

TABLE OF CONTENTS

Table of Contents	i
CHAPTER 1: INTRODUCTION.....	i
1.1 <i>Background.....</i>	1
1.2 <i>Methodology of Data Collection.....</i>	1
1.2.1 <i>Data collecting</i>	1
1.2.2 <i>Literature review</i>	2
1.3 <i>Objectives</i>	2
1.4 <i>Scope of works</i>	2
1.5 <i>Data Analysis.....</i>	3
CHAPTER 2: RATTAN STANDING STOCKS AND ANNUAL ALLOWABLE CUT BASED ON INVENTORY	3
2.1 <i>Current Condition of Rattan Resources.....</i>	4
2.2 <i>View of Some Commercial Rattans</i>	5
2.2.1 <i>Calamus manan</i>	5
2.2.2 <i>Calamus flabeeloides.....</i>	6
2.2.3 <i>Calamus caesious.....</i>	6
2.2.4 <i>Calamus inops</i>	8
2.2.5 <i>Calamus zilingerii.....</i>	8
2.2.6 <i>Calamus dienpenhorstii</i>	9
2.2.7 <i>Daemonorops sabut (pulut merah)</i>	10
2.2.8 <i>Calamus trachycoleus (Irit)</i>	11
2.3 <i>Strength and Weakness of Rattan Commodities in Indonesia</i>	11
2.3.1 <i>Stength.....</i>	11
2.3.2 <i>Weakness</i>	12
CHAPTER 3: RATTAN STANDING STOCK IN NATURAL FORESTS AND PLANTATION	13
3.1 <i>Inventory.....</i>	13
3.2 <i>Rattan Standing Stock.....</i>	15
3.3 <i>Rattan Standing Stocks of Cultivation Areas.....</i>	22
3.4 <i>Rattan Standing Stocks and Annual Allowable Cut from Natural Forest and Plantation Compared to Export.....</i>	24
CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS.....	26
4.1 <i>Conclusions</i>	26
4.2 <i>Recommendations.....</i>	27
BIBLIOGRAPHY	28
APPENDICES	29

CHAPTER 1: INTRODUCTION

1.1 Background

Rattan has long been known as the most important and potential commodity amongst non wood forest products in Indonesia. Rattan has also contributed significantly to Indonesia economy, in which about 4 to 5 million peoples involved in the rattan-base industry.

There are about 600 species of rattan grow naturally in the world, of which 350 species are found in Indonesia. Unfortunately, from the 350 species found in Indonesia only 20 species are accepted by rattan industry and while the others are for local use and not promoted. Although, Indonesia has a vast potential of rattan resources the production is still low. Besides, the yearly supply of commercial raw rattan has been declining. This condition is a consequence of the dissimilarity of standing stock data available and the reality in the field. Some of commercial species are over-exploited such as: Manau (*Calamus manan*), Pulut merah (*C. flabelloides*), Sarag buaya (*C. erioacanthus*), Lacak merah (*Calamus spp.*) and others become endanger or out of the markets.

1.2 Methodology of Data Collection

1.2.1 Data collecting

Data collecting was conducted through field survey to four provinces. “**Systematic Sampling with Lines Systems**” was applied to estimate standing stock. Sample plots, of size 0.01 hectare in each area were established for measurement. Weight data for every sample for each species collected are converted to total volumes for each species. Data recorded in the field are:

- a. Quantity and distribution of rattan in each plots, clustered and solitaire; number of cane in each cluster; the weight of one mature cane from each plot; stems divided into mature, half-mature, young, including shoots; these data is recorded in the tally sheets. Data analysis is made to develop annual allowable cut for each maturity stage (age). Maturity stage of rattan canes depend on species, for Sega (*Calamus caesioides*) mature canes is of 10 years old.
- b. Site quality, the sum of total environment factors that determines yearly growth rate of rattan for each species. Rattan (plant) growth is the function of micro-climate, soils and soil nutrients. Micro climate and soil moisture are closely related to the local topography that is bottom part of lands, lower slope sites, upper slope sites, ridge and hill sites and mountain sites.
- c. Trees found in the plots; their distribution, tree diameter, height, canopy distribution (light intensity), basal area, and vegetation (tree) strata. These data were recorded and mapped, in the map of vegetation phenotype of the area.

Phenotype of vegetation in sample plot area, density and basal areas, and soils condition information are then prepared.

Field measurement covers:

- 1) Tree canopy-height, density, canopy basal areas, distribution of tree, and phenotype of vegetation;
- 2) Rattan species, total amount of canes in cluster, volumes of rattan canes, and distribution of rattan species;
- 3) Soils characteristics and climate.

These data were recorded in tally sheets for further analysis to carry out the management of rattan regeneration intensively.

1.2.2 Literature review

Secondary data were gathered from literature reviews, forestry districts, Ministry of Forestry, and Ministry of Industry and Trade of Indonesia.

1.3 Objectives

- i. To develop technical method in estimating rattan standing stock both in natural forest and cultivated area;
- ii. To develop intensive and suitable cultivation method in order to attain the sustainable rattan source for ensuring continuous and sustainable supply of rattan products for rattan industry;
- iii. To develop models of people participation in rattan plantation programs for people surrounding the forest to increase their income;
- iv. To develop the arrangement of rattan trade that secures fair sharing of benefit among producers (growers) and industry;
- v. To develop efficient techniques in the utilization of rattan raw material through diversification of products.
- vi. To develop models of surrounding forest-community participation in protecting the remaining natural forests.

1.4 Scope of works

Data collection and field measurement activities to attain the objectives and output of the project which include information on rattan standing stock and the utilization cover:

- (1) Estimate of the available standing stock of rattans for Sumatra, Kalimantan, and Sulawesi through field measurement of four provinces and development of baseline data on the available standing stock for each species covered;

- (2) Current status of rattan resources in natural forests and cultivation that is consumed by rattan industry.
- (3) Identification of the appropriate harvesting technique, processing after harvested, and facilities requirements meet markets requirements;
- (4) Identification of training needs to establish rattan rehabilitation especially endanger and commercial species preferred by rattan industry.

1.5 Data Analysis

Field measurement, literature reviews, and data analysis to obtain the standing stock of commercial and non commercial rattan species, and rehabilitation endanger species to guarantee supply of rattan raw material continuously from sustainable sources.

CHAPTER 2: RATTAN STANDING STOCKS AND ANNUAL ALLOWABLE CUT BASED ON INVENTORY

Rattan is one of the non timber forest products that contribute about 6.5% of revenue coming from entire forest products industry in Indonesia. Indonesia is considered the leader of rattan producers; it supplies about 80% of rattan consumed by rattan industries in global markets.

Although Indonesia has ample potency of rattan, from 350 species grown naturally in the forest only about 20 species is categorized commercial that are accepted by rattan industries both local and abroad. Based on their utilization commercial species are divided into two groups: large-diameter cane and small-diameter cane. Large canes are usually used for frame of furniture such as chairs, table, bed or others. Small-diameter canes are usually used for banding, webbing, *lampit*, *Sabrina*, and others, but sometimes they are used as frame also.

