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PRIMITIVE MAN'S IMPACT ON GENETIC RESOURCES OF THE MALAYSIAN TROPICAL RAIN FOREST

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SUMMARY:- As a component of the Malaysian tropical rain forest ecosystem for tens of thousands and probably millions of years, primitive man has influenced the evolution of other species within this system. He has done so through direct selection as a result of hunting and plant gathering, dispersal of seed, habitat modification, and domestication. The activities of primitive men have driven a few species into extinction, increased the range and numbers of some, and resulted in genetic modification in others. In view of this great impact of the aboriginal population on the Malaysian forest it is misleading to view it as a pristine natural ecosystem; rather it should be appreciated that its genetic resources have already been strongly influenced by man and therefore plans to conserve these resources must take this into account.

INDEXING KEY WORDS: Genetic resources; Hominid fossils; environmental impact.

Men in many, if not all cultures, both primitive and civilised draw a clear and sharp distinction between those things that are man-made and those believed to be in a state of nature. The division is so pronounced that some anthropologists believe that it represents one of the fundamental categories of all human thought, a pattern of dichotomous thinking shared by all men regardless of their particular cultural affiliations. Certainly modern scientific workers, both those in biology and in the social sciences, frequently speak of nature as if it were somehow separate and distinct from man and his activities. Even ecologists, who more than most others see the world in terms of it being made up of a series of complexly inter-related systems and subsystems, tend to treat man as a relatively recent, and until the population explosion of recent years, a relatively insignificant interloper into ancient natural ecosystems.

It is the contention of this paper that the dichotomy between what is natural and what is cultural is a false one that leads us to profoundly underestimate the impact that primitive man has had on his environment, one that we persist in calling "natural" despite the fact that tool-using men, guided by cultural patterns rather than instincts, have been functioning as integral components of the Southeast Asian rain forest ecosystem for close to two million years. Given the antiquity of human presence in the region, the forests of Taman Negara or Endau-Rompin are no more "natural" than are the Lake Gardens or, for that matter, the P.J. municipal rubbish tip. All Malaysian ecosystems, regardless of how wild they may appear to the casual observer, have been profoundly altered by human activities in ways significantly influencing the evolution and conservation of genetic resources. Recognition of this may be unpleasant for those of us who have been taught to cherish unspoiled nature but is seems a necessary step in clarifying our thinking about how best to protect remaining "wild" forest areas.

THE ANTIQUITY OF MAN IN MALAYSIA

Hominid fossils resembling the famous *Australopithecus* finds of East Africa have been

gaurus). Serow *(Capricornis sumatrensis).* Barking Deer *(Muntiacus muntjak).* Sambar Deer *(Cervus unicolor).* Wild Pig *(Sus scrofa).* Pig Tailed Macaque *(Macaca memestrina)* along with other unidentified primates, various squirrels, porcupines (*Hystrix* sp.), Malayan Sun Bear *(Hellarctos malayanus).* tortoises and soft shelled turtles, Bamboo Rat (*Rhizomys* sp.), and many species of marine and fresh water bivalves, snails, and fish, have all been found in Hoabinhian occupation sites in the Peninsula (Gorman, 1971).

Contemporary Orang Asli populations exploit an equally wide variety of wild animals species. The Jahai Negritos observed by the author in Kelantan catch and eat virtually all animals found in their habitat with the exception of snakes, earthworms, leeches, and some terrestirial snails which are taboo for ritual reasons but heaviest hunting pressure is exerted againsnt wild pigs, monkeys, and squirrels. An indication of the extent of Orang Asli hunting pressure on wild species is provided by records kept by one of my students of animals killed by ten Temuan households over a ten day period in the Ulu Langat District of Selangor. Using shotguns, blow-pipes, catapults, and traps, they killed a total of 92 animals including 4 wild pigs, 45 birds, 5 porcupines, 15 monkeys 15 frogs, 5 monitor lizards, 1 barking deer, 1 snake, and 1 flying fox. The same ten households caught 191 fish of eight varieties during the same ten day period (Zainuddin, 1977). To extrapolate from such a limited temporal sampling to the overall annual wildlife harvest of even this one Orang Asli population would be methodologically unsound but it should be evident that the Orang Asli exert, and have exerted for thousands of years, great selective pressure on many wild species. Presumably such selection has resulted in both changes in population size and even extinction of some species while resulting in evolutionary change (coadaptation) in others (Rambo, 1978).

