"Ecological Patterns and the Property Status of Minor Forest Products in East Kalimantan, Indonesia"

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ABSTRACT

Why are some forest products in Borneo held by villages as common property while others are owned more privately? We argue that these differences in property status reflect differences in the natural characteristics of tropical forest resources, specifically ecological patterns of spatial distribution (dispersed vs. concentrated) and temporal availability (predictable vs. unpredictable). Typical forest products are dispersed and unpredictable, and are owned as common property, while those exceptional resources that are concentrated and predictable tend to be privately owned. However, we also recognize that people's adaptations to particular, local circumstances can lead to property arrangements not explicable in terms of resource characteristics.

We focus on three minor forest products--rattan, aloes wood, and edible bird's nests--to show how (1) features of the species' biology give rise to resource patterns; (2) people interact with the species and with each other in exploiting the resources. Examples are drawn from our field work in two parts of the interior of East Kalimantan (eastern Borneo), Indonesia, and are placed in appropriate historical and environmental context.

INTRODUCTION

In this paper we ask why community-level property arrangements governing the use of some tropical forest products differ from those of others. Our approach has been, first, to identify what seems to be a general pattern, then to seek explanations for exceptions to the pattern. Following the framework proposed by Oakerson (1984), our explanations are made in terms of (1) natural and technical characteristics of resources, and (2) other, situational factors such as constraints of technology and organization.

The pattern we find in traditional, village-level property systems is that most forest products are treated as common property within a village territory. This seems to fit the typical ecological characteristics of tropical forest species, which tend to be dispersed (locally rare) and unpredictable as resources. Those exceptional products that are or can be "privatized" are either more concentrated, more reliable, or both. However, having taken our analysis thus far, we recognize that exceptional cases still remain within these categories of resources, and we discuss why this may be so in light of variable, local circumstances.

Our case study is from the Indonesian province of East Kalimantan, in Borneo, where we have done human ecological research as part of a US-Indonesian project in the Man and Biosphere (MAB) Program (see map.) The purpose of our research was to investigate the environmental effects of people's forest-related activities, such as shifting cultivation and the collection of forest products, and to identify the relevant contexts in which people engage in or alter those activities. East Kalimantan was chosen as a site for MAB research because of the rapid social and environmental changes that accompanied the recent timber boom there, changes which, on the one hand, were believed to seriously threaten forests and, on the other hand, were poorly understood by scientists and development planners (Kartawinata and Vayda 1984, Vayda 1983, Vayda et al. 1980).

We believe our study reflects more than a parochial interest in what may be, to some, a little-known corner of the world. East Kalimantan, with a wealth of forest products and great

cultural diversity, provides many opportunities to test the versatility of theories about resource use. Furthermore, East Kalimantan is no longer the obscure backwater portrayed by Conrad in An Outcast of the Islands and Lord Jim. Despite a small population (1,214,604 in 1980, less than 1% of the nation, with a mean density of 5.7 people per sq km [Zimmermann 1982:33]), it has become Indonesia's richest province. Its natural resources--mainly timber and oil, but also rattan and other minor forest products--accounted for almost 25% of the Indonesia's export earnings in 1978. From 1967, just before Southeast Asia's "timber boom" began, to 1978, East Kalimantan's timber exports grew more than fifty-fold in volume and 8,750 times in value, contributing about 50% of all Indonesian timber exports (Daroesman 1979), while rattan exports grew almost 30 times during the 1970's (see Table 1). East Kalimantan's forests are among the richest on earth in their biological diversity, but many species are threatened with extinction as the forests are increasingly exploited.

Forest Products of East Kalimantan

Most useful species of tropical forests provide products other than timber. These are the so-called minor forest products, on which we focus in this paper. Though now overshadowed by large-scale commercial logging, rattan, dammar, edible bird's nests, and other products now called "minor" have been traded since antiquity and were, even until the 1930's, the major commercial products of Southeast Asia (Jacobs 1982, Peluso 1983b). They still contribute more than timber does to the incomes of people living in or near forests.

Some forest products, in some situations, are more easily controlled by collectors, others by traders or other actors. Actual exploitation of resources in the forest often deviates from the regulatory policies set at higher levels, and stratagems for circumventing regulations may sometimes be as diverse as the ways of exploiting resources (cf. Lees 1985). In our case-study, networks of collectors and traders, and the activities of timber companies, migrant farmers, and other forest users, provide a better context for analysis than the notion of

property as fixed within a bounded area. This is due partly to the diffusely scattered spatial distribution of tropical forest species, partly to the shifting interactions of collectors, traders and other actors in a frontier province such as East Kalimantan.

The principal commercial forest products of East Kalimantan are timber, rattan, edible bird's nests, natural resins, illipe nuts, aloes wood, beeswax, and reptile skins (Table 1). Wood exports grew tremendously during the "timber boom" of the late 1960's and 1970's. The most abundant and, as a group, most valuable of the region's timber trees are the dipterocarps (Dipterocarpaceae), which are used for high-quality woodwork and, increasingly, in plywood. Dipterocarps are also the main sources of natural resins (dammar) and illipe nuts. Resins are used in the manufacture of varnishes, paints, window panes, and linoleum. Illipe nuts yield an oil used as a "texturizer" in cosmetics and chocolate. Their production is highly variable and unpredictable due to natural fluctuations in the flowering and fruiting of the trees (cf. Table 1). Rattans are a diverse group of climbing palms, very versatile in their uses. The stems of slender rattans are used in woven mats, baskets, and wicker-work. Larger species provide cane for furniture and other articles. Edible bird's nests, made by cave-dwelling swiftlets, are the principal ingredient in bird's nest soup, prized in China and Southeast Asia for its supposed restorative and invigorating properties. Aloes wood, a resinous wood found in certain diseased trees, is an ingredient in various Chinese and Malay medicines. Beeswax is used as a high-quality wax for furniture and in the manufacture of candles. Reptile skins--particularly those of monitor lizards--are used to make shoes, belts, and handbags.

