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16

ASPECTS AND IMPLICATIONS OF ECOLOGICAL DIVERSITY IN FOREST SOCIETIES OF THE BRAZILIAN AMAZON

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The vast expanse of tropical lowland forest in Amazonia is still home to a number of different indigenous societies (Rowe 1974; Clay 1993; Lizarralde 1993). Some larger societies, such as the Yanomami (> 10,000 people; Chagnon 1968), have received considerable academic attention (Chagnon 1968; Chagnon and Hames 1979; Smole 1976) and have a fair degree of public recognition as well as legal title to a large continuous tract of forest (ca. 23 million acres; de Oliveira 1993; MacDonald 1993). But many of the smaller forest societies remain largely unknown to the outside world and do not have legal title to their land.

Because these smaller societies typically number fewer than four hundred people, they lack the population density and multiple villages that could help buffer them from the changes invariably experienced with increased exposure to outside influences (Coimbra et al. 1996; Santos et al. 1997). Furthermore, because these groups are small, they also lack the numbers necessary to stage dramatic marches or to organize large meetings to bring political and media attention to their demands for land demarcation and other rights (Conklin and Graham 1995).

Information about the ecological practices of these little-known societies can serve a useful function in that it brings them into the public eye and documents their residence in and myriad uses of their forest environment. I shall present comparative data on some features of the dietary ecology of four small, forest-based indigenous societies in Brazil, as well as on the medicinal practices of two

of them. As we shall see, these groups differ one from another in many aspects of their ecology—a finding that helps to emphasize the loss of cultural diversity that can occur with the demise of even one such group (Clay 1993).

BACKGROUND

In the early 1980s, having learned that there were still a number of indigenous societies living in lowland tropical (terra firme) forests of the Brazilian Amazon that had been little exposed to outside influences (at least for most of the twentieth century), I decided to visit some of them to learn more about their ecological practices. In carrying out this research, I chose to depart from the more traditional anthropological approach in which years are spent immersed in the examination of one particular society. This is a valuable and time-tested method of study, but, given the speed with which cultural practices can alter and the increasing rate of contact with these remaining forest groups, I did not think that time permitted a leisurely approach. Rather, I wanted to visit as many different societies as I could as rapidly as possible and compile the same comparative data in each case. Because all data would be collected by means of the same methodology, the end result should be a body of material that permitted valid comparisons among the ecological practices of these different forest-based groups.

In much of the earlier literature, forest societies in Amazonia were often lumped together in discussion as if they were all the same—basically static and interchangeable entities, for example, "hunter-gatherer societies," "forest-based cultures," "forest peoples," and the like—or the ecological practices of particular forest societies were compared with those of societies in other habitats such as savanna-woodland societies or riparian fisher-gardener societies. Because each environment has its own characteristics (Nelson 1973), such comparisons are likely to be forced and may often be inappropriate. Designating these forest-based groups as hunter-gatherers is, in itself, inappropriate because almost without exception such forest-based societies practice small-scale horticulture as well as hunt and gather and have done so for hundreds of years—in my opinion since well before the first Europeans ever entered the New World. For this reason, hunter-gatherer societies are extremely rare in Amazonia—one such example being the Maku of the northwestern Brazilian Amazon—and literature professing to discuss "hunter-gatherers of Amazonia" generally is discussing the behavior of hunter-gatherer-horticulturalists since small-scale cultivation has long been a feature of almost all terra firme Amazonian societies.

Three of the four groups discussed here, the Araweté, Parakaná, and Mayoruna, were visited in 1986 and 1987; the fourth group, the Matis, was visited in 1995 and 1997. The Parakaná and Araweté occupy neighboring territories in the state of Pará; each speaks a language of the Tupí-Guaraní family. The Mayoruna

and Matis, who speak Panoan languages, are more distant neighbors in the state of Amazonas. Though "neighbors," traditionally each localized pair has had hostile relations with the other in the past. and overt hostilities occurred between the Araweté and Parakaná as recently as 1983 (CEDI 1981).

In this chapter, the term *in contact* is used to designate the point at which each of these societies or my particular study village of that society was brought into more or less continuous contact with members of the Brazilian Indian Bureau, Fundação Nacional do Indio (FUNAI). With such "formal contact," FUNAI personnel establish a contact post and begin living near or with the indigenous group. At the time of my initial visit, each of my study groups (or villages) had been "in contact" for only a short time.

For this reason, few individuals in any of the four societies I worked with spoke Portuguese. I did not attempt to master the language of each group but rather learned from each some more essential words and phrases. Most data were compiled through detailed observation and the systematic sampling of different activities, ecological practices, and environmental parameters rather than elicited through detailed interviews, although some interviews were possible when a reliable interpreter or translator was present.

PARAKANÁ AND ARAWETÉ OF PARÁ STATE

The Araweté live south of the town of Altamira in a single village, Ipixuna, on the Ipixuna River, while the Parakaná have three villages—two near the Tocantins River, north of the town of Marabá, and one well to the west of Marabá on the Bom Jardim, a tributary of the Xingu River. The Bom Jardim village lies to the south of the Araweté village of Ipixuna. Prior to settling on the Bom Jardim, these Parakaná had been living in the forest as nomadic hunter-gatherers for fifteen years or more. As nomads, they had been fleeing encroaching Kayapó, a populous (> 3500) Jê-speaking society whose villages traditionally were based farther to the south. The migrating Kayapó, in turn, were fleeing invasion of their traditional homeland by colonists and entrepreneurs. Because the Parakaná had only bows and arrows, they were largely defenseless when faced with Kayapó armed with rifles. Thus they fled their villages and took to the forest.

The Araweté, though they had shifted the location of their village at various times in the past, appear to have been living in the same general region, though perhaps not so far west, for hundreds of years (de Castro 1992). Like the Parakaná at Bom Jardim, the Araweté appear to have been displaced to this northwest region close to the Xingu River primarily by the movement of hostile Kayapó. The Araweté have been the subject of detailed study by E. de Castro (1988, 1992) and considerable historical and other information about them can be found in his book, *From the Enemy's Point of View.*

THE MAYORUNA AND MATIS OF AMAZONAS STATE

The Mayoruna are a fairly populous society numbering some thousand individuals in total. Most Mayoruna live in Peru, where they are known as Matses (Romanoff 1984). There are, however, some 350 Mayoruna in Brazil, living in five villages on or near the Javari River (Erikson 1996), a long, twisting tributary of the Amazon that forms a portion of the Brazil-Peru boarder. I worked with the Mayoruna of Lobo Village, which is located on the Lobo River, a small tributary east of the Javari. During the period of my research the Matis, like the Araweté, had only a single village. It is found on the west bank of the Itui River, a large tributary lying east of the Javari. Like the Araweté, the Matis have shifted the location of their villages at various times in the past but appear to have lived in the same geographical region for hundreds of years.

STAPLE CROPS

My study revealed many differences in diet among these four forest-based indigenous societies (Milton 1991). In terms of horticulture, both Pará groups devoted themselves largely to the production of a single staple cultivar, a very common tropical pattern. But each cultivated a different staple crop. The Parakaná cultivated bitter manioc, although they lacked the elaborate basketry and other equipment generally associated with its cultivation as a carbohydrate staple. The Tucanoans, for example, who are riparian fisher-gardeners found living beside large tributaries in the northwestern Brazilian Amazon, cultivate bitter manioc intensively and have a highly elaborated basketry complex, graters, large ceramic toasting pans and other equipment associated with its preparation (Milton, personal observation).

In contrast, the Parakaná place freshly harvested manioc roots into a shallow area of the river for several days. After much of the cyanogenic compounds in the manioc presumably have been leached out by water, the manioc roots are removed from the river and peeled. The water-softened pulp is wrapped in pieces of cotton cloth and squeezed by hand to further remove harmful chemicals. The squeezed root pulp is then molded into small balls that are placed on a wooden rack in the sun to dry. The dried manioc "flour" is then toasted into cakes on small clay griddles. To verify that bitter manioc was the staple cultivar of other Parakaná, I visited a second larger Parakaná village near the town of Marabá, where I found bitter manioc cultivation and the same preparation techniques.

While living as nomads in the forest, the Bom Jardim Parakaná depended heavily on nuts of the babacu palm (*Orbignya* sp.) as a carbohydrate staple. This palm species is extremely common in most forests of Pará and its density is hypothesized to relate, at least in part, to anthropogenic influences (Balée 1989; Tribin et al. 1998). At Bom Jardim, although the Parakaná cultivated bitter manioc, they

also continued to utilize babacu nuts as an important food. They had sites in the forest where rocks occurred that were used to process the palm nuts, and huge heaps of shells and young palm sprouts could be found at such sites. After removal from the shell, the palm nuts were processed and used to make a type of flour to prepare a "bread" just as is done with the manioc flour.

In striking contrast to the Parakaná, the Araweté were strongly dependent on maize as a staple carbohydrate for almost all of the year (de Castro 1992). Though most forest peoples cultivate some maize, typically maize is a seasonal food, not the carbohydrate staple of the annual diet (de Castro 1992; Milton, personal observation). The Araweté had a highly elaborated technology associated with maize cultivation, storage, and utilization. It is often not appreciated that the successful exploitation of a particular crop may involve a tremendous number of human activities associated not only with the planting, tending, and harvesting of the crop, but also with the technology required to store or preserve it until it is utilized and the culinary practices required to prepare the most nourishing dishes from it (Katz, Hediger, and Valleroy 1974; E. Rozin 1983; P. Rozin 1987).[1]

Rather than having only a single staple carbohydrate crop, both the Mayoruna and Matis cultivated two: sweet manioc and plantains. Climatic and soil data show that the area of Amazonia inhabited by the Mayoruna and Matis has richer soil and receives higher and more evenly distributed annual rainfall and more hours of insolation than is the case for the area occupied by the Parakaná and Araweté (Milton 1991). These climatic and edaphic features contribute to a higher overall productivity in forests occupied by the Mayoruna and Matis. I believe it permits these groups more freedom to diversify their staple cultivars than is the case in Pará.

Data compiled on horticultural practices of the Matis some twenty years ago indicate that plantains were little in evidence (CEDI 1981). Currently, however, plantains are grown to such an extent that they are as important in the diet of the Matis as sweet manioc. My data also suggest that cultivation itself has grown more intensive among the Matis in the past twenty years. The reasons for these changes appear to relate largely, although not entirely, to recent outside influences. In order to secure a continuous flow of trade goods—now possible because of more regular contact with the outside world—recently contacted forest groups such as the Matis must have something to trade. One obvious trade good is farinha—toasted manioc flour that is consumed by most Brazilians in massive quantities. By cultivating more manioc than they require for their own nutritional needs, the Matis, who traditionally do not eat farinha but rather boiled manioc roots (and now considerable amounts of roasted plantains), can use the surplus manioc to prepare farinha for trade.

The dependence on two crops rather than one can occur, I believe, because in this more productive area of Amazonia there is freedom to diversify the diet (lesser risk if a particular crop fails and lesser likelihood of failure). The importance of plantains appears to increase in part because of increased manioc culti-

vation: larger fields for growing surplus manioc provide more scope for the planting of plantains and, unlike a manioc cutting, which produces only a single root crop in one or two years and then is finished, an individual plantain cutting, providing the undergrowth around the base is kept clear, will produce new shoots and stalks of fruit for a period of five or more years. Thus, plantains continue to produce far longer than manioc, and as new fields are opened each year to plant manioc, some plantains are also planted. These outlast the manioc, and slowly but surely plantain abundance continues to increase year after year.

STAPLE PREY

During my study, which involved two visits at different times of year to the Parakaná, Mayoruna, and Matis and one visit to the Araweté, I noted that the staple item of prey (here defined as the prey type with the highest number of individuals brought into the village during my periods of residence) also differed among these groups. The Araweté tended to specialize on large forest birds, the Parakaná on land tortoises, the Mayoruna on peccaries, and the Matis on woolly monkeys. This is not to imply that other prey species were not taken by each group nor that there was no overlap in many prey species between both neighboring and more distant groups.

Indeed, to a modest extent, the prey differences I documented between societies could be due to sampling error; since I was not with each society over the entire course of an annual cycle, I cannot say with certainty that the pattern I observed in each village during my visits prevailed throughout the year. De Castro (1988, 1992), whose visits to the Araweté spanned more than one annual cycle, stressed the importance of tortoises in the diet of the Araweté, but few tortoises were brought into the village during my observation period some four years later; this fact suggests that the tortoise supply in this region may now be exhausted or that there are fluctuations in the use or abundance of different prey species in different seasons or years.

But the Parakaná whose territory extends north to meet that of the Araweté consumed impressively large numbers of tortoises during my two observation periods, one of which occurred at the same time of year and same year as my visit to the Araweté. FUNAI employees who had been with the Bom Jardim Parakaná since contact stated that when the Parakaná first settled in the Bom Jardim area, tapir had comprised a very high percentage of the prey-based portion of the diet. While I was visiting the Parakaná, family groups frequently left the village and went on treks in the forest lasting ten days or more. On returning, they brought with them the remains of smoked tapirs. This is of interest because the Araweté ate no tapir while I was with them, and de Castro (1992) noted that for the Araweté, tapir is a "dangerous" food that requires special ritual preparation.

It is said that traditionally no Tupí-Guaraní-speaking societies ate monkeys.

The Bom Jardim Parakaná, who have been in contact for a shorter time than the Araweté, do not eat monkeys, nor do they kill them for any reason. In contrast, some Araweté do kill monkeys, and de Castro (1992) states that howler monkeys, though considered, like tapir, to be a "dangerous" food, are eaten by the Araweté, although I never observed this. I did, however, note that on one occasion a howler monkey was killed by an Araweté to be used as fish bait.

As the Araweté have been in formal contact for longer than the Bom Jardim Parakaná, it is tempting to suggest that their traditional food prohibition against the eating of monkeys is breaking down with increased exposure to outside ways. But de Castro's (1992) description of the ritual surrounding the eating of howler monkeys by the Araweté raises some questions, for it indicates that howler monkey–eating may extend back in time to well before formal contact.

The Mayoruna and Matis are avid monkey hunters and eaters, and both focus hunting principally on the same two monkey species—woolly monkeys and spider monkeys. Yet the Mayoruna, who have been in contact longer than the Matis, hunt with the bow and arrow (or shotguns if they have shells), whereas the Matis hunt monkeys exclusively with the blowgun and poisoned darts. The Matis take monkeys routinely in high numbers (on one occasion over forty woolly monkeys in one hunt), something I did not note for the Mayoruna.

In spite of considerable dietary overlap in most prey species, I also noted that prey prohibited as food in one society was often the single most important prey species in the diet of its nearest neighbor, a fact that suggests that neighboring societies might use particular prey species as cultural boundary markers (Milton 1991, 1997). Each of these forest-based societies had a very clear opinion of what constituted their hunting area, and the suspected presence of strange individuals anywhere in that hunting area elicited an immediate highly hostile response. Traditionally, relations between neighboring Amazonian indigenous societies have tended to be extremely hostile (Balée 1984; Roosevelt 1989; Milton 1991).

Items of diet are natural vehicles for symbolic meaning. Food and eating are intimate acts: foreign objects (foods) are placed in the mouth (a potentially dangerous as well as intimate gesture), and it is appreciated that there is a relationship between eating and body appearance, indicating that food is in fact incorporated into the body of the feeder. For this reason, it seems natural to view an enemy's favored prey species as "like" the enemy and to avoid eating such prey lest you take on enemy characteristics (Milton 1991, 1997). Furthermore, eschewing such prey as food shows that one is of a different people and helps to reify one's own cultural identity.

CULTURE CHANGE

Today, all Matis live together in a single village on the Itui River and have been in more or less continuous formal contact with FUNAI for about twenty years.

Though the Lobo Creek Mayoruna have been in contact for only about twenty-five years in terms of consistent interactions with FUNAI, because of their location in the Javari River area, they have actually been interacting fairly extensively with outsiders for centuries (Romanoff 1984)—something probably not the case for the Matis. The Lobo Creek Mayoruna might therefore be said to represent one level of acculturation and the Matis another, although during my two visits some Mayoruna at Lobo largely avoided contact with outsiders and still lived together in a *maloca*, a traditional multifamily longhouse constructed of wooden poles and palm thatch. Anecdotal accounts suggest that prior to around 1980 the Matis, who then lived in malocas at five different sites adjacent to the Itui River (Erikson 1996), devoted more time to life in the forest and hunting and gathering and less time to horticulture than is the case today.

In 1980, although the Matis were known to practice small-scale horticulture, they were reported to have almost no western implements associated with such cultivation and, as discussed above, plantains were stated to be little in evidence (CEDI 1981). From my observations in 1995 and 1997, it appears that in the last twelve years the Matis have become far more involved in manioc cultivation and widened their subsistence base to include the routine consumption of plantains. In addition, at present all Matis live together in a single village with each family or small extended family in an individual dwelling rather than in malocas.

The weapons each group used for hunting may also represent changes brought about through different levels of acculturation. For example, the fact that the Mayoruna do not manufacture or use the blowgun may reflect their longer period of exposure to outside influences; I was told by a Marubo informant that in the past all three Panoan-speaking groups in this region of Brazil, namely the Marubo, Mayoