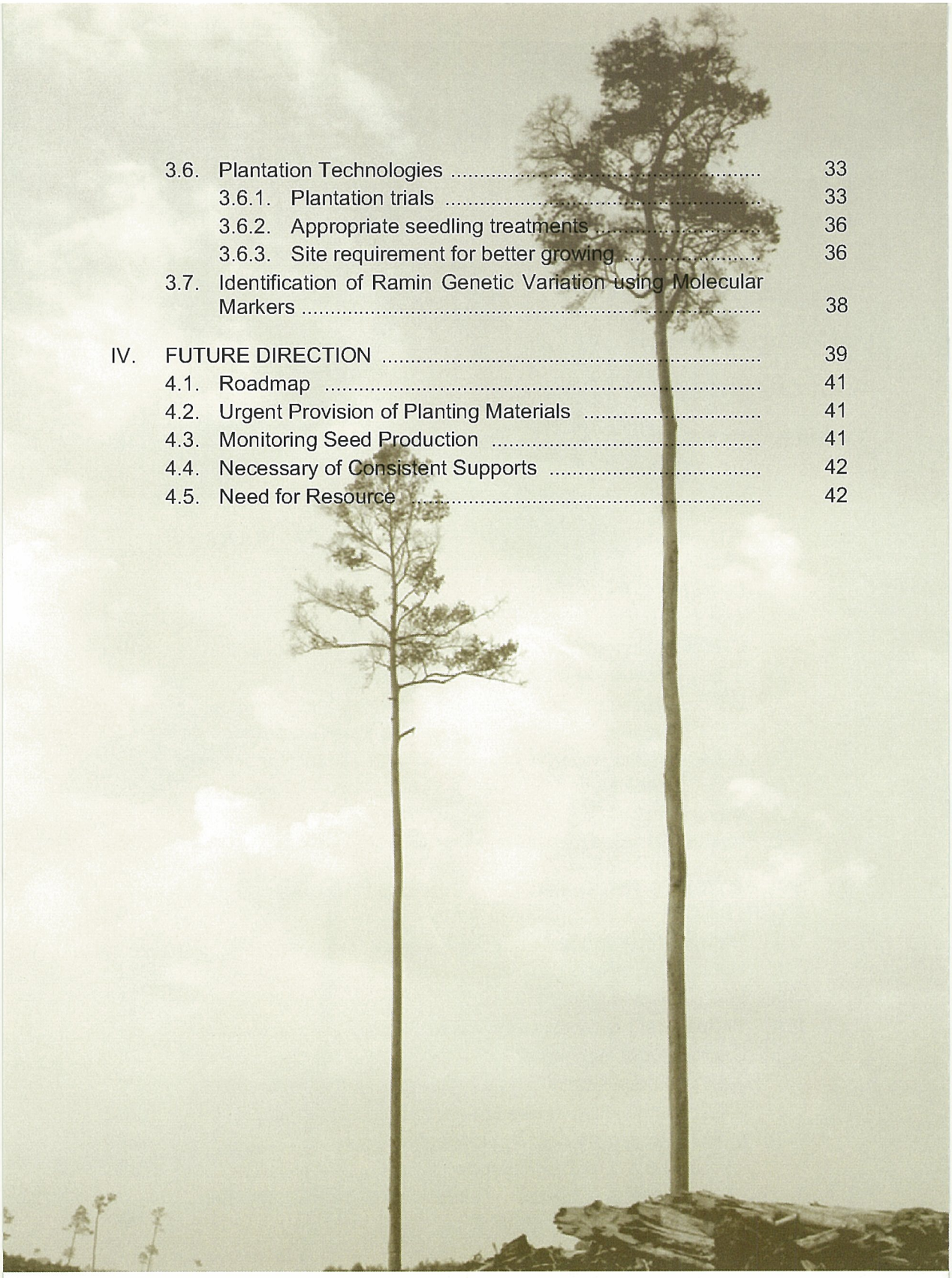

Abbreviations

APKINDO	Asosiasi Panel Kayu Indonesia (Indonesian Wood Panel Producers Association)
ASEAN	Association of Southeast Asian Nations
BKSDA	Natural Resources Conservation Institute, Indonesia Provincial Offices of the CITES Management Authority
BRIK	Forest Industry Revitalization Board
CBTI	Center for Biotechnology and Tree Improvement
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
FORDA	Forestry Research and Development Agency
GNRHL	Gerakan Nasional Rehabilitasi Hutan dan Lahan (National Movement on Forest and Land Rehabilitation)
HTI	Hutan Tanaman Industri (Industrial Plantation Forest)
ISWA	Indonesian Sawmill and Wood working Association
Dit. KKH	Direktorat Konservasi Keanekaragaman Hayati (Directorate of Biodiversity Conservation)
ITTO	International Tropical Timber Organization
LIPI	Lembaga Ilmu Pengetahuan Indonesia (Indonesian Institute of Science)
MA	Management Authority
OKI	Ogan Komering Ilir
PSF	Peat Swamp Forest
SA	Scientific Authority
SFM	Sustainable Forest Management
Spp	Species
TRAFFIC-SEA	Trade Records Analysis of Flora and Fauna in Commerce – Southeast Asia
USDA	United States Department of Agriculture

Chapter 1

Introduction

Chapter 1. INTRODUCTION

Approximately 120 million ha of tropical forests in Indonesia and nearly 20 millions ha of its are peatland. In this peatland there is an estimate of approximately of 13 million ha of Peat Swamp Forest (PSF) which consists of several types of forest based on its management status and function for timber production and its associated products, conservation and protected forest and areas for non-forest uses.