The increasing demand of rattan finished products in the local and international market has influenced the available standing stocks in natural forests. Lack of supervision by the government in imposing annual allowable cut of commercial species resulted in the problem of unavailability of rattan standing stocks data in MOF office. The data available in MOF office only covers standing stocks in general (for whole species). On the other side the data needed is that covers condition of standing stocks for each species both of natural forest and plantations, both of commercial and non-commercial.

Most of large-diameter rattans are solitaire, and therefore the after-cut do not have regeneration from stem clump. It means the available standing stocks in natural forest decreased rapidly. Until present time, the regeneration of large-diameter rattan cane is not made seriously with the harvest being higher than the annual allowable cut. As the consequences, these species become scarce and endangered. Meanwhile, the plantation made by the government is not in the

economical scale or in trial plots. On this plantation, although some large-diameter rattans are clustered in nature, the stem amount is lesser compared with those of small-diameter.

For small-diameter rattan cane, mostly clustered, the after-cut stem lump generates new shoots, and so the production capacity is higher than large-diameter canes. There are only two species of a small-diameter rattan cane already planted by the inhabitant in Kalimantan, and consequently, other commercial small-diameter rattan cane will originate from natural forests. Meanwhile, for small-diameter current harvest rate is higher than the annual allowable cut, which results in that some species become endangered too.

There is an ample room to promote the lesser used species such as *Korthalsia sp.* and *Daemonorops sp.* by using appropriate technology to increase their performance meeting market requirements. If it is made, the value added of the species will be generated. These two groups of species have the largest standing stocks in natural forests compared with commercial species'.

At present, rattans growers are still attracted to cultivate quick yielding small-diameter rattan canes such *C. caesioides*, Irit (*C. trachycoleus*) and *C. flabelloides*. There are strong indications that some commercial rattan species both large and small-diameter canes are becoming scarce as for *C. manan*, Tohiti (*C. inops*), *C. flabelloides*, Pulut putih (*C. flabellatus*), *C. eriocanthus*, and Lacak merah (*Calamus spp.*).

2.1 Current Condition of Rattan Resources

Currently, most of rattan raw material production come from natural forests, except for two species that already been cultivated in Kalimantan. As a result, obvious problem in rattan resources is obvious. The identified problems for rattan resources are:

- a. The available standing stocks in natural forest of commercial rattan species has been decreasing yearly. This is resulted from the exploitation of the species that is higher than the annual available cut.
- b. Degradation of natural forests was followed by the decreasing available standing stocks of rattans, and further the species become scarce.
- c. Some commercial species do not grow naturally in all conditions due to the plant distributions. This affects available standing stocks in the field measurement. Some species grow abundantly, but some others grow limitedly and hence the standing stock is low.
- d. Data of standing stocks of rattan commodities that recorded by Ministry of Forestry is in gray feature and not specific for commercial and non-commercial species.
- e. There is lack of appreciation of the government to regenerate rattan although these commodities contributed 6.5% (US\$ 300 millions) per year of the total income from forestry sectors.

- f. Over-cutting of commercial species resulted in that some species become endangered, scarce, and out of the markets such as *C. manan*, *C. flabelloides*, *C. flabellatus*, *C. erioacanthus* and Lacak merah (*Calamus spp.*). In the near future the condition will be followed by *C. inops*, Lambang (*C. diepenhorstii*) and Batang (*C. zillingerii*) from Sulawesi.
- g. Price of rattan raw material at grower level is low and the regulation that does not encourage rattan cultivation. This is because of low bargaining position of rattan growers in this business. Meanwhile, the government of Indonesia obtains income from taxes of US\$ 5.56 per tons for small-diameter canes, and of average US\$ 0.22 per strips for large-diameter canes.

These commodities have to be managed in sustainable to guarantee continuous supply of raw materials, in order that all sides, rattan growers, rattan industries, and the governments obtain best solutions. Regeneration of endangered commercial species as below is needed.

2.2 View of Some Commercial Rattans

The followings show figures of some species of commercial rattan species that are found in natural forests. Two species are already cultivated intensively in Kalimantan, they are Sega and Irit. However, some of commercial species become endangered due to over-cutting. For this reason, the problem needs to manage seriously.

2.2.1 *Calamus manan*



Figure 2.3.1. *Calamus manan* as exclusive rattan species from Sumatra already out of the market -View of Manau in the top of tree & canes of manan

In Indonesia, *C. manan* is one of rattan species endemic from Sumatra. In other islands, there are a few species that have similarity to this species, they are Seuti

(*C. ornatus* or *C. gigantea*) and Semambu (*C. scipionum*), but the quality and performance is quite different. Nowadays, *C. manan* species is already out of the market caused by scarcity of the resources, the price of raw material gets higher that is not competitive in international market. This is one of reasons the regeneration of *Calamus manan* has to be realized for the future.

2.2.2 *Calamus flabelloides*

C. flabelloides grows naturally in peat swamp fresh water areas in Central Kalimantan. This is a small-diameter rattan species, has a high value canes with easy bending characteristic for furniture, and has beautiful performance with brown colors. At present, this species has turned scarce in natural forests; it is caused by over exploitation.



Figure 2.3.2. *Calamus flabelloides* seedlings



Raw material

2.2.3 *Calamus caesious*

Figure 2.3.3 shows seedlings of *Calamus caesious* of age 3 (three) months in plastic basket, and ready to move to plastic bags. The maintenance in nursery to follow takes six months before they are ready to move to the field. At plantation field they need maintenance until 3 years old, at which time the top parts of rattan already reaches the second or the top parts of supporting trees canopy.

Figure 2.3.4 shows a view of *Calamus caesious* plantation in Sampit, Central Kalimantan of age 25 years old. The top parts of rattan canes canopy already reaches top parts canopy of supporting trees. *Calamus caesious* is preferably planted on moist alluvial soils, normally the bank of rivers. It is flat land that is mostly flooded for one week duration. In a cluster of 25 years old planted rattan, about 200 to 300 canes which consist of mature, nearly mature, young, and shoots, are found.

Calamus caesious is already planted intensively by the inhabitant in Kalimantan, especially Central Kalimantan. This species grow in Sumatra and Kalimantan,

although in Sumatra grow in the hill Dipterocarpaceae forest areas with the internodes longer compared with the same species that grow in lowland Kalimantan.



Figure 2.3.3. *Calamus caesious* seedlings



Figure 2.3.4. *Calamus caesious* plantation in Sampit, Central Kalimantan



Figure 2.3.5. W&S raw material of *Calamus caesious*

Figure 2.3.5 shows *Calamus caesious* raw materials already washed and sulphurized. After harvested, raw rattan are washed, dried, sulphurized, and sorted based on the quality, before they are bundled. Each bundle consists of 70 to 80 canes of 6 meters length, of weight about 100 kilograms. They are finally stored before sale.