Little information is available on prehistoric man's use of Malayan plants but at the Hoabinhian site of Spirit Cave in Thailand, specimens of almond, betel, broadbean, pea, bottle gourd, water chestnut, pepper, butternut, candle nut, and cucumber have been found in a layer dated at between 10,000 and 6,000 B.C. Charred fragments of bamboo, presumably remains of cooking vessels, were also found (Gorman 1971). Contemporary Orang Asli know and utilize a wide range of wild plant species for food, medicine, and making of cultural artifacts. No complete inventory has been made for an any aboriginal group but another of my students, in a brief survey, identified several dozen species named and used by the Temuan of Ulu Langat (Stephenson, 1977).

The nomadic forest peoples, such as the Negritos and the Punan of Borneo are, of course. heavily reliant on wild plants for their supply of carbohydrates. In the case of the Negritos, wild yams and other tuberous plants are collected in great numbers, while the Punan and other groups in Sarawak cut large numbers of sago palms to obtain the starch stored in their trunks.

More devastating for floral resources than collection for direct consumption by the relatively small aboriginal populations is collection of plants and plant products for trade with the external market system. Rattan, **petal** *(Purkia speciosa)* and **kerdas** *(Pithecellobium jiringa)* and numerous different medicinal plants are gathered in vast quantities by the aborigines for sale to Malay and Chinese middlemen. That this trade in forest products is a very ancient one in Malaysia has been shown by Dunn (1975). Many forest areas today are almost denuded of rattan because of over-exploitation while at the turn of the century ruthless over-tapping killed off many of the trees providing "damar" resin for the lucrative export trade.

Slash and burn (swidden) agriculture as practiced by the aboriginal peoples may also have considerable effect on the floral composition of the forest. In clearing plots certain very large white barked trres, called "tualang" by the Jahai Negritos, *(Koompassia excelsa).* are left standing because their wood is so tough that, as one of my Jahai informants said, "the axe can't eat it." This tree is a popular nesting-site for wild bees which is another reason that it is not cut by the Orang Asli who are avid honey collectors.

discovered in Java in geological deposits radiometrically dated as being approximately two million years old. Fossil bones of the more evolved *Homo erectus*, tentatively dated as about 600,000 years old, have also been found in Java as well as in several sites in China. Stone tools of assumed Middle Pleistocene provenence have been found throughout Southeast Asia including Peninsula Malaysia (Kota Tampan, Perak) and may be taken as evidence of early man's presence here although, as Hutterer (1977) points out in his valuable review of regional prehistory, in no case have these artifacts been found in direct association with *Homo erectus* fossils so that dating is conjectural at best.

A skull from Niah Caves in Sarawak, dated at 39,600 B.C., provides the first direct evidence of prehistoric man's presence in Malaysia. Interestingly, it is identified as being that of a *Homo sapiens*, the earliest known representative of our species anywhere in the world. Fossil remains of man found so far in Peninsular Malaysia appear to be from the Pleistocene-Holocene transition period. They are found in association with chipped stone core tools and cord marked pottery which are referred to by archeologists as the Hoabinhian cultural complex. Similar materials are found widely distributed throughout mainland Southeast Asia.

The links between prehistoric man and the present day inhabitants of the Malaysian rain forest, the Aborigines or *Orang Asli*, as it is now preferable to call them, have not yet been traced, but it is probable that the modern day Negrito and Senoi are descended from the Hoabinhian populations of the late Pleistocene — beginning Holocene period. The Orang Asli way of life today, especially with regard to their interactions with the plants and animals of the rain forest, is probably much the same as it was thousands of years ago. Thus by looking at Orang Asli adaptation to forest life, accompanied by examination of the limited archeological evidence available on the ecology of prehistoric man, it is possible to make reasonable inferences about the long-term impact of primitive man on the genetic resources of the Malaysian rain forest.

THE IMPACT OF PRIMITIVE MAN ON THE GENETIC RESOURCES OF THE MALAYSIAN RAIN FOREST

Primitive man has had an impact on forest genetic resources in four different ways:

1. Direct selection
2. Dipersal
3. Habitat modification
4. Domestication

Each of these types of impact will be discussed in turn below.

Direct Selection

Man, as a heterotroph, is wholly dependent on plants and animals for his energy supplies. Primitive man meets his nutritional requirements by hunting, fishing, and collecting of wild species and thus functions as a selective agent for these species. Hunting has a particularly dramatic impact on wild fauna with some archeologists (Martin, 1973) attributing the extinction of the North American Pleistocene megafauna to over-hunting by the paleo-Amerindians. In the case of Malaysia, Harrison (1969/70) argues that the Tapir, Tiger, and Giant Pangolin *(Manis palaeojavanica)*, fossil remains of which have been found in Niah Cave in Sarawak, were all "exterminated by the aggressive hunters of Borneo in the past". Such dramatic extinctions do not appear to have occurred in the Peninsula but hunting by Hoabinhian and successor Orang Asli populations has certainly been a strong selective pressure on many local animal species. Faunal remains recovered from several Hoabinhian sites in the Peninsula indicate that a wide range of species were killed by these early hunter-gatherers. Remains of the Lesser One-horned or Javan Rhinoceros *(Rhinoceros sondaicus)*, Seladang or Gaur *(Bos*