In this PSF, there are a number of forest tree species which are important for timber production. One of the species is *Gonystylus* spp. with commercial name called ramin. Ramin from *G. bancanus*, is growing naturally only in PSF in Riau, Jambi, South Sumatra, West, Central and South Kalimantan. In the last three decades, after severe harvesting period, this species is facing various threats driven primarily by economic development and growing needs of lands.

To prevent further loss and promote conservation of ramin, several policies have been issued. Two of the policies are logging moratorium throughout the country since 2001 and the inclusion of this species into Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix which is expected to support various efforts for conservation.

The logging moratorium has been expected to reduce over exploitation in natural forest, providing space and time for ex-logged over areas to naturally recover and resume growth and improve existing forest management. The listing of Gonystylus as a genus, which consists of approximately 30 species, in CITES Appendix is expected to reduce the rate of illegal logging and illegal trade of ramin log and products. In order to obtain effective implementation of the two policies and other policies toward the sustainable management and conservation of ramin, more enabling conditions and field actions are still needed.

Among several conditions required, two areas are addressed in this activity as funding is provided. The two main areas are (1) improving institutional and human resources capacity in the implementation of rules, regulation and its associated policies including its effective implementation of ramin and (2) promoting rehabilitation and plantation to restore habitats and ramin forest potentials. These two main areas are in line with the national priority actions on the promotion of forest rehabilitation/plantation and combatting illegal logging. One of rehabilitation program related to that is the National Movement on Forest and Land Rehabilitation (Gerakan Nasional Rehabilitasi Hutan dan Lahan - GNRHL), ramin should include in this program, however, lacking of planting materials and specific habitat requirements have made this species still left behind in the progress of field plantation activities.

Hedge orchard in Tumbang Nusa, Central Kalimantan

Wildlings collection garden in Tumbang Nusa, Central Kalimantan

Chapter 2

Promoting Effective Implementation of Rule and Regulation

Chapter 2. PROMOTING EFFECTIVE IMPLEMENTATION OF RULE AND REGULATION

2.1. Decreasing Stock of Ramin

Commercial ramin standing stock decrease significantly in last 20 years. This has caused closed down some ramin wood industries in Indonesia. It has been indicated that the constant decrease of standing stocks and production is due to unsustainable method of harvesting, substantial lost of habitat, degradation due to illegal logging and forest fires and slow recovery of forest condition. The current commercial standing stock is estimated only 6.8% from previous prediction in 1983 or approximately 14 millions m^3 in 2005 (Bismark *et al.*, 2006)* assuming no significant illegal logging, forest fire and conversion after that period. No recent data available regarding commercial standing stock and ramin timber production at national level.

Over exploitation in ramin forest is caused by poor implementation on harvesting rules and regulations, especially harvesting quota and illegal logging which were widespread in the period after the year 2000. The harvest of ramin follows the selective cutting with diameter limit over 40 cm and cutting cycle of 40 years. In this silvicultural system, a number of large seed trees and core trees to be logged with diameter of over 30 cm must be kept in logged over forest. Seed trees are maintained to ensure natural regeneration taking place after logging operation until the next cycle. The core trees are allocated for timber production in the subsequent cutting cycle.

Illegal logging has also contributed to the great reduction in ramin growing stock in Sumatra and Kalimantan, not only in production forests (mostly in abandoned forest concession areas), but also in conservation areas, such as National Parks and Nature Reserves. Berbak National Park of Sumatra and Tanjung Putting and Sebangau National Park of Kalimantan are some of the areas. Intensity of illegal logging decreases lately but still occurs in some areas. The impact of illegal logging, in some cases, even worst leaving wide and unproductive areas.

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*Bismark, M., A. Wibowo, T. Kalima, and R. Sawitri. 2006. Current Growing Stock of Ramin in Indonesia.

The slow growing and poor regeneration capacity with no enrichment planting applied, also caused decreasing in ramin growing potential. Ramin diameter growth rate, at later growing stage, is mostly less than 0.4 cm/year. This is far below the assumption in current silvicultural system (The Indonesian Selective Cutting and Planting System) which assumed diameter growth rate of 1 cm/year. Lack of successful artificial regeneration also contribute to the reduction of ramin timber production.

2.2. Law Enforcement

Weak law enforcement has been blamed in the unsustainable management of forest resources including ramin as described earlier. If rules and regulation related to harvesting practices were implemented properly, ramin timber production in production forests could be maintained, with only slight reduction caused by unavoided impact of logging operation. Similarly, temporary ban for ramin logging issued since 2001 should enable the existing ramin forests to recover. The listing of ramin in Appendix of CITES has been expected to reduce potential illegal logs to be exported illegally to outside country. However, its implementation is still facing several problems related to the institutional and human resources capacity. Some institutions such as provincial forest services, customs and excise are lacking capable staffs to execute supervision and monitoring and even to prevent illegal logging. They are also still weak in ramin wood identification, coordination with other relevant institutions and lack of trained individuals at various check points.

