# People and Forests in East Kalimantan[1]

**Kuswata Kartawinata Timothy C. Jessup A. P. Vayda S. Riswan Cynthia Mackie Nancy E. Peluso[2]**

**Abstract:** Two major Indonesian-MAB (Man and the Biosphere) projects were carried out in the province of East Kalimantan, Indonesia, in the 1980s. Investigators found that farmers vary in their reason for practicing shifting cultivation of logging and agriculture, in their intensity of farming, and in the amount of damage they caused forests in their practices. Shifting cultivation includes a variety of practices that under some circumstances, however, can benefit people and protect their environment. In more recent times in East Kalimantan, commercial logging in lowlands has continued at a quicker pace, and the practice has shifted from the export of raw logs to plantation timber and local wood processing.

Research conducted under the UNESCOs' MAB (Man and the Biosphere) Programme began in East Kalimantan in 1979 with a joint Indonesian-U.S. project on "Interactions between People and Forests" (Kartawinata and Vayda 1984). The project brought together American and Indonesian scientists to investigate various forest-related activities throughout the province and some of their biological effects. East Kalimantan had been selected as the location for the Indonesian MAB Programme on "Project 1: Ecological effects of increasing human activities on tropical and subtropical forest ecosystems" (UNESCO 1974).

The initial project on "Interactions" was followed, from 1982 to 1984, by a second Indonesian-U.S. MAB project called "Shifting Cultivation and Patch Dynamics in an Upland Forest in East Kalimantan" (Mackie and others 1986). The "Patch Dynamics" project was more narrowly focused than its predecessor, but it continued the theme of studying people's forest-related activities and their effects on forest organisms, communities, and ecosystems. A number of smaller MAB projects also were conducted in East Kalimantan around the same time as these two, many focused on people-forest interactions but others on the basic ecology of intact or less heavily exploited forests (Kartawinata 1984, Kartawinata and others 1983).

The activities studied under the "Interactions" and "Patch Dynamics" projects were those known or believed to have clear and significant effects on forest organisms, communities, or ecosystems. These included large- and small-scale commercial logging, non-commercial timber-cutting, migrant pepper farming, the collection of non-timber forest products, and shifting cultivation. Among the biological effects of these activities, some that were studied were the removal of individual plants and animals, conversion of primary and secondary forests to other vegetation types and successional changes that followed, and changes in environmental conditions and nutrient flows following the removal of trees or forest conversion. These basic ecological studies helped to provide data on the "natural background" against which to interpret the biological effects of human activities.

In addition to identifying activities with a clear and significant impact on forests and studying some of the biological effects of those activities, the projects on "Interactions" and "Patch Dynamics" had another purpose. This was to develop a better understanding of who engaged in these activities, in what circumstances, and how and why the practice of those activities and their effects might vary. The methodology used in the research was called at first "situational analysis" (Vayda and others 1980) and later "progressive contextualization" (Vayda 1983). Human actions, the consequences of those actions (whether biological, environmental, or otherwise), and variations in both actions and consequences can be explained by placing them in a context of interconnected causes, constraints, and other influences affecting the actors. These include not only physical factors but also what a person knows and believes—at least those found to be relevant to the performance (or non- performance) of the actions under investigation. Some of these contextual factors are discovered in the particular cases studied in the field. Others can be deduced through comparison with other cases previously studied and perhaps already understood. A contextual explanation of any particular case or generalization from more than one case can be made progressively denser or more extensive by considering more factors in greater detail over a longer period of time, a greater number of actors, and so on.

In the "Interactions" project, in which a variety of forest-related activities were studied at several widely separated sites, the contexts built up by this method were in most cases not very dense. Our sample sizes were necessarily small and many potential factors that might possibly affect actions and or their consequences could not be investigated in detail or with great rigor. However, the contexts we developed were broad. They included, for example, linkages between people and places involving long distance migrations (from the remote interior of East Kalimantan to the lowlands and from other islands such as Sulawesi) and trade (for example, of forest products from upriver areas, through coastal ports, to cities such as Surabaya, Singapore, and Hong Kong).