Other commercial forest products of less importance are bezoars (the gallstones of certain monkeys and porcupines), bear claws and bear bile, all used in various Chinese medicines; gutta percha, a latex once used industrially but now replaced by synthetic substitutes; durians and other fruits; and sago, an edible palm starch (not commercially important in East Kalimantan but exported from other parts of Indonesia). Fruits and sago in commerce come mainly from cultivated sources, but the same species occur in the forest.

We will use the examples of rattan, aloes wood, and bird's nests to show how differences in biological characteristics of species affect the way they are treated as property. Rattan and aloes wood are typical tropical forest resources in their scattered distributions and relatively unpredictable occurrence. They are held as common property within village territories, which we identify as the general pattern for ownership of forest products. Bird's nests, in contrast, are a concentrated and reliably recurring resource, and they are owned as private property. We chose to focus on these three products because they are economically important and because we have first-hand experience of them from our field work. Before considering them in detail, we briefly review the general characteristics of tropical forest resources and the history of forest regulation in East Kalimantan. (Our main sources of information about Southeast Asian forests and forest products are the following. General references: Burkill 1935, Corner 1952, Dunn 1975, Jacobs 1982, Jessup et al 1982, Peluso 1983b, Whitmore 1973b, 1975; rattan: Corner 1966, Dransfield 1979, 1981, Peluso 1983a, Whitmore 1973a; bird's nests: Medway 1960, 1969. Other references are cited in the text.)

Tropical Forest Resources and Patterns of Resource Use

The tropical rain forests of Borneo and Malaya are the most diverse ecosystems on earth. The number of tree species alone often exceeds 150 in a single hectare of lowland forest (compared with about 30 in the richest temperate forests). Associated with this diversity is a low density, or rarity, of individuals in most species, many of which fluctuate in local abundance or are otherwise unpredictable as resources. People living in or near tropical forests utilize a great number of species, many for specialized uses but others more or less interchangeably; this is partly explicable as a "generalist" adaptation to the ecological patterns of diversity and unpredictability (Hutterer 1982). Burkill (1935) lists about 2,432 useful species of plants and animals in Malaya. Nearly half of these are native flowering plants with uses other than for timber, comprising c. 16% of the indigenous flora.

Most collectors of commercial forest products in Borneo are peasant farmers, whose repertoire of economic activities includes shifting cultivation (the predominant form of agriculture in forested parts of the tropics), production of rubber, pepper, fruit, and other perennial crops, and occasional wage labor, e.g., as loggers (Dransfield 1981, Miles 1976, Jessup 1981, Padoch and Vayda 1984). Some also can fall back on forest foods if their crops fail. Here, too, we see a generalist strategy, one adapted to fluctuations in commodity prices and employment as well as to environmental uncertainty.

Where tropical rain forests are cleared for shifting cultivation, a less diverse assemblage of trees and other species develops on fallow field sites within a few years after cultivation. This is called "secondary" forest, as distinct from the original or old-growth "primary" forest. Most commercial forest products come from primary forests, but species of both forest types are used locally. Established, traditional shifting cultivators re-use sites in secondary forest, but recently, in East Kalimantan and elsewhere, much primary forest has been cleared by pioneering and migrant farmers--often following in the wake of logging--as well as for plantations and government colonization schemes (Lanly 1982, Kartawinata and Vayda 1984, Myers 1984).

History of Forest Product Regulation in East Kalimantan

The last 100 years in East Kalimantan have been marked by an expansion of government authority and commercial exploitation of forests in upriver, interior areas. Our summary is based on Peluso's thesis (1983b). Various ethnic groups in the 18th and early 19th centuries struggled in eastern Borneo for control of the overseas forest product trade, while Dayaks in the interior used warfare and headhunting to gain exclusive access to valuable bird's-nest caves. During the 19th century, the Mahakam River was under the political control of the Sultanate of Kutai, at least as far as the upriver market town of Long Iram. The sultan's harbormaster (shahbandar) controlled shipping as well as trade up the river. Royalties were levied on forest products, most of which were destined for overseas export. The sultan

delegated authority to kinsmen, members of an aristocratic class, to supervise the collection of bird's nests and beeswax, these being the two most important commercial forest products at that time. Upriver, in the interior, the sultan's authority was tenuous and local Dayak chiefs commanded considerable military force. Traders there had to pay fees to village headmen in order to obtain forest products. The Sultan's authority to tax imports and exports was ceded in 1900 to the Dutch, who also established upriver posts to regulate trade at about the same time (Nieuwenhuis 1929). Dutch sovereignty passed, de facto, to the Japanese in 1942 and, de jure, to the government of Indonesia in 1949. Taxes on forest products (including timber royalties) were collected by the provincial government after 1957, when East Kalimantan became a separate province. The Kutai Sultanate was legally abolished in 1959.

