



# The Assessment of Ramin Plantation Requirement and the Establishment of Ramin Genetic Resources Conservation Gardens

*an Executive Summary*

Support to ITTO-CITES Implementation for Tree Species and Trade/Market  
Transparency (TMT)



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**Center for Conservation and Rehabilitation Research and Development  
Forestry Research and Development Agency  
Bogor-Indonesia, 2014**





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Author:

**Tajudin Edy Komar  
Dian Tita Rosita  
Nurul Ramdhania**

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## **An Executive Summary of ITTO-CITES Phase II Project**

### **Author:**

Tajudin Edy Komar  
Dian Tita Rosita  
Nurul Ramdhania

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## Preface

The Activity “*The assessment of ramin plantation requirement and the establishment of ramin genetic resource conservation garden*” has been implemented from September 2012 - through February 2014 (18 months).

This executive summary contains the main results and findings of the Activity which may be useful for the enhancement of sustainable management and conservation of ramin in Indonesia. Several recommended sites for initial plantation of ramin have been identified, the approximate number of planting materials has been made and the schemes or cooperations have been explored. Conservation gardens which also function as source plant for cuttings have been established and expanded. These all are expected to be followed up and further explored by concerned and relevant stakeholders on ramin.

Bogor, April 2014

Author



## List of Abbreviation and Acronyms

BPTH	:	<i>Balai Perbenihan Tanaman Hutan</i>
CCR	:	Center for Conservation and Rehabilitation R&D
CITES	:	Convention on International Trade in Endangered Species of wild fauna and flora
FORDA	:	Forestry Research and Development Agency
Ha	:	Hectare
HO	:	Hedge Orchard
ITTO	:	International Tropical Timber Organization
MoF	:	Ministry of Forestry
OKI	:	Ogan Komering Ilir
PSF	:	Peat Swamp Forest
RRC	:	Regional Research Center
SFM	:	Sustainable Forest Management
WCMC	:	World Conservation Monitoring Center

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## 1. Introduction

Over-exploitation, illegal logging and forest fire have contributed to the rapid degradation of habitats and ramin population. One of the impacts is that the natural regeneration in the habitats occurs unsatisfactorily which also cause rapid reduction of population density. On the other hand, intervention through rehabilitation and artificial regeneration have faced serious barrier. One of the barriers is related to the scarcity of planting materials. The holders of forest concession in Peat Swamp Forests have the obligation to plant indigenous species in their area, including ramin, either as enrichment in logged over areas or re-plantation. However, the obligation could not be executed satisfactorily due to the unavailability of planting materials.



**Figure 1.** Ex-burnt Peat Swamp Forest

Intervention to enhance the rehabilitation and re-plantation of *Gonystylus bancanus* in its original and natural habitats need to be taken through various activities. These include the identification and exploration of potential source of planting materials (seed stand, seed production areas and seed trees) including macro-micro propagation, identification of suitable areas for rehabilitation and re-plantation, and scheme for continuous plantation involving various stakeholders.

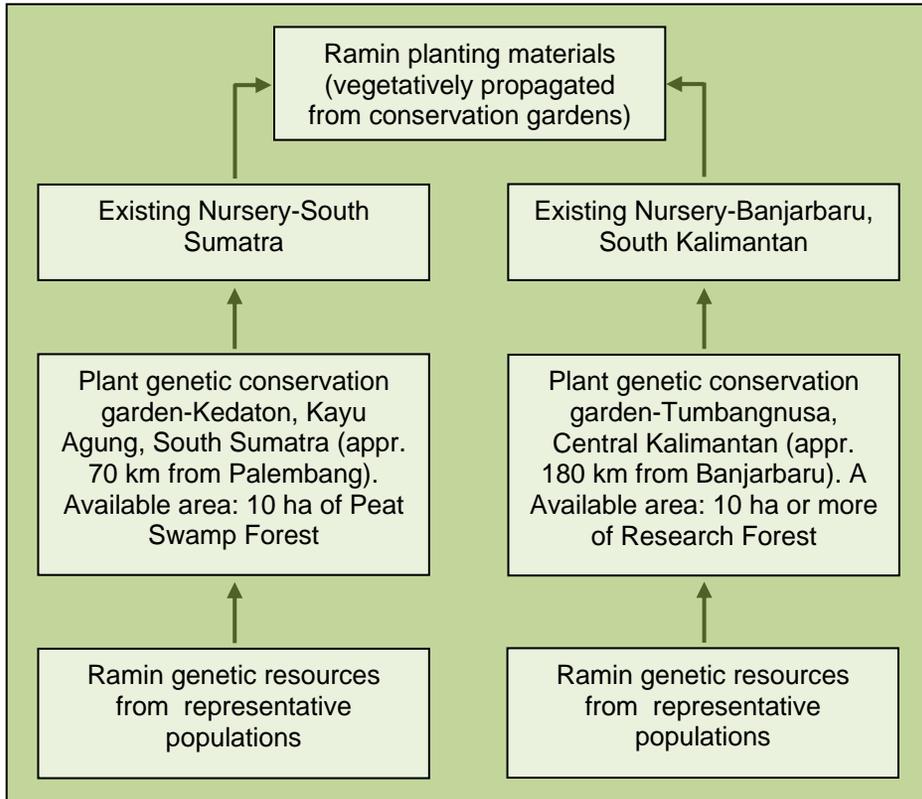
One of the solutions to the scarcity of planting materials is now through macro-propagation primarily from rooted cuttings. This technique has been explored and developed in the previous activities. The production of rooted cuttings using various combinations of technique has produced promising results and has been applied for mass and routine production.

