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Relationships of Forest Biodiversity and Rattan Jernang (*Daemonorops draco*) sustainable harvesting by Anak Dalam tribe in Jambi, Sumatra

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ABSTRACT

*Adiwibowo A, Sulasmi IS, Nisyawati. 2012. Relationships of forest biodiversity and Rattan Jernang (*Daemonorops draco*) sustainable harvesting by Anak Dalam tribe in Jambi, Sumatra. Biodiversitas 13: 46-51.* Conservation of tropical trees can be achieved if supported by the sustainable use of forest by community live nearby through harvesting of non timber woods, for instance rattan. Furthermore, rattan jernang individuals and trees have significant associations. Therefore, objective of this paper is to investigate the utilization of rattan jernang (*Daemonorops draco* Wild) related to the forest tree biodiversity by Anak Dalam tribe in several villages in Jambi, Sumatra. The study has identified that populations of *Daemonorops draco* were varied among villages, ranged from 40 to 71 clumps in the forests and up to 500 clumps in plantations. Moreover, 73 individual trees consisted of 32 species were identified as rattan host and conserved by the community. *Dialium platyespalyum. Quercus elmeri,* and *Adinandra dumosa* were rattan host trees with the highest populations. Meanwhile, a biodiversity of non-host trees consisted of 30 individual trees from 16 species. Interviews revealed that traditional harvesters have acknowledged that trees have significant important ecological roles for the rattan livelihood and therefore it is very important to conserve the forests for the sustainability of harvest in the future. Furthermore, to secure the availability of rattan, the traditional harvesters had started rattan plantation.

Key words: biodiversity, harvest, rattan, trees, tribe.

INTRODUCTION

Major causes of climate change are massive deforestations. Loss of forest stands will lead to the decrease of carbon dioxide sequestrations and followed by carbon emissions to the atmosphere. The accumulation of greenhouse gasses then will affect the global climate. Consequently, increased precipitation is most likely; rain will tend to run off more, and infiltrate soil less, thus leading to drier soils in the forest (Meretsky and Moore 2009).

A solution to mitigate the impact of climate change is by shifting to the non timber products. This practice has significant advantage because it does not affect the carbon sequestration ability in the forest since it requires less tree stands. Therefore, non timber harvest practice will conserve forest biodiversity and increase carbon stocks.

Rattan has been known and widely used as non timber forest products (NTFP) (Oteng-Amoako and Ebanyele 2001). Rahayu et al. (2007) reported the utilization of various rattan species for making handicrafts. However, *Daemonorops draco* is different to other rattan species that have been used for NTFP. Commonly, rattan was logged for its stems for further processed into furniture, basket, and serving trays. In contrast, the utilization of this species is only based on the extraction of the resin (known as jernang) from its fruit. Furthermore, *D. draco* is strongly correlates with the floral diversity of the surround forest and depend on the host trees for climbing purpose (Langenheim 2003). Therefore, the use of *D. draco* for NTFP has positive ecological impact because it only require fruit collecting and thus can promote forest biodiversity. Likewise, *D. draco* can provide microhabitat to wildlife, for example woodpeckers (Styring and bin Hussin 2004), and as woody species, it can increase carbon sequestrations (Snitzer and Bongers 2002).

Due to its diverse application, *D. draco* has been over-exploited. Because of its overexploitation and excessive trades, rattan jernang was identified as potentially threatened amongst the 22 species in the Workshop of Specialist Ethnobotany and Economic Botany In 1997. Excessive logging of rattan host trees, cutting directly the rattan stems, and collecting rattan fruits in high frequency have caused this species listed as vulnerable species and also cited in IUCN Red List (Gupta et al. 2008).

