REVIEW OF MANAGEMENT AND CONSERVATION STATUS OF ULIN (*Eusideroxylon zwageri* Teijsm & Binn.), EBONY (*Diospyros celebica* Bakh.) AND CEMPAKA (*Michelia champaca* Linn.) IN INDONESIA

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Review of Management and Conservation Status of Ulin (*Eusideroxylon zwageri* Teijsm & Binn.), Ebony (*Diospyros celebica* Bakh.) and Cempaka (*Michelia champaca* Linn.) in Indonesia

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This report is a part of program ITTO Project PD 539/09 Rev.1 (F) "Promoting Conservation of Selected Tree Species Currently Threatened by Habitat Disturbance and Population Depletion" in cooperation with Center for Conservation and Rehabilitation Research and Development, Forestry Research and Development Agency, Ministry of Forestry.

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PREFACE

This Technical Report is a result of Activity 1.1.1: Review the current status of forest tree species currently threatened by habitat disturbance. The activity is part of ITTO Project PD 539/09 Rev.1 (F): Promoting Conservation of Selected Tree Species Currently Threatened by Habitat Disturbance and Population Depletion.

Purpose of the review is to present the forest conditions of ulin (*Eusideroxylon zwageri* Teijsm. & Binn.), ebony (*Diospyros celebica* Bakh.) and cempaka (*Michelia champaca* Linn.), including taxonomy, geographical distribution and utilization, the status of their management and conservation, conservation efforts, as well as the conservation and management challenges. The review also presents recommendations of efforts and activities needed to be carried out to preserve the threatened tree species. The presented information is expected to assist policy makers in determining the steps needed to preserve ulin, ebony and cempaka.

We would like to express our sincere thanks to all parties, who contribute to this review for their valuable comments and supports.

Finally, we hope this review can support conservation efforts of the selected threatened species.

Bogor, February 2011

Authors

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ABSTRACT

Utilization of natural resources, particularly plants has been increasing during the last few decades. However, population of some species including ulin (Eusideroxylon zwagery. Teijsm & Binn.), from Lauraceae and ebony (Diospyros celebica Bakh.) from Ebenaceae family keep decreasing. Ulin is native species from Kalimantan and Sumatra and ebony is originated from Sulawesi. Both species have a great value and luxurious wood and recently these species are categorized as a fancy wood, which are classified into endangered (vulnerable). Although cempaka (Michelia champaca Linn), not includes as an endangered species, it has good prospects to be developed and maintained because of its multiple uses. Continuous extraction of its flower feared has caused natural regeneration of this species will decrease gradually or even disappear. Some conservation activities have been done to conserve those three species. However, so far based on the growth of the species, it seems to be unsuccessful. For that reasons, government need to declare that ulin, ebony and cempaka are the main species to be correlated in rehabilitation or plantation program. Complementary regulations that lead to a better conservation of these species need to be formulated as well. The purpose of this review is to present information about (a) recent condition of these species (b) management and conservation status (c) the efforts of conservation that have been conducted in their natural habitat (in-situ conservation) or outside of their natural habitat (ex-situ conservation) and (d) management and conservation problems. The review also presents recommendations to be done for the conservation of that three species by encouraging people to enlarge planting both inside and outside native habitat as well as preserve forest stand as original seed sources.

Keywords: Ulin (*Eusideroxylon zwagery* Teijsm & Binn), ebony (*Diospyros celebica* Backh), cempaka (*Michelia champaca* Linn), *in-situ/ex-situ* conservation, management.

I. INTRODUCTION

Indonesia is known as a mega diversity country. Among the many tree species that grow naturally, there are some tree species having a high value and a great demand, among others ulin (*Eusideroxylon zwageri* Teijsm. & Binn.), ebony (*Diospyros celebica* Bakh.) and cempaka (*Michelia champaca* Linn.). Wood of the tree species will be much favored if it has good natural properties both in quality and beauty.

Ulin wood also called Borneo iron wood is very strong and very durable which is classified into Strength and Durability Class I. Because of its strength and durability, ulin wood is in great demand. Ebony belongs to luxury timber species because of its strength and also the heartwood has a beautiful appearance. Increase demand for these two tree species has caused a high price and accelerated logging activities including illegal logging. Hence, their potency and population decreased significantly. Cempaka is in great demand for its fine fiber that it is very suitable for industry raw materials. Its flowers are used for perfumery raw materials and essential oils. In natural forests the existence of ulin, ebony and cempaka are getting difficult to find, the availability of these species is mostly found only in national parks, protected forests, forest research areas and remote forest production areas. Due to continuous decline of their population, ulin and ebony were listed in category of vulnerable species (IUCN, 2010).

Various efforts including government policies wich are related to the management and utilization, maintenance and plantation in their natural habitat (in-situ conservation) and outside their natural habitat (ex-situ conservation) are required to keep the sustainability of those tree species. The natural stands of ulin, ebony and cempaka in protected forests, national parks and primary forests need to be maintained as germplasm, seed stands and mother trees. Activities such as enrichment planting and planting of ulin, ebony and cempaka need to be conducted immediately, even though in some places it has been done, but the results have not been maximum yet.

The purpose of the Review of Management and Conservation Status of ulin, ebony and cempaka is to present the forest conditions of ulin, ebony and cempaka, including (1) taxonomy, geographical distribution and utilization, (2) the status of their management and conservation, (3) efforts of conservation in their natural habitat (in-situ) and outside their habitat (ex-situ) and (4) conservation and management challenges such as illegal cutting of trees under the specified diameter and those in protected forests. This review also presents recommendations of efforts and activities needed to be carried out to preserve those tree species. The presented information is expected to assist policy makers in determining the steps needed to preserve ulin, ebony and cempaka.

II. METHODOLOGY

Data and information of ulin, ebony and cempaka were obtained through secondary data collection (literature data either electronic or print media) and field surveys (interviews, discussions and direct observations).

Literature review was conducted by collecting and reviewing the results of research conducted by among others, universities, research institutes, communities and individuals concerned about the sustainability of ulin, ebony and cempaka. Study literature is generally in form of journals, magazines, newspapers, and unpublished information (reports, thesis, etc.). The study on government policies including study of regulations (Decree of Forestry Minister, Director General, and other decrees by Central and Local Government) related to the management and conservation efforts that have been done. To find out the problems and constraints faced in the implementation of the management and sustainability of the three species, interviews with communities, community leaders and relevant agencies were carried out.

Field surveys were aimed at obtaining data and current information about the potency and the existence of ulin, ebony and cempaka. Survey activities include data collection and information through interviews/discussions and direct measurements in the field (establishment of observation plots). Some locations of natural habitats and conservation sites (in-situ and ex-situ) visited, are among others: (1) East Kalimantan (Kutai National Park and KHDTK (Forest Area with Specific Purpose) Samboja, South Sumatra (areas of PT Restorasi Ekosistem Indonesia, Musi Banyuasin District and Mambang Custom Forest at Musi Rawas District) for observation and data collection of ulin, (2) Central Sulawesi (Parigi Moutong District: West Kasimbar Village – Kasimbar Sub district, Sausu and Maleali villages - Sausu Sub district) for ebony data collection and (3) East Java (Districts of Pasuruan, Nganjuk and Malang), South Sumatra (community gardens and cempaka seed stand areas in Lahat District) for observation and data collection of cempaka.

III. TREE SPECIES DESCRIPTION

A. Ulin (E. zwageri Teijsm & Binn.)

Ulin (*E. zwagery* Teijsm & Binn.) belongs to Lauraceae family. It is generally 30-35 m tall with a diameter at breast height (dbh) 60-120 cm, some reached 50 m height with 200 cm diameter. It has straight trunk, buttressed, canopy round shaped and a horizontal branching (Argent *et al.*, 1997 in Yusliansyah *et al.*, 2004). At Sangkima, Kutai National Park, ulin tree reaches 50 m height and diameter up to 275 cm and was recorded as the tallest and largest ulin tree in Indonesia (Figure 1).