This is a complimentary to the continuous monitoring for flowering, fruiting and seed production in the remaining population of ramin in Sumatra and Kalimantan.

The propagation technique using stem/shoot cuttings and grown in fogging nursery system has indicated excellent results. Under this nursery system, within 11-12 weeks, almost 90% of cuttings are rooting. However the limiting factors for mass propagation using cuttings is the availability of cuttings. The number of source plant is still limited. The cutting cycles are mostly twice a year and not all source plants could produce mature cuttings at the same time. Therefore more source plants (Hedge Orchards) need to be established and expanded. The establishment and expansion could be combined with the establishment of conservation garden (gene pool) where all possible genetic materials of ramin are pooled in one site and at the same time their cuttings could be harvested for as planting materials.

In addition, in order to secure the rehabilitation and re-plantation activity of ramin, the accessible, suitable and secured sites need to be identified. There are many sites qualified for rehabilitation and re-plantation of ramin but they are not secure enough from fire, conversion and other disturbance. This is important to be considered since ramin is relatively slow growing and requires intensive care at the early stage of development, which is different from that of natural regeneration.

Since rehabilitation and re-plantation of ramin requires long term efforts, collaboration with relevant stakeholders need to be established and maintained. This is also important, especially in field maintenance. Ramin is relatively slow growing and requires intensive care at the early stage. Ramin growing also faces possible disturbances, such as fire.



**Figure 2.** Flow chart of current production of vegetatively propagated planting materials

## 2. Main Objective

The main objective of this activity is to contribute to the enhancement of recovery of ramin population and habitats and conservation of ramin plant genetic resources in Sumatra and Kalimantan. The objective could be achieved through the assessment of sustainable areas for replantation, the number of planting materials required and the establishment of ramin genetic conservation gardens in several places, which also serve as source of cuttings. Ramin genetic resources pooled in the conservation gardens represent ramin natural populations in Sumatra and Kalimantan.

### 3. The Outputs

The outputs achieved under this Activity are:

- 1) The identified areas in the deforested-degraded ramin habitats to be restored and planted.
- 2) The estimated number of ramin planting materials required for plantation.
- 3) The establishment ramin genetic resource conservation gardens in several areas.

### 4. Approaches (Methodologies)

- 1) The identification of degraded and deforested site for ramin re-plantation in Sumatra and Kalimantan through primary, secondary data collection and field survey.
- 2) Identification of the estimated number of planting materials required for the re-plantation and its potential production in Sumatra and Kalimantan through technical workshop, field survey etc.
- 3) National workshop to determine plantation scheme and institutions responsible for future maintenance.
- 4) Collection and production of planting materials from representative sources of rooted cuttings and wildlings.
- 5) Planting of naturally regenerated seedlings and vegetative propagated seedlings and their routine maintenance of the gardens.

## 5. The Achievement

The data and information on the areas to be restored and planted have been identified in this activity. This identification is based on the accessibility, suitability and security from fire, conversion and illegal occupation. Many other sites may qualify for the re-plantation but might be unsecure and the accessibility is poor. The accessibility is critical primarily for fire prevention.

The estimate of required number of ramin planting materials has also been projected to support the re-plantation in the identified areas. This includes the potential sources for planting materials. The estimated number is developed based on the expected number of mature ramin trees per ha at the end of cycle (200 mature trees per ha). The estimated number also uses the assumption of the survival rate of around 20%.