To augment this body of work, this paper tested the hypothesis that the utilization of rattan jernang (*Daemonorops draco*) will contribute to the forest biodiversity. Furthermore, several objectives are formulated to test that hypothesis, they are as follows: (i) To compare the availability of *Daemonorops draco* in the wild and from plantation; (ii) To measure resin productions and prices among Anak Dalam tribe villages; (iii) To estimate rattan jernang (*Daemonorops draco*) host and non host trees biodiversity; (iv) To describe some important contributions that Anak Dalam tribes have recently made, applying their traditional conservation knowledge’s and practices to the sustainable utilization of *Daemonorops draco.*

MATERIALS AND METHODS

Study area

The data for this study was collected from 4 villages (Figure 1) inhabited by Anak Dalam tribe in 4 Districts, Jambi Province, Sumatra from January to February 2011. The villages were located in District of Batanghari, Sarolangun, Tebo, and Tanjung Jabung (East) that consisted of 40 households with 250 persons.

The specific name of the villages were (i) Desa Jebak, Kecamatan Muara Tembesi, Kabupaten Batanghari, (ii) Desa Sipintun, Kecamatan Pauh, Kabupaten Sarolangun, (iii) Desa Mersam Kabupaten Batanghari Mersam at Tebo, (iv) Berbak at Tanjung Jabung (East). Rattan wild population and host trees data were collected from field surveys in the forest near the tribe’s villages with altitude 20 m above sea level. Geographical locations were 103◦5’-103◦15’ East longitude and 01◦40’-01◦50’ South latitude. Temperature in the sites ranged from 20-29◦C with humidity ranged from 81-87%.

Communities based *D. draco* plantation were located and concentrated near their villages. The seeds were collected from fruits that harvested from wild populations. Rattan seeds sowed flatly in the fields. Seedlings are ready when rattan seed is germinated. After that seedlings were moved to the nursery sites with fertile media until they are ready to be planted (7-9 months).

Procedures

Materials used and collected in this study were plant specimens. For all sites, voucher specimens, of all tree species were collected and identified. The vegetations were surveyed by establishing 50 randomly located 10 m x 10 m quadrates (Ban et al. 2005). Species and number of individuals of rattan and host trees were recorded. These procedures were conducted in order to estimate rattan jernang individual (*Daemonorops draco*) availability along

