SOME NOTES ON NATURAL REGENERATION IN EAST KALIMANTAN

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Introduction

Natural regeneration has been practised in an effort to sustain the tropical rain forest.

East Kalimantan has benefited from her natural forest resources, but natural regeneration is only in an experimental stage.

In this paper the authors tried to gather information about and experience in natural regeneration, especially in East Kalimantan. Based on the information collected, the authors will present their conclusions so as to draw the attention of the distinguished members of the symposium to this problem.

Practices of natural regeneration in East Kalimantan

Basically, practices of natural regeneration in East Kalimantan can be differentiated into two broad groups, the intentional and the unintentional one.

Natural regeneration was practised unconsciously in what we will term as:

1. Natural regeneration after uncontrolled selective cutting;
   Felling of some selected trees by the natives for their own use may be the oldest method of natural regeneration which has unconsciously been practised in East Kalimantan. Other form of activity is harvesting fruits such as tengkawang by felling the trees. This form of regeneration is still practised today. The natives still fell ulin wood *(Eusideroxylon zwageri)* for their livelihood and for the construction of their houses.

2. Natural regeneration after clear felling;
   As the people acquired knowledge on cultivation, this form of natural regeneration has been developed. The forest was clear felled for the crops. The trees were burned and the land was sowed with seeds especially for food crops. As the harvest decreases the land is abandoned and the people move to other areas to be cleared.
   Through succession, on the abandoned area secondary forest will grow. The people will return and the soil in the original area will be fertile through the accumulation of litter and organic matter. The native people unconsciously regenerated the forest naturally and they were actually wise ecologically. They never disturbed the forest any more, except for their essential needs.

3. A form of conscious regeneration practice with we will call "controlled natural regeneration" started simultaneously with legalisation by the government of the large scale exploitation of natural rain forest. Formerly the traditional method "banjir kap" or log sleigh system was used to harvest the timber. The success of the operation is heavily dependent upon the availability of rivers or waterways as transportation means. In 1970, as the scale of operation was greatly increased and also as a result of the application of modern mechanical logging methods, it was realized that the residual stand was a secure insurance to maintain the future harvest, stimulating the government to legalise the utilization of natural rain forest.

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The government imposes some obligations and regulations upon concession holders to ensure observation of the sustained-yield principle. The most important regulation concerned with the utilization of natural rain forest as formulated by the Director General of Forestry includes the Indonesian selective cutting (TPI) system clear felling over natural regeneration (THPA) and clear felling over artificial regeneration (THPB).

Basically the TPI system may be described as follows:

(1) The diameter limit of commercial trees allowed to be felled is 50 cm and up.
(2) To ensure the future harvest there has to be a certain number of sound trees of commercial species left in the residual stand which may be called important trees.

Alternatives on the number of important trees depend on the condition of the forest and determine the diameter limit and felling cycles in accordance with the following table:

Diameter limit (cm)	Felling cycle (years)	Number of important trees	Diameter of important trees
50	35	25	35 cm
40	45	25	35 cm
30	55	40	20 cm

Although the regulation has been imposed, research and further studies on the application and effect of the systems on the tropical rain forest i.e. damage of residual stand, soil erosion and so on, still need to be done.

Some notes on the studies of natural regeneration

1 Species of growing trees

Tropical rain forest in East Kalimantan is composed mainly of Dipterocarp species. Human activities have significant impact on the pattern of structure and composition of the vegetation. Different patterns of structure and composition of species depend on the degree and type of forest utilization.

Studies made by Riswan (1976) on the plots in primary stands and abandoned areas after shifting cultivation practice at the Mulawarman University Forest, show that there is a change in pattern of structure and species composition. In the primary forest, the number of species of Dipterocarps is adequate. When the trees in the basal area are very much higher than trees of other species, the number of individual trees of Dipterocarpaceae is only 6% of the total number of trees found in the plots. *Shorea parvifolia, Shorea polyandra, Shorea johorensis* are abundant and other species of the family are *Shorea ovalis, Shorea leprosula, Shorea smithiana, Hopea rudiformis* and *Dryobalanops becarii*. In terms of individuals, *Eusideroxylon zwageri* is the most abundant, with a total percentage of 7.3% among a total of 445 trees per hectare. Dominant species found in abandoned areas after shifting cultivation are *Macaranga* spp., *Artocarpus* spp. and *Pternandra galeata*. Species of Dipterocarpaceae represented by *Hopea rudiformis* amount to 0.45% among a total of 552 trees per hectare. The percentage of species of *Eusideroxylon zwageri* trees is only 0,20%. Several fruit trees such as the species of *Nephelium lappaceum, Artocarpus integer, Garcinia mangostana* and *Durio kutejensis* can also be found.

Hadrijanto (1978) from his studies in the concession area of PT. Good Hope in the upper river of Mahakam reported that succession in abandoned areas of shifting cultivation started with the occurrence of short-lived secondary forest composed of pioneer species i.e. *Trema* spp., *Macaranga* spp., *Nauclea* spp. and *Vitex* sp. The most dominant species in abandoned shifting cultivation areas are *Trema orientalis* and *Trema cannabina*. Study of residual stand in the same areas shows that besides the species of *Macaranga gigantea, Dilennia* sp., *Trema* sp., *Anthocephalus* sp. regeneration

of species of *Shorea* spp, and *Dipterocarpus* sp. can be found. The pattern of structure and species composition are influenced by several factors. Kartawinata (1975) stated that variation and composition of pioneer species depend on the location, habit and composition of plant communities surrounding the area.

Prawira and Tantra (1971) reported that not less than 12 species of *Nauclea*, 16 species of *Macaranga*, 10 species of *Duabanga*, 13 species of *Pterospermum*, 8 species of *Artocarpus, Mallotus, Octomeles* and *Saluma* are found in East Kalimantan, and Sukotjo (1976) reported the occurrence of species of *Duabanga mollucana, Nauclea subdita, Pterospernum* sp, *Octomeles sumatrana, Mallotus echinatus, Anthocephalus* spp., *Macaranga* spp. and *Artocarpus* spp. in a certain residual stand in East Kalimantan.

Besides the species occurrences reported by the writers mentioned above, there are still many species of tropical vegetation that are unknown and unidentified yet. We already realize that the tropical rain forest has the richest species among the ecosystems in the world.

2 Degradation of residual stand

The use of heavy equipment for logging operations may have an ecological impact on the residual stand. Damage of trees of commercial species may degrade the residual stand and the volume of standing stock for future harvest.

Damage caused by logging operations at the concession of PT. Kutai Timber Indonesia has been studied by Syahrani et al. (1974). The writer reported that the damage of commercial species reached 32.82%. It is somewhat lower than the figure reported by Wyatt, Smith and Foenander (1962), while Nicholson (1958) reported that the damagge caused by logging operations in North Borneo is about 45%.

Detailed information is reported by Uktinal and Pallenewen (1977) in the logged-over forest at Beloro, East Kalimantan. The writer stated that the total damage reaches 50.1%. It was stated further that even excluding the damage caused by the climbers, the figure is still high i.e. 36%. In this, 28.6% "fallen and broken off" trees represent the greatest loss.

The use of tractors in areas with different topography may raise problems for the residual stand. Natadiwirya (1976) reported from his study of residual stands at Berau, East Kalimantan, that topography has a significant effect on the percentage of damage. In areas with slopes of 30% and more the damage reached 28.0% and in those with slopes of 15—19% the damage was 22.4% while in the plant area (slopes of 0.0—14%) the damage was 19.1%. Usually in modern exploitation with heavy equipment, damage is caused by fallen trees, by the equipment itself and by the timber skidded or yarded. Unplanned skidding road or spur road may lengthen and widen the tractor path. Improving the techniques of felling by regulations and those of skidding by road improvement may lower the percentage of damage.

3 Fallow period

With no other disturbances, shifting cultivation has contributed to the growth of secondary forest. Fallow period draws special interest as it is considered as an effort of the native people to restore the fertility of the forest soil.

Moekiyat et al. (1978) tried to estimate the fallow period through biomass analysis on the secondary growth at the area of PT. ITCI, Balikpapan, East Kalimantan. Four age-classes of secondary growth in areas abandoned after shifting cultivation were chosen, i.e. 0.75 year, 2 years, 6 years and 10 years. After 10 years the rate of productivity of the biomass decreased and became nearly stagnant. The writers concluded that a 10-year fallow period indicates the time enabling to recultivate the soil. A longer period would represent a waste of time.

The estimation of soil fertility through fallow period is one of the important methods to know the potential of soil and other environmental factors of the land to determine the cycle of cultivation.

Of course, there are variations in natural regeneration on the logged-over forest. Consequently, depending on the location and conditions, the biomass is likely to vary.

Conclusions

(1) The natural regeneration of the East Kalimantan tropical rain forest requires great attention because of the increasing logging activities.
(2) Indonesian selective cutting system should be revised to ensure the maintenance of sustained yield principles.
(3) Lesser known species should be developed in addition to the present commercial species.

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Discussion

Takasu, H. (Japan): Is a ten-year fallow period sufficient?

Answer: The length of the fallow period varies depending on the geographical location.

Choob K. (Thailand): Is there any problem in relation with weeds or undesirable species growing during the fallow priod?

Answer: A large number of weeds grow. As for the length of the fallow period, it is evident that it depends on the geographical location.

Sambas W. (Indonesia): More studies based on anthropological data, soil and biomass analysis are needed to evaluate the beneficial effect of the fallow period.