To ensure the availability of genetic materials and sufficient genetic diversity of ramin, several genetic conservation gardens have also been established and expanded under this Activity. Two locations, one each in Sumatra and Kalimantan have been established earlier. Further expansion has been carried out for Tumbangnusa, Central Kalimantan to enlarge the number of the existing genetic materials. Similar activity has also been executed for South Sumatra by planting rooted cuttings from Kalimantan (Tumbangnusa). Newly established conservation garden containing 4,800 (at the time of planting) has also been established in Lubuk Sakat, Pekanbaru, Riau. The seedlings were collected from Giam Siak Kecil Bukit Batu Biosphere Reserve in the Province of Riau.

All possible representatives of ramin population in their natural range of habitats have been pooled in conservation gardens. More genetic materials need to be collected and pooled in the gardens. The production of rooted cuttings approximately 4000 rooted cuttings have been made, a half of them are growing and transplanting to Kedaton, OKI and Sukomoro Nursery, South Sumatra.

In addition to the above activities, the efforts of re-plantation and the conservation of ramin genetic materials have also been growing through dissemination of data and information and other related issues on ramin. Collaboration with relevant stakeholders is continuously maintained and expanded. The collaboration is essential to achieve the ultimate goal for ramin sustainable management and conservation.

## 6. Benefits and Beneficiaries

The benefits of this Activity are:

- 1) Identified areas in deforested-degraded ramin habitat to be replanted with ramin.
- 2) The estimated number of ramin planting materials required for the plantation activity.
- 3) Ramin plant genetic resource garden which could also be used as source of cuttings.
- 4) Continuous production of ramin planting materials through rooted cuttings.
- 5) Capacity building and awareness raising.
- 6) Compliance with CITES general objective and World Conservation Monitoring Center (WCMC) for the SFM and conservation of internationally traded timber species.

The primary beneficiaries of this activity are:

- 1) The Ministry of Forestry (MoF), DG of Forest and Land Rehabilitation and Social Forestry (Now DG of Catchment Area Management and Social Forestry);
- 2) CITES Management Authority (Directorate of Biodiversity Conservation, MoF);

- 3) CITES Scientific Authority (Indonesian Institute of Science);
- 4) Research Institutions;
- 5) Provincial and District Forest Services;
- 6) Universities; and
- 7) State Owned and Private Companies.

## 7. Identification of Sites for Rehabilitation and Re-plantation of Ramin

Ramin is naturally growing in peat swamp forest in Sumatra and Kalimantan. The population of the species is drastically decreased since last 10-15 years. The decrease is indicated by sharp decrease of timber production and even more decrease in recent years. The causes of the decrease are primarily deforestation and degradation of peat swamp forest. Conversion, illegal logging and frequent forest fires that occur every year also the causes. Extreme weather frequently hit the peat swamp forest. Earlier, the total area of PSF was approximately 20.6 millions ha and now reduced to approximately 13 millions ha. This 13 millions has been converted into various uses and conditions.

In order to restore ramin population, rehabilitation and re-plantations of ramin is necessary to be carried out. The first stage in the rehabilitation and re-plantation of ramin is identification of suitable, accessible and secure site. As in addition, the provision of planting materials of ramin is also important.

### **Methodology**

The methodology used in this identification consisted of collection of primary data and information, interview, discussion and technical

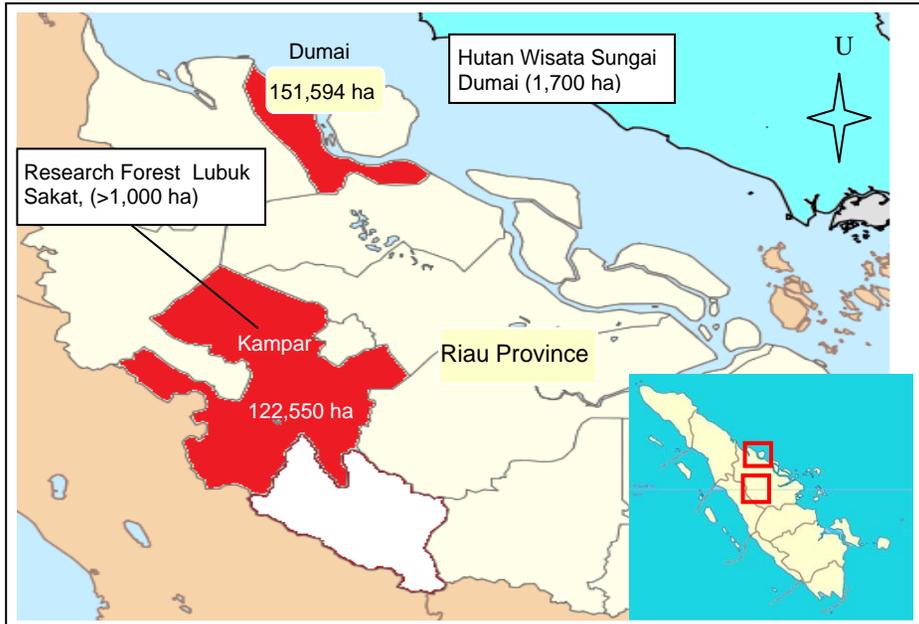
workshop; collecting secondary data and information through literature search and other document collection. At the last stage the draft containing the recommended areas based on sustainability, accessibility and security was presented and discussed in a workshop (Focus Group Discussion) attended by competent individuals from relevant institutions. The workshop is to validate the data and information obtained and the feasible sites for the purpose of rehabilitation and re-plantation of ramin.