2.3. CITES Implementation Improvement

2.3.1. Evaluation on its implementation

Ramin is listed in Appendix of CITES in 2001 and up-listed in 2004. A national workshop was held to evaluate its implementation in Jakarta, 24 July 2007. This workshop was attended by all relevant stakeholders from scientific authority, regulator and the primary users (executors). They are CITES Management Authority (CITES MA) CITES Scientific Authority (CITES SA - LIPI), Forest Industry Revitalization Board (BRIK), Directorate General of Forest Production Management, Indonesia-TRAFFIC SEA, ISWA, APKINDO, Regional Office for Natural Resource Conservation (BKSDA-Jakarta) and Forestry Research and Development Agency (FORDA). The theme of the workshop was "*Evaluation and the Promotion of CITES Implementation on Ramin in Indonesia*". The topics discussed in the workshop are as follows:

(1) Brief review on the government policy on ramin;
(2) The implementation of ramin trade regulation;
(3) Trade policy on ramin by CITES MA;
(4) Overview on ramin trade with specific to SEA by TRAFFIC SEA;
(5) Trade statistics of ramin and trade monitoring measures (HS Code).

Presentation materials, discussion and recommendations made during the workshop and list of participants have been compiled in the workshop proceeding "Evaluation and the Promotion of CITES Implementation on Ramin in Indonesia".

2.3.2. Training needs for CITES implementation

The identification of problems related to capacity building or training needs to improve CITES implementation was carried out in order to improve implementation. One of the primary barriers in the implementation, especially during ramin product transportation is the ability to differentiate ramin and non-ramin wood. There are a number of wood specimen which have similar features or look alike with ramin. There is only limited experties enable to differentiate this wood specimen, even still limited community is aware on the inclusion of ramin into CITES Appendix and its implication to the government, producers and traders.

2.3.3. Manual and guidelines for CITES implementation

In order to improve CITES implementation on ramin, some manuals (guidelines) have been produced. One of the manuals has been printed and distributed for field staff working in airport and seaport customs and excise office and other parties working on wood product check points. The manuals is in Indonesian "*Pedoman Identifikasi Kayu Ramin dan Kayu Mirip Ramin*" (Manual for Ramin Wood Identification Technique).

This manual has been used in the National Training Workshop on ramin wood identification in Bogor Forestry Training Center, 21-23 January 2008 and in the workshop of ASEAN-Wildlife Enforcement Network in Bogor, 19-23 February 2008.

2.3.4. Holding training on ramin and ramin like wood identification

A National Training Workshop on ramin wood identification was carried out in Bogor Forestry Training Center, 21-23 January 2008. This workshop was attended by 23 participants from CITES MA, Customs and Excise office, BKSDA, Port Authority from Jakarta, Riau, Jambi, West and Central Kalimantan and

Surabaya. The instructors were senior wood anatomists of Forest Product Research and Development - FORDA, CITES MA (Dit. KKH) and Indonesia TRAFFIC-SEA. The contents consisted of introduction to CITES, its rules and regulation, wood anatomy and identification technique.

In addition to the above wood identification training workshop, a ramin wood identification training workshop was held in Singapore 30 October - 3 November 2007. Potential and suitable participants were selected and prepared. The cost for the workshop was borne by the official sponsor (USDA Forest Service, International Program) and organizer (TRAFFIC SEA).

Training workshop for ramin wood identification, in Bogor Forestry Training Center, 21-23 January 2008:

A. Preparatory meeting.

B. Participants.

Training workshop on ramin wood identification in Singapore, 30 October - 3 November 2007 by USDA - TRAFFIC - SEA.

2.4. Review on Logging Moratorium Policy on Ramin

To prevent further loss and promote conservation, ramin logging moratorium throughout the country was issued in 2001, almost at the same time, the inclusion of this species into CITES Appendix.

The objectives of the issuance of logging moratorium are to reduce illegal logging and trade of illegal timber. Over extraction of ramin, providing space and time for ex-logged over areas to naturally recover and resume growth, and to improve existing forest management. Policy on ramin logging moratorium, along with other policies on the management of PSF, was reviewed. From the review, it revealed that there are some inconsistencies and lacking field guidance causing some confusion in the field. The policies have some potential contraproductive (ineffective) on the effort toward the conservation and sustainable management of ramin and PSF as a whole ecosystem. Evaluation, supervision and monitoring of the policies were not regularly reviewed which was important to see the effectiveness.

In fact, illegal logging, trade of illegal ramin timber, with various modes, still occurs, causing gradual degradation of forest resources. Using this fact finding and many requests of permit to harvest ramin, this logging moratorium policy is proposed to be lifted up and the permits are expected to be granted to other concession holders who have passed certificate of sustainable forest management.

Discussion meeting on ramin harvest protocol.

Discussion meeting on the review of ramin silviculture

Discussion meeting on ramin logging moratorium

Seminar on ramin silviculture, harvest protocol, and policy review.

2.5. Review on Silvicultural System on Ramin

The harvest of ramin silvicultural system using selective cutting with diameter limit of over 40 cm and cutting cycle of 40 years. This system has been imposed since the beginning of logging operation in PSF in mid 1980. There were some slight modification in the stage of field practices, which directed to ensure sustainable producktion of ramin and PSF as a whole production forests. In this system, diameter cutting was 40 cm and up, cutting cycle of 35 - 40 years, retaining seed trees and core trees which must be sufficient for natural regeneration and subsequent standing stock. The enrichment planting in the stands which insufficient ramin seedling and sapling were required under the prescription. The assumption on the diameter growth rate for ramin followed the overall growth rate assumption of tropical forest and later modified and adjusted. Ramin diameter growth rate, except in the earlier growth, is mostly less than 0.4 cm/year.