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Dispersal

In a paper published in 1893 "on the dispersal of seed by mammals", H.N. Ridley called attention to the role played by the Orang Asli in spreading of fruit trees in the forest. He observed that seeds of rambutans were often swallowed whole and later germinated near deserted encampments where they had been excreted (Ridley, 1893). When walking in the forest with Orang Asli I have several times observed them picking wild fruits which they then proceed to eat as they walked along the track casting the seeds down as they went. As tracts tend to have disturbed soil surfaces, and to be more open to sunlight than the forest floor, the chances of successful germination of such seeds is presumably higher than the deep forest.

Numerous domesticants such as manioc, pineapple, papaya, bananas, areca palm, coconut palm, marigolds, etc. are also introduced by the Orang Asli into their ladangs inside the forest. At least some of these plants, especially pineapple and banana, often persist in a feral state for many years after these temporary clearings are abandoned and succession back to forest has begun. Some of these feral plants, especially fruit trees such as durian and rambutan, may back-cross with wild relatives, thus altering the genetic pool of the forest varieties.

Habitat Modification

Primitive man modifies the habitat of forest organisms in two ways: first, his mere presence establishes a new component of the forest ecosystem with which other components establish interactive relationships, and second, man's activities cause changes in a wide variety of ecosystem variables.

Simply by being present in the forest ecosystem, man provides a food resource to other organisms. The Jahai Negritos, for example, have a well-founded fear of tigers stemming from the killing of Jahai by tigers within the memory of living people. Man is, however, probably a much more important food source for smaller parasitic forms such as leeches, mosquitoes, various protozoa and other disease organisms, many of which are specifically adapted to human hosts. Malaria, for example, is almost absent from forest areas lacking permanent human settlements.

It is man's ceaseless activity, rather than his mere presence, which results in the most significant changes in the forest ecosystem. Man's agricultural activities have a particularly profound impact on the habitat. Clearance of even the relatively small plots that primitive man can make, radically changes the microclimate of the area. The floral community is vastly simplified compared to the complex community of the rain forest and the faunal species inventory is correspodningly reduced. In a recent study of a Negrito ladang in Kelantan, I observed only eight species of resident birds (Greater Coucal, Giant Spinetail Swift, House Swift, Common Brown Babbler, Yellow-vented Bulbul, Magpie Robin, Wren-Warbler, and White-rumped Munia) and seven occasional visitors over a nine day period. All are species known for their opportunistic character in exploiting disturbed habitats. In contrast, Dunn (1975) reports observing about 130 species in an undisturbed forest area in Ulu Selangor.

Few mammals are found near human settlements (largely because of hunting pressure) but, perhaps ironically, ladangs that have been recently abandoned or that are isolated from settlements, are favourite foraging grounds for wild pig, various deer, and the seladang. Wharton (1968) has suggested that the very survival of wild cattle in Southeast Asia is linked to the grazing opportunities provided by abandoned aboriginal agricultural clearings.

Forest clearance also provides ideal breeding conditions for the *Anopheles maculatus*, the major malaria vector in the uplands of Malaysia, which requires clear, moving, sun-lit streams for its larva. Human settlement sites also offer desirable niches for a number of species, in particular cockroaches and houseflies, which cannot survive in undisturbed forest. The rubbish tips associated with human settlements offer zones of

enhanced soil fertility and hence ideal nurseries for a variety of plants. Some theorists such as Sauer (1963) have been suggested that agriculture originated on the basis of "weeds" that colonized such tips.

Practice of swidden agriculture on tropical soils, if continued for thousands of years, may lead to reduction and ultimate exhaustion of the supply of nutrients with consequent changes in the faunal communities supportable by these soils. Stark (1978) suggests that some tropical soils in the New World may have a "biological life span" of under two hundred years if exposed to slash and burn cutting on a thirty year cycle. Such exhausted soils can support only the earliest successional series as appears to be the case with some over-exploited lateritic soils in Malaysia that can only support lalang grass. In general, however, aboriginal populations have been too small and widely dispersed to have had any significant impact on soil fertility of the forest lands of the Peninsula and Borneo.

Domestication

One of the few things that archeologists concerned with Southeast Asia now agree on is that domestication must be seen as a long-term on-going process rather than as a discrete event. To speak of an "agricultural revolution" as we speak of the "industrial revoultion" gives a wholly misleading impression of an evolutionary change process that began some 15,000 years ago and is still continuing among the aboriginal populations of Malaysia. In the course of this evolution, man's relation to several plant and animal species has gradually shifted from that of predator to protector to, and this is what concerns modern breeders, producer of new varieties.