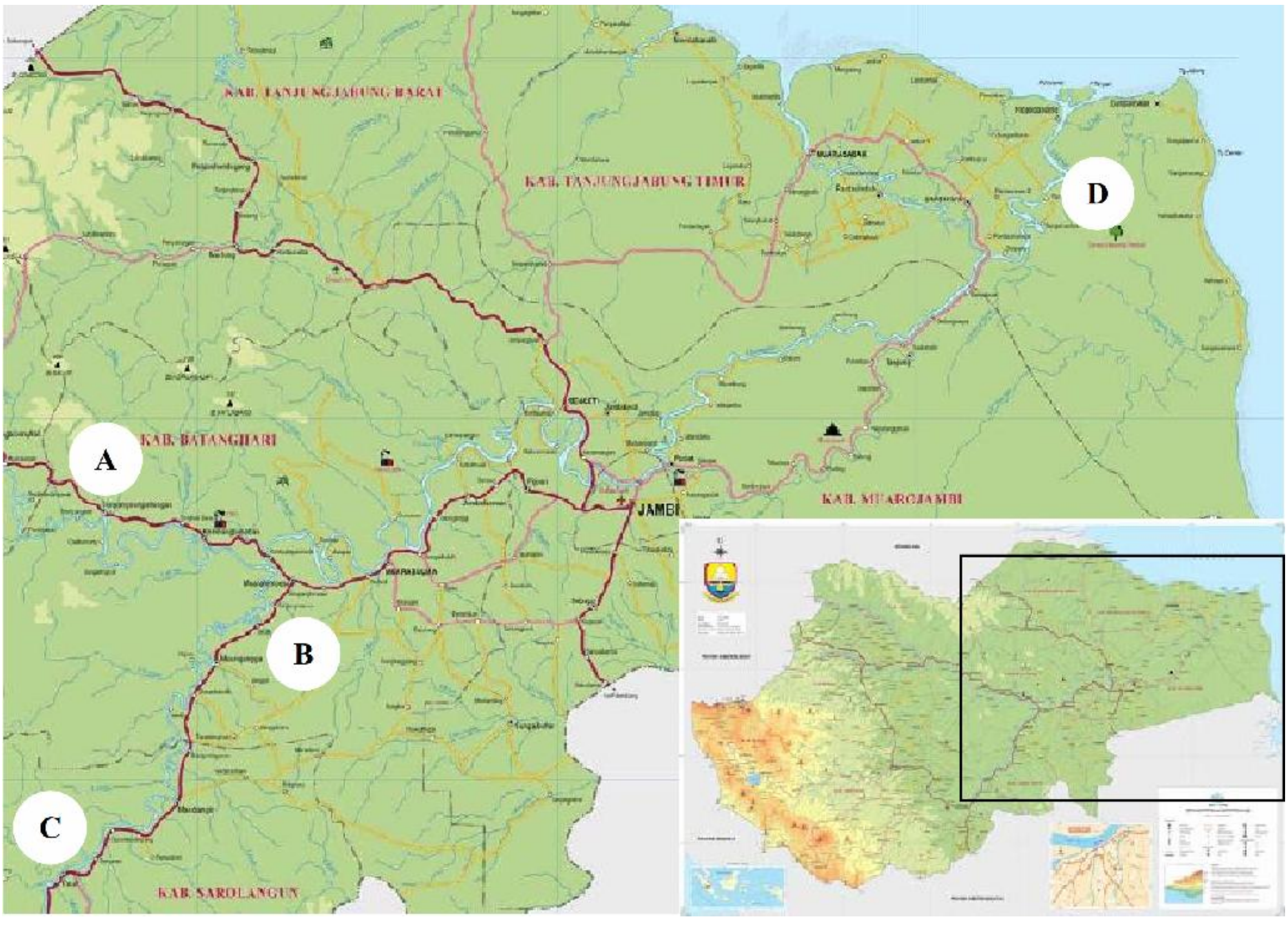

Figure 1. Locations of four Anak Dalam community tribes. A. Mersam village, Mersam sub-district, Batanghari district, B. Jebak village, Muara Tembesi sub-district, Batanghari district, C. Sipintun village, Pauh sub-district, Sarolangun district, and D. Rantau Rasau village, Berbak sub-district, East Tanjung Jabung district, Jambi province.

with trees biodiversity and the availability of *D. draco* in the wild and from plantation . To describe characteristics of rattan harvesting by local community, rattan harvesters and villagers (250 persons) from the tribe were interviewed with questionnaire focused on the local knowledge regarding the rattan harvest practices, rattan host trees, resin extraction methodology, agriculture practices, revenues, and resin productions (Garcia-Fernandes and Cascado 2005).

Data analysis

The data collected from the survey, both for biological aspect data (rattan clumps, trees) and socio data were analyzed descriptively, mainly by means and percentages, summarized and presented in tables and bar graphs where necessary. The statistical measurement was based on comparison of the mean and standard deviation values.

RESULTS AND DISCUSSION

Availability and economy of rattan jernang

The mean values of *Daemonorops draco* clumps from wild populations was lower than from plantation in every villages (Table 1). However, high standard deviation from plantation data indicates that clumps were absent in several villages. Conversely, wild rattan clumps were distributed among villages even though the numbers were varied.

Table 1. Mean And Standard Deviation Of Rattan Clumps From Wild Population And Plantation In Jambi