This system is currently reviewed and there are some aspects which are not sufficient to enable sustainable production of ramin timber and sustainable management of the PSF resources. Those aspects range from field operation (technical matter) until the administrative matter, whether, the operational activities complied with the rules and regulation, especially monitoring and supervision and law enforcement associated with logging practice and residual stands maintenance. In general, monitoring and supervision were weakly implemented and, therefore, they are lacking information on whether the principle of sustainable forest management is applied. Because no information regarding the violation, as a consequence, there was no any sanction or penalties imposed.

Academic paper preparation to review current policy on ramin.

In 2009, a new regulation related silvicultural system on ramin was issued. In this regulation, diameter cutting limit of ramin reduces from ≥ 40 cm, as before, to ≥30 cm. Under this new regulation, before reducing diameter cutting limit of ramin to ≥ 30 cm, the concessions should consult and receive recommendation from research authority (Forestry Research and Development Agency), whether or not a block area to be harvested is feasible and remain sustainable if diameter cutting limit reduces to ≥ 30 cm.

The previous silvicultural system was reviewed and field observed under ITTO-CITES project (2010). Result of the review and field observation has been confronted with the new regulation on silvicultural system on ramin and PSF. Several scenarios are presented. If the regulation would be applied, the forest stands would be likely to be similar as clear cutting of ramin. This is because the larger portion of ramin stems are in the range of 30 cm. In addition, the field control is the most difficult one, even more in PSF. Otherwise, ramin stem is harvested based on proportion of harvestable species based on result of pre-harvest inventory. This scenario is complicated and not practical in timber harvesting.

Based on the above observation and several discussions made, it is proposed that the new regulation of silvicultural system on ramin need to be reviewed, focussing on feasilibity, effectiveness and impact of the system on sustainability of ramin timber production and if it is not feasible, it is proposed to be modified. Comprehensive academic paper has been discussed and forwarded to relevant authority for further consideration.

Chapter 3

Promoting Restoration, Rehabilitation and Plantation

Chapter 3. PROMOTING RESTORATION, REHABILITATION AND PLANTATION

3.1. Natural Regeneration

Decreasing ramin growing stock is related to the poor natural and artificial regeneration. The high intensity of regeneration requires large number of planting materials. Large number of planting materials is easily provided if seed is available. The problem is that the seed is scarce in the last 5 - 7 years. The seed sources have not been well documented in term of their location, production capacity and status. The flowering-fruiting of ramin does not occur yearly. Ramin produces flowers/fruits in the interval of 4 - 5 years and the seeds are recalcitrant which have short longevity. The viability of ramin seeds greatly reduces for several days and the viability is zero after over one week. These characteristics have caused difficulty in providing ramin planting materials, especially from nursery grown seedlings. Wildlings could be collected from forest floor under mother trees, but the number is mostly limited.

Seed source (above) and artificial plantation of ramin (below).

3.2. Habitat Degradation

Ramin habitats have also been severely decreased due to land conversion, peat swamp forest fires and inappropriate logging system. The major ramin habitat conversion occurred in late 1990s called a Mega Rice Project in Central Kalimantan. This conversion has caused over more than one million hectares of peat swamp forest diminished. Ramin population is leading to extinction and predicted to be permanently disappears in this ex-Mega Rice Project. Other conversion includes conversion for Industrial Plantation Forest (HTI) and lately for oil palm plantation.

Habitat loss and degradation by illegal logging, forest fire, and conversion.

3.3. Fires in Ramin Habitat

Peat swamp forest fire is also another problem faced for ramin forest management. The fires mostly occur during the dry season mostly caused by human activities. Land clearing for shifting cultivation and oil palm plantation contributes to peat swamp forest fire that occurs during the dry season. Underground fire in the PSF is mostly out of control. Dried organic materials accumulated in the peat layers are prone to wild fire.

Habitat loss and degradation by forest fire and conversion.

3.4. Silvicultural Practices and Harvest Protocol

Inappropriate silvicultural practices have contributed to the decrease of ramin growing stock and population, especially in the maintenance of residual stands of ramin after logging operation. According to the existing silvicultural prescription, the maintenance of residual stands must be carried out until 5 - 6 years after logging operation. The maintenance includes enrichment planting, refining etc. In fact, soon after logging operation all access and facilities in the ex-logging compartment have been deteriorated (removed) and therefore the location is no longer accessible for monitoring and supervision. This leads to poor maintenance of the residual stands. In the proposed review, these points have been accomodated in the harvest protocol.

3.5. Source of Planting Materials

3.5.1. Ramin seed sources in Sumatra and Kalimantan

Ramin seed sources in both Sumatra and Kalimantan have been explored. Two exploratory reports have been published. The reports contain the information of potential ramin seed sources in Sumatra and Kalimantan. This exploratory activity is very crucial since it has been fully understood that the only way to restore ramin population is through field plantation and rehabilitation of its habitats.

Seed source identification in Sumatra.

Four major habitats of ramin (provinces of Riau, Jambi, West and Central Kalimantan) were explored to identify potential seed sources of ramin. Several types of forests were visited: production forest, national park and nature reserves. From these forests explored, there has not even one stand or source have been officially selected for seed sources of ramin.