The criteria for the selection of site are land legal status, accessibility, security, the damage, vegetation, sustainability and support from the government at local level.

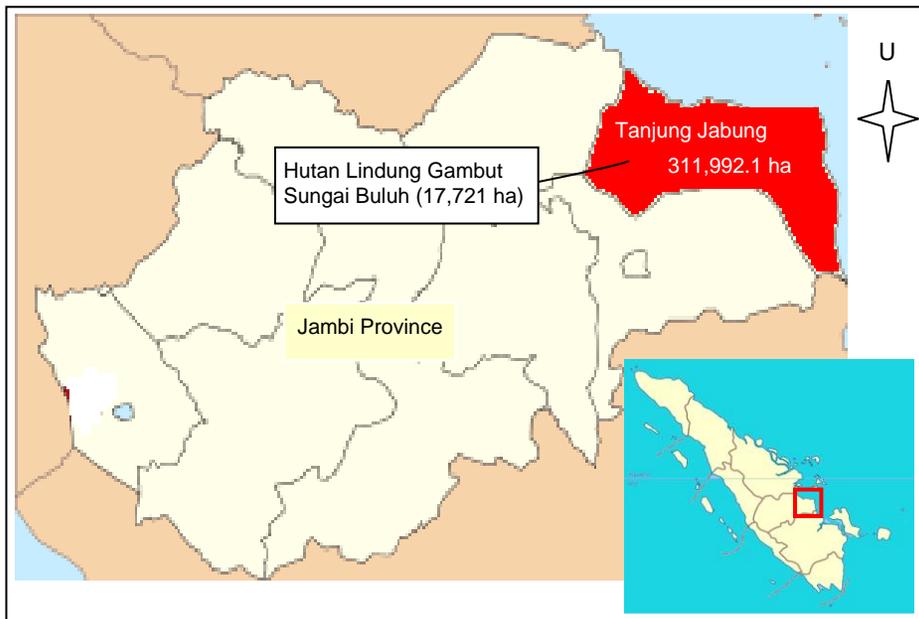
### **Recommended Areas**

Based on the criteria and inputs from the workshop there are six areas recommended for re-plantation of ramin. There are four locations in Sumatra: Hutan Wisata Sungai Dumai, Research Forest of Lubuk Sakat; Hutan Lindung Gambut Sungai Buluh; and Restricted Production Forest Padamaran. There are two locations in Kalimantan are: Hutan Kota Sungai Raya and Taman Nasional (National Park) of Sebangau. The area of the above locations is from 25 ha to large areas.

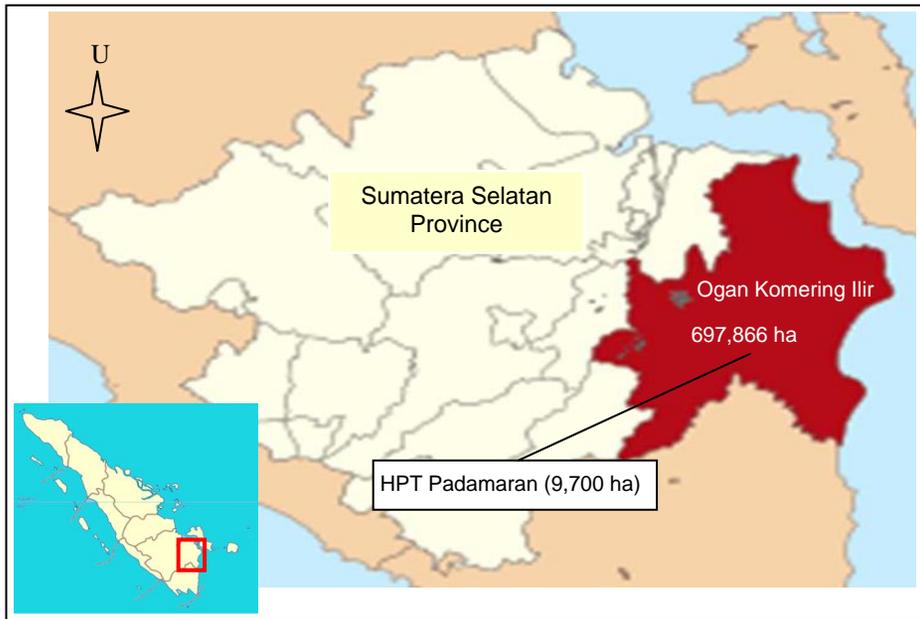
The maps of recommended areas for rehabilitation and re-plantation of ramin are as follows:



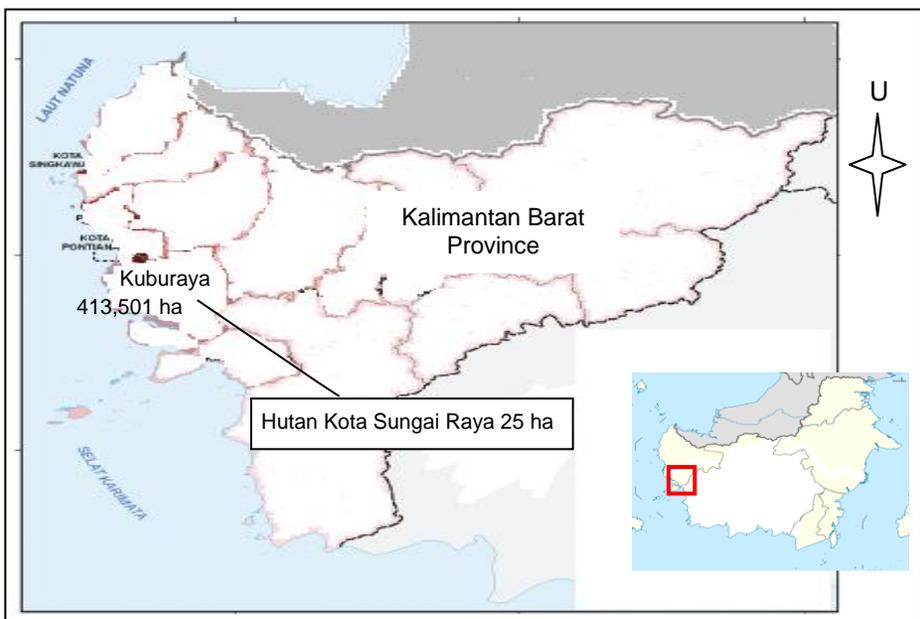
**Figure 3.** Location of Hutan Wisata Sungai Dumai and Research Forest of Lubuk Sakat in Riau



**Figure 4.** Location of Hutan Lindung Gambut Sungai Buluh in Jambi



**Figure 5.** Location of Restricted Production Forest Padamaran in South Sumatra



**Figure 6.** Location of Hutan Kota Sungai Raya in West Kalimantan



**Figure 7.** Location of National Park of Sebangau in Central Kalimantan

## 8. The Estimated Number of Required Planting Material

The estimated number of required planting materials has been presented by representative of five provinces Riau, Jambi, South Sumatra, West and Central Kalimantan in a national workshop organized by the Activity. Detail of the information is presented in a complete paper. Some of the information presented are the area of PSF in each province which have been deforested and degraded, the area of priority to be replanted with indigenous species and the number of ramin planting materials required for rehabilitation and re-plantation of ramin regardless the number of planting materials be able to be provided yearly by the existing seed source and propagation technique.

## **Methodology**

Methods used to estimate the number of planting materials required by each province is primarily based on the total area to be replanted (rehabilitation), spacing and the estimated mortality which will be replenished. The estimate is developed based on the assumption that the sources of planting materials are from seeds. The number of estimated required planting material differs from that of planting materials grown from rooted cuttings. The estimated number of planting materials was also discussed in the workshop.

### **The estimated required planting materials from rooted cuttings**

Based on field routine practice on the plantation of rooted cutting the mortality rate varies in each stages of development from cutting to rooting, hardening and transplanting to the field. Since the survival rate is relatively low, the number of required planting materials may be over estimated or under estimated.

If the number of trees is expected to be at least 200 trees/ha at mature stage (> 40 years) the number of required planting materials is 1,800 per ha. The workshop concluded the highly prioritized areas of PSF for ramin re-plantation is 85 ha and the estimated number of required planting materials from cuttings is 165,000.

## **9. The Establishment of Conservation Gardens**

There are several recommendations related to the sustainable management and conservation of ramin. Two of them are the establishment of conservation gardens (ex-situ/in-situ conservation) and the development of mass propagation using the previously developed technique. The conservation gardens could also function as source of

cuttings to support the propagation of planting materials using rooted cutting. This is because the technique for mass propagation using rooted cutting technique has been developed and successfully tested with relatively high percentage of rooting under the conventional and environmentally controlled nurseries.

Since the sources of cuttings (source plant) are still extremely limited the expansion of conservation is highly recommended by pooling all possible plant genetic materials which represent population from Sumatra and Kalimantan.



**Figure 8.**  
The rooted cutting in the nursery of Sukomoro, Palembang, South Sumatra

Two conservation gardens have been previously established in Kedaton, OKI South Sumatra and Tumbangnusa, Central Kalimantan. A newly established conservation garden is in Lubuk Sakat, Pekanbaru, Riau. These three conservation gardens could be further expanded in term of areas. Kedaton conservation garden was originally up to 10 ha and has granted for this purpose for 20 ha. At the end of 2011, only 4 ha out of 20 ha have been planted with ramin using planting materials grown from seed and rooted cutting. The planting designs used are based on the availability of planting material which are not similar and the planting carried out in different time period. At the time, 3,000 to 4,000 planting material were planted and based on last evaluation in 2013 only approximately 1,000 ramin survive and grow. This high mortality is caused by several factors even though intensive care has been done such as weeding (4 times a year) and fertilizer application in the first 1-2 years. The cause of mortality is primarily from extreme dry, this site was ex burnt PSF covered only with small shrubs. The other disturbances are by insect (pests) and some of young ramin seedling, were attacked by wild pigs. The wild pigs searched soil worm in the fertile soil where the ramin roots are growing underneath of ex-polybag.

Under this Activity, more planting materials have been transplanted into this conservation garden also with high percentage of mortality (only up to 20% survival). Extreme temperature and lack of water distribution facilities also worsen the mortality. To solve this problem the new rooted cuttings will be further hardened in the nursery of Sukomoro, Palembang prior to field planting. Other treatment of rooted cutting to avoid high mortality is by placing rooted cutting under the shade areas under the shelter. However the result is still not satisfactorily. Therefore research and trial to obtain optimum condition and size of rooted cuttings before transplanting need to be further carried out.

Similar to that of Kedaton, conservation garden in Tumbangnusa which also function as source of cutting has also been established in 2010. In that time, three different sets of establishment has been carried out. The first one was the establishment of Hedge Orchard (conservation garden) nearby camp with 1,300 genetic materials (wildlings) and the other two set, with 5,000 genetic materials were established with the design of line planting and space gap planting. Approximately 11,300 genetic materials have been pooled. The survival rate was also approximately 20-30% and replenishment has been carried out to maintain the number of lived ramin is approximately 11,300 as in the design. The replenishment has been carried out using RRC South Kalimantan fund and ITTO CITES project fund.

In addition to the above conservation gardens, the expansion of shaded Hedge Orchard has also been carried out. The expanded Hedge Orchard is just next to the previously established Hedge Orchard nearby camp and accommodated 1,800 wildlings. If ramin plants in these conservation gardens (HO) grow well and could produce stem cuttings, the numbers of source plants are already sufficient to support yearly production of 5,000-10,000 rooted cuttings per year, with the present technique and method of handling and no extreme weather condition occurs. In earlier production, nearly 80% of source plant could produce cuttings; however, based on recent practice the harvestable shoot-stem is dependent on many factors such as weather condition and growth performance.

Under this Activity a new conservation garden is also established in Research Forest of Lubuk Sakat, Riau. This site has been planted with oil palm plant and the conservation garden is placed in between the oil palm plant.

The conservation garden is established in two designs, one in shaded areas and other in between the oil palm plant. The existing oil palm plant is retained to prevent extreme sunlight. Approximately 4,800 wildlings of ramin with various sizes (height) have been pooled in this garden which also functions as source of cutting. The garden could also be expanded in the future until genetic diversity is sufficient.

In addition to the collection of wildlings, approximately 4,000 rooted cuttings have been produced during this Activity period. Those rooted cutting have been transplanted in Kedaton, OKI and some have been pooled in Hedge Orchard Sukomoro. RRC South Kalimantan also collected shoot stem cuttings from conservation garden of Tumbangnusa for both research and other purpose.