Figure 2. Ulin fruits.

Ulin fruit is egg-shaped, pointed or blunt tip. Fruit size varies, large fruit sizing 10-18 cm long with diameter of 7-10 cm (Figure 2). In each fruit contains one seed (Beckman, 1949 in Yusliansyah *et al.*, 2004). Ulin wood is one of the heaviest wood, (Specific Gravity 1.04 (0.88 to 1.19), classified as Durability Class I and Strength Class I (Martawijaya et al., 1989, Barly, 2002).

E. zwageri grows naturally in lowland primary forest at an altitude of up to 400 m above sea level (Heyne, 1987). In South Sumatra ulin grows in soils having sandy clay loam texture with low soil fertility (Nugroho, 2006). Ulin is very strong and very durable, hence it is widely used for various purposes such as foundation in water and wetlands, shingle roof, frames and doors. In Banjarmasin, ulin fossil is used as stone rings and jewelry (Anonymous, 2009).

Ulin is a native tree species (indigenous tree species) of Indonesia. Ulin naturally found in the island of Sumatra (South Sumatra, Jambi), Bangka Belitung and on the island of Kalimantan (Figure 3).



Junaidah *et al.* (2006) reported the locations of ulin natural forests in Sumatra as presented in Table 1.

No	Province	Locations of natural forests		
1	South Sumatera	- Mambang Indigenous forest, Musi Rawas District		
		 Sungai Lilin Sub district 		
		 Tungkal Ilir Sub district 		
		 Bayung Lincir Sub district 		
2	Jambi	 Senami Grand Forest Park, Batanghari District 		
		– Durian Luncuk II Nature Reserve, Batanghari		
		District		
		- Durian Luncuk I Nature Reserve		
3	Bangka Belitung	- Mount Serumput, Lalingan village, East Belitung		
		District		
		- Gunung Kubing Protection Forest, West Belitung		
		District		
		- Gunung Tajam Protection Forest, West Belitung		
		District		

Table 1. The locations of ulin natural forest in Sumatera Island.

Furthermore, Effendi (2004) reported that in East Kalimantan province ulin natural forests almost found in all districts of this province as shown in Table 2.

No.	District/Municipality	Locations of ulin natural forests	
1	Balikpapan City	Sungai Wain Protection forest	
2	Samarinda City	UNMUL Samarinda Botanical Garden	
3	Kutai Kertanegara District	Samboja Research Forest	
4	West Kutai District	Mencelew village	
5	East Kutai District	Kutai National Park (Sangkima, Mentoko)	
6	Berau District	Labanan Research Forest	
7	Malinau District	- Forest Reserve of Setulang village,	
		- Research Forest of CIFOR Seturan	
		- Mitra Alam Forest Malinau	
8	Paser District	Gunung Lumut Protection Forest	
9	Penajam Paser Utara District	- Semoi Dua Research Forest	
		- Gunung Meratus Protection Forest	

The distributions of ulin natural forests were also reported by Nurhayati and Felani (2005) namely in Sotek, Petung, Pasir district, Kayan Mentarang National Park (Districts of Malinau and Nunukan) and Melak (West Kutai District).

B. Ebony (D. celebica Bakh.)

Ebony (*D. celebica* Bakh.), classified as luxury wood species (fancy wood). Beside it is durable and strong wood, the heartwood with black and reddish brown stripes makes the texture very beautiful. In international trade, ebony is known as Macassar ebony, Coromandel ebony, streaked ebony and black ebony. Other names in Indonesia including kayu itam, toetandu, sora, kayu lotong kayu maitong, etc. (Anonymous, 1976 in Soerianegara, 1967a).

Trees, with the height reaching 40 m with clear bole height 10-21 m, diameter can reach 100 cm, large trees have buttresses of 3 m high , the color of sapwood is white, pink with 4.5 to 7 cm thick. Heartwood color is black or chocolate brown striped or black striped, when viewed its in cross-section line is a circle (Soerianegara, 1967a). According Martawijaya *et al.* (1989), ebony wood is very hard (Specific Gravity 1.05), Strength Class I and Durability Class I and widely used for luxury furniture, sculpture, carving, fan, statues, decorative tools, fancy veneer , musical instruments and ornaments (Figure 4).



Figure 4. Furnitures, souveniers made from ebony woods.



Figure 5. Ebony seeds.

The canopy is cylindrical to cone-shaped, leaves single alternate. Flowers are small white colored. The fruit is oval and hairy. Flesh of fruit whitish colored and are eaten by wildlife both by birds and mammals. The fruit has 10 seeds, but only 2-8 seeds become good seeds. Fruits ripe in September and October (Soerianegara, 1967a). The seeds belong to recalcitrant seed (germinate quickly) so they cannot be stored for a long time (Figure 5). Directly germinated fresh seeds may reach 90 %, while those stored for 12 days in the refrigerator, the germination decreased to 20% (Allo and Sallata, 1991).

In nature *D. celebica* is commonly found in mixed forests ranging from Central Sulawesi (Poso, Donggala, Toli-Toli, Kolonodale and Banggai) to the South Sulawesi (Mamuju, Luwuk, Malili, Bone, Wajo, Barru, Maros, Pangkajene, and Polmas) (Soerianegara, 1967a, Anonymous, 1981) and in North Sulawesi (Paembonan and Nurkin, 2002). Grows at an altitude of 10 m - 400 m above sea level, on various soil types, ranging from chalky soil, clay to sandy or rocky, ground sloping to steep topography ranges 15-65%, with rainfall between 1230 to 2737 mm/year (Soerianegara, 1967a). According to Santoso (1997), ebony distributes naturally in Celebes (Sulawesi) island at an altitude of 50-700 m above sea level. Ebony is categorized as slow-growing tree species, its diameter increment is 0.5 cm/year (Steup (1935) in Soerianegara (1967a). The experimental results by Soerianegara (1987b), in Cikampek and in Bogor (West Java) during the first 20 years its diameter increment was 1.5 cm/ year, then decreased to 0.5 cm/ year.

C. Cempaka (M. champaca Linn.)

Yellow cempaka (*Michelia campaca* Linn. Synonyms of *M. velutina* BL or *M. pilifera* Bakh, f) belongs to Magnoliaceae family. Cempaka tree generally 15-25 m tall and has a trunk diameter of 40-50 cm (Heyne, 1987). In nature the tree can reach 50 m high with a trunk diameter of 1.8 m. Flowering throughout the year, the color ranges from yellow to orange (Figure 6). The tree starts flowering after the age of 4-5 years (Oyen and Xuan Dung, 1999). The flowers are used as fragrances and raw material of essential oils. The plants can be propagated by seeds or grafting (Figure 7). Cempaka wood has a fine fiber, classified into Strength Class II and Durability Class II and can be used as raw material for industry, construction, furniture, veneer, plywood, particle board, carving and decoration items (Martawijaya, 1989). In Indonesia this species distributes in Sumatra, Jawa,

Sulawesi and Lesser Sunda Islands. It grows at an altitude of 250- 1500 m above sea level (Oyen and Xuan Dung, 1999), at climate type A or B according to Smith and Ferguson classification with rainfall ranging from 1000 to 2000 mm/year (Saputra, 1991 in Iskandar, 2003). In Jawa cempaka cultivation is carried out on land up to about 1200 m above sea level (Heyne, 1987). Cempaka grows well in soils dominated by clay, slightly moist soil conditions and normal pH (Iskandar, 2003).



Figure 6. Cempaka flower.



Figure 7. Cempaka seedlings in nursery at Muara Payang, Lahat, South Sumatera.