Therefore for the purpose of plantation, ramin planting materials are reliant on the natural seedling (wildlings) in the forest floor and seeds in production forest, conservation areas and nature reserve. Seeds are only found in the interval of 3 - 5 years and only small number of seeds are available in between. Small number of seeds produced are mostly attacked by predators such bats, birds, etc.

In Central Kalimantan, Lahei is the only location where ramin seeds could be collected. Lahei is a portion of production forest of approximately 200 ha which has been managed as seed source of ramin by local community and administered under Forest Service of Central Kalimantan province.

Seed source identification in Kalimantan.

3.5.2. Stimulation of seed production

In order to overcome the lack of seed in nature trial to stimulate flower and fruit production is being conducted using chemical substance, namely paclobutrazol. This stimulant has been widely applied to stimulate fruit production in arboriculture. By applying this stimulant it s expected to have positive effect in seed production of ramin. This trial has been conducted in Tumbang Nusa Research Forest, Central Kalimantan.

Trial to stimulate flowering - fruiting on ramin in Tumbang Nusa, Central Kalimantan.

Trial to stimulate flowering - fruiting on ramin in Tumbang Nusa, Central Kalimantan.

3.5.3. Vegetative propagation technologies

Vegetative parts of plant have been developed for planting materials. Two methods are commonly used for propagation: macro propagation using stem (shoot) cuttings and micro propagation using tissue culture technique. The two methods have been developed. The results are as follows:

3.5.3.1. Stem cuttings

There was no abundant flowering and fruiting of ramin reported from 2005 until 2012 on the usual source of seeds collected. Therefore, at this time, stem cuttings are primary source of planting materials for ramin. The stem cuttings are shoot of wildlings collected from forest floor in PSF of production, conservation forest and nature reserve, including Lahei (Central Kalimantan) as described earlier. The other source of wildlings were also available to be collected in the area allocated for other uses (Forest allocated for other uses), which was previously secondary forest or ex-concession areas. Number of wildlings in these areas gradually decreases, since the flowering and fruiting season in the last 5 - 6 years gave no significant number of seeds that reach forest floor for natural regeneration.

To continually produce stem (shoot) cuttings, stock plants are necessary to be established. The stock plants were arranged in any design with primary purpose is to produce stem (shoot) cuttings. The stock-plants could also be from seedlings raised from seeds and or raised from wildlings. The term Hedge Orchard is used to the name the stock plants gardens.

Two relatively representative site for Hedge Orchards have been established, one in Kedaton, Ogan Komering Ilir (OKI) South Sumatra and another one is established in Tumbang Nusa Research Forest, Central Kalimantan. During the period of 2008 - 2011, a temporary Hedge Orchard (potted stockplants) was established in the nursery complex of FORDA, Gunung Batu-Bogor. In the hedge orchard, 400 stock plants were grown as source of cuttings.

In Kedaton, a location site which was an ex-burnt PSF of 20 ha has been granted by District Forest Service of OKI for trial of ramin. This site has been planted with ramin planting materials with various planting designs. The planting materias are from seedling raised from seeds, wildlings and seedlings raised from stem (shoot) cuttings. The plantation of ramin in this site was carried out using no specific trial design. The purpose of this plantations is primarily for conserving ramin seedlings, rescue wildlings from lands which will be converted to other uses and for mass production of stem (shoot) cuttings. Until mid 2012, nearly 4000 ramin seedlings have been pooled in this site which occupied 4 ha, with spacing from 2x3 m up to 5x5 m.

In Tumbang Nusa Research Forest, a portion of site (0.25 ha) located behind the basecamp and 4 ha of secondary PSF have been used for the establishment of Hedge Orchard of ramin. Behind the basecamp, nearly 1300 ramin stockplants have been pooled in strip planting 0.5x1 m covered with shading net. Inside the secondary PSF two different planting design hedge orchards were established. The first Hedge Orchard was establlished using strip planting of spacing 0.5x1 m

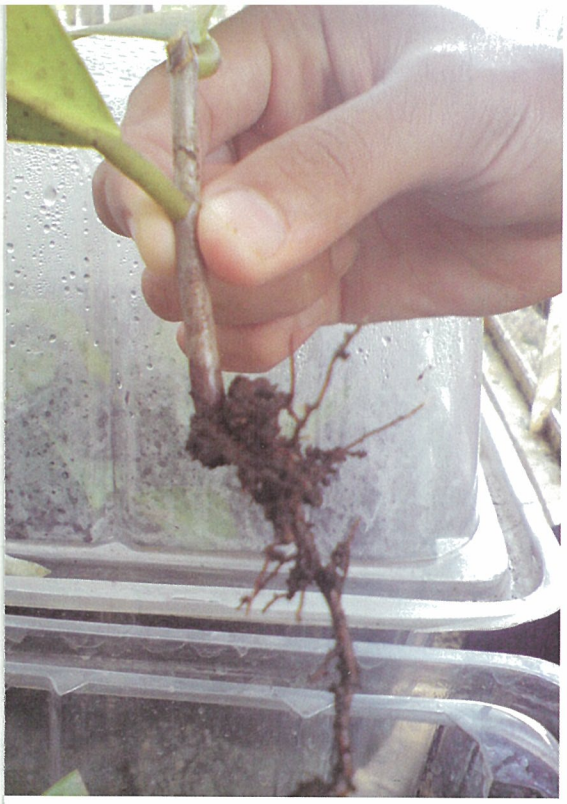
(block of 2.5x50 m, 5 lines, 500 wildlings per block, 10 blocks or total of 5000 wildling are becoming stockplant) and vertically circled gap planting with diameter gap of 10 m and 100 wildlings were planted in each gap or total of 5000 wildlings are becoming stockplants. Not all wildlings grow and survive after replanting in Hedge Orchard. Replacement of dead wildlings with the newly collected and live wildlings are carried out regularly. Approximately 11.000 stockplants have been pooled and maintained in growing condition in this research forest.