The second MAB project ("Patch Dynamics") was focused on a smaller range of forest-related activities (shifting cultivation and non-commercial timber cutting) primarily within a single research location (the Apo Kayan, in the far interior). The contexts for these activities and their consequences (biological disturbance and successional recovery) could therefore be made denser than those developed in the first project. In particular, we gathered more detailed information on a whole range of factors affecting the spatial distribution and temporal frequency of gap-

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[2]Programme Specialist in Ecological Sciences, UNESCO Regional Office for Science and Technology for Southeast Asia, Jakarta, Indonesia; Project Leader, Kayan Mentarang Nature Reserve, World Wide Fund for Nature Indonesia Program, Jakarta, Indonesia; Professor of Anthropology and Ecology, Rutgers University, New Jersey; Head, Botany Division, Centre for Research and Development in Biology, Indonesian Institute of Sciences, Bogor, Indonesia; Program Manager, Indonesia Program, Conservation International, Washington, D.C.; University of California, Berkeley, California.

forming human activities, including histories of migration and forest use; we also conducted more thorough and rigorous biological studies of plant succession following anthropogenic (and some natural) disturbances.

This paper summarizes results of the two principal Indonesian-U.S. MAB projects in East Kalimantan and the various smaller projects carried out during the 1980s, and considers the future of the MAB Programme in East Kalimantan.

## Results of the MAB Research

### Logging and Agriculture

Kartawinata and Vayda (1984) reveal that integrated social and biological research at several tropical forest locations in the Indonesian province of East Kalimantan is indicating variation among farmers in their reasons for practicing shifting cultivation, the extensiveness of their farming, and the amount of forest damage they cause. It is among the most remotely located farmers that long-fallow, forest-maintaining practices are the norm. The subjects studied included migrant pepper farmers and unlicensed woodcutting teams in addition to shifting cultivators. All subjects were responsive to economic pressures and opportunities, but, with the possible exception of government-sponsored transmigrants, they engaged in activities causing environmental damage, not because no other means of gaining subsistence for themselves and their families were available, but rather because the activities seemed more profitable than any perceived alternatives. None of the subjects, however, cause as much forest damage as do timber companies. Studies in areas mechanically logged by the companies show genetic erosion, reduction in species diversity, and very slow recovery of the forest. The less damaging methods of our subjects may provide foundations for appropriate technologies of forest use and management.

During the explosion of general economic prosperity at the time of *banjir kap* (the name for practices which were common at the beginning of the timber boom in the late 1960s and early 1970s when trees were manually felled near rivers and then floated downstream), clever entrepreneurs built boats or shops which they retained after the general trade in logs was restricted to timber companies approved by the central government. Since that time, some of these relatively new entrepreneurs have limited their business activities to the sale of trade goods and foodstuffs; other have participated in the trade in minor forest products only when the prices for certain products have been particularly high; still others have taken on trade in minor forest products as a regular occupation. The competition at all stages of trade has thus increased sharply and is even more pronounced when the urban prices on forest products rise significantly. At such times, the number of part-time river middlemen looking for lucrative deals also increases. Collectors gain more bargaining power in that there are more potential buyers of their forest products, but they do not make the best of this situation by trying to improve the quality of their products. Rather, knowing that someone will buy, they offer large quantities instead of high quality. Formerly, regular traders could enforce greater quality control over contractors with whom they had credit ties. In addition, there seemed to be more mutual respect among the traders in certain locales in regard to territorial rights - the rights to forest products collected by particular contractors and other debtors. However, control is becoming increasingly difficult as part-time or new entrepreneurs offer, for example, to pay cash for wet or dry rattan of any quality in order to break into the market. Regular traders subsequently accept low-quality forest products to protect their relationships with, and their investments in, their contractors.

Here again, short-term economic considerations are apparently being put ahead of long-term ecological ones. Like the other investigators, Peluso (1983) found that her subjects typically acted in what they considered to be their best interests. The problem is not one of ignorance. Collectors, whose harvesting methods are destructive, know, for example, the regeneration cycles of the varieties of rattan growing in their locales and the reproductive cycles of the swiftlets whose nets are taken. The fact is that the people's resource-destroying behavior brings quick profit to them and, since traditional controls over these resources (such as the village chief's rights to certain valuable forest produce) have been eliminated, policies of harvesting as much as one can from a resource before somebody else gets to it inevitably gain ground. An important but often ignored implication of such findings is that education and propaganda will be insufficient to change people's behavior. Some way will have to be found to institute effective new controls in place of the lapsed traditional ones, or some concrete and profitable alternative sources of income will have to be offered to those who are now acting destructively.