The Basic Agrarian Law of Indonesia, passed in 1960, made no provision for traditional, local control over forest products. Ownership of all forest land was claimed by the national government. Although the Indonesian constitution does recognize the authority of "traditional law" (adat) in some matters of local concern, customary village rights to forest land and products were excluded by the 1960 law (Vargas 1985, Weinstock 1979). In fact, traditional property laws are still important in many areas, particularly in matters of land tenure, inheritance, and the collection of forest products. Conflicts occur, however, where established residents compete for resources, directly or indirectly, with more recent settlers, itinerant collectors, and timber companies. Sometimes these conflicts are settled within the traditional law or by ad hoc agreements (Vargas 1985); often they are not settled at all.

The first entrepreneurs to take advantage of the timber boom in the late 1960's were established traders and exporters, many of whom then dealt mainly in minor forest products such as rattan and dammar. They organized logging crews on a small scale, using labor-intensive methods and floating the logs out by river. Then, in 1971, the national government banned manual logging in favor of more capital-intensive, mechanized techniques, which were said to be more efficient and less wasteful. The government also centralized control over timber

concessions and royalties and set a minimum size for concessions beyond the capacity of the smaller companies. The new policy succeeded in attracting investment by multinational timber companies--including road-building and imports of heavy machinery--but it effectively excluded the smaller traders and contractors from logging.

Responses to Technological Change

Many traders, forced out of logging after 1971, returned to the business of minor forest products. The situation was changing, however, owing to new economic, environmental, and technical factors. Not only was the provincial economy booming, attracting would-be collectors and other immigrants to East Kalimantan (the population grew by 67% in the 1970's [Zimmermann 1982:33]), but world demand for rattan, the most important of the "minor" forest products, was rising sharply (Whitmore 1973a). Loggers made inroads on the forest (literally), but the more remote parts of the province, still the vast majority, were accessible only by river--as they are even now, except for a scattering of small, dirt airstrips served mainly by missionary pilots. These remote areas were made much more easily accessible by the use of small outboard motors, which had been introduced in the 1960's. Traders and collectors used them to navigate the shallow, rapidly flowing streams of the interior, penetrating farther than large motor boats could go and doing so more rapidly than was possible when there were only man-powered canoes.

The Upper Mahakam and Apo Kayan Study Areas

We draw on our field work in two, fairly nearby parts of East Kalimantan (see map). Peluso studied the trade in rattan and bird's nests in the Upper Mahakam River area (Long Bagun sub-district in the Kutai district). Jessup did research on forest-related activities in the Apo Kayan (Long Nawang sub-district in the Bulongan district), where aloes wood is the most important commercial product. Peluso also visited the Apo Kayan to investigate the aloes wood trade there. The two areas are similar in many ways, including the kinds of forest products used locally (such as rattan and dammar), the practice of shifting cultivation, the ethnic

affiliations of the people (Kenyah and related Dayak tribes), and the interior locations of both areas. However, they differ in the greater isolation of the Apo Kayan, the proximity of commercial logging to the upper Mahakam, and the commercial importance of particular forest products. Bird's nests are important in the Upper Mahakam, aloes wood in the Apo Kayan, apparently because they are only available in one area or the other. Rattan occurs in both places but it is not traded much in the Apo Kayan because of the difficulty of transporting bulky products.

RESOURCE CHARACTERISTICS OF THREE MINOR FOREST PRODUCTS

We now turn to a more detailed consideration of three minor forest products: rattan, aloes wood, and edible bird's nests.

Rattan and Aloes Wood: Dispersed and Unpredictable Resources

Rattans and the trees that produce aloes wood occur as scattered individuals in the forests where they grow, as is typical of tropical species. Both regenerate relatively slowly, if at all, after harvesting, so their location tends to be uncertain. These are characteristics shared with timber trees and many other forest products, but not by such products as dammar, fruit, and bird's nests.

Rattan

Rattans are spiny, climbing palms, comprising nearly 600 species with their center of abundance in Borneo (c. 150 species) and Malaya. Their distribution is similar to that of the dipterocarps. Some rattan is cultivated but most is collected from wild stocks in the forest. Rattans are remarkable not only for their biological diversity but also for the diversity of their uses, mainly of the stems but also of the fruits and leaves. Local uses far outnumber those of commerce. Commercial rattans are classified by size: the thicker ones make "cane"

while slender varieties are used as "rattan" for weaving and wicker. Indonesia produces about 90% of the world's rattan, and East Kalimantan is one of its chief sources. Recently, Indonesia and other rattan producing countries have imposed export restrictions on raw rattan in order to protect and encourage local processing industries,

Demand for rattan has surged ahead of supply to such an extent recently that natural stocks are threatened with depletion or, in some areas, have already been exhausted. Formerly, about 20 "elite" species comprised the bulk of the commercial trade (though many more are used locally), but, as stocks are depleted and prices rise, collectors take take other, inferior species as well. As Dransfield (1981:184) observes: "It appears now that no species can be classed as useless--a worrying fact for the rattan conservationist."

Rattans occur throughout Southeast Asia's rain forests, from sea level to 3,000 m in the mountains and in virtually all forest types. Most useful species grow mainly below 800 m, in lowland primary forest. Some species are more restricted to specialized habitats than others, but two of the most valuable--Calamus caesius and C. manan--are widespread. Rattans reach to the top of the canopy, 45-60 m above the ground. They climb by means of sharp, barbed spines and a twisting habit of growth. Due to coiling and sagging, the stems are commonly 60-90 m in length and weigh enough to snap tree branches. Corner (1966:221) describes the arduous and sometimes dangerous task of rattan collection, or "pulling."

> The best rattans live in the high forest. Dead and living limbs, clumps of epiphytes with their biting ants, wasp-nests, and other upper debris tumble down and, if the crown of the rattan should be dislodged, it flops with its cruel whips flaring. The crown of old stems is generally too securely fixed to be dislodged. The puller is content with the loose coils or the younger stems not so firmly established. The last part of the stem is, in any case, too fresh and sappy to be of use, but it does provide a bud which, if bitter, is generally edible. During the pulling, the puller pauses to clean off the dead leaves in order to get a new grip. When as much stem as possible has been pulled down, it is coiled up and carried back on the shoulder to the village.

Actually, collectors "pulling" rattan for the commercial market usually cut the stems to appropriate lengths as they pull them down. Cane is sold fresh in lengths of about 3 m. It

must be boiled in oil to remove natural gums and resins. If this is not done within 15 days, the cane will spoil. Slender rattans need only be coiled and dried near the collection areas before being sold. The stems are later split to make the strips and cores used by manufacturers.

Species with multiple (clumped) stems regenerate from the base after cutting, but single-stemmed (solitary) species only grow from seed. The solitary habit of C. manan, a valuable cane species, has led to its depletion by over-cutting. However, the slender, multi-stemmed C. caesius and C. trachycoleus sprout readily, a characteristic that not only has made wild populations somewhat more resilient, but has also facilitated their cultivation (for at least a century in Central Kalimantan).

Growth rates vary both within and between species of rattan. Maximum reported rates range from 1.2 m to 3 m per year for C. manan, and up to 4 or 5 m a year for C. caesius and C. trachycoleus, respectively. However, these rates are probably rarely attained in the forest. Seedling mortality is high and only a small proportion of individuals reach the canopy. Many species only grow when seedlings are "released" by light from tree-fall gaps. All these factors contribute to the unpredictability of the resource.

Aloes Wood

Aloes wood is a "pathologically diseased, fragrant wood" produced by trees of the genus Aquilaria, in the Thymeleaceae family. There are altogether about 15 species, of which 5 occur in Malaya. (The number of species in Borneo is not known but we suppose it is similar to that in Malaya.) Only one, A. malaccensis, is widespread, and it apparently is this species that produces the best grade of aloes wood. Traded since ancient times, aloes wood is used as an ingredient in liniments, tonics, and other medicines in Southeast Asia and China. Inferior grades (including wood produced by Gonystylus, a related genus) are used for incense in Southeast Asia, China, and the Middle East. Demand for Borneo aloes wood rose sharply around

1977, possibly because the supply from Cambodia and Vietnam had been cut off (Paul Chai, personal communication). This led to a flurry of collecting in parts of East Kalimantan.

Apparently, very little is known about the biology of species that produce aloes wood. What data we have found suggest that they are widespread in range but restricted to certain localities or habitats, possibly according to soil characteristics. Furthermore, the diseased wood occurs sporadically; even in a species that can produce aloes wood, not all trees contain it. Thus, aloes wood is ecologically the least predictable of the three resources we consider in detail in this paper, a characteristic that bears on how it is exploited.

The pathological cause of aloes wood is unknown. Burkill speculates that it may be a fungus. Jessup observed ants tunnelling in the infected portions of trees, an association already well known to his local informants in the Apo Kayan, but there is no evidence that ants cause the diseased wood to develop. Trees containing aloes wood sometimes appear sickly, an appearance collectors use to help them find the wood. (M. A. McKean, in a personal communication, suggested that selective cutting of infected trees might reduce the incidence of infection in Aquilaria populations, thereby diminishing the resource. However, for this to be true, three conditions must be met: [1] no alternate hosts or environmental sources of the pathogen are available; [2] infected trees are not a source of further infection until the aloes wood has already developed; [3] collectors find and cut down infected trees as soon as, or soon after, aloes wood develops. The last condition we consider to be unlikely. As for the others, we know too little to speculate.)

Jessup studied the collection of aloes wood in the Apo Kayan during several periods from 1979 to 1984, soon after it became a commodity of trade there (Jessup 1983). Since the ecology of Aquilaria is not well documented, we here summarize what Jessup learned from his Kenyah informants and his own observations, with the caveat that the data are not from controlled studies and that they may not be typical of Aquilaria elsewhere. Much of what the Apo Kayan people know about aloes wood they learned from their recent collecting activities. This made

the processes of learning and related innovation interesting objects of study in themselves. Botanical specimens collected in the Apo Kayan by Jessup and Herwasono Soedjito were identified at the Herbarium Bogoriense (Indonesian Institute of Sciences) as Aquilaria beccariana, a small to medium-sized tree less widespread than A. malaccensis. Other species may also occur in the area.

Collectors in the Apo Kayan avidly sought aloes wood soon after itinerant traders began to offer a price for it, in 1978. It was found to occur in only two areas, one of which lay within the territory of the village where Jessup was living, Sungai Barang, at an altitude of about 800 m. The following information was gleaned from collectors in Sungai Barang and elsewhere. Aquilaria trees, known locally as sekau, do occur elsewhere in the Apo Kayan but so far they have been found to yield either no aloes wood or at best a very inferior grade. In the vicinity of Sungai Barang, sekau occurs only in primary forest and only on "white" soils (probably highly leached, podzolic). Collectors recognize two varieties (possibly different species) of sekau, distinguishable by the size of their leaves. These differ somewhat in their topographic situation (hillside versus streamside) and in the likelihood that they contain aloes wood, though both can produce the wood. The presence of aloes wood in a tree can only be ascertained by cutting into the tree (not necessarily felling it), although a sickly appearance sometimes indicates an infected tree.

Once aloes wood is found, the tree is felled and cut up with an axe. Since the wood is soft and the trees are not large, women, children, and old people as well as young men can collect the wood easily, in contrast to rattan pulling, which can tax even a strong man. The timber is split and resplit in a search for aloes wood. Any pockets are cut out with a bush-knife and brought home to the village, where the pieces are finally cleaned and pared with a small knife before being sold. The amount of aloes wood collected from a tree, or during a collecting expedition, is highly variable. Collectors (and traders seeking to induce people to collect) tell tales such as of a single tree yielding many kilograms of high-quality wood worth

hundreds of dollars. Some people of Sungai Barang have found a kilogram or more in a single day, but typically a collector gets less than a kilogram from dozens of trees examined during an expedition of up to a week or more.

Burkill reports that Foxworthy made experimental plantings of A. malaccensis, which were successfully raised through the third year, but we do not know whether they survived to maturity and, if so, whether they produced aloes wood. Nor do we know of any indigenous cultivation systems.

Bird's Nests: A Concentrated Resource

Edible bird's nests are unusual among tropical forest products in that they are highly concentrated. The nests are made by cave-dwelling "swiftlets," which typically live together in large colonies, but only in a very specialized habitat. The resource is also reliable, or predictable, because the birds nest each year in a regular breeding season. Finally, bird's nests are the most valuable, per unit weight, of all Borneo's forest products.

Edible-nest swiftlets are small, cave-dwelling, insectivorous birds belonging to the genus Collocalia in the Apodidae, or swift family. There are 17 species, five of which occur in Borneo. Actually, only two species, C. maxima and C. fuciphaga, produce edible nests. These are extremely valuable. One kilogram (about 100 nests) of high quality nests brought $200 to $400 in 1979 on the Upper Mahakam, while the lowest quality sold for about $19 per kg. (By the time they had reached Hong Kong, the chief center of trade, "top quality" nests cost nearly $9,000 per kg in the early 1980's [de Groot 1983].) By comparison, in early 1980 the best grade of aloes wood was bought by upriver traders in the Apo Kayan--admittedly a more remote area--for $20 per kg and was resold to urban traders for about $100 per kg. Rattan prices are even lower on a per-weight basis.

The birds nest mainly in limestone caves, which can attain a very large size in Borneo. (The floor of Niah Cave in Sarawak, one of the largest, covers 25 acres.) The number of

swiftlets that can inhabit a single cave is astounding: Medway (1960) estimated the combined population of three species living in Niah Cave to be about 2,000,000, and noted that such a large number nesting together is "not unique" (although Niah is certainly larger than most caves). Cave swiftlets are able to fly in the absolute darkness of deep caves by means of echolocation, similar to that of bats but less precise; they must use sight to catch their insect prey.

The birds make their nests and attach them to the cave walls with a mucin-like protein secreted from their salivary glands, which become greatly enlarged during mating seasons. This protein, commonly called "nest-cement," is the edible part of the nests. Chemical analysis has shown it to have negligible nutritional value (though, we might add, that in itself does not rule out a pharmacological effect). Clean, or "white" nests made purely of nest-cement fetch the highest price. They are produced by C. fuciphaga. "Black" nests, made by C. maxima, contain feathers as a structural component in addition to nest-cement, and are inferior in quality and price. Nests soiled by feces and other extraneous material, and those that have been allowed to deteriorate before being collected, are much reduced in value. Thus, there is a strong incentive for collectors to take nests early in the breeding season while they are still clean and fresh.

Breeding seasons differ between species of swiftlets, but all are relatively slow breeders. C. Maximus (the best studied, and probably typical) breeds only once a year at different times in different parts of Borneo. If their nest is collected during the breeding season, a pair of birds will immediately build another one. Swiftlets require at least 40 days to build a nest and lay an egg; half the birds studied by Medway had not completed their nests even after 85 days. Incubation takes 28 days and fledging another 65 days. As we have said, collectors much prefer to take unspoiled nests, about 40 days into the cycle, before the eggs hatch. While this does not necessarily prevent the birds from rearing young, since they can

build a second nest, harvesting nests at fixed intervals (a common basis for the regulation of collecting) can be disruptive because the birds in a cave do not breed in synchrony.

Collectors studied by Peluso get nests by knocking them down with a bamboo pole; a torch or flashlight is needed to find the nests. In some large caves in Malaysian Borneo, collectors must ascend a bamboo and rattan ladder 60-90 meters to reach nests near the roof (de Groot 1983). Some East Kalimantan collectors purposely leave the highest nests in a cave to ensure that a few birds will breed and later return to make new nests. Inaccessible portions of some very large caves provide nesting birds with natural refuges from collectors.

PROPERTY RIGHTS AND REGULATION OF RESOURCES

Feasibility of Exclusion

The spatial distribution, abundance, and predictability of a resource, together with its value, determine (in part) the level or scale at which users might gain by trying to exclude other, potential users. Exclusion is more easily enforced at the level of an individual source for a concentrated, predictably and rapidly renewable resource than for a dispersed and unpredictable one, and it is more worthwhile the greater the local abundance and value of the resource. Thus, bird's nest caves are guarded individually because many nests occur in one cave and they are produced regularly each year during a known breeding season. The difficulty of entry to some bird's-nest caves also makes them easier to guard; owners have been known to seal off some entrances to their caves, leaving only one that is hidden or guarded. Finally, the high value of the nests makes guarding them especially worthwhile. Aloes wood and rattan, on the other hand, are produced by unpredictable sources scattered through the forest, regenerating at long and uncertain intervals. It would not make sense for a collector to stand by a wild rattan seedling waiting for it to grow, or by an Aquilaria tree hoping for aloes wood to develop. (Note, however, that it does "make sense" for some farmers to cultivate some species of rattan.) With these products, it is better for the collector to proceed in search

of other sources. Exclusion from dispersed resources is indeed enforced in some situations, but there it is done at the level of a village commons. Of course, the possibility of exclusion depends also on the ability of users to defend a resource or to exploit products not easily accessible to other people, such as in remote or difficult terrain. (The latter "strategy" is attributed by Hoffman [1983] to nomadic Punan groups, for example.)

Traditional Rules of Access and Exclusion for Forest Products

Village and Household Property

In the Apo Kayan and many other parts of Borneo, tribal people recognize village territories within which residents of each community hold exclusive rights to use land and forest products. Weinstock (1979) found this to be a general principle of land tenure among shifting cultivators of Borneo, but recognized two subsidiary systems of individual or household-level tenure: one in which permanent individual or household rights to recultivate a site are established by clearing primary forest; the other in which cultivation rights lapse after the crops are harvested, when the fallow land returns to the village commons. Permanent rights are inherited, and they can be borrowed or bought. Similar individual, transferable rights to trees or tree products are found among at least some groups reviewed by Weinstock (1979) and Appell (n.d.), or studied by us. These rights are established either by planting a tree or by tending or marking a wild tree. The kinds of trees for which this has been reported or observed include fruit trees (planted or tended), dammar trees (tended, known to be cultivated in Sumatra) and timber trees (marked but not planted or tended, as far as we know). Other forest products are not claimed as private property, but rather are held jointly within the common village territory.

Kinship, real or ascriptive, is an important underlying component of the property arrangements outlined above. Ethnic groups and villages tend to be identified with more or less inclusive kin groups. Residence in a village, with the common property rights it confers,

is established by birth or marriage, and so, too, is membership in a household with its more private rights of tenure (whether permanent or temporary). Conversely, property rights are forfeited by a person who permanently leaves a village. Inheritance is according to kinship; in the so-called "cognatic" societies that predominate in Borneo, male and female descendants share equally in the inheritance of land-use rights and other property. This in turn requires arrangements to distribute property, if necessary, among several eligible claimants, which is done for land by alternating its use among households, and for fruit trees by dividing their product. Precedence is given to heirs more closely related to the original owner. Since rights to use property or receive a share of the product may be distributed over a number of households linked by kinship, the property is not simply "private" as we generally understand it, although the rights to which it is tied are less "common" (more exclusive) than those conferred by village residence alone. Rather, the property we call private lies at the focus of a hierarchy of potential users ordered by their degree of relatedness to the original owner.

It is important to recognize that traditional property systems are not stagnant and unchanging, and that adaptations to local circumstances may shift them in unexpected ways. Padoch (1982) shows, for example, how in some Iban communities in Sarawak, where the formal rules of land-use are those of permanent household tenure, land scarcity led to frequent borrowing of land between households. Although an ideology of relatively private, kin-based rights of use was maintained, in practice land was treated more as common property than was the case in some land-abundant Iban communities. But this is not to say that land shortages are correlated with less exclusive land use. Jessup (1983, 1984) found that many farm sites in secondary forest in the Apo Kayan were left unclaimed when their former owners moved away during a period of emigration, and these came to be treated as common village property under conditions of abundant arable land. Thus, two very different demographic situations produced similar transitions towards a more common use of a resource. The point that people adapt in unexpected ways to particular circumstances or situations is raised again, below.

Tree Rights and Forest Rights

The characteristic shared by most forest products that can be privately owned seems to be the reliability of a renewable source, which is associated with some degree of concentration of a resource in space and time. Fruit and dammar trees yield their products on a more or less regular basis (e.g., during an annual season for many fruit species) from a known source. Older, larger trees are more prolific, and trees benefit from tending. Bird's-nest caves also fit the pattern of predictable, concentrated resources; they are discussed below. Timber trees, which at least in the Apo Kayan are subject to individual claims, seem to be an exception for which we have no good explanation. (Peluso's informants suggested that rattans in the forest are not claimed because they cannot be marked, in contrast to dammar trees, which show the scars of previous tapping. People in the Apo Kayan mark timber trees with a distinctive blaze, suggesting a similarity to tapping scars, but this explanation is unsatisfying. Why, for instance, are aloes wood trees not similarly marked and claimed, or permanent rattan-collecting sites delimited in some way?) Timber also has been privatized on a grand scale by the granting of concessions to logging companies. This, we suggest, reflects an economy of scale in which a locally scattered and uneven resource is made more homogeneous by technological and organizational means, including the use of heavy machinery, road networks, and international financing and marketing. However, the logging industry has been vulnerable to unstable prices, and the methods of extraction are unsound from the standpoint of a sustained yield (Kartawinata and Vayda 1984).

An Attempt to Control Aloes Wood in the Apo Kayan

Most forest products within a village's territory are common property. These include rattan, aloes wood, and most other useful plants and animals. Outsiders can ask permission to collect in the territory but they may be required to pay compensation. For example, some people in the Apo Kayan said that a difficulty of resettling in less isolated, lowland areas was that the forest in many of those places is already claimed by resident groups, and that

they charge fees to hunt or collect rattan in their territories. In the Apo Kayan itself, we had the opportunity to see how outside collectors of aloes wood were treated in the village of Sungai Barang soon after the local collecting boom began in the late 1970's. Collectors were attracted to Sungai Barang by the availablity of high-quality aloes wood there. They used the village as base from which to travel into the forest on collecting expeditions. Virtually all the outside collectors were members of various Kenyah tribes and were considered kin, in some degree or other, of people living in Sungai Barang. They could also claim a certain amount of reciprocal "generosity" in return for past help given Sungai Barang people: for example, the provision of food, shelter, and other assistance to men on trade expeditions. Indeed, the outsiders were not excluded from collecting in Sungai Barang's territory, but they were required (after much deliberation within the village) (1) to sell the aloes wood they collected to a local "contractor" in Sungai Barang, and (2) to pay a tax (about 10% of the sales value) to the village treasury. The second rule at least applied to village residents as well (though of course they, unlike the outsiders, received some benefit from village expenditures, and a voice in how the money was to be spent). Most of the aloes wood collected by residents was, in fact, sold to the contractor there, but some was taken by ad hoc "consortiums" (kongsi) of collectors to downriver markets in an attempt to get a better price (cf. the collective sale of bird's nests, described below). These expeditions met with little success in the absence of any advance agreement with traders, however, although expeditions to collect and sell other forest products had been successful in the past.

The outcome of this attempt to control exports of aloes wood from Sungai Barang's forests was disappointing for the community. Apparently, there was a good deal of "cheating" by outside collectors, who smuggled most of their wood out of the village. They were encouraged to do this by contractors in other villages who offered (at least initially) higher prices in order to attract sellers and so gain entry to the market. Peluso (1983a) saw a similar pattern of competition between rattan traders on the Mahakam River, with new traders not only offering higher prices but also buying immature and inferior grades of rattan in order to increase their

market share. They could afford to do so because they recouped their losses by selling imported trade goods to the collectors (often on credit), a business Apo Kayan contractors also engaged in. There seemed to be much less cheating within the community of Sungai Barang, however. We attribute this to the effectiveness with which people in a village can "monitor" one another, together with the value to individuals of maintaining their personal reputations for honesty and civic responsibility (Runge 1984; cf. J. Cordell's comments at the October workshop and Shiva et al. 1981).

Rattan Collecting in Remote Areas

Commercial rattan collectors often travel to areas far from any village, where there are no resident local groups to lay claim to the forest. In these areas, rules of initially open access and temporary exclusion apply, according to Kenyah collectors interviewed by Peluso in the Upper Mahakam. Collectors travel by boat, usually a motorized longboat or canoe, often under contract with and subsidized by the trader who will buy the rattan. They travel and work in groups for reasons of safety and logistical efficiency, but, in most instances, each man is paid individually for the rattan he collects. Collectors in a group space themselves apart from one another while they work, each in a different part of the same local area. If another group, on a separate expedition, should enter the area while the first group is still collecting, they are expected to choose another locality in which to work so as not to interfere with the first group. (The extent of a "locality" was not specified by Peluso's informants.) However, once a group has left an area, its members retain no exclusive right to collect there again (though they may benefit from having learned about the location, quality, and abundance of forest products in the area).

Control of Bird's Nests in Kutai District

Bird's-nests caves tend to be privately owned because they provide a predictable, highly concentrated, and easily defended resource. Historically, they have been more closely regulated than either rattan or aloes wood. Proprietary rights to some very large caves in Sarawak, Sabah, and Java have long been held by state or national governments. Some caves in East Kalimantan may be the common property of villages; others, especially in remote areas, are unowned, but most are claimed and defended by individual owners. In the Kutai district of East Kalimantan, which includes the Upper Mahakam area where Peluso worked, there are two stages or levels of access rights to bird's nests. Both are regulated by the district and sub-district governments. The first is the right to harvest nests in a particular cave, based on a registered claim of ownership. The second stage is the right to buy nests and export them from the sub-district where they were collected. This right is granted by the district government at an annual auction.

Ownership of Bird's Nest Caves

The owner of a cave is usually the person who has found and subsequently guarded a previously unclaimed cave, or an heir of the original owner. Owners can register their claims, which establishes their exclusive right to harvest nests in their caves and to sell them within the sub-district. Caves are guarded by posting people at their entrances when birds are nesting. Owners may guard their caves themselves or they may call on kin or hire guards, in which case the guards may be paid with a share of the nests. In addition to physical guarding, owners may also invoke supernatural sanctions to protect their caves from intruders. The efffectiveness of such magical protection has declined in the Mahakam area in recent years, however, as more people in upriver areas have abandoned their old religious beliefs to become Christians. (Christianity does not necessarily preclude belief in the old spirits and magic but is believed to offer protection against them.)