2.2.4 *Calamus inops*

Calamus inops is a solitaire species with diameter of canes from 15 mm up to 34 mm or more, its internodes are very short similar to *Calamus manan*, with cane colors creamy yellowish, but not bright. The cane is used as frame for furniture finished products. Most of canes are attacked by insects that is one reason very few of this species found without black spot. Polishing is one solution that is applied.



Figure 2.3.6. View of *Calamus inops* grown in the natural forest in Kendari Southeast Sulawesi



Figure 2.3.7. Drying of *Calamus inops* stems before polishing

2.2.5 *Calamus zillingerii*

Calamus zillingerii is clustered differently compared with *Calamus inops*, the color of leafsheath and cirrus is yellow, the diameter of cane is smaller than the later. According to a farmer in the surveyed area, there are four varieties of the species.

The cane color is yellow brownish, it is used as frame in the furniture finished products.



Figure 2.3.8. Bottom parts of *Calamus zillingerii* grown in natural forests



Figure 2.3.9. *Calamus zillingerii* polishing in the factory

2.2.6 *Calamus dienpenhorstii*

Calamus dienpenhorstii grows faster compared with other species of rattan concerned, one cluster consists of more than 10 stems, Heart of cane part is used as raw materials for *fitrit*, its color is white, has good elasticity and easy to web. and they are abundant in the river streams in lower parts between two mountain.



Figure 2.3.10. Young stages of *Calamus dienpenhorstii* grown in the natural forest in Kendari, Southeast Sulawesi



Figure 2.3.11 *Calamus dienpenhorstii* dried before further processing

2.2.7 *Daemonorops sabot* (pulut merah)

Daemonorops sabot, local name pulut meah or rotan sabot), is a clustered moderate size rattan, old stem climbs up to 20 m, with diameter of 1.0-1,5 cm, its sheaths about 3 cm, with internodes from 6 to 10 cm long. The sheath color is bright green, it is densely armed with collars tipped with black horse hair like spines varying from 1 to 6 cm long, and the collars is oblique. It grows naturally on alluvial forest lands or fresh water peat swamp in the lowlands. Harvest of this rattan is at young age, while mature cane is rarely utilized.



Figure 2.3.12. *Daemonorops sabot* grows naturally in peat swamp forest areas



Figure 2.3.13. Wild seedling of *Daemonorops sabot*

2.2.8 *Calamus trachycoleus* (Irit)



Figure 2.3.14. *Calamus trachycoleus* (irit)



Figure 2.3.15. Stem of *Calamus trachycoleus* (creamy colors) and green colors *Calamus caesioides* stem

2.3 Strength and Weakness of Rattan Commodities in Indonesia

2.3.1 Strength

- a. Rattan is non wood forest products and renewable resources grow naturally in the Tropical Rain Forest contributed 6.5 % (US\$ 300 millions yearly) of total export from forestry sectors.
- b. Indonesia dominated about 80% of the total global market in the world of rattan business.

- c. There are 350 of rattan species founded grow naturally in the natural forest, but only 52 species already utilized as a commercial species. There is an ample room to promote non commercial species by using appropriate technology.
- d. Rattan is beauty, arts, bright colors, natural, renewable, friendly to the environment, and easily to recycle.
- e. High demand of rattan finished products as furniture, floor mate (*lampit*), and souvenir in the local and international markets.
- f. Macro and micro climatic conditions suitable to establish rattan commodity in the tropical rain forest in sustainable manner in Indonesia.

2.3.2 Weakness

- a. Over exploited of commercial species resulted to the scarcity of some species in natural forests, In order to maintain the sustainable supply harvest must be fit to the annual allowable cut of each species of rattans.
- b. Awareness of the government and rattan industry for these commodities are limited, in fact only two commercial species planted intensively in Kalimantan and the others commercial species still exploited from natural forest.
- c. Basic data of the available standing stocks that presented by MOF is unusable to define a strategy of the utilization of rattan commodity in sustainable, all the data in “grey” conditions.
- d. Conflicts between the government and rattan growers about legality of the land tenure of rattan plantations must be clarified immediately to ensure the inhabitant working in their lands.
- e. The role of government policies in encouraging rattan cultivation in fact that only two of these commodities planted by the inhabitant with out supporting by the government.
- f. The grower has trend to convert their land to others commodity such cacao that promises significant economic revenue, and also other reason as high tax that collected by the government actually some amount US\$ 5.56 per tons for small-diameter canes.
- g. Low prices of rattan raw materials in the grower and their bargaining position in this business unfair play.
- h. Beside Indonesia has huge rattan as raw materials to process, shortcomings in the processing business persist, that is lack of design skill. Along with this are lack of management and marketing skill. Rattan industries are dictated to a high degree by buyer orders.
- i. There is a trend for the last few years that some commercial rattan species turn into scarce in natural forests. As the consequence, at present rattan industries face problem to fulfill the buyers’ order.

In Indonesia, obviously extensive regeneration of commercial rattans programs is required if the country aims to remain one of world leading producers of rattan commodities. Promoting programs of non-commercial rattan through research and development and universities to obtain value added of rattans needs to introduce. For rattan growers, the government has to create programs to facilitate grower to cultivate these commodities through financial support and incentives. Financial support can be allocated from *Resources Royalty Provision (PSDH)* collected from rattan produced, which is currently of US\$7.78 per tons for small-diameter, and US\$ 0.18 to US\$ 0.26 for large-diameter. For illustration see Table 2.1.

Table 2.1 The government income tax from rattan export from 1998 to 2002

Year	Actual export tons wet		Tax income in US\$		Total in US\$
	Large-diameter (strips)	Small-diameter	Large-diameter	Small-diameter	
1998	7,001.14	16,910.85	154,03	93,956.68	94,110.71
1999	30,807.65	91,390.53	677,77	507,765.79	508,443.55
2000	33,180.91	107,714.27	729,98	598,604.95	599,190.48
2001	32,472.52	111,809.06	714,40	621,211.12	621,925.51
2002	36,646.56	124,571.87	806,22	692,121.31	692,927.53
Total	-	-	-	-	2,516,597.78

Notes:

- US \$ 1.00 equivalent to Indonesia currency Rp 9000,-
- Tax for large-diameter cane averaged US\$ 0.022 per strips wet (10 % of US\$ 0.22).
- Tax for small-diameter cane of US\$ 5,56 per tons wet (10% of US\$ 55,56)
- This figure is only for tax from Resource Royalty Provision (PSDH).

CHAPTER 3: RATTAN STANDING STOCK IN NATURAL FORESTS AND PLANTATION

3.1 Inventory

Rattans inventory on natural forests and cultivated area aims to estimate standing stock and identify characteristics and ecological requirements of each species concerned, their geographical distribution, their production capacity, and others. Study provides the information on current conditions of these commodities, management of cultivation, silvicultural aspect, cultivation system, and harvesting technique. The information is required for attaining the goal of optimum growth of rattan.

Obviously, in Indonesia there are vast potential of rattan, however only few species already utilized by rattan industry. In general, rattan canes are graded according to diameter and quality of canes based on physical appearance,

elasticity and weight. Those commercial rattan species that are currently accepted or preferred by rattan industry are shown in the table below.

Today, the installed capacity of rattan industry in Indonesia totals to 533,000 tones of raw material, however industry can absorb only in the neighborhood of 108,658 tones a year. Consequently, numbers of rattan industries have to work under capacity or closed down.

Production planning is based on data of resources from natural forests is unreliable since the available data is not accurate, meanwhile rattan cultivation does not start yet. This situation will continue unless new policy such financial support is made.

There are three types of data on rattan potential area that reported by Ministry of Forestry since 1983 until the present time: first in 1983 total forest area potential of producing rattan is reported to be about 12 million hectares, secondly it is about 9.37 million hectares, thirdly of 2004 it is of about 1,489,900 hectares. Further, all of these data are not specific for every species. In reality, not all of these raw materials are accepted or preferred by rattan industry in Java. See table 3.1. for detailed figure of rattan species accepted by industry.

Table 3.1. Commercial rattan species based on diameter canes accepted by rattan industry

Small-diameter canes		Large-diameter canes	
Scientific name	Vernacular name	Scientific name	Vernacular name
1. <i>Calamus blumei</i>	Tikas	1. <i>C. inops</i>	Tohiti
2. <i>C. caesious</i>	Sega, Taman	2. <i>C. manan</i> or <i>C. gigantea</i>	Manau
3. <i>C. erioacanthus</i>	Sarang buaya	3. <i>C. ornatus</i>	Kesup, Buku dalam, Lambang
4. <i>C. flabellatus</i>	Pulut putih	4. <i>C. scipionum</i>	Semambu
5. <i>C. flabelloides</i>	Pulut merah	5. <i>C. tumidus</i>	Manau tikus
6. <i>C. javensis</i>	Lilin, Cacing	6. <i>C. zillingerii</i>	Batang, Pondos Saisagan
7. <i>C. optimus</i>	Balam	7. <i>D. burkianus</i>	Balukbuk
8. <i>C. trachycoleus</i>	Irit	8. <i>D. fissa</i>	Kotok
9. <i>Calamus spp.</i>	Lacak merah	9. <i>K. flagellaris</i>	Dahan
10. <i>Daemonorops sabut</i>	Sabut		
11. <i>Korthalsia scaphigera</i>	Semut		

Total area potential for producing rattan in natural forests is about 11,501 million hectares with annual available cut of 696,900 tons per year, thus the production capacity is of 12,391 million ton (Rombe and Malik, 1987). Ministry of Forestry, Directorate Wood Industry, Directorate General Forest Conservation, 1986 reported that the available rattan standing stock in natural forests is about 533,000 tons per year, but the real production per year was only 108,658 tons per year or 20,40 %. In 2001, Ministry of Forestry reported that annual available cut about 622,000 tons per years and the real production of rattan industry only 242,000 tons. Ministry of Forestry, Center of Statistics and Inventory (2004), reported that total area of natural forest producing rattans is about 1,489,900 hectares for whole

Indonesia. Although, in Indonesia there is enormous potential of rattan standing stock in natural forests, unfortunately only 20 species as main species that really accepted by rattan industry and about 34 species used as substitution raw material with low quality.

In order to maintain Indonesia position as the leading rattan producers, rattan regeneration is needed. In Kalimantan, there are two species of rattans that have been cultivated intensively by the inhabitants, namely rotan sega (*Calamus caesious*) and rotan irit (*Calamus trachycoleous*). The area nearly 47,154 hectares or 96.27 % of total 48,979.60 ha of planted rattan areas in Indonesia (Januminro, 2000).

Nowadays, the resources, especially for commercial species, is seriously threatened by the loss. The loss is caused by habitat destruction through timber exploitation, conversion of land to agriculture or other landuse, and over exploitation of commercial rattan itself on the remaining stock in natural forests.

Rattans inventory on natural forests and cultivated area aims: to estimate the standing stock of rattan in the two lands, to identify the ecological requirements, geographical distribution, production capacity for each species, and other aspects. Study will be targeted on the management cultivation based on the silvicultural aspects, cultivation systems, and harvesting technique, as the basis for enhancing economics contribution of rattan and its sustainability.

3.2 Rattan Standing Stock

The potency for each species of rattan both natural and plantation from rattan inventory is calculated using the formula:

$$\text{Potency (kg/ha)} = \frac{\sum y_i}{\sum x_i}$$

Notes:

- i = the i^{th} strip made in inventory (=1, 2,n)
- x_i = area of strip i (in hectare)
- y_i = weight of rattan found in strip i

The standing stock of rattan for each species (ha) in dry is calculated with the formula:

$$(\text{Potency}_i \times \text{area size}_i \times 0.8 \times 0.7) / \text{water contents}_i$$

Notes:

- a. Potency per hectare based on field measurement in the field for each species.
- b. Area size is based on available information from Ministry of Forestry report.

- c. 0.8 is correction factor in harvest.
- d. 0.7 is utilization factor.
- e. Water contents of rattan canes, for small-diameter about 40 to 60 % and for large-diameter from 40 to 50 % depending on the species.

If the data presented only for rattan standing stocks and the annual allowable cut directly calculated after cutting, then canes is in wet condition, water content factor will reduce the weight of canes after drying. The formula will change if the data presenting only standing stock and the annual allowable cut of rattan in wet conditions such as:

The annual allowable cut of rattan raw material in wet is calculated as:

$$\text{AAC} = (\text{Potency per ha of species}_i \times \text{area size}_i \times 0.8) / \text{age of maturity species}_i$$

Notes:

- a. Potency per hectare is based on the measurement in the field for each species.
- b. Area size on which rattans grow, natural forests or plantation.
- c. 0.8 correction factors of processing after harvest.
- d. Age of maturity at which age rattan is ready to harvest, different for each species.

As described above, three types of data on rattan potential area were reported by Ministry of Forestry since 1983 up to present time. Based on these data the team analyze on the available rattans standing stock based on species that are found in sample plots, as presented in Table 3.2.1 up to Table 3.2.3.

Based on data in 1996, reported by Ministry of Forestry, total area producing rattan in the natural forest estimated about 9.37 million hectares. Field measurement has been made in area: Jambi-, East Kalimantan-, and Sulawesi Province, to define rattan standing stock and the annual allowable cut yearly. The annual allowable cut for each species for the three islands are as in the following tables (Table 3.2.1, 3.2.2, 3.2.3).