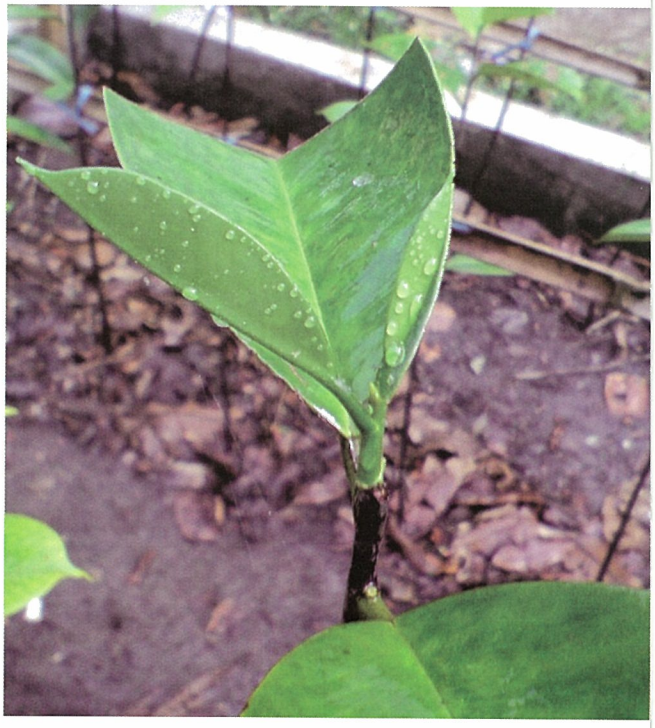
Stock plants in these Hedge Orchards are still growing. At the current stage, only 10 - 20 persen of the total stockplant are becoming ready to be harvested for stem (shoot) cuttings. The harvesting time is normally every 6 - 7 months or twice a year. The fertilizer treatment has been applied to enhance the growth and the maturity of stem to be used for cuttings. While observing the response of fertilizer treatment, the harvest of stem (shoot) cutting are continually carried out to maintain the production of planting materials and to enlarge the number of stockplants in the Hedge Orchard.

Until recently, 1000 stem (shoot) cuttings have been harvested and raised in the fogging-cooling nursery. These vegetatively propagated planting materials are prepared to raise the number of ramin planted in the trial site.

Collection of stem/shoot cutting

Preparation of stem/shoot cuttings





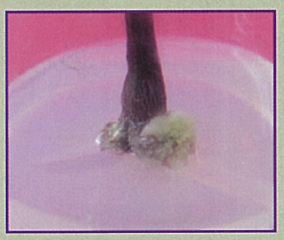
The newly growing leaf and roots.

3.5.3.2. Tissue culture technique (In-vitro propagation)

The other technique which has been explored is the development of tissue culture (in-vitro propagation). This technique has been widely developed for species not only agricultural species but also forestry species.

This activity has been carried out in co-operation with Center for Biotechnology and Tree Improvement (CBTI - FORDA) - Yogyakarta. This activity has been carried out since 2008. The 200 ramin seedlings raised in the nursery to support frequent collection of material (short ex-plant) for developing technique to produce planting materials from tissue culture technique.

Explant



Yields

Developing in-vitro propagation technique

3.6. Plantation Technologies

Plantation technologies for ramin have not been readily applicable. Scarcity of planting materials has made limitation to scale up and comprehensive plantation trials. Seed sources in natural forest have been limited and scattered and no specified seed source has been established, except a seed stand, locally bordered and mananged by local initiative in Central Kalimantan. Vegetative propagation, including tissue culture has not been available to be applied in the field. High quality genetic materials, such as plus tree clone which shows faster growing trait has not been identified and collected. This slow progress in developing technology for ramin plantation is also caused by the lack of incentive scheme to plant slow growing species like ramin.

3.6.1. Plantation trials

Ramin plantation in various scale of trial has been carried out mostly before 2000. Most of the trials were carried out for enrichment planting under forest stand. The trials are mostly to fill the minimum requirement of natural regeneration under the forest stands after certain period of logging. Since the growth is so slow, most of the trials were abandoned after several years and no sufficient maintenance applied and no monitoring afterward. Small scale plantation trial has been restarted. In south Sumatra the trial was carried out in ex-burnt and relatively open area. The results revealed that with intensive care with fertilizer application, ramin grow well and mostly reach 1 - 2 meters heights after two years. The other trials under forest floor (shade areas) may have been underway in some areas.

Two years ramin plantation trial in Ogan Komering Ilir (OKI), South Sumatra.

Ramin plantation in Ogan Komering Ilir, South Sumatra






Ramin plantation in Tumbang Nusa, Central Kalimantan

3.6.2. Appropriate seedling treatments

Ramin seeds are classified as a recalcytrant with very short period of storage. Existing information indicates within a week after seedfall or extracted from fruits, the viability has been decreased. The handlings of ramin seeds are nearly similar to that of most recalcitran seeds, including methods of packing and storage.