## 10. Building Cooperation to Sustain the Initiated Activities

Several cooperations to achieve sustainable management and conservation of ramin have been started and also evaluated in a workshop dated 24 February 2014. One of the main activities is the establishment of conservation gardens which also function as source plant for cuttings. Because these gardens are also designed to produce cuttings, these gardens are also called as Hedge Orchard. The term Hedge Orchard is used for their cutting production in each cycle mostly twice a year depending on the condition of the source plant. The term source plant is also used as for mother plant in breeding program.

The two conservation gardens (Hedge Orchard) which have been established earlier located in Kedaton, OKI, South Sumatra and Tumbangnusa, Central Kalimantan. There is one additional conservation garden which later will also be used as source of cuttings (Hedge Orchard) is located in Lubuk Sakat, Riau.

A Hedge Orchard with specific design for cutting productions has been being developed, located in Sukomoro Permanent Nursery, approximately 10 km from Palembang city, South Sumatra. This Hedge Orchard (we called Hedge Orchard Sukomoro) will never be converted to conservation garden since the source plants are grown in large size plastic bag (potted source plants) and pooled in permanent nursery. All the source plants for the time being are from Central Kalimantan (Tumbangnusa Hedge Orchard) and grown from rooted cuttings. Until 1,500 potted plants will be grown in this nursery.

### **Plant Genetic Conservation Garden of Kedaton, South Sumatra**

This conservation garden (also as Hedge Orchard) is located in Kedaton, approximately 15 km from Kayu Agung (capital city of Ogan Komering Ilir District) and approximately 80 km from Palembang. The site is ex-burnt peat swamp forest with the total area of 20 ha. Only 4 ha have ever been planted with ramin and evaluation in 2013 it is found that from approximately 4,000 planted ramin, only  $\pm$  1,000 plants survive and well growing. This Hedge Orchard is intensively cared with at least 4 times weeding (removing unwanted plants) and at least 2 times fertilizer applications. This site (conservation garden) is established in cooperation between District Forest Service of OKI, Regional Research Center (RRC) of South Sumatra and Center for Conservation and Rehabilitation with financial assistance from ITTO and ITTO CITES.

District Forest Service of OKI allocated and granted the site of 20 ha and infrastructure (concrete bridge), fire prevention and field supervision. RRC South Sumatra provides expertise and maintenance cost for after project completion and on certain activities which are not funded by other parties. CCR with the assistance of ITTO and ITTO CITES provides supports on expertise, financial, materials and infrastructure

including after project maintenance. Security and legality status of Kedaton Hedge Orchard has been granted by District Forest Service of OKI as district contribution to this cooperation. This cooperation will be kept indefinite until the total of 20 ha is filled with ramin and become a show window for ramin re-plantation, conservation garden as source of cuttings (Hedge Orchard). Each party in this cooperation has allocated its own budget for annual maintenance. The amount of each is determined by each institution based on its interest.



**Figure 9.** Growing ramin in Conservation Garden, Kedaton, OKI

### **Plant Genetic Conservation Garden of Tumbangnusa**

Conservation garden in Tumbangnusa is located in Research Forest of Tumbangnusa, Central Kalimantan. The Research Forest is approximately 8,000 ha and the conservation garden occupies approximately 4 ha, which hold nearly 11,300 planted wildings. This conservation garden also functions as source of cuttings. This conservation garden is established in cooperation with Regional Research Center of South Kalimantan (Banjarbaru). RRC South Kalimantan provides space (site), technicians and infrastructure and CCR with the support from ITTO and ITTO CITES provides expertise

and financial support to carry out the activities. The maintenance cost after project is supported by both RRC of South Kalimantan and CCR. The utilization of this conservation garden (also as Hedge Orchard; source of cuttings) is for genetic conservation; source of cuttings for production of rooted cuttings and also for research purpose by researchers of RRC South Kalimantan.



**Figure 10.** Newly planted ramin in Conservation Garden in Tumbangnusa

### **Conservation Garden (Hedge Orchard) Lubuk Sakat, Riau**

This conservation garden is located in Research Forest of Lubuk Sakat (the name is interchangeable to Kepau Jaya), approximately 30 km from Pekanbaru city (capital city of Riau Province). This Research Forest is managed by RRC of Kuok, Province of Riau. The total area to be used for conservation garden (Hedge Orchard) could be until 5 ha. This conservation garden is established in cooperation with RRC of Kuok and CCR with financial support of ITTO-CITES. The future maintenance, including the replenishment of the dead ramin wildlings, weeding and fertilizer application will be shared between RRC Kuok and CCR. At the time of establishment (December 2013-February 2014), 4,800 wildlings have been collected from Wildlife Reserve of Giam Siak Kecil Bukit Batu and have been pooled in the garden. A number of 1,800 wildlings is planted under shaded nursery and the remaining were planted in open

areas in between oil palm plants. RRC Kuok provides expertise, infrastructure, labor and other facilities.