Table 3.2.1 Annual allowable cut based on species in Sumatra with area 2,461,000 hectares

Species	Potency kg/ha wet	Available standing stocks tons dry	AAC tons/year	Remark
1. <i>Calamus caesioides</i>	25.8	17,778.26	1,777.83	CV
2. <i>C. exillis</i>	15.6	21,499.30	855.97	CVL
3. <i>C. javensis</i>	10.5	5,788.27	578.83	CVL
4. <i>C. laevigathus</i>	7.6	6,284.41	628.44	CVL
5. <i>C. manna</i>	3 strips	2,480.69	99.23	CV
6. <i>C. optimus</i>	37.8	31,256.67	3,125.67	CV

Species	Potency kg/ha wet	Available standing stocks tons dry	AAC tons/year	Remark
7. <i>C. ornatus</i>	11 strips	12,127.81	606,39	CV
8. <i>C. polytacthys</i>	4.5	3,100.86	206.73	NC
9. <i>C. scipionum</i>	15 strips	14,884.13.	744,21	CV
10. <i>Calamus spp.1</i>	29.4	20,258.95	1,350.60	NC
11. <i>Calamus spp.2</i>	23.5	16,193.38	1,619.34	NC
12. <i>Calamus spp 3</i>	26.5	18,260.06	1,826.06	NC
13. <i>Calamus spp 4</i>	15.5	10,680.07	1,068.07	NC
14. <i>Calamus spp 5</i>	10.4	7,166.43	716.64	NC
15. <i>Daemonorops burkianus</i>	30.5	25,220.33	2,522.03	CVL
16. <i>D. crinitus</i>	12.4	10,253.51	1,025.35	NC
17. <i>D. draco</i>	15.7	12,982.26	1,298.23	CVL
18. <i>Korthalsia scaphigera</i>	5.5	3,031.95	303.20	CVL
19. <i>Korthalsia spp.1</i>	12.6	6,945.93	694.59	NC
20. <i>Plectocomia spp.1</i>	9 strips	8,930.05	446,52	CVL

Notes:

Production of 1 strip based on rattan species in wet condition:

No.	Species	Length (m)	Wet weight (kg)
1	<i>Calamus manan</i>	3.10	2.50
		4.10	3.20 up to 3.50
2	<i>C. ornatus</i>	4.10	1.80 up to 2.00
3	<i>C. scipionum</i>	4.10	1.80
4	<i>Plectocomia spp. 1</i>	4.10	3.50 up to 4.00

CV : Commercial Value

CVL : Commercial Value for Local

NC : Non-commercial or not in trade yet.

- Small-diameter rattan canes, used for webbing, local use: 2, 3 and 18
- Small-diameter canes, used for webbing, *fitrit*, and frame: 1
- Middle diameter canes used for frame, *fitrit*, skin for webbing local and international market: 10
- Middle diameter canes, used as frame for local use: 4 and 11
- Large canes use as frame for local use: 6, 7, 8, 9, 14, 15, 17 and 20
- Middle rattan canes, used for *fitrit*: 12, 13 and 19
- Large rattan canes, used for frame for local and international markets: 5
- Middle rattan diameter canes fruits producing *dragon blood* and cane used for *fitrit*: 17

In order to utilize rattan standing stocks in efficient and sustainable, for forests in Sumatra the annual allowable cut for each species are:

- (1) *Commercial Value* of small-diameter for export and used for webbing, *fitrit*, and frame, annual allowable cut 1,777.83 tons dry per year.
- (2) *Commercial Value* of small-diameter for local use or sometimes export as finished products, annual allowable cut 3,820.2 tons dry per year.

- (3) Non commercial both local and international markets, annual allowable cut 8,507.38 tons dry per year.
- (4) Commercial rattans of large-diameter, having high value in international and local markets, annual allowable cut based on species are: *Calamus manan* about 99.23 tons dry per year, *Calamus scipionum* about 6.075.91 tons per year, *Calamus ornatus* about 606.39 per year, and *Plectocomia spp* about 6,331.30 tons per year.

Table 3.2.2 Annual allowable cut based on species in Kalimantan with area 2,931,157 hectares

Species	Potency kg/ha wet	Available standing stocks tons dry	AAC tons/year	Remark
1. <i>Calamus.axilliaris</i>	21.05	13,820.99	1,382.10	NC
2. <i>C. caesius</i>	51.95	51,163.93	5,116.39	CV
3. <i>C. flabelloides</i>	7.85	5,154.15	736..31	CV
4. <i>C. javensis</i>	19.95	13,098.75	1,309.88	CVL
5. <i>C. laevigathus</i>	1.70	1,674.28	111.62	NC
6. <i>C. optimus</i>	5.56	5,475.87	547..59	CV
7. <i>C. ornatus</i>	15 strips	26,591.46	1,329.57	CV
8. <i>C. pogonacanthus</i>	5.20	5,121.32	512.13	NC
9. <i>C. scipionum</i>	26 strips	30,279.91	1,536.40	CV
10. <i>C. sordidus</i>	11.35	7,452.17	496.81	NC
11. <i>C. trachycoleus</i>	38.95	25,573.76	3,653.39	CV
12. <i>Calamus ssp.6</i>	9.45	9,907.01	620..47	NC
13. <i>Calamus .spp.7</i>	3.95	2,593.49	172..90	CV
14. <i>Daemonorops.fissa</i>	16.25	13,336.76	889..12	NC
15. <i>D. .hystrix</i>	12.50	10,259.90	683..94	NC
16. <i>D. longispatha</i>	9.85	6,467.99	646.80	NC
17. <i>Daemonorops spp.1</i>	9.45	6,204.67	413.64	NC
18. <i>Korthalsia .flagellaris</i>	30 strips	70,910.55	3,545.53	CVL
19. <i>K.rostrata</i>	5.50	4,513.98	300..93	NC
20. <i>K.scaphigera</i>	5.60	3,676.84	367.68	CVL
21. <i>K.tunuissima</i>	2.90	1,904.08	126..94	NC

Notes:

No.	Species	Length (m)	Weight (kg) wet
1	<i>C. ornatus</i>	4.10	1.80 up to 2.00
2	<i>C. scipionum</i>	4.10	1.80
3	<i>Korthalsia flagellaris</i>	4.10	2.40

CV : Commercial Value
 CVL : Commercial Value for Local
 NC : Non commercial or not in trade yet.

- Most valuable small rattan canes, used for webbing, *fitrit*, and as frame for furniture products: 2
- As substitute for *Calamus caesious*, low quality: 6 and 8
- Small-diameter canes, used for *lampit* and *fitrit*: 11
- Small-diameter rattan canes, used for *fitrit*: 4 and 20
- Use for basket frame, for local use: 1, 5, 16 and 21
- Use for frame, for local use: 10, 12, 14, 15, 18 and 19
- Most valuable small rattan canes, used for webbing and good quality for export: 3
- As substitute of *Calamus manan*: 10 and 15
- Small-diameter canes, used for basket frame for international markets: 13
- Fruit producing “*dragon blood*”: 17

In order to utilize rattan standing stocks in efficient and sustainable in Kalimantan the annual allowable cut for each species are:

- (1) *Commercial Value* of small-diameter export as webbing, *fitrit*, *lampit* and frame, annual allowable cut about 8,769.78 tons dry per year.
- (2) *Commercial Value* for local use small-diameter canes, annual allowable cut about 1,677.56 tons dry per year.
- (3) Non-commercial of small-diameter, annual allowable cut in natural forests about 5,654.03 tons dry per year.
- (4) *Commercial Value* of large-diameter, used for frame, annual allowable cut for *Calamus scipionum* about 1,514.00 tons dry per year, *Calamus ornatus* about 1,329.57 tons dry per year, and *Korthalsia flagellaris* 5,170.56 tons dry per year.