Common practice in germinating ramin seeds is that seed is directly planted into polybags with the germination media close to its original growing condition (peat soil mixed with sands). Seedlings are ready to be transplanted after 6 - 12 months in the nursery raised condition or approximately after the height of seedling at least 50 cm.

3.6.3. Site requirement for better growing

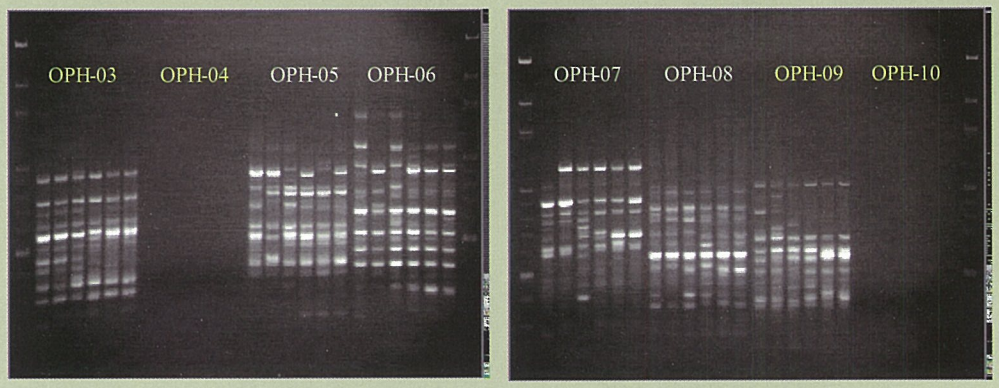
This activity consists of reviewing the existing results of research and development on site requirement for growing at various stage of development, from seed, seedling and young trees. Factors influencing plant growth and development, such as light intensity, growth medium (chemical and physical properties), nutrients, micro-organism and its associated species are included in the review.

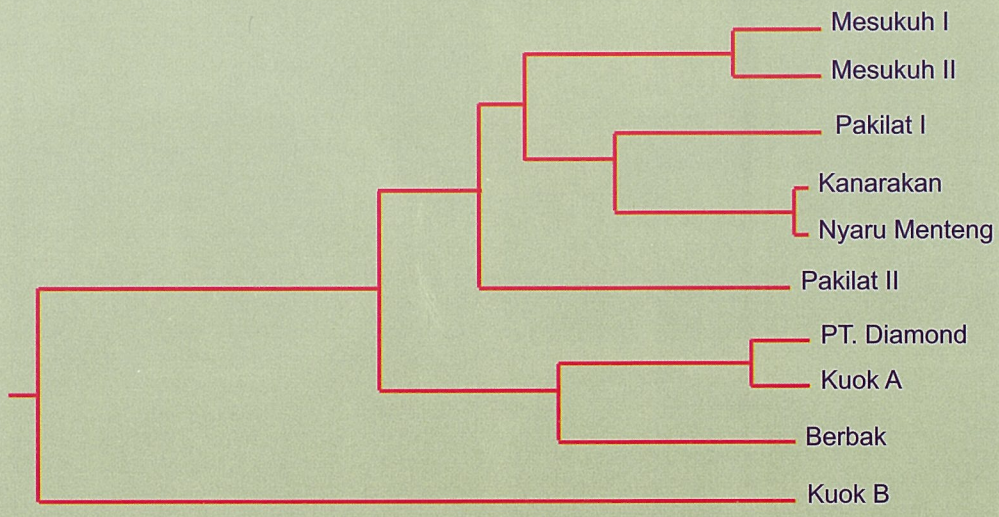
Ramin is semi-tolerant species which requires low light intensity (shade) at seedling stage and require more sunlight at sapling, pole and mature stage. However, there is no consistent results regarding light requirement, vary between one trial to other trials. One experiment employing wildling (naturally regenerated seedlings) replanted under secondary forest stand at 6 months old (< 50 cm height) showed better performance in semi-shade (half light intensity) than in the open and fully shade areas. Other trial showed better reponse of seedling growth in open areas. In relation to media, seedling at 12 weeks old in nursery planted in the growth media of mixed media of peat and mineral soil (3:1) showed better performance in seedling heights. Whereas, fertilizer application show significant reponse to ramin growth planted in open area trials. Infestation of media with certain micro-organism (mycorrhizae) mostly provides positive reponse to plant growth but no signficant effect to ramin growth. In summary, fertlizer application give promising result to ramin growth in combination with treatment of light intensity and media.

Maintenance and fertilizer application

3.7. Identification of Ramin Genetic Variation using Molecular Markers

Genetic diversity (variation) of ramin the populations of Riau, Jambi, West and Central Kalimantan were assessed using molecular marker. Leaf materials of populations in Sumatra and populations in Kalimantan were collected. Overall result revealed that genetic diversity of ramin accross population is relatively high.





Profile of DNA marker (above); Dendrogram of ramin populations (below).

Chapter 4

Future Direction

Chapter 4. FUTURE DIRECTION

4.1. Roadmap

Remaining gaps and potential barriers toward the achievement of sustainable ramin timber production, conservation and PSF as a whole have been identified. Those gaps and potential barriers have been accommodated and translated into a roadmap towards sustainable management and conservation which contains national strategy, action plans, time period, approach and institutions responsible to field implement and supervision.