IV. MANAGEMENT AND CONSERVATION STATUS

A. Management status

Since 1970, management of natural forest in Indonesia was conducted by the Indonesian Selective Cutting and Planting (TPTI) system, including natural forests with ulin or ebony tree species as major component of forest vegetation. Management of TPTI system is based on the diameter limit of trees to be felled, maintenance of the residual stand and enrichment planting. But the practice in the field, there were deviation from the rules of this system, therefore, in 1972 the government issued the Decree of the Minister of Agriculture No.54/Kpts/Um/ 2/1972. The content of the decree was prohibition to cut down ulin and ebony with diameter less than 60 cm. Felling of ulin trees are allowed only for trees above 60 cm in diameter and are only allowed for the communities surrounding the forest. It is prohibited to be felled by concessions holders. Some policies are made by both the central and local government for the sustainability of ulin and ebony.

1. Ulin (E. zwageri Teijsm. & Binn.)

Increase demand of ulin wood for various purposes, has resulted in tree felling in natural forests without considering its sustainability. Felling of ulin was conducted not only in production forest but also in protected forests and national parks. Although some regulations concerning the prohibition of logging ulin has been made by both central and local government, ulin illegal logging is still continuing, such as occurred in Kutai National Park and Mount Meratus Protection Forest.

Regulations relating to ulin management has been set up by the government in the form of regulations and decrees issued by the Ministry of Agriculture, Forestry Minister, Director General of Forest Utilization, Head of Provincial Forestry Service and Head of District Forestry Service (Table 3).

In the Forestry Minister Regulation No. P.35, 2009 that export of ulin only permited for processed ulin wood product (prokalino) which raw materials were ulin logs felled from natural forest concession areas, plantation forest concession, wood utilization permit, GPA, ILS, community land, and ulin wood taken from stump on area of industrial plantation forest or on plantation areas. In East Kalimantan the chain of ulin utilization by communities are as follows (Nurhayati and Felani, 2005):

- Ulin seeker, starting from the seeking tree in forests or ulin wood stumps or ulin waste. Furthermore ulin trees are cut down and sawn in form of transportable size by man.
- Log carrier, transporting ulin wood from the felling location to road side to be collected at log yard.
- Animer, the investors who provide money for ulin seeker and log carrier. Usually animer has a fleet of transport to bring ulin.
- Middleman. Generally the middleman directly related to ulin seekers. The middlemen usually sell ulin wood to sawmill.

Table 3. Regulations related to management of ulin wood

No	Summary of Regulation content		
1	Ministry of Forestry Regulation No.P.35/Menhut-II/2009 (Dephut,		
	2009)		
	Procedures for Issuance of Recommendation for Exporting Processed Ulin		
	Wood Product (PROKALINO).		
2	Decree of Tanah laut (South Kalimantan) District Head No. 77/2006		
	Utilization Permit of ulin stump outside the forest area with an area of 100		
	ha at Sungai Karuh location.		
3	Decree of Forestry Minister No.126/Kpts-II/2003		
	Every ulin wood that will enter Temporary Log yard, primary industries		
	and storage warehouses are required to posses Legal Forest Products		
	Specification (SKSHH).		
4	Decree of Forest Utilization Director General No.3627/IV-BPH/1996		
	date 9 th December 1996.		
	Replanting of felled ulin wood due to road construction. Planting ulin		
	species on both sides of road transport as the local superior species.		
5	Decree of East Kalimantan Governor No. 43/Th-Ek/SK/1996 dated 3 rd		
	April 1996.		
	Prohibition of felling and trading either domestics and or abroad, the tree		
	species on the basis of interest must be protected		
6	Letter of Forest Utilization Director General No. 3065/IV-BPH/1994		
	dated 20 th October 1994.		
	Logging permits of protected species (including ulin) in conservation forest		
	for non-forestry purposes, the permit holder must plant the species with the		
	same amount of harvested trees.		
7	Decree of Head of East Kalimantan Provincial Forest Service No.		
	522.21/005.79/DK-V/1991 dated 20 th August 1991.		
	The obligation of concession holders to appoint ulin mother trees as wide		
	as 100 ha. The obligation to maintain ulin tree stands.		

- Intermediate traders. Their role as an intermediary between animer or brokers and industry.
- Retailers, selling ulin wood to consumers. Ulin wood purchased from middlemen in the form of board.
- Ulin industry, processing ulin wood into exportable products such a flooring.
- Exporters, who export ulin processed products among others to China.

2. Ebony (D. celebica Bakh.)

Since the Government Regulation No. 21 of 1970 on licensing of forest concessions holder (HPH) and Forest Product Harvesting Rights (HPHH) is issued, ebony become a main company's commodity especially in the provinces of Central Sulawesi. The large amount of demand and high selling prices of ebony wood has increased logging in natural forests and accelerated illegal logging activities. Despite the ban on felling ebony with a diameter less than 60 cm (Decree of the Minister of Agriculture No. 54/KPTS/UM-2/1972), however, after 20 years of logging periode, in natural forests in Central Sulawesi is hard to find ebony with diameter more than 40 cm.

Excessive forest harvesting, have resulted in the depletion of ebony stock in natural forests. For these reasons, the government issued the Decree of the Minister of Forestry No. 31/KPTS/IV/86 which regulates licensing, logging, processing, circulation and prohibits any new logging types of ebony. With this decree, the government gives opportunity to the ex Permit Holders of Forest Product Harvesting Rights (IHPHH) which still has the wood on the inside and outside the forest, to remove the wood for the enactment, within the period specified by the Director General of Forest Utilization. However, after a period of time given over, not all wood can be removed, so that the holder of IHPHH through local governments requests an extension of time. From our observation, the periode extension to remove the old logs, will possibly lead to new illegal logging. Subsequently this new logging obtained can be manipulated as the old logging. To prevent deforestation and extinction of ebony wood, some government policies relating to its management were issued, among others, as shown in Table 4.

Table 4. Regulations related to	o the management of	ebony
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Summary of regulation			
Decree of Central Sulawesi Governor No. 522-21/166/BKDHUT-G-			
ST/2005			
Central Sulawesi Local Company (PD Sulteng) was appointed as the company which responsible for transporting and marketing of an old leaved above			
which were collected by PD Sulteng in Donggala and Parigi Moutong			
Districts PD Sulteng is required to make periodic reports of the realization of			
the transporting and marketing of ex old logged ebony addressed to Central			
Sulawesi Provincial Forestry Service. PD Sulteng is obliged to pay the forest			
levies (PSDH) to the state and the Reforestation Fund (DR) as well as levy to			
local government of all ex. old felled ebony.			
Decree of Central Sulawesi Governor No.522-21/107/Ro.Huk/99. Date			
March 23 ¹⁴ 1999.			
Pointed the Central Sulawesi Local Company (PD Sulteng) as a coordinator			
of utilization, collection, transportation to log yard and setting of community s			
Decree of Forest Utilization Director Ceneral Department of Forestry			
No. 2606/IV-BPH/1998. Dated 30 th December 1998.			
Approval of Central Sulawesi Local Government to coordinate the utilization			
of community's old felled ebony by keep involving PT INHUTANI II.			
Decree of Forest Utilization Director General, Department of Forestry			
No. 925/IV-BPH/1998 dated 14 th May 1998			
Approval of cooperation assistance of PD Sulteng to PT INHUTANI II in the			
management of old felled ebony.			
Instruction of Forestry Minister No. 239/Mennut-11/1996. Improvement of Forestry Minister Instruction 1205/Menhut 1/1005			
Instruction to PT INHUTANI II to incorporate the results of marketing/ sales			
of ebony wood as stated in Forestry Minister Instruction No. 1295/Menhut-			
I/1995, to become operations result of PT. INHUTANI II			
Decree of Governor No.SK.05/GKDH-ST/I/96.			
All ebony which logged by the people from concession forest areawhich were			
further given to Inhutani II and those that logged from unencumbered forest			
areas, its collection, transportation to log yard and selling were carried out by			
PT Inhutani II in cooperation with Local Government and related institutions.			
Distribution of ebony wood was prioritized to PT Sulawesi Ebony Sentra and			
from the Governor of Central Sulawesi. Ehony old collection that was not			
absorbed by the wood processing industry in Central Sulawesi can be sold to			
other regions.			