	Wild population	Plantation
Mean	58.25	135.00
Standard Deviation	12.63	211.36

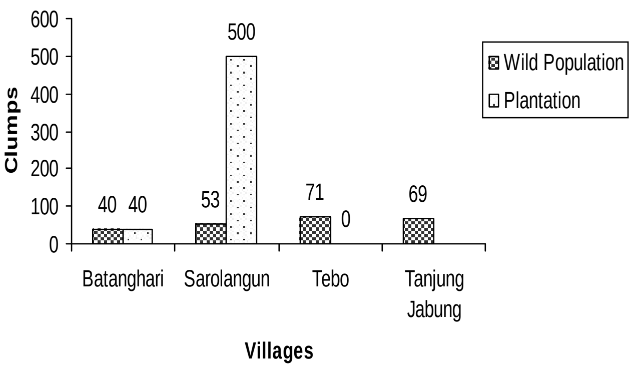

Figure 2. Comparison of *Daemonorops draco* clumps in the wild and from plantation in every Anak Dalam tribes villages at Batanghari, Sarolangun, Tebo, Tanjung Jabung (East) districts, Jambi Province

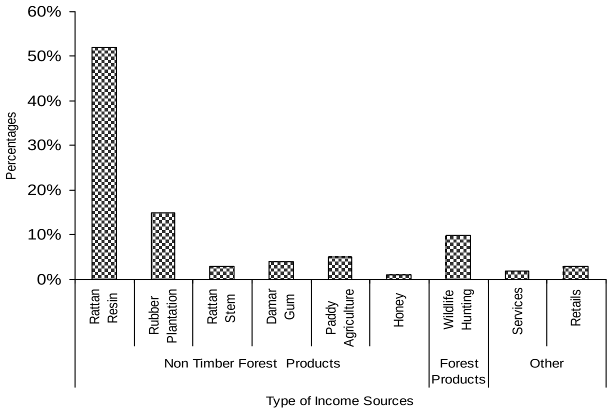

Figure 3. Income sources of Anak Dalam tribes, Jambi

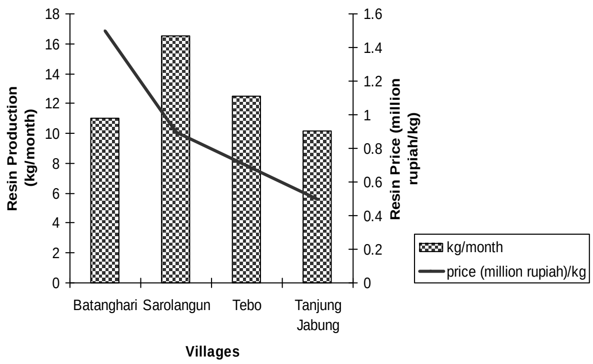

Figure 4. Average resin production and price within Anak Dalam tribes villages at Batanghari, Sarolangun, Tebo, Tanjung Jabung (East) districts, Jambi Province

Village at Tebo district has highest wild population and Batanghari was the lowest one (Figure 2). Variability of *D. draco* among sites are related to the several abiotic factors (Siebert 2005). According to the altitude, location of the site, which is in the lowland elevation (20 m above sea level) can increase rattan populations. Snitzer and Bongers (2002) reported that rattan abundance thought to peak in low altitude and decrease in higher altitude (Ban et al. 2005).

The availability of *D. draco* among those villages has provided significant contributions to the Anak Dalam tribes. Likewise, figure 3 revealed that Non Timber Forest Products were dominant income sources for the tribes. Furthermore, harvesting rattan resin has become major activities for them. These results are consistent with Banjade and Paudel (2008). The NTFP can yield significantly higher level of incremental benefits, especially through rattan harvesting.

Figure 4 confirmed that resin productions and prices among villages were different. Differences in price related not only to the resin production but also due to rattan availability. Important factors that can affect the price are supply and demand. As reported by Singh et al. (2004), it is common situation when supply from the wild resources is unable to meet local demand. This can lead in the shrinkage of wild population and thus put the gene pool diversity under threat. As a consequence, price will increase. For instance, low population in Batanghari (Figure 2) may lead to the decrease in resin production and thus resulted in the higher price compare to other villages considering the high demand. Even though high price can provide the community harvesters with significant income, yet, it is common that the harvesters almost no access to financial capital and low managerial capacity (Aquino and Adriano 2006). In fact, community-based NTFP harvesters have not been the priority sector for the financial institutions (Kunwar et al. 2009).

Shortage of supply is not the only important factor that could affect the prices. The disparity of resin production among villages was also related to the differences of harvesting skills across the members of Anak Dalam tribes. Since numbers of rattans were isolated in remote area, it is almost impossible to impact knowledge of rattan jernang from all aspects ranging from physiology through harvesting, value addition, and chemical constituents. The diversity of income sources may indicate some portions of community were not received the knowledge. According to Banjade and Paudel (2008), traditionally knowledge available locally is usually preserved in the minds of limited number of tribe members and is not shared to the next generations.

Rattan Jernang host tree biodiversity

Table 2 confirmed approximately 32 species trees with 73 individuals had been conserved by harvesters because those species were rattan host trees. Trunks and stems of intact trees that required by rattan for climbing purposes have reduced the elimination of surrounding vegetations by harvesters (Singh et al. 2004). Therefore, numerous trees species found within the forests related to the tribe activities that were emphasized on the harvesting of NTFP.

Since harvesting rattan resins become more popular (Figure 3) and profitable (Figure 4), conservations of host trees become important. Significant income from rattan resin has lead to the protection of trees instead of logging. Compare to other NTFP, rattan requires less intensive management, as a result there is less interference with the natural product of forest recovery. Hence, forest biodiversity can be preserved.

Figure 5 revealed that there were several non-host tree species also besides host trees. The current presence of non-host trees indicate the absence of logging practices since harvesting resin is more profitable. The deforestation can be reduced and avoided since the community can yield incomes from non timber forest products. Population of host trees that higher than non-host trees can promote biodiversity of forests. Since rattan depend in many species trees, then, it will lead directly to the protection and conservation of those trees (Dovie 2007; Jones and Lynch 2007).

The current trees biodiversity related to the forest harvested for rattan in this study is consistent with study by Garcia-Fernandes and Cascado (2005). They confirmed that the structure of the rattan induced forest was similar to that of the intact forest, with comparable tree species richness. According to Ban et al. (2005), if the volume of rattan is conserved, the diversity of forest ecological systems then is preserved.

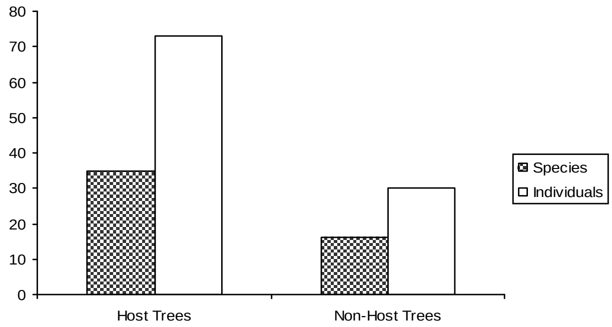

Figure 5. Comparison of host and non host tree species and individuals

Table 2. Rattan jernang host trees in Jambi

Scientific name	Individuals
Dialium platysepalum	4
Quercus elmeri	4
Eugenia sp.	4
Adinandra dumosa	4
Lansium domesticum	3
Durio zibethinus	3
Shorea teysmanniana	3
Celtis wightii	3
Paederia foetida	3
Castanopsis inermis	3
Gironniera subaequalis	3
Sloetia elongata	2
Koompassia malaccensis	2
Diospyros pilosanthera	2
Dyera costulata	2
Pangium edule	2
Pithecellobium saman	2
Spondias cytherea	2
Pithecolobium lobatum	2
Parkia speciosa	2
Mangifera foetida	2
Litsea sp.	2
Artocarpus champeden	2
Dillenia indica	1
Cinnamomum parthenoxylon	1
Nephelium lappaceum	1
Macaranga hypoleuca	1
Adina minutiflora	1
Archidendron bubalinum	1
Artocarpus rigida	1
Rhodamnia sp.	1
Eugenia densiflora	1
Total	73

Traditional conservation knowledge and practices

Figure 6 summarize community attitudes towards rattan jernang resin harvesting. In general, Anak Dalam tribes consider forest conservation as very important. They also agreed that forest should be managed by community. Correspondingly, the sustainability of rattan can be achieved if rattan resin were harvested only based on necessity. Furthermore, it is also important to limit the harvest frequency. The tribes only harvest the resin twice, in August and December; this fact consistent with Hindra (2007). According to the Banjade et al. (2008) and Yang et al. (2003), the sustainability of non timber forest products are depend on the frequency and timing of harvesting.

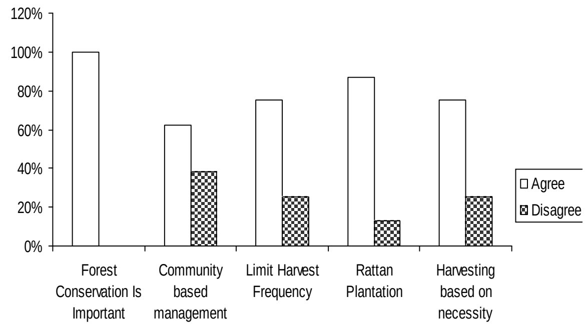

Figure 6. Community attitude towards rattan harvesting within Anak Dalam tribes, Jambi

Nowadays, main threats of rattan jernang are related to the logging of tree host species. Local wisdom has great consideration regarding the roles of host trees to the rattan. However, recent deforestation and land clearing have caused great loss of host trees (Crevello 2003). To anticipate this, ex situ plantations have been prepared in several villages (Figure 2). For instance, villages in Batanghari district had anticipated the shortage of resin stock by planting 40 clumps. Moreover, villages in Sarolangun district had plant significant amount of rattan clumps. The community planting initiative in that village was 10 times higher than wild population.

Sunderland (2001) argued that it is essential to induce ex situ plantation besides rely on wild populations. Several steps need to be considered and undertaken in order to ensure the success of ex situ plantations, for instance seed storage and pre treatments. Plantation can be established within other NTFP, for instance rubbers that are no longer productive. Therefore, it is essential to establish community-based trials emphasizing on the introduction of rattan jernang into agroforestry systems as well as enrichment planting of secondary forest, farm bush, or even abandoned lands (Singh et al. 2004).

The characteristic of rattan resin harvesting within Anak Dalam tribes is based on the community based management. This particular management is emphasize on the principle that every member of the tribe has equal and open access to collect the rattan. The data confirmed that most of the communities agreed with this concept (Figure 6). Therefore, NTFP involves more people community around forest compared with timber forest products (Crevello 2003; Malik and Sumadiwangsa 2003). However, Banjade et al. (2008) argue that community based management have several disadvantages. Open access approach will encourage competition in harvesting the products without considering the maturity or even the quality of the products. While collecting the rattan fruits from the trees, harvesters deliver risk to destroy the whole plants or trees, severely impacting their regeneration potential and causing severe ecological destructions (Sunderland 2001). Therefore, within community based management forest, these threats can be reduced if the timing and method of timing of harvesting are set.

Harvesting techniques are essential besides harvesting managements. Some particular techniques have an impact on the potential of sustainability of rattan extraction, particularly for clustering species. For instance, harvester often cut all stems in a clump (Sunderland 2001). Beside that, rattan resins that harvested by traditional using conservative technology were traded as raw material or half-finished products. The consequence is very low added value for the harvesters (Malik and Sumadiwangsa 2003).. However, Anak Dalam tribes have considered these and develop skills that can minimize the impact on the clumps. Usually, in collecting the fruits, they will deliberately avoid to cut the stems. They believe that by implementing these practices, the stems keep alive and still can produce fruits.

CONCLUSION

As essential socio-economic information combined with biological and ecological on rattan jernang resources originated from Jambi become available and suitable strategies to ensure NTFP harvests are implemented, there is significant potential for particular sustainable use by Anak Dalam tribes to contribute the forest biodiversity. Nowadays, it possesses several challenges. Among villages, there were disparities of rattan availability. The study has identified that wild populations of *Daemonorops draco* were varied among villages. These conditions have affected the resin production capacity and prices. For instance, low population in Batanghari may lead to the decrease in resin production and thus resulted in the higher price. However, through community based management, ex situ plantation and timing of harvesting, rattan jernang utilization could provide an opportunity for the sustainable development of Anak Dalam tribes along with forest trees biodiversity conservation. Comparatively, there were several non host tree species besides host trees. The current presence of non host trees indicate the absence of logging practices since harvesting resin is more profitable. Therefore, it is essential that baseline research contribute to the development and implementation of long term NTFP.

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REFERENCES

Aquino A, Adriano J. 2006. The Philippines rattan value chain study. United State Agency for International Development, Washington DC.

Ban NK, Regalado J, Hung NP, Dung NQ, Binh BM, Anh TP. 2005. Rattan resources of Bach Ma National Park, Thua Thien Hue Province. Agricultural Review 14.

Banjade MR, Paudel NS. 2008. Economic potential of non-timber forest products in Nepal. J For Livelihood 7 (1): 36-50.

Crevello SM. 2003. Local land use on Borneo: applications of indigenous knowledge systems and natural resource utilization among the Benuaq Dayak of Kalimantan, Indonesia. [Dissertation]. Lousiana State University, USA.

Dovie BDK. 2007. Relationship between woody biodiversity and use of non timber forest products in the savanna biome of South Africa. [Dissertation]. University of Witwatersrand, Johannesburg, South Africa.

Garcia-Fernandes C, Cascado MA. 2005. Forest recovery in managed agroforestry systems: the case of benzoin and rattan gardens in Indonesia. For Ecol Manag 214: 158-169.

Gupta D, Bleaklye B, Gupta RK. 2008. Dragons blood: botany, chemistry, and therapeutic use. J Ethnopharmacol 115 (3): 361-380.

Hindra B. 2007. Guidelines on harvesting and extraction techniques of dragon blood. PD 108/01 Rev 3(1). ITTO-Ministry of Forestry, Jakarta.

Jones ET, Lynch KA. 2007. Nontimber forest products and biodiversity management. For Ecol Manag 246 (1): 29-37.

Kunwar SC, Ansari AS, Luintel H. 2009. Non-timber forest product development: regulatory challenges in the Koshi Hills, Nepal J For Dev 8 (2): 39-50.

Langenheim J. 2003. Plant resins: chemistry, ecology, evolution, and ethnobotany. Timber Press, Cambridge.

Malik J, Sumadiwangsa ES. 2003. Research, development, and utilization strategy of non timber forest product: Indonesia case. XII World Forestry Congress, Quebec City, Canada.

Meretsky VJ, Moore T. 2009. Climate change and indiana's non timber products.

Oteng-Amoako A, Ebanyele E. 2001. The anatomy of 5 economic rattan in Ghana. In: Sunderland TCH, Profizi JP (eds.) New Research On African Rattans. International Network On Bamboo and Rattan, Beijing, China.

Rahayu M, Susiarti S, Purwanto Y. 2007. Study of the utilization of non-timber forest vegetation by local society at PT Wira Karya Sakti Sungai Tapa Conservation Area-Jambi. Biodiversitas 8 (1): 73-78.

Siebert S. 2005. The abundance and distribution of rattan over elevation gradient in Sulawesi, Indonesia. For Ecol Manag 210:143-158

Singh BH, Puni L, Jain A, Singh RS. 2004. Status, utility, threats and Conservation options for rattan resources in Manipur. Curr Sci 87 (1): 90-94.

Snitzer F, Bongers F. 2002. The ecology of liana and their roles in the forests. Trends Ecol Evol 17: 223-230.

Styring AR, bin Hussin MZ. 2004. Effects of logging on woodpeckers in Malaysian rainforest: the relationship between resource availability and woodpecker abundance. J Trop Ecol 20: 495-504.

Yang JC, Xu HC, Yin GT, Li RS. 2003. An overview of rattan plantation management. XII World Forestry Congress, Quebec City, Canada.