4.2. Urgent Provision of Planting Materials

There are lack of seed sources have been allocated officially and developed specifically for ramin. Only one site, Lahei, located in Mentangai District of Central Kalimantan has been officially bordered as seed source. This seed source is officially managed by District Forest Service. Therefore, this is urgent to re-explore and revisit the potential seed source of ramin in Sumatra and Kalimantan. This is because, the requirement for planting material of ramin is large and the large number of planting materials could only be fulfilled through seed production. At this time, only vegetative propagation from cuttings is as primary source of planting materials.

4.3. Monitoring Seed Production

The availability of seeds and seedlings are still expected in the years to come, therefore monitoring of seed production is critical important. To monitor the seed production several approaches have been made, as follows:

(1). Keep monitoring for flowering and fruiting season with local forestry institutions and potential collaborators both in Sumatra and Kalimantan;

(2). Establish several contact persons, such as local community and local seedling suppliers, in Sumatra and Kalimantan;

(3). Enhance the establishment of a Hedge Orchard (as source of cuttings) for consistent production of shoot or stem cuttings for the provision of planting materials.

4.4. Necessary of Consistent Supports

Activities related to the plantation trial and productions of planting materials have been initiated in collaboration with Regional Research Center of South Sumatra and Regional Research Center of South Kalimantan. This activity is expected to be continued by these institutions as a part of their regular activities in the development of plantation trial for forest tree species.

Field plantation, with various design, has been initiated in an PSF area of 4 ha (out of 20 ha allocated), in District of OKI, South Sumatra. Regional Research Center of South Sumatra is expected to allocate cost for maintenance of this site and continue conducting trial and producing planting materials of ramin using vegetative cuttings. District Forest Service of OKI has allocated financial support for fire prevention, which is a serious threat to the site.

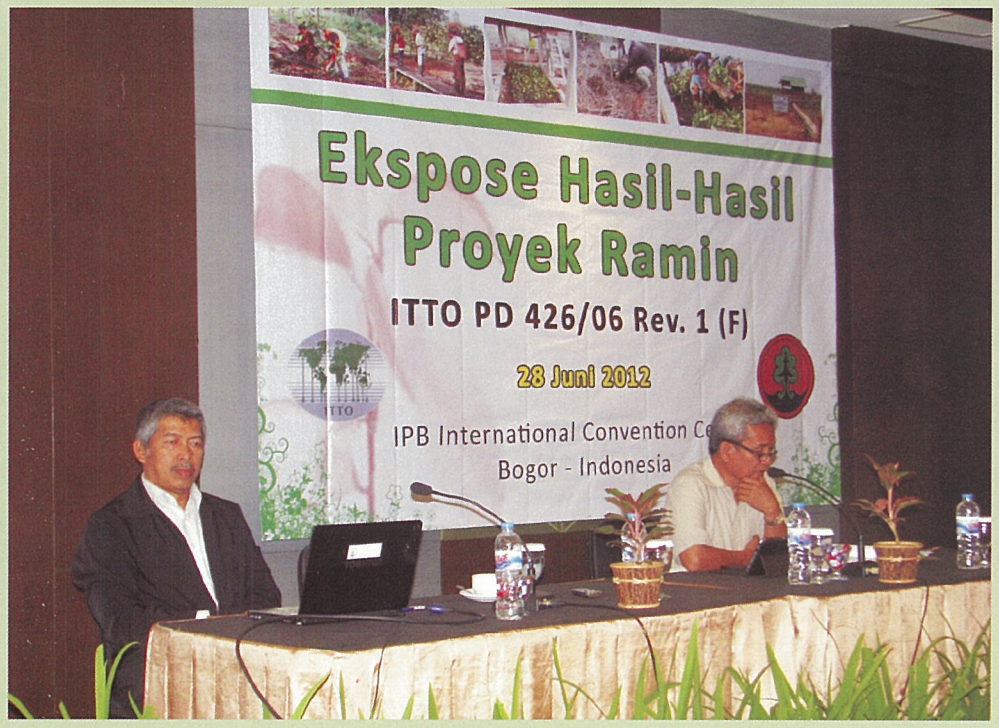
A Hedge Orchard (as a source of cutting) and plantation trial have been also initiated in Tumbang Nusa Research Forest in cooperation with Regional Research Center of South Kalimantan. The Hedge Orchard is constructed with naturally regenerated seedlings (wildlings). Initial collections of the wildlings were over 10,000 wildlings and it is expected that over 6,000 wildlings grow and could be used as source of cuttings. Regional Research Center of South Kalimantan is expected to maintain this Hedge Orchard to continue producing vegetative cuttings for plantation trials.

Trial to stimulate seed production of ramin in Tumbang Nusa Research Forest has also been conducted in collaboration with Regional Research Center of South Kalimantan and University of Lambung Mangkurat. This stimulation trial could be continued in the effort to enhance seed production of ramin.

The initiation of in-vitro propagation (tissue culture) of ramin. Project has established in cooperation with Center for Bio-technology and Tree Improvement (FORDA – Yogyakarta) in the development of propagation technique using in vitro propagation of ramin. This initiation is expected to be continued by the institution as a part of their research activities.

4.5. Need for Resource

In general, consistent financial support is required to maintain the initiated activities. Strong commitment from related institutions to keep on the activities is critical importance, since ramin is a very slow growing, require long term effort and currently its habitats (PSF) are facing serious threat, prone to fire. International support is still required.



Expose of ITTO project findings

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