**Figure 11.** Ramin in Conservation Garden of Lubuk Sakat

### **Hedge Orchard Sukomoro**

Hedge Orchard Sukomoro is a newly established Hedge Orchard in a permanent nursery compound. This permanent nursery is managed by Center for Seed Production (BPTH) Sumatra and the land for the nursery is managed by RRC South Sumatra. This Hedge Orchard is established under the cooperation between RRC South Sumatra, BPTH Sumatra and CCR with the support of ITTO CITES. The contribution of RRC South Sumatra is the use of land, the contribution from BPTH is daily watering and maintenance and the role of CCR is to provide supervision and financial support. The Hedge Orchard will also function as for the production of cuttings and research sites and therefore the design is also for research activities.



**Figure 12.** Ramin in Hedge Orchard Sukomoro

### **Other Cooperation**

Cooperation with other institutions is still exploring and the existing ones need to be further expanded. One additional cooperation is being initiated with PT Arara Abadi (Pulp & Paper Company from Sinarmas Group). Current agreed informal cooperation is in genetic material exchange of ramin. PT Arara Abadi has also established a potted Hedge Orchard in Perawang R&D site, Riau with the assistance of Center for Biotechnology and Tree Improvement (FORDA)-Yogyakarta. The source plants of this Hedge Orchard are from several places in Sumatra and Kalimantan. The collection sites are not overlapped with those collected for Lubuk Sakat, Kedaton and Tumbangnusa conservation gardens. The purpose of this cooperation is to ensure the conservation of ramin genetic materials by duplicating genetic copy from its natural ranges of habitats. The cooperation is also to enrich and share the collection between the company and FORDA, knowledge and experiences on ramin propagation and conservation. Future cooperation will be on field plantation of ramin.



**Figure 13.** Genetic material in shaded Hedge Orchard of PT Arara Abadi

## 11. Revision of Technical Guideline for Vegetative Propagation

The rooted cuttings (previously called as vegetative cuttings or vegetative propagated planting materials) are an alternative of ramin planting material other than from seeds.

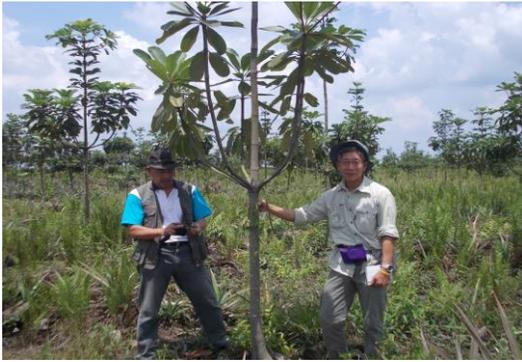
Since the wide use of the previously developed technical guideline and the need to improve the content, this technical guideline is requested for revision. The main changes are dual languages, Indonesian and English, the order of the content and the description of some necessary equipments or nursery. The improvement process of this technical guideline involved many qualified and competent personnels. A series of discussion meetings was organized. By this improvement, it is expected that this technical guideline become more useful to relevant stakeholders, from the simplest to the completely equipped nursery.

## List of Contact Person of Ramin Cooperation

No.	Activities	Institution	Contact Person
1.	Plant Genetic Conservation Garden of Kedaton, South Sumatra	Regional Research Center of Palembang, South Sumatra	<b>Ir. Bastoni</b> Jl. Kol. H. Burlian Km 6.5 Puntikayu, Palembang – South Sumatra Phone: +62-711-414864
2.	Plant Genetic Conservation Garden of Tumbangnusa	Regional Research Center of Banjarbaru, South Kalimantan	<b>Ir. Rusmana &amp; Riswan Ariani, S.Hut</b> Jl. A. Yani Km 28.7 Landasan Ulin, Banjarbaru – South Kalimantan Phone: +62-511-4707872
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4.	Hedge Orchard Sukomoro	Center for Seed Production (BPTH) Sumatra	<b>Riza Yanuardie, S.Hut &amp; Ir. Nelsi Adelina, M.Si</b> Jl. Kol. H. Burlian Km 6.5 Puntikayu, Palembang – South Sumatra Phone: +62-711-417140
5.	Genetic Material Exchange of Ramin	PT Arara Abadi (Pulp & Paper Company from Sinarmas Group)	<b>Isno &amp; Murdani, S.Hut</b> Jl. Teuku Umar No. 51 Pekanbaru, Riau Phone: +62-761-23332

## Appendix: Focus Group Discussion and Ramin Activities







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