Table 4. (Continued)

No	Summary of regulation		
7	Letter of Forestry Minister No 1227/Menhut-IV/1995 dated August		
	21 st 1995		
	Securing forest and collection of old ebony wood. Forest security in		
	Central Sulawesi to be intensified. Old felling wood originally designated		
	for utilization was PT INHUTANI I was used by PT INHUTANI II and		
	the results were delivered to PT Sulawesi Ebony Centra for distribution to		
	other ebony handicraft industries		
8	Minister of Forestry Instruction No. 1295/Menhut-I/1995		
	The transportation and selling of ebony wood ex-people felling:		
	Appointment of Inhutani II to carry out the collection, transporting and		
	market/sell of ebony wood ex-people felling in the region of Central		
	Sulawesi Province.		
9	Decree of Forest Utilization Director General No. 038/Kpts/IV-		
	Tib/1986		
	Ebony wood Control implementation Guidelines: Announcement and		
	Registration: Ex Permit holders Forest Product Harvesting Rights (HPHH)		
	having ebony wood was obliged to register their ebony wood to the Local		
	Team Cq. Local Forest Service.		
	Limited inventory: Conducted by the Local Team to determine the legal		
	timber, illegal timber and timber in dispute.		
	Solving of untransportable ebony wood to log yard: The ebony wood still		
	in the concession area that cannot be transported out of the concession		
	area in accordance with the specified time limit, was utilized by the		
	involved Concession (HPH) and were calculated in that Annual Work Plan		
	(RKT) target, while the ebony wood outside the concession area, their		
	utilization was for the benefit of domestic purpose. Illegal newly felled		
	ebony wood was resolved according to Government Regulation No. 28 of		
10			
10	Decree of Forestry Minister No. 31/KPTS/IV/86		
	Control of ebony wood in Central Sulawesi, North Sulawesi and Southeast		
	Sulawesi: Provide opportunity to the ex- Forest Product Collection Permit		
	Holders having wood inside or outside the forest to extract them to be		
	legalized		

3. Cempaka (M. champaca Linn)

Cempaka is a multi-use plant species. Its wood is used for building materials and furniture. Its flowers are for perfumes and essential oils ingredients. Cempaka oil has high economic value and the original cempaka oil is very difficult to obtain. However, in Jawa planting cempaka is not yet popular, Cempaka is planted in the yard only to pick its flowers. Wood taken for building materials are usually derived from trees that do not produce flower anymore. In West Jawa, cempaka is planted through reforestation program on land affected by erosion.

In South Sumatra, cempaka was already widely cultivated. In the village of Muara Payang, Lahat District, cempaka has been cultivated by the society since 1960 althought still in a small area. Recently cempaka has been cultivated by local community with an area of 0.5 hectares or an average of 100 trees for every family in the form of a mixture of coffee plantations (as shade coffee plants). Seeding is done by the community and has been distributed/marketed outside of South Sumatra Province, among others, to Jambi, Riau and Bangka Belitung (Figure 7).

At the age of 30 years, it had reached a diameter of 60 cm and the timber production reached $\pm 5 \text{ m}^3$ /tree. People like to plant cempaka in their own property because it is fast growing, easy to maintain and high wood prices. In 2008 Farmer Group Purnomo has won National Champion in the field of conservation of this type of cempaka. The spread of cempaka in Lahat District was almost in all sub-districts and villages (75%).

B. Conservation status

Conservation is an effort for widely sustainable use. Conservation should be interpreted as a continuity between the research, utilization and protection (Waluyo, 2002). Conservation does not mean just for protection but must also be widely used. To determine the conservation status of a species, its ulilization, potency, distribution and regeneration status must be known.

1. Ulin (E. zwageri Teijsm. & Binn.)

Increased demand of ulin wood in three recent decades has led to significant declined to existence of this species both its area and potency in natural forests. For example in South Kalimantan, lately ulin wood was difficult to obtain, this conditions made the price increased sharply. Abdurachman and Saridan (2006),

reported that the potency of ulin in Labanan natural forest, Berau regency, East Kalimantan, only 5 trees/ha. Nugroho *et al.* (2006) reported ulin potency in several areas in Indonesia (Table 5) and a general description of the condition of natural stands of ulin in southern Sumatra (Table 6).

No	Location of natural forest	N/ha	References	
1	Kutai National Park, East Kalimantan	54	Susilo and Riswan, 1987	
2	Research Forest of Lempake, East	33	Riswan, 1987	
	Kalimantan			
3	Senami forest, Jambi	28	Herbangun, 1985	
4	Riam Kanan, South Kalimantan	14	Sumantri & Mahfud, 1986	
5	Specific Purpose Forest Area	9,7	Iriansyah & Rayan, 2006	
	(KHDTK) Samboja, East Kalimantan			
6	KHDTK Labanan, Kaltim	9,71	Noor'an, R.F. 2006	
7	Natural forest of Labanan, Kaltim	5	Abdurahman & Saridan, 2006	
8	Research forest of Sebulu, East	18,81	Yusliansyat et al., 2004	
	Kalimantan			
9	Sintang, West Kalimantan	17	Sidiyasa, 1995	
10	Kutai National Park, East Kalimantan	45	Prajadinata, 2010	
11	Specific Purpose Forest Area	17, 5	Prajadinata, 2010	
	(KHDTK) of Samboja, East			
	Kalimantan			

Table 5. The density of ulin trees in various natural forest locations

Observation in the Kutai National Park (Prajadinata, 2010) resulted that the ulin potency decreased from 54 trees/ha to 45 trees/ha. Main reason of this situation is because of the land encroachment and converted settlement area. However, recently KHDTK Samboja areas are managed more intensive, so that ulin potency increased from 9.7 trees/ha to 17.5 trees/ha. Seeding procurement and planting of both in- situ and ex-situ has been conducted in some areas in Kalimantan and Sumatra. Hakim *et al.*, (2005) reported that outside Sumatra and Kalimantan islands ulin species are also found in the Arboretum of The Center for Forest and Nature Conservation Bogor (approximately 15 trees) and the Forest Research of Sumberweringin Bondowoso, East Jawa. To improve the conservation status to a safer level, some surveys are still needed in other places to find out its potency, and its overall regeneration.

Cause of damage	legal logging	legal logging nd mversion to ulm oil	legal logging ad onversion to alm oil	
Variation fruit/bark Stem/leaves		There are 3 bark color II variations: black, an white and red co	There are 2 bark color II variation: black and an red co	There are 2 fruit forms variations: Long and round and 2 variations of leave form: long and oval
Fruit season	1	November	Augusts	February – April. Augusts There are auxiliary fruit
Coppice/Natural regeneration	No wildings and fruit at forest floor Only coppice from stem (3-4 coppice/ stem)	Plenty of fruits and wildings at forest floor	Plenty of fruits and wildings at forest floor	Plenty of fruits and wildings at forest floor
Condition	Heavily Damaged	Good. Area 47.4 ha from 75 ha at the beginning	Good Ulin stand 6 ha. Appointed by BPTH as seed source with Identified Seed Stand class	Good
Administrative Area	Sridadi, village, Muara Bulian, Sub District, Batang Hari, District Jambi Province	Jangga Baru, Village, Bathin XXIV, Sub District Batang Hari, District Jambi Province	Beliti Jaya, Village, Muara Kelingi, Sub District Musi Rawas, District South Sumatera Province	Lalingan, Village Gantung, Sub District East. Belitung District Bangka Belitung Province
Location	Senami Grand Forest Park	Durian Luncuk II Nature Reserve	Mambang Custom Forest	Gunung Serumput Protection Forest
No		7	3	4

Table 6. Condition of ulin natural stands in Sumatra Island

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Source: Nugroho (2006).

Considering the diminishing of ulin potency, in 1997 ulin tree species has been listed on the Red list of threatened species of IUCN (International Union for Conservation of Natural Resources) (Wahyuni, 2006; IUCN, 2010). At present the conservation status (over all) of ulin species is vulnerable (VU A1 c, d and 2 c, d). The VU Code A1 c, d means that based on the observation it can be assumed, that in the last ten years or three generations, the average population of this species declined more than 20%, based on territory or actual declined. VU Code 2 c, d means in the next ten years or the next three generations, average population are predicted will decline more than 20%, based on reduction in the presence region, distribution areas and/or habitat quality and level of potential/actual exploitation.