Primitive hunters and gatherers, who are generally thought of as purely predatory, actually show amazing knowledge of the propagation and growth habits of many useful "wild" plants and systematically apply this knowledge to manipulate their productivity. After digging up wild yams, for example, many Orang Asli groups carefully reset the top of the tubers to ensure their regeneration. The Jahai Negritos, as well as other Orang Asli such as the Temuan, also deliberately set fire to wild clumps of bamboo in the forest each year. The firing clears away the accumulated litter making it easier to cut the bamboo and also, according to my aborigine informants, promotes the vigorous growth of new shoots.

The step from such protective manipulation of wild plants to actual domestication is not a big one and it has probably been taken many times in the past by different forest populations with regard to many different species. A Temiar group that I studied in Ulu Kinta, Perak, is presently actually taking this step with regard to domestication of **petai** (*Parkia speciosa*). With no encouragement or support from scientists or government agencies, these supposedly backward people have begun collecting **petai** seedlings in the forest and transplanting them into their ladangs in order to establish permanent orchards. They have carefully noted which plants do well and which fail in the new environment and now only draw on those wild stocks that appear best adapted to cultivation.

Domestication of animals presumably followed a similar pattern. Contemporary Orang Asli keep a wide variety of wild birds and mammals as pets including pigs, monkeys, bamboo rats, woodpeckers, etc. It was probably the keeping of captured baby jungle fowl and wild boar that resulted in the domestication of the chicken and the pig, Southeast Asia's two most important contributions to modern livestock resources. The latent potential for profitable domestication of remaining wild species in the Malaysian forest such as the mouse deer, serow, and the seladang, should certainly receive greater attention from animal breeders than it has to date.

CONCLUSIONS

It has been my intent to show that man is not a new factor in the functioning of the

Malaysian rain forest ecosystem. The hominid presence is an ancient, although not necessarily honourable one, and has had profound impact on the genetic resources of what we often mistakenly conceive to be a natural system. Therefore, in planning conservation measures for forest genetic resources we must recognize that many "wild" species may have co-evolved with primitive man and thus may have achieved a degree of co-adaptatio 1. Preservation of the seladang may, for example, be contigent on allowing continued slash and burn cultivation by small Orang Asli populations within the boundaries of national parks and game reserves.

A less obvious conclusion is that co-evaluation works in two directions so that aboriginal man has also become adapted to the forest ecosystem. Anthropologists usually stress the critical role that a non-genetically based system — culture — play in this adaptation, and the numerous ingenious devices such as the blowpipe and the fire piston and that make up the cultural inventory of Malaysian aborigines are too well known to need reviewing here (Rambo 1977). It is less commonly recognized, however, that Malaysia's aboriginal populations display a remarkable degree of genetic adaptation to the forest environment as well. The Negritos, for example, almost perfectly exemplify the application of Bergmann, Allan, and Gloger's ecological rules to a race evolving in the lowland humid tropics. A perhaps more significant genetic adatpation, given the current worldwide resurgence of malaria, is the resistance to this disease given the Orang Asli by the high frequencies of abnormal hemoglobin E in their populations (Livingstone, 1967). The rapid evolution of mosquito strains that are resistant to DDT and malaria strains that are resistant to available prophylactic medicines may give greatly increased selective value to this biological adaptation. While certainly not suggestion that SABRAO get into the business of breeding people, I think that preservation fo human genetic and cultural diversity is as important a priority as the clearly vital task of preserving the genetic resources of the other species that make up the Malaysian rain forest ecosystem. In the highly unpredictable environment of the future both sets of resources may prove equally essential for the survival of our species.

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RINGKASAN: Manusia purba, sebagai suatu komponen sistem ekologi hutan tropika Malaysia selama beribu-ribu dan mungkin berjuta-juta tahun, telah mempengaruhi evolusi spesies-spesies lain di dalam sistem ini. Ia berbuat demikian melalui pilihan terus menerus akibat pemburuan, pengutipan tumbuhan, penyebaran biji, penguòahsuaian habitat dan penjinakan. Aktiviti-aktiviti manusia purba telah memupuskan beberapa spesies, meluaskan banjaran berbilang spesies dan menghasilkan pengubahsuaian genetik yang lainnya. Oleh kerana kesan populasi Orang Asli yang amat sangat ke atas hutan belantara Malaysia, adalah silap menganggapkan hutan ini sebagai suatu sistem ekologi semula jadi yang asli; sebaliknya harus disedari bahawa sumber-sumber genetiknya telah kuat dipengaruhi oleh manusia dan segala rancangan-rancangan untuk memelihara sumber-sumber ini harus mengambil pertimbangan fakta ini.

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