The present ownership of many caves is based on recent claims. Prior to 1960, ownership of bird's nests was ultimately vested in the sultan. With the end of the Kutai sultanate and the establishment of the district-level rules, there was a general scramble for nests. Claims were made on some caves, but others were either unclaimed or the claims were not enforced by effective guarding. With no proprietary interest in the sustained productivity of the unclaimed and unguarded caves, many were over-harvested. Informants say this caused birds to seek other nesting sites, resulting in a decline in the rate of nest production from those caves.

Authorized Buyers of Bird's Nests

The right to buy and export nests from each sub-district is held by an "authorized buyer" (faktar), who is the highest bidder at an annual auction held in the district capital. Prices are bid for nests from each sub-district. A buyer may bid on, and win, rights to nests in more than one sub-district. He must pay a tax on the nests he gets from each sub-district; the tax paid in a sub-district determines the floor price for bidding in the following year. The authorized buyer in each sub-district is required to see that nests are not harvested too frequently or in a destructive manner. He must also report in advance his plans to harvest nests and, afterwards, the amount collected in each cave. None of these regulations were observed when Peluso was in the field (1979-1980), as far as she could determine. The amounts of nests harvested were reported inaccurately or not at all; harvesting methods known to disturb nesting birds (such as the use of kerosene torches) were used. Furthermore, some nests were taken by illegal buyers (other than the faktars).

Collective Action and Adaptation

Consideration of people's adaptations to local situations and changing circumstances must lead a more complete analysis than this one beyond the confines of a property-oriented framework. The study of common property can be viewed as a subset of theories of collective

action, regarding which Hirschman (1982:77-91) criticizes Olson (1965) and others for treating actors as if they were "without a history." To this we would add (following Vayda 1983 and other references cited in the introduction) that the actors in many of these theories seem to be also without a context, either of social obligation or of environmental constraints. We offer two examples of collective action in response to local circumstances.

In the village of Long Apari, people reportedly have organized the harvest, transport and sale of bird's nests on a collective basis. Long Apari is situated far up the Mahakam River, above a long stretch of rapids. Farther downriver, in the villages of Rukun Damai and Ujoh Bilang, bird's nests are sold by individual cave owners. Long Apari's more remote location may explain this difference. The cost and risks of travel to remote, upriver areas are reflected in lower prices offered by traders for the forest products they buy there (and correspondingly higher prices charged for imported goods). The collectors can obtain a better price if they take their products to markets farther downriver. Such a venture requires an investment in canoes--now usually equipped with outboard motors--travel time, and supplies for the journey as well as an acceptance of the considerable risks involved. Some of these costs and risks are lower if they are shared among many people in a large expedition. Similar collective trade expeditions are undertaken by people from the even more remote Apo Kayan. They often jointly collect and sell forest products, divide the proceeds to buy trade goods individually, then cooperate in bringing the goods home (see Jessup 1981 and 1983 for details).

Another example of collective enterprise as a means of risk-sharing is that of rattan collecting by early settlers in Rukun Damai. The village was established on the Upper Mahakam in 1973 by migrants from the Apo Kayan, but (as is typical of village migrations) the people did not move all at once. A group of young men preceded the others to make ricefields. To supplement their needs, they also contracted with a trader to collect rattan. In this case, however, since they were working on behalf of the community, they pooled the money they earned rather than dividing it according to how much rattan each man collected. Later, after the

village was well established, expeditions were organized along the lines of individualistic cooperation described previously.

SUMMARY AND CONCLUSION

We have argued in this paper that the typical pattern of community-level regulation of forest products in East Kalimantan is one of village commons, which are suited to the dispersed distribution and unpredictable occurrence of most tropical forest species. Exceptions to this pattern of property arrangements, that is, more privately owned forest products, are generally explicable as a consequence of deviations of resource characteristics from the typical ecological pattern, although there are other exceptions, notably timber, that we cannot explain. Rattan and aloes wood are examples of typical tropical forest resources that are held as common property within village territories. Bird's-nest caves, on the other hand, provide an exceptionally concentrated and reliably recurring resource, and they tend to be owned as private property. Dammar and fruit trees are similarly owned. Both the common and private property rules we have discussed operate in a context of closely woven kin ties and obligations, but these permit a considerable degree of flexibility in people's adaptations to local circumstances.

We would like to close with a general comment on efficiency and equity, which Oakerson (1984) and others have proposed as criteria for evaluating the success of common property arrangements. Efficiency is an ostensibly objective measure, but it actually depends on the viewpoint of the evaluator. (R. Hunt made a similar point at the October workshop about the use of income as a criterion of success in development projects.) For example, if logging yields more revenue than the collection of minor forest products per unit of time, area, or investment, then timber companies and the government bodies that collect timber royalties may be inclined to view logging as the more efficient activity. However, when rattan and other minor forest products are destroyed in the course of logging, this is inefficient (to say the least) to the mind of a collector who derives no benefit from logging. As for equity, how is

it to be measured when different groups of users exploit different resources in conflicting ways? What are the boundaries of the set of potential users and available resources? A commons, whether it is the forest within a village territory or the forests belonging to a nation, may be exploited equitably by those users with access to it, while others are excluded unfairly, at least from own their point of view. We have no more objective standard to propose in place of efficiency and equity; we do not believe there is any. We do, however, object to the use of subjective measures of efficiency to disenfranchise users of a resource, or to justify environmentally destructive methods of forest exploitation (cf. Jacobs 1982), and we suggest a critical approach to the notion of equity in any domain bounded by the exclusion of some potential users.

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