2. Ebony (D. celebica Bakh.)

According to the inventory in primary forest of Central Sulawesi, of 4850 seedlings/ha there is a 90 ebony seedlings with 5% distribution. Regeneration of sapling stage for ebony species was very few, i.e 1 wilding per hectare with 1% distribution. While in the logged over forest, out of 6480 wildings/ha, there is only 10 wildings of ebony species (Bismark, 2002, Sunaryo, 2002). Inventory results of *D.celebica* Bakh at Pangi Binangga Nature Reserve for trees with diameter > 20 cm, both its Relative Density and Relative Frequency were 12.87% and Importance Value Index was 35.36 (Tim Ekologi KSDA Sulteng, 2010).

Since 1990 ebony was declared as protected species and prohibited to be felled. Ebony only be able to exploite based on approval and special permit from the government represented by the Ministry of Forestry (Decree of Forestry Minister No. 950/IV-TPHH/90). However, the activities of illegal exploitation of ebony wood still exist, eventhough recently logging largely conducted at logged over areas and at hill top.

Because in nature its population decreased drastically, the IUCN registered *Diospyros celebica* Bakh belong to vulnerable (VU AL cd) category, which means that in natural habitat it is at a high risk for extinction. Criteria for determining this status is its population were diminished or decreased more than 20% in the last ten years and need to become a main target of conservation either its habitat or species. To prevent the excessive utilization trend that may worsen the status of this species, efforts towards sustainability of this species must be conducted immediately.

3. Cempaka (M. champaca Linn.)

Cempaka wood is often used as materials for furnitures because its quality is quite good and has beautiful performance. To get mature timber, based on cilviculture system, cutting rotation of cempaka plant is 35-year. An annual height and stem diameter growth are between 1 to 1.8 m and 1.5 - 2 cm respectively. At the age of 16 years the diameter trunk reached 48 cm with a height of 19.7 m and at the age of 34 years has reached 20.2 m high with a trunk diameter of 65 cm (Asumijarto, 2002 *in* Iskandar, 2003). In Sulawesi, besides for local needs, cempaka wood also exported mainly to Japan and Australia. Nowdays, market demand both local and outside the country has increased which is followed by increase in price. Hence, the trees are already harvested in age of 15-20 years although the production of wood has not optimal yet. In that case, cempaka wood will diminish if it is not followed by intense planting. Based on its properties (grow fast and has a large distribution areas), planting of those species both in natural habitat and outside growing area promising a success plantation. Enlarge plantation hence will not be lack of timber supply of cempaka any more.

V. IN-SITU AND EX-SITU CONSERVATION

A. In-situ conservation

1. Ulin (E. zwageri Teijsm . & Binn.)

The efforts of ulin conservation both in-situ and ex-situ are necessary to guarante its sustainability. Some primary forest that can be able to use as conservation areas of ulin was reported by Hakim (2005). Among them are:

- a. Ulin seed sources area belong to PT. ITCIKU, Balikpapan which is located in Jalan 5000, KM 42. Plot 47, 48 and 58, in the area of 120 ha, Sepaku Sub District, Penajam Paser Utara District, East Kalimantan Province.
- b. IUPHHK PT Sari Bumi Kusuma Kalteng. Ulin forest is located in the coordinates 111039'-112025' East longitude and 00036'-01010' of South latitude. It is located in log over area of RKLPH I/TPTJ, year 1999 to 2004, this area are in Kiham village, Seruyan Hulu Sub District, Kotawaringin Timur District, Central Kalimantan.
- c. Nature Arboretum of PT Suka Jaya Makmur. The area is located about 49-50 km from log pond, in Nanga Tayap Sub District, Ketapang District, West Kalimantan.
- d. Sumber Barito Sub District, Murung Raya District, Central Kalimantan Province.
- e. Kawasan Hutan Dengan Tujuan Khusus (KHDTK: Forest Area For Special Purposes), Samboja, East Kalimantan in the survey area of 47,28 ha, there are 459 trees, consisting of 195 ulin trees with diameter of 10-30 cm and 264 trees with diameter > 30 cm. (Iriansyah and Rayan, 2006).
- f. South Kalimantan. In 2010 ulin was planted through "One Million Tree Planting Program" (Pemda Kalsel, 2010).
- g. Village Society of Tanjung Harapan Sembakung Sub District, Nunukan District, East Kalimantan Province. Since 1977, they have been planting ulin mix with coffee plantation, after 6 years old the diameter of ulin was 13 cm. (Sutisna, 2004).
- h. In Paser District East Kalimantan Province. People plant ulin in the area of custom forest, rattan plantation and coffee plantation. The rural community in this village has commitment among them that if someone cut 1 stem of trees, he has to plant 5 to 10 trees (Wirasapoetra, 2006).

- i. KHDTK Samboja. East Kalimantan. Colaboration between Forest Research Institute and PT. Kelian Equatorial Mining (KEM) Balikpapan, East Kalimantan. Planted ulin in the large area of 10 ha respectively.
- j. In Sangkimah, Kutai National Park, East Kalimantan. There is a huge ulin tree naturally grows with 225 cm diameter, 45 m height of branch free stem or it is equal to 150 m3 of stem volume.
- k. Forest Reserve in Bukit Soeharto, East Kalimantan.
- 1. Setulang village, Malinau District, East Kalimantan in the area of 48 ha. The custom of rural community in this village is planting various trees species including ulin in the 5000 ha of village authority's areas. Kalpataru awards was granted from government to Setulang village for ulin forest conservation (Susanto, 2006).
- m. In KHDTK Kintap, South Kalimantan, ulin has been planting for research purposes (Saepudin *et al.* 2006).
- n. Musi Banyuasin District, South Sumatra Province. In the area belongs to PT Reki (Indonesia Ecosystem Restoration). In-situ conservation of native species in which is ulin species have been carried out (Figure 8). In March 2009, PT REKI has conducted an inventory with systematic line sampling method for an area of 52,170 ha (sampling intensity: 0.2%). The number of sample plots was 331 plots and the size of each plot was 0.25 ha so that the total area was 82.75 ha. From 331 sample plots, 12 plots were existed of ulin, it means that ulin existence was approximately 3.6% (Murniati, 2010). The data of ulin density and basal area are presented in Table 7.
- o. Sungai Kandang (PT REKI's areas in Jambi province), In area 4000 m² (200 m length and 20 m wide) there were found 1 tree of \pm 60 cm diameter, 12 trees of $\emptyset > 20$ cm and 6 trees with diameter < 20 cm. (Murniati, 2010).
- p. In March to June 2010, PT REKI had planted more than 20 thousand ulin seedlings in 20 ha of open area and bushes, planting space is 3 m x 3 m (Figure 9).
- q. A 21 hectares of Ulin Seed Source, located in Mambang custom forest, Beliti Jaya III (E) village, Muara Kelingi sub-district, Musirawas District, South Sumatra Province. With the Decree of Minister of Forestry (SK Menhut) No 670/Kpts-II/1997 was defined as Ulin Identified Seed Stand. Insist of 3262 trees or about 150 trees/hectares. Results of vegetation analysis in Plot size of 20 m x 20 m for trees (> 20 cm girth diameter), 10 m x 10 m for poles

(diameter 10-19 cm) and 5 m x 5 m for seedlings (diameter less than 10 cm, height > 1.5 m) with 5 replications, showed that ulin trees was found in 4 plots (80%), saplings in 2 plots (40%) and seedlings in 2 plots (40%), but no one of poles was found in that site (Murniati, 2010).