### Implications for Development: Comparison of Shifting Cultivation in Two Sites

The approach advocated and used in the East Kalimantan MAB projects has produced some findings which are important for development planning in the province and which may be relevant to other tropical forest areas. In the remote Apo Kayan, the inhabitants, the Dayak people, are not reckless destroyers of the forest—the prevalent image of shifting cultivators. Rather, they maintain and re- use sites, farming almost entirely in secondary forest with a long history of land use. Their migrations are not, in most instances, caused by a shortage of land but are mainly responses to economic problems brought about by their geographic isolation.

The more accessible Telen River lowland area, to which people have migrated from the Apo Kayan, is quite different. Despite the hopes of government planners that 'resettled' shifting cultivators could be induced to use more intensive agricultural methods, shifting cultivation there is more, not less, extensive than in the Apo Kayan, and it is being practiced mainly in primary rather than secondary forest. This is not due to any 'backwardness' on the part of Dayak farmers but is a result of inappropriate methods. These include irrigated rice cultivation, which has been promoted by extension workers and brought

about by economic circumstances that, on the one hand, encourage extensive agricultural production (access to markets) and, on the other, make the clearing of large areas of primary forest relatively easy because of the ready availability of chain-saws, outboard motors, and fuel. A related factor is the low inherent fertility of soils in the area which precludes intensive sedentary agriculture.

In the homegardens, Soedjito (1988a) found 91 species in Sungei Barang and 129 species in Long Segar, indicating that the two Dayak settlements have sufficient additional food and medicinal plant supply. The function of homegardens tends to decline as a result of "modernization" influences as indicated by the settlement in Long Segar, although it has higher number of species cultivated which are mostly ornamental species not present in Sungei Barang.

Research to date suggests that development planners should pay close attention to circumstances which may vary from one locality to another and which can have important influences on people's actual behavior. Such circumstances are usually more important than generalities such as the "type" of agriculture practiced or a group's "level of development" or "culture." The generalization that "shifting cultivation is destructive and therefore should be eliminated" (or the reverse, that "shifting cultivation is not destructive") is bound to be wrong some of the time because "shifting cultivation" includes a great variety of actual practices in a diversity of environments. Under some circumstances, shifting cultivation can benefit people and protect their environment.

### Shifting Cultivation and Patch Dynamics in the Apo Kayan

Shifting cultivation and tree-felling for timber in the remote Apo Kayan region of Indonesian Borneo are compared with natural disturbance events (tree-falls and landslides) generally known to affect tropical forests. The causes of spatial and temporal patters in human-caused disturbances are examined. Farmers in the Apo Kayan practice a traditional, forest-maintaining form of shifting cultivation, which over time has created a non-random mosaic of fields, old fields, secondary forests of varying age, and primary forest in "relic" patches.

Mackie (1987) found that tree species common in secondary forest appear early in old field succession. These species appear to be particularly well adapted to regenerate after shifting cultivation. Soedjito (1988b) found that roots of trees within secondary forests penetrate deeper into the soil, have longer lateral roots, and contain higher levels of nutrients and greater biomass than trees of primary forests. Field site selection is influenced by social interactions as well as by environmental factors and the local history of land use.

On a broader scale, migration has repeatedly redistributed villages and village-centered patterns of shifting cultivation within the Apo Kayan. Recent emigration from the region has greatly reduced the human population and has led to contraction of the areas affected by shifting cultivation. Most shifting cultivation has been in areas of secondary forest. Primary forest reserves are maintained near villages in order to supply local needs for timber and other forest products.

The gaps made by tree-felling for timber rather than for farming are similar to natural treefall gaps both in size and in the density of regenerating seedlings. Felling and extraction of timber cause little damage to the surrounding forest. Large landslides are similar in size to shifting cultivation fields. However, they disturb soil and vegetation more severely than any other natural or human-caused disturbance in the region.

The biological diversity of the Apo Kayan and the opportunities for basic and applied research there make it an excellent site for an international biosphere reserve. Recommendations are made for a program of research, forest conservation, and environmentally appropriate development within a biosphere reserve.

### Studies on Primary and Secondary Lowland Forests

A study of a primary lowland dipterocarp forest in Lempake near Samarinda shows that it has a high degree of species diversity (205 tree species of d.b.h. > 10 cm in a 1.6-ha plot with a density of 445 trees/ha) (Riswan 1982, 1987), although slightly lower than that at Wanariset, near Balikpapan (239 tree species in a 1.6-ha plot with a density of 541 trees/ha) (Kartawinata and others 1981). The occurrence of secondary forest species at different proportions indicates regeneration within gaps caused by fallen trees. Naturally occurring gaps of different sizes were recorded also in the Wanariset forest (Partomihardjo and others 1987). Regeneration observations on an experimentally established gap of one hectare within the Lempake primary forest with partial burning treatment for a period of 1.5 years reveal that in the early stage of succession, seedlings play a more important role than coppices (Riswan 1982; Riswan and Kartawinata 1989), which is just the reverse of the regeneration in *kerangas* (heath) forest on podsolized soil over white sands in Samboja (Riswan 1982; Riswan and Kartawinata 1988b). The number of species, percentage of cover and frequency of seedlings and coppices, as well as the number of primary forest species, were greater in the unburnt plots than those in the burnt ones. Recovery in the unburnt plot was attributed primarily to an undisturbed seedbank in the soil, while that in the unburnt one mainly to seed rain.

In the Lempake Forest, a 35-year-old man-made gap of several hectares (i.e., a secondary forest developed from an abandoned pepper plantation) shows a relatively high species diversity (121 tree species of d.b.h.> 10 cm in a 0.8 ha plot with density of 578 trees/ha) (Riswan 1982; Riswan and Kartawinata 1988a). Although 70 percent of them were primary forest species, the biggest tree, the emergents and the most common species were secondary forest species, particularly *Macaranga* spp. Only one species of Dipterocarpaceae was recorded, although the plot was surrounded by primary dipterocarp forest. By using a floristic similarity index, stem biomass, and girth measurement, it was estimated that it would take around 150 to 500 years for the forest to reach the stage similar to the primary forest. Riswan and others (1985) compared the above data from primary, secondary, and experimentally cleared forest sites to estimate the minimum time required for various phases involved in the re-establishment of tropical rain forest after disturbance.

A model they developed predicts a minimum period for the stabilization of secondary species numbers of 60-70 years and the replacement of primary species in 150 years, at which point gap formation is initiated. After approximately 220-250, years mass stabilizes while individual trees exist for over 500 years.

## Future of MAB Programme

Many changes have occurred in East Kalimantan since the MAB research of the early 1980s. Despite the devastating drought and fires of 1982-83, commercial logging in the lowlands has continued at a rapid pace, although there has been an important shift from the export of raw logs into local wood processing and, more recently, development of planted timber "estates." The trade in rattan has also expanded, with a ban on the export of raw cane, development of Indonesia's rattan manufacturing industry, and attempts to establish rattan plantations.

Transmigration and so-called "spontaneous" immigration into East Kalimantan from other provinces has continued, but there has been a decline in emigration from the Apo Kayan since the large migrations of the 1970s and early 1980s. Some resettlement communities in the lowlands (including those on the Telen River) were badly disrupted by the drought and fires of 1982-83, and people from those communities have since moved to other locations within the lowlands. Population growth has been especially rapid around the coastal town of Bontang, where industrial and mining projects have attracted immigrants. This has contributed to accelerated encroachment into nearby Kutai National Park. On the other hand, there has been more attention paid in recent years to the Kayan Mentarang Nature Reserve in the far interior of the province (including part of the Apo Kayan), where the human population is sparse and threats to natural forest are less than in the heavily exploited lowlands.

We who have been involved in the MAB Programme in east Kalimantan will continue to work closely, as in the past, with the Indonesian Institute of Sciences (LIPI) and the Mulawarman University. We are also developing closer ties with the Directorate General for Forest Protection and Nature Conservation (PHPA); the Office of Minister of State for Population and Environment (KLH); and such conservation organizations as the World Wide Fund for Nature (WWF), Indonesian Environmental Forum (WALHI), Conservation International, and others. We are in the process of planning conservation-oriented research and a training component in the Kayan Mentarang Reserve in collaboration with WWF, LIPI, and PHPA and with the possible participation of Wildlife Conservation International. We also continue to advocate the establishment of a biosphere reserve in the Apo Kayan, a goal supported by WALHI and Conservation International. This new generation of MAB research, training and guidance for policy-makers will build on the experience gained in the earlier Indonesian-US MAB projects focusing on forest biology, human ecology, and the involvement of local communities in conservation management.

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