Table 3.2.3 Annual allowable cut based on species in Sulawesi with area 2,512,468 hectares

Species	Potency kg/ha wet	Available standing stocks tons dry	AAC tons/year	Remark
1. <i>Calamus adpersus</i>	170.30	143,765.43	9,584.36	CVL
2. <i>C. diepenhorstii</i>	206.80	174,578.34	6,983.13	CV
3. <i>C. flabellatus</i>	51.20	43,222.50	2,881.50	CV
4. <i>C. inops</i>	132.35	111,728.45	4,669.14	CV
5. <i>C. javensis</i>	10.20	5,740.49	574.05	CVL
6. <i>C. minahasae</i>	127.50	107,634.13	7,175.61	CV
7. <i>C. optimus</i>	39.20	33,092.22	2,206.15	CV
8. <i>C. sympisipus</i>	6.50	5,487.23	368.82	NC
9. <i>C. zillingerii</i>	204.98	173,041.91	6,921.68	CV
10. <i>Calamus spp. 8</i>	192.10	162,168.75	6,486.58	NC
11. <i>Calamus spp. 9</i>	8.10	6,837.93	455.86	NC
12. <i>Calamus spp. 10</i>	88.50	74,710.75	4,980.72	CVL
13. <i>Calamus spp. 11</i>	31.00	26,169.87	1,744.66	NC
14. <i>Calamus spp. 12</i>	15.40	13,000.51	866.70	NC

Species	Potency kg/ha wet	Available standing stocks tons dry	AAC tons/year	Remark
15. <i>Calamus spp. 13</i>	32.40	27,351.73	1,823.45	NC
16. <i>Calamus.spp. 14</i>	55.00	46,430.41	3,095.36	NC
17. <i>Calamus.spp. 15</i>	19.80	16,714.95	1,114.33	NC
18. <i>Calamus spp. 16</i>	86.50	73,022.37	4,868.18	NC
19. <i>Calamus spp. 17</i>	67.00	37,707.71	2,513.81	NC
20. <i>Daemonorops.burkianus</i>	68.30	57,658.13	3,843.88	CVL
21. <i>Korthalsia scaphigera</i>	78.60	44,235.52	4,423.55	CVL
22. <i>Korthalsia spp. 2</i>	55.56	31,268.77	2,084.58	NC

Notes:

- CV : Commercial Value
 CVL : Commercial Value for Local
 NC : Non commercial or not in trade yet.

- Most valuable rattan canes for frame: 2, 4 and 9
- Local used as *fitrit*: 7, 10, 12, 20 and 21
- Used for webbing for local or international market: 3 and 5
- Non-valuable rattan: 1, 6, 8, 11, 13, 14, 15, 16, 17, 18, 19 and 22.

In order to utilize rattan standing stocks in efficient and sustainable based on the annual allowable cut for each species are:

- (1) *Commercial Value* of small-diameter, used as frame, annual allowable cut about 9,381.76 tons per year.
- (2) *Commercial Value* of small-diameter, used as webbing, *fitrit*, and frame, annual allowable cut about 3,455.55 tons per year.
- (3) *Commercial Value* of small-diameter for local use and also export as finished products, annual allowable about 23,406.56 tons per year.
- (4) *Commercial Value* of large-diameter, annual allowable cut about 18,373.95 tons per year.
- (5) Non commercial value of large-diameter both for local and international markets, annual allowable cut about 22,908.69 tons per year.

Table 3.2.4 Annual allowable cut of commercial large-diameter rattan canes from natural forests in Sumatra, Kalimantan, and Sulawesi

Species	Available standing stocks tons dry	AAC tons dry/year	Remark
1. <i>Calamus dienpenhorstii</i>	174,578.34	6,983.13	Clustered
2. <i>Calamus inops</i>	111,728.45	4,469.14	Solitaire
3. <i>Calamus manan</i>	2,480.69	99.23	Solitaire
4. <i>Calamus ornatus</i>	38,719.27	1,935.96	Clustered
5. <i>Calamus scipionum</i>	45,611.92	8,809.47	Clustered
6. <i>Calamus zillingerii</i>	173,041.91	6,921.68	Clustered
Total Volume	546,160.58	20,409.14	-

In Sulawesi there are 3 (three) commercial rattan species of large-diameter canes with available standing stocks 459,348.70 tons dry, and annual available cut of 18,373.95 tons/dry/year. In Sumatra, there is one species of large rattan canes with available standing stocks 2,480.58 tons dry, and annual allowable cut of only 99.23 tons dry/year. In Kalimantan and Sumatra there are 2 (two) species of large-diameter rattan canes, *Calamus scipionum* and *Calamus ornatus* with the available standing stocks about 84,331.19 tons dry, and annual allowable cut of about 10,745.43 tons dry/year. These two species are used mostly as substitute of raw materials when most valuable species such as manau, tohiti, batang, and madona are not available. The two species are used only locally, that is *Plectocomia spp.* and *Korthalsia flagellaris* with available standing stocks of 79,840.60 tons dry and annual allowable cut 5,617.08 tons dry per year.

Table 3.2.5 The annual allowable cut of commercial small-diameter rattan canes from natural forests in Sumatra, Kalimantan, and Sulawesi

Species	Available standing stocks tons dry	AAC tons dry/year	Remark
1. <i>Calamus caesius</i>	68,942.19	6,895.22	Clustered
2. <i>Calamus flabelloides</i>	5,154.17	736.31	Clustered
3. <i>Calamus flabellatus</i>	43,222.50	2,881.50	Clustered
4. <i>Calamus optimus</i>	33,095.22	3,673.26	Clustered
5. <i>Calamus trachycoleus</i>	25,573.76	3,653.39	Clustered
Total Volume	175,987.84	17,839.68	-

There are 5 (five) commercial small-diameter rattan canes found in field measurement areas in natural forests with available standing stocks about 175,987.84 tons dry and annual allowable cut of 17,839.68 tons dry/year. Unfortunately, valuable species grown naturally in Sumatra, that is Lacak merah (*Calamus spp.*) is not found in field measurement areas.

Table 3.2.6. Annual allowable cut of commercial small-diameter rattan canes for local use from natural forests in Sumatra, Kalimantan, and Sulawesi

Species	Available standing stocks tons dry	AAC tons dry/year	Remark
1. <i>Calamus exilis</i>	38,391.60	1,289.96	Clustered
2. <i>Calamus javensis</i>	45,401.98	2,271.39	Clustered
3. <i>Calamus laevigathus</i>	20,377.88	530.58	Solitaire
4. <i>Calamus minahasae</i>	107,634.13	7,175.61	Clustered
5. <i>Calamus spp. 10</i>	74,710.75	4,980.72	Solitaire
6. <i>Calamus spp. 11</i>	26,169.87	1,744.66	Clustered
7. <i>Calamus spp. 13</i>	27,351.73	1,823.45	Clustered
8. <i>Calamus spp. 14</i>	46,430.41	3,095.36	Clustered
9. <i>Daemonorops burkianus</i>	132,718.63	4,776.72	Clustered

Species	Available standing stocks tons dry	AAC tons dry/year	Remark
10. <i>D. draco</i>	38,637.70	865.48	Clustered
11. <i>Korthalsia scaphigera</i>	61,447.86	670.88	Clustered
Total Volume	619,927.54	29,224.81	-

Table 3.2.7 Annual allowable cut of non commercial small-diameter rattan canes from natural forests in Sumatra, Kalimantan, and Sulawesi

Species	Available standing stocks tons dry	AAC tons dry/year	Remark
1. <i>Calamus adpersus</i>	143,765.43	9,584.36	Clustered
2. <i>Calamus axilliaris</i>	13,820.99	1,382.10	Clustered
3. <i>Calamus pogonacanthus</i>	5,121.32	512.10	Clustered
4. <i>Calamus polytachys</i>	11,074.50	206.72	Clustered
5. <i>Calamus sordidus</i>	11,178.26	745.22	Clustered
6. <i>Calamus sympisipus</i>	5,487.23	368.82	Clustered
7. <i>Calamus spp.1</i>	72,353.40	1,181.77	Clustered
8. <i>Calamus spp.2</i>	57,833.50	1,619.34	Clustered
9. <i>Calamus spp.3</i>	62,216.50	1,742.06	Clustered
10. <i>Calamus spp.4</i>	38,145.50	1,068.87	Clustered
11. <i>Calamus spp.5</i>	25,594.40	716.64	Clustered
12. <i>Calamus spp.6</i>	9,307.01	620.47	Clustered
13. <i>Calamus spp.7</i>	3,890.23	259.35	Clustered
14. <i>Calamus spp.8</i>	162,168.75	6,486.75	Clustered
15. <i>Calamus spp.9</i>	6,837.93	455.86	Solitaire
16. <i>Calamus spp.12</i>	13,000.51	866.70	Clustered
17. <i>Calamus spp.15</i>	16,714.95	1,114.18	Solitaire
18. <i>Calamus spp.16</i>	73,022.37	4,868.18	Cluster
19. <i>Calamus spp.17</i>	55,560.68	3,770.72	Solitaire
20. <i>Daemonorops crinitus</i>	30,516.40	1,025.35	Cluster
21. <i>D. fissa</i>	13,336.76	889.12	Cluster
22. <i>D. hystrix</i>	10,259.05	683.94	Clustered
23. <i>D. longispatha</i>	9,700.96	970.10	Clustered
24. <i>Daemonorops spp.1</i>	6,204.60	413.64	Clustered
25. <i>Korthalsia rostrata</i>	4,513.98	300.93	Clustered
26. <i>K. tunuissima</i>	1,904.08	126.94	Clustered
27. <i>Korthalsia spp.1</i>	31,008.00	649.59	Clustered
28. <i>Korthalsia spp.2</i>	31,268.77	2,084.58	Clustered

This data does not include those of eastern parts of Indonesia such as: Mollucas, Nusa Tenggara, and Irian Jaya (Papua) since all rattan sources of rattan industries currently come from Sumatra, Kalimantan, and Sulawesi.

3.3 Rattan Standing Stocks of Cultivation Areas

Rattans were planted by the inhabitants and government some times ago. So far, the planting only succeeds in growing for two species, they are *Calamus caesiosus*

and *Calamus trachycoleus*, which are inhabitants' plantations. See Table 3.3.1. for details.

Table 3.3.1 Rattans cultivated in Indonesia

Location	Species	Total area (ha)	Remark
Riau	Manau and Sega	10.00	No, information **
West Sumatra	Manau	30.00	No, information **
West Java	<i>D. melanochaetes</i>	50.00	No, information **
	Sega	270.00	No, information **
South Kalimantan	Sega and Irit *	200.00	No, information **
Sampit	Sega and Irit *	18,654.00	Intensively
Central Kalimantan	Sega and Irit	28,500.00	Intensively
North Sulawesi	Tohiti and <i>D.robustus</i>	30.00	No, information **
South Sulawesi	Tohiti	120.00	No, information **
PERHUTANI, West Java	Manau, Irit, and Sega	1,030.00	No, information **
PERHUTANI, East Java	Manau, Irit, and Sega	32.60	No, information **
PERHUTANI, Central Java	Manau, Irit, and Sega	53.00	No, information **
Total		48,979.60	-

Source: Januminro (2000)

Notes:

- * Cultivated intensively by the inhabitant in Kalimantan.
- ** No further information about production, especially PERUM PERHUTANI there is about 1,115.60 hectares already planted in 1985, three commercial species as mention in Table 3.3.1.
 - In Sampit (Central Kalimantan) about 80 % of total areas planted are Sega and 20 % Irit
 - In Central Kalimantan 70 % of total areas planted are Sega and 30% Irit.

Table 3.3.2 Annual allowable cut of rattan cultivated in Central Kalimantan

No.	Species	Size of area (hectares)	Potency (tons dry/ha)	Available standing stocks tons dry	AAC tons dry/year
1	<i>C. caesious</i>	32,023.20	2,50	80,058.00	8,005.80
2	<i>C. trachycoleus</i>	15,130.80	3.00	45,392.40	6,484.63

Notes:

- *C. caesious* mature after 10 years aged.
- *C. trachycoleus* mature after 7 years aged.

The available standing stocks of cultivated rattans are 125,450.40 tons dry, and the annual allowable cut are 14,490.43 tons dry per year.

3.4 Rattan Standing Stocks and Annual Allowable Cut from Natural Forest and Plantation Compared to Export

Most of rattans in Indonesia are produced by certain areas that is: Sumatra, Kalimantan, and Sulawesi, with each has specific of rattan species. Sumatra rattans are dominated by Manau, Lacak merah and some Sega and Dragon blood, from natural forest. Kalimantan rattans are dominated by Sega, Irit, Pulut merah, and Sarang buaya, the first two species are cultivated by the inhabitant intensively. Sulawesi rattans area dominated by Tohiti, Batang, and Lambang.

Annual allowable cut of raw material, based on field measurement on 52 species of rattans found in Sumatra, Kalimantan, and Sulawesi, is applied to five categories:

- (1) Small-diameter rattan canes, utilized for furniture for export, consists of: *Calamus caesiosus* (Sega), *C. trachycoleus* (Irit), *C. flabelloides* (Pulut merah), *C. erioacanthus* (Sarang buaya), *C. flabellatus* (Pulut putih), and *Calamus* spp. (Lacak merah) with black color, especially for baskets.
- (2) Small-diameter rattan canes, utilized for local furniture and sometime also exported as finished products, consists of: *Korthalsia scaphigera*, *Calamus javensis*, *C. minahasae* (Minahasa) and others.
- (3) Large-diameter rattan canes, utilized for furniture frames for export, consists of: *Calamus manan* (Manau), *Calamus scipionum* (Tabu-tabu), *Calamus ornatus* (Kesup), *Calamus inops* (Tohiti), *Calamus zillingerii* (Batang), *Calamus diepenhostii* and others.
- (4) Large-diameter rattan canes, utilized as frame for local, consists of: *Korthalsia flagellaris*, *Plectocomia* spp. and others.
- (5) Non commercial (not in trade yet).

Table 3.4.1. Available Standing Stocks and Annual Allowable Cut of Commercial Rattans in Natural Forests and Plantation Areas

Items	Natural Forest Annual Allowable Cut tons dry/year	Plantation Annual Allowable Cut tons dry/year
1. Large-diameter rattan canes, commercial value for export	20,409.14	Non
2. Small-diameter rattan canes, commercial value for export	17,839.68	14,490.43
3. Large-diameter rattan canes, for local and also export as finished products	5,617.08	Non
4. Small-diameter rattan canes for local and also export as finished products	29,224.81	Non

Total annual allowable cut for all commercial rattan species (commercial value for export and local) for large and small-diameter is about 75,626.24 tons dry yearly, and non commercial rattans is about 44,714.03 tons dry yearly. As a comparison, Table 3.4.2 below shows rattan raw material exported annually that is W&S, furniture, *Lampit*, and basket.

Table 3.4.2 Rattan commodities exported from Indonesia during 1998-2002

Items	Total export volumes tons yearly				
	1998	1999	2000	2001	2002
W&S	542.01	7,020.82	16,545.57	18,558.96	17,188.53
Furniture	17,831.59	92,222.42	95,437.61	92,375.59	104,875.58
Lampit	430.59	431.53	639.60	612.99	665.36
Basket	4,052.53	19,424.35	21,900.00	22,956.21	26,845.60
Total	22,856.42	119,099.12	134,522.78	134,503.75	149,575.07

The above data is not the actual export of finished products; it is calculated from actual data of raw material harvested from the field, through the following method:

- (1) Factors of 0.8; the actual rattan raw materials is 100 divided by 80. For washed and Sulpurized rattan raw material is considered as exploitation export reported yearly.
- (2) Furniture; the actual raw materials are deducted from other raw materials such as wood, 1% of its total export. The result is then corrected by correction factors 0.8, the actual of raw material 100 divided 80 times of the export that reported yearly.
- (3) Basket; the actual raw materials is calculated with correction factor of 0.8.
- (4) Lampit; the actual raw materials is calculated as in (b).

For the others finished products such as *Sabrina*, data is not available since 1998, so it is not included or the data is included in *lampit* finished products. Based on these illustration Table 3.4.3 will be changed.

Table 3.4.3. Actual exported rattan finished products compared to the available standing stocks and annual allowable cut of commercial rattan species

Year	Exported volumes tons dry		Available standing stocks volumes/dry tons		Annual allowable cut volumes/dry tons	
	Large diameter	Small diameter	Large diameter	Small diameter	Large diameter	Small Diameter
1998	12,519.89	11,273.90	546,160.58	190,046.42	20,409.14	32,330.11
1999	66,016.39	57,119.08	546,160.58	190,046.42	20,409.14	32,330.11
2000	71,101.94	67,321.43	546,160.58	190,046.42	20,409.14	32,330.11
2001	69,583.97	69,880.66	546,160.58	190,046.42	20,409.14	32,330.11
2002	78,528.34	77,857.42	546,160.58	190,046.42	20,409.14	32,330.11

Table 3.4.4 The actual export of rattan finished products compared to the annual allowable cut in five years

Year	Actual export/volumes tons/dry		AAC tons dry		Difference between harvest and AAC tons dry	
	Large diameter	Small diameter	Large-diameter	Small-diameter	Large-diameter	Small-diameter
1998	12,519.89	11,273.90	20,409.14	32,330.11	+ 7,889.25	+21,056.21*
1999	66,016.39	57,119.08	20,409.14	32,330.11	- 45,607.25	- 28,462.23
2000	71,101.94	67,321.43	20,409.14	32,330.11	- 50,692.09	- 24,788.97
2001	69,583.97	69,880.66	20,409.14	32,330.11	- 49,174.83	- 37,253.86
2002	78,528.34	77,857.42	20,409.14	32,330.11	- 58,119.20	- 46,198.23

* = economics crisis

Notes:

- Not include small-diameter for local use (CVL), total amount about 29,224.81 tons dry per year.
- Not include large-diameter for local use (CVL), total amount about 5,617.08 tons dry per year.

Above figures imply that over exploitation occurred since 1999 up to 2002, export of large-diameter canes averaged about 71,307.66 tons dry per year, and for small-diameter canes about 52,319.65 tons dry per year.

If this situation persists, in the long run large-diameter canes will last only 5 years to come, and as a consequence there will be a stagnate in raw material supply (mature canes) for 10 to 15 years to come. This situation applies to small-diameter canes that will last just for 3 years. It means that the harvest will be from nearly mature rattan canes that actually will be cut at the following year.

CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

- (1) In order to maintain supply of rattan raw material continuously and in sustainable, it is compulsory that harvesting to follow the annual allowable cut that applies for different species.
- (2) Detail inventory is needed to obtain standing stocks data for each rattan species that grow naturally in Indonesia to define development and management of rattan commodities in the future.
- (3) Rattans are classified to a commercial and non commercial species and also large and small-diameter based on their utilization.
- (4) The available of rattan standing stock data as presented by the MOF that is too general in property, must be classified into species and each species is classified into commercial and non commercial.

- (5) There is a huge potency of non commercial rattan raw materials that is available in natural forests to introduce and promote in the local and international markets.
- (6) All of researches on rattan in Indonesia are of "Trial Plots" level, as results they can not be used as guidance to apply in rattan establishment on economics scale.
- (7) There are some species of commercial rattans that become endangered or out of market; the situation is obviously caused by over exploitation and forest degradation.
- (8) Land tenure legality of rattan growers must be defined clearly by the government to ensure that the growers are the owner of the lands.
- (9) Low rattan prices in the grower level, unfair business between producers and industries, are among the current situation. Securing fair sharing of benefit among producers, industries, and other parties has to be encouraged.
- (10) The government policy does not encourage rattan growers to cultivate rattans commodities.
- (11) At the grower side, lack of knowledge and information in management rattan cultivation is one of current situation.

4.2 Recommendations

- (1) To establish rattan supply in continuous and sustainable to supply raw materials for rattan industry the regeneration of commercial rattan is needed especially for endangered species. Of first priority is for planting endangered commercial species, implemented in economic scale through involving participation of surrounding natural forests inhabitant.
- (2) To improve rattan growers' skill in cultivation, harvesting, after harvest field-processing, storage and packaging, and semi-finished processing techniques, training is recommended.
- (3) Training information center is recommended to establish to accommodate rattan growers need in learning and sharing information in rattan business as cultivation, processing, and marketing.
- (4) The government financial support and incentives for rattan growers are needed to encourage program in rattan development, and in order to increase rattan growers' income significantly.
- (5) Collaboration and cooperation between rattan growers, rattan industry, and the government to realize the program in point (4) is needed.

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APPENDICES