 Table 7. Density (N/ha) and basal area (cm²) of ulin species in log over forest in PT REKI

	Light secondary forest		Mid secondary forest		Dense secondary forest	
Growth stage	Density	Bassal area	Density	Bassal area	Density	Bassal area
Mature tree (Diameter > 35 cm)	0,177	1,618	0,182	0,456	0,047	0,204
Stem (Diamater 20-34 cm)	-	-	-	-	0,316	0,103
Pole	1,266	0,041	1,36	0,022	-	-
Sapling	60,832	0,909	-	-	-	-

Source: PT Reki, 2009. Data hasil survey flora di lokasi Sumatera Selatan.



Figure 8. Ulin plantation in Musi Banyuasin, South Sumatera.



Figure 9. Ulin seedling in PT REKI's Nursery.

To ensure that the stock of ulin seeds is available continuously, some of seed source in different sites was defined by The Directorate General of Land Rehabilitation and Social Forestery. Until year 2009, The Directorate General of Forestry Community and Land Rehabilitation had defined five sites of seed source as showed in Table 8.

2. Ebony (D. celebica Bakh.)

Because of its high economic value and deminishing populations, it is necessary to do some efforts for preservation of ebony species. These efforts can be a policy or government regulations and field actions of conservation such as planting activities in native (*in-situ*) or outside (*ex-situ*) growing areas. Until now there are six seed stand areas that had been designated as Identified Seed Stand, i.e Morowali, Parigi Moutong, Barru, East Luwu (2 locations) and Mamuju. In addition, local government/District Forestry Services have established ebony plantation in private communities areas, combined with activities of Government Community Forestry Program.

Since 1989 in Ranang (West Kasimbar Village, Kasimbar sub District, Parigi Moutong District) one of local people has been gradually planting ebony in his own gardens. Up to year 2010, the planting has covered area of 5 hectares of about 5,000 ebony trees (Figure 10). In 2009, an ebony farmer group, named "*Kelompok Ebony Lestari*" was set up with its main objective is to keep sustainability of ebony. The main activity of this group is planting ebony on their own gardens as mix farming with other tree species.



Figure 10. Ebony plantation in Kasimbar, Central Sulawesi.

Owner		Dinas Kehutanan Kab. Musi Rawas Lubuk Linggau	Dishutbun Kab. Sanggau	PT. Dwimajaya Utama	PT. ITCI Kartika Utama
Deerce No.		38/V/BPTII. Sum- 3/ssb/2006	077V/BPTILKAl- 2/STFK//2004	037/V/BPTII.KAL- 2/STFK//2004	
Fruits mature	Sep – Oct	Sep – Oct	Jan-Feb	lul – nul	Aug - Sep
Status	Identified Seed Stand	Identified Seed Stand	Identified Seed Stand	Identified Seed Stand	Identified Seed Stand
Size (ha)	18.00	21.75	61.90	100.00	120.00
Village	Jangga Baru	Beliti Jaya	Mengkiang	Tumbang Manggo	Pemaluan
Sub District	Batin 24	Muara Kelingi	Kapuas	Sanaman Mantikei	Sepaku
Sub. District	Batang Hari	Musi Rawas	Sanggau	Kati-ngan	Penaja Paser Utara
Province	Jambi	South Sumatera	West Kalimantan	Central Kalimantan	East Kalimantan
No	15.03.023	16.05.007	61.03.013	62.02.010	64.01.017

Table 8. The List of Seed Source of ulin (Eusideroxylon zwageri)

Source: Direktorat Perbenihan Tanaman Hutan, 2009.

3. Cempaka (M. champaca. Linn).

One of the efforts within the framework of implementing *in-situ* conservation, some seed sources of cempaka in South Sumatra were identified (Table 9). Tree Tree performance of cempaka in Muara Payang Identified Seed Source as shown in Figure 11 and 12.

	Site 1	Site 2
No SB	16.04.018	16.01.009
Province	South Sumatera	South sumatera
District	Lahat	South OKU
Sub District	Muara Payang	Buay Sandang Aji
Village	Muara Payang (700 m dpl)	Kuripan
Large of area	2 ha (30 trees)	1,69 ha
Class of seed source	Identified seed source	Identified seed source
Seed mature	Fruiting season 3 times in 2	July
	years	
Seed production	70kg/tree/fruit periode	-
No. Of seed source	No. 55/V/BPTH/Sum-	-
certificate	3/SSB/2006.	
Owner	Kelompok Tani Purnomo	M. Nuh (Personal)
	(Set up in 1999)	

Table 9. The Identified seed source of cempaka (*Michelia champaka* Linn)



In East Jawa, cempaka trees have been planted in gardens around the slopes of Mount Arjuno as native habitat of cempaka in the area of about 410 to 764 meters above sea level. In the 2004/2005 Local Government supplied cempaka planting stock to communities in the villages along the edge of Mount Arjuno, Pasuruan District, to be planted in their gardens and house yards. Planting materials were come from vegetative propagation (air leyering/grafting). The aim of this plantation is for flower productions. After 5 years, it showed that an average of cempaka stem diameter reached of 23.9 cm and tree height was about 13.3 m. Description of diameter, stem height of cempaka plantation trees and its coordinate place are shown in Table 10 (Prajadinata, 2010).

Table 10.	Height and diameter of cempaka (Michelia champaca Linn.) plantation
	in Pasuruan, East Java

No	District	Sub	Village	Coordinate	Total height	Diameter
		District			(m)	(cm)
1	Pasuruan	Purwosari	Catang	S. 07°47'32.3"	9	16.3
				E 112°43'34.0"		
2	Pasuruan	Purwosari	Catang	S. 07°47'34.5"	10	22.7
				E 112°43'27.0"		
3	Pasuruan	Purwosari	Catang	S. 07°47'34.4"	8	27.0
				E 112°43'26.9"		16.2
4	Pasuruan	Purwosari	Catang	S. 07°47'36.0"	13	32.3
				E 112°43'26.6"		
5	Pasuruan	Purwosari	Catang	S. 07°47'36.4"	15	28.0
				E 112°43'26.5"		
6	Pasuruan	Purwodadi	Gajahrejo	S. 07°47'43.4"	21.5	15.5
				E 112°43'06.8"		
7	Pasuruan	Purwodadi	Tambaksari	S. 07°47'37.3"	15	31.0
				E 112°40'37.5"		
8	Pasuruan	Purwodadi	Tambakwatu	S. 07°47'12.8"	15	26.0
				E 112°40'09.0"		
9	Pasuruan	Purwodadi	Tambakwatu	S. 07°47'12.5"	13	20.0
				E 112°40'08.8"		
10	Pasuruan	Purwodadi	Tambakwatu	S. 07°47'37.3"	12	14.0
				E 112°40'37.5"		
11	Pasuruan	Purwodadi	Tambakwatu	S. 07°47'05.1"	12	29.0
				E 112°40'02.1"		
12	Pasuruan	Purwodadi	Tambakwatu	S. 07°47'05.6"	16	32.5
				E 112°40'01.8"		

B. Ex-situ conservation

1. Ulin (E. zwageri Teijsm. & Binn.)

Many efforts in the framework of *ex-situ* conservation of ulin tree species have been carried out by government and societies. Ex-situ conservation sites are:

- 1. Sumberwringin Research Forest in Bodowoso, East Jawa. The total area of 3 hectares, manages by Biotechnology and Forest Tree Improvement Reseach Center, Yogyakarta (Hakim *et al.*, 2005.).
- 2. Arboretum of Center for Conservation and Rehabilitation Reseach and Development, Bogor, consist of about 15 trees.
- 3. Suban Jeriji, South Sumatra. Experimental plantings of ulin under *Acacia mangium* stand and local communy rubber plantation. Total area of the experiment was 1.5 hectares.
- 4. KHDTK Kemampo.
- 5. PT Kiani Hutani Lestari in East Kalimantan. Planted in 1995-1997, in the area of 25.80 ha. However, the plant burned during forest fires in 1997/1998.
- 6. KHDTK Samboja, Sebulu, Berau, Balikpapan PT ITCI, and Kutai National Park. Planted by Forestry Research Institute, Samarinda (East Kalimantan) in 2004, in the area of 1.2 ha.
- 7. Sebulu, East Kalimantan, in the area of 1 ha combined with aloes (*Aquilaria* sp) (Yusliansyah *et al.*, 2004).
- 8. Barabai City Forest. South Kalimantan. Planted by Local Government of Hulu Sungai Tengah (Fakhrurazi, 2010).
- 9. Sempaja Arboretum and in the office circumstance of Forestry Research Center for Dipterocarp, Samarinda (former name was Forestry Research Institute of Kalimantan). Planted in 2003, after 3 years old, life percentage of ulin plantation was 92%, with the average of tree height and diameter was 1.70 m and 2.02 cm respectively (Abdurachman dan Suyana, 2004).

2. Ebony (D. celebica Bakh.)

Some planting activities have been done outside of the original habitat for conservation and research objectives. Among others were carried out in West Jawa (Cikampek, Figure 13), Central Java (Wanagama), at local communities lands in Central and South Sulawesi. Since 2001, in terms of "Prospective local species of Central Sulawesi Developing Program", Forestry Services of Central Sulawesi Province, has been planting ebony in some places as shown in Table 11.

Ministry of Forestry through BPDAS has been providing forest tree species seedlings (in which it is ebony) for local communities to be planted in their fields. Although ebony has not been included as a main plant species, more or less ebony has been planted in every moment of planting activities.



Figure 13. Ebony plantation at arboretum Cikampek.

 Table 11. The implementation of ebony rehabilitation in Central Sulawesi Province

Type of activities	Site	Area/Number of trees	Year of planted
Plantation	Nupaboma Village, Tawaeli	100 Ha	2001
	sub District, Palu (Km 12 to	50.000 stems	
	17)		
Rehabilitation Maleali and Sausu Piore		57 Ha	2003 to
	Village, Sausu Sub District	5000 stems	2006
	(Parigi Moutong District)		
Plantation of Local	Damsol (Donggala District)	1.400 ha	2006
prospective species		250.000 stems	
Hutan	Lende Village, Sirenja Sub	500 stems	2008
Kemasyarakatan	Distric, Donggala District.		
Hutan	Siweli Village, Balaesang	5000 stems	2009
Kemasyarakatan	Sub District, Donggala		
	District.		

Source: Dinas Kehutanan Provinsi Sulawesi Tengah, 2005.

3. Cempaka (M. champaca. Linn).

In 1988 cempaka were planted in the Jasa Tirta/Sumber Brantas Arboretum as an *ex-situ* conservation. The area is located in Tulungrejo village (Bumiaji sub-District, Malang District, East Jawa), The soil, geographic and climate conditions were: altitude: \pm 1,500 m (asl), average rainfall: \pm 2.500 mm/year, soil type: andosol with dust texture, crumb structure, deep solum and soil pH is alkaline, the Arboretum Size is \pm 12 ha. Inventory and observations for cempaka growth was conducted in 2010. The data of cempaka growth include site coordinates are shown in Table 12 (Prajadinata, 2010). In Lahat District, cempaka has been planted on communities land as a shading of coffee plantation (Figure 12).

Table 12. Height and diameter of cempaka (*Michelia campaca* Linn) in JasaTirta/Sumber Brantas Arboretum, Malang, East Jawa

No	Coordinates	Altitude	рН	Total height	Diameter
140.	Coordinates	(asl)		(m)	(cm)
1	S. 07° 45'25.1"	1673	6.2		39.5
1	E 112°31'40.1"				
2	S. 07°45'24.6"	1668	6.8		56
2	E 112°31'40.0"				
2	S. 07°45'22.0"	1668	6.8	17	46.8
3	E 112°31'39.8"				
4	S. 07°45'21.0"	1673	6.4	10	29.7
4	E 112°31'39.7"				
~	S. 07°45'16.0"	1673	6.7		53.5
5	E 112°31'35.4"				
6	S. 07°45'15.3"			12.0	30
0	E 112°31'39.8"				
7	S. 07°45'17.4"	1673	6.7	15	50
/	E 112°31'41.3"				

Some cempaka trees (*M. champaca* Linn.) have been planted in the Botanical Gardens, Purwodadi (East Jawa). The average diameter of trees have reached 22 to 28.4 cm with average height of 11-14 m. In 2008, the Purwodadi Botanical Garden has planted cempaka in Bajulan Village (Loceret Sub District, Nganjuk District) in an area of KRPH Bajulan, BKPH Pace, KPH Kediri, East Jawa, at an altitude of

732 m asl and the coordinates S 02°46'47" and E 112°50'34.9". An average height and stem diameter of 2 years old cempaka was 1.5 to 3.8 m and 1.9 to 5.3 cm respectively (Figure 14). Some seeds and seedlings from seed sources in Lahat District (South Sumatra) have been marketed and distributed to Jambi, Riau and Bangka Belitung. Thus, cempaka have been planted spread out of that all three areas (Figure 15).



VI. CONSERVATION AND MANAGEMENT CHALLENGES

A. Management challenges

1. Ulin (E. zwageri Teijsm. & Binn.)

Ulin is a native tree species in Sumatra and Kalimantan, various efforts must be made to protect this species. In the past three decades, existence area and potency of ulin both on the island of Sumatra and Kalimantan continues to decline. Felling of ulin in natural forests had been done without regard to its sustainability. Challenges faced in the management of ulin species was proposed by Effendi (2009) as follows:

- Based on regulations, ulin tree felling should only be undertaken of the trees with a diameter above 60 cm, but in fact, the tree felling was done to the trees with a diameter up to 40 cm. As a result, extinction ulin trees are threatened.
- Law enforcement against the perpetrators of ulin tree felling which is less than 60 cm is still weak. As a result, huge amount of small ulin trees were felled, especially during the last of four decades.
- Slow growth of ulin has affected to its limited wood stocks in natural forests. After tree felling, there was only small replanting done either by communities or government. Big demand to ulin for flooring materials in the 2000s, which were exported to China, causing stump and buried logs in forest area of East Kalimantan region, were extracted by native people.

A similar opinion was noted by Wahyuni (2006), that weakness of regulation capacity has resulted in a limited science ability to influence the management of ulin in Indonesia. The illegal felling of ulin trees was done by those who are not responsible for ulin conservation.

Abduh (2010) reported that in West Kutai and East Kutai Ditricts (East Kalimantan) forest communities led by indigenous stakeholders (pejalung) filed a petition to the police/government officials to conduct ulin logging. In their opinion, ulin is the source of their livelihood. Ulin is also used to build houses and construction of bridges in rural areas. It was reported that the Governor of East Kalimantan, further stated that cutting ulin trees for social purposes such as houses

of worship, the people living around the village can apply or ask permition to the device and to local police.

In Tenggarong, Kutai Kartanegara, East Kalimantan, the police managed to arrest as many as 295 pieces of ironwood timber of various sizes. In Loa Janan police also arrested cases of illegal timber which were transported by pickup truck. The police also arrested a total of 227 pieces of 4 cm x 8 cm x 400 cm processed ulin without documents (Anonymous, 2010). In Samarinda Police has arrested 68 ulin logs, size of 5 cm - 8 cm ulin in diameter and length of 4 m which has no official document (Banjarmasin Post, 2010).

In South Kalimantan, along Trans Kalimantan in Bati-bati region (Tanah Laut District), ulin is carried by motorcycle, rider was named "*pengojek Ulin*" because the bicycle were filled with about 0.5 tons of ulin logs. Ulin were bought from villages surrounded forest at Tanah Laut, to be sold to Banjarbaru, and Banjarmasin, more than 100 km distance (Kompas, 2009). Ulin growth is very slow (Masano, 1984) as a result, lack of stakesholder interested in established Ulin forest plantations. Hence, there is must be regulations to obligate plantation forest companies to plant ulin in their consession areas, to make ulin sustained.

2. Ebony (D. celebica Bakh.)

As like ulin, potency of ebony is dwindling, and even in some areas its potency decreased seriously. Ebony will become extinct, if there is not immediately addressed both in the management and circulation system of timber trade. According Sunarno (1996), several factors are suspected causing the potential decrease of ebony in Central Sulawesi, among others are:

- Implementation of an inefficient harvesting and replanting is not done in log over area.
- Illegal logging practices was uncontrolled.
- Low awareness and supervision to companies and public that done illegal cutting have not effective yet.
- Still lack of data and information on research results that can be used as technical guidance for field management.
- Technology transfer of available research results have not yet reached to practitioners.

In Central Sulawesi, Government gave an authority to one of regional company to manage all of old harvested ebony which still remained in forest. Although there is a time limited to take out logs from inside forest, in fact that not all of logs could be extracted during that period of time. In this case, the company proposed extension time to complete transported logs. This situation raises susceptibility to continue to extent time, furthermore continues to make new cutting and manipulated it to old harvested.

3. Cempaka (M. champaca. Linn).

In Jawa, cempaka generally plant in small scale private properties, so far no government intervention and assistance to promote stakeholders to invest on large scale cempaka plantation. Deficits and high prices of original cempaka oil should be encouraging the native people to plant more cempaka. Unfortunately, people prefer sell fresh flowers, because it can directly get money without waiting for the time to process cempaka flowers to be an essential oil. In addition, in Jawa cempaka planting is not as popular as in South Sumatera. It was only planted in yards, or as an additional crop in gardens. Native people obtain yields from cempaka cultivation only for an additional income, thus the purpose of planting has not led to large-scale cultivation for industry.

In Sumatra and Sulawesi, people have been familiar with cempaka cultivation and planting. They use the timber both for their own purposes and for sale. Wood marketing to outside of native habitat still in the form of wooden planks and beams. In addition so far only small scale timber industries which are using cempaka wood as raw materials. To increase value of timber, the product must be as finished goods or ready use goods such like furniture, vinir or hand craft, but not as logs form.

Until now, there is no government policy maintaining the management and distribution of cempaka. Increase in logging before completely cutting rotation without follow by adequate large area of plantation, will affect to decrease in wood stock and furthermore scarcity of this species.

B. Conservation challenges

1. Ulin (E. zwageri Teijsm. & Binn.)

Nowadays, ulin natural forests are generally found in protected forests, national parks, areas of Forest for Special Purpose (KHDTK) and unreachable primary forest. Many challenges faced within the framework of conservation of ulin species. As an example, trans-Kalimantan roads that passed primary forest where ulin trees grew there, have encouraged people to cut down the ulin trees. They extracted ulin from forests and cut into shorter logs and then mobilize it by motorcycle. The same thing happened in Kutai National Park. The existence of the highway which divides the Kutai National Park in East Kutai District has resulted in reduction of ulin potency.

In Kutai National Park, East Kalimantan, ulin grow naturally in a good vegetative circumstance with a good regeneration system. For better grow, ulin seedlings or young plant need a little of shading. Research result show that mother trees of ulin spread widely over this areas, while seedling grows in a group in certain shaded areas and adult trees grow more in open areas not far from mothers trees (Hidayat, 2004).

Because ulin fruit is relatively heavy in weight, natural regeneration is generally located not far from the parent tree (Effendi, 2004a), this is of course cause a limited distribution of ulin trees. Ulin usually spread out in groups but sometimes also spread out among other as individuals such like in KHDTK Samboja, East Kalimantan (Effendi *et al*, 2003). The cutting of young trees before produce fruit, will lead to threaten of the existence of this species. In Gunung Meratus Forest Protection in East Kalimantan, ulin fruit often found under the parent tree, which can not grow because the fruit were eaten by wildlife such as hedgehogs (Effendi, 2004).

2. Ebony (D. celebica Bakh.)

As like ulin, ebony grows very slowly. It takes long time to have large terrace with good wood performance. In addition good quality terrace is generally produced by the trees that grow in sandy or rocky areas. Until now, ebony plantation has not been done on a large scale area. In planting programs undertaken by the government, ebony are still classified as an enrichment plant but not as main tree species. Planting done simply as an enrichment planting or mix farming in

community gardens. Long time of cutting rotation and low wood production of ebony, led to logging companies become less interested in investing in these ebony plantation.

Ebony planting has been done by government in several places both inside and outside original site to preserve sustainability of ebony. However, in many planted sites, the plantations were grow unsuccessfully. This failure is due to the planting project have not been followed by maintenance activities. Maintenance was done only in the first year after planting, so the grow percentage of ebony was low because of competition with weeds and other nuisance plants.

3. Cempaka (M. champaca. Linn).

Nowadays, in natural forests sites (in Java and Sumatera island), where cempaka naturally grow, it is hard to find cempaka trees. In Java, the community is still reluctant to cultivate cempaka. Cempaka generally planted for producing flowers production, so the tree will not be allowed to grow taller, but it is trimmed to get a lot of branches that will generate much flower. During flower famine the price of 1 flush of cempaka flower can reach Rp.1000, but at a big fruit season the price dropped to Rp.100, - per flush, so the money gained not as much as they expected. Seeds as source of regeneration will not be formed, as it has been harvested during flowering time. The propagation is done by vegetative (grafting, air layering) in limited quantities.

In Sumatra, local communities are very interested in cempaka cultivation. Especially in Lahat and Empat Lawang Districts as well as in Pagar Alam town, most of communities have planted cempaka in Agroforestry systems mixed with coffee, durian and petai. The wood used for houses contruction and furniture. Guidance, motivation and innovation from the government is still required in order to increase added value to improve social welfare of the community.

VII. CONCLUSSION AND RECOMMENDATION

A. Conclussions

- 1. Ulin (*Eusideroxylon zwageryt* Teijsm. & Binn.) is a native species of Sumatra and Kalimantan, and ebony (*Diospyros celebica* Bakh.) is a native species of Sulawesi that must be maintained/preserved by the government, local communities even the international societies.
- 2. Currently, classified the ulin and ebony as Vulnerable species. Since forest area and the potential of both species are decreased significantly in the last three decades, efforts to preserve and increase the population through planting are needed.
- 3. Ulin and ebony both are classified as prospective local plant species in provinces where those species grow originally.
- 4. Ulin, ebony and cempaka (*Michelia champaca* Linn.) are part of the culture of local communities and have much usage, hence the management of those species cannot be separated from their lifelyhood.
- 5. Although cempaka (*M. champaca* Linn.) is not include in category of vulnerable species, but it should be maintained. Since cempaka has much usage, such as construction materials, furnitures and raw material of essential oil, will make cempaka become interesting species and more people will interested in this commodity. Meanwhile, in some native habitat especially in Jawa communities, cempaka cultivation is not well known.

B. Recommendations

- 1. In the short term, it is needed to determine the location of *in-situ* conservation especially in their natural habitat (national parks, nature reserves and KHDTK) such as in Sumatra and Kalimantan for ulin and in Sulawesi for ebony.
- 2. To establish *ex-situ* conservation areas on site that is suitable for its growing requirements which are free from public disorder.
- 3. Define, ulin, ebony and cempaka in the One Billion Tree Planting Program and obligate the IUPHHK HTI to plant ulin, ebony or cempaka in part of their territory in order to preserve the native species of Indonesia.

- 4. Socialization to the communities to preserve ulin, ebony and cempaka trees by implementation of no cutting of trees with small diameter or before trees provide fruits for natural regeneration.
- 5. Recommend to the communities who currently has been planting ulin (such as in the village of Setulang, Malinau, and in the village of Tanjung harapan, Nunukan District, East Kalimantan), ebony in Kasimbar Barat Village and cempaka in Lahat District, to increase and continue planting of those trees.
- 6. Giving admittion, insentif or award to the village and the people who have preserved forest by planting and maintaining ulin, ebony and cempaka forests.
- 7. Conduct a comprehensive study of standing stock and management of natural forests and plantation forests to get accurate data. Access the circulation and timber trade system of that species to generate sufficient condition and information for the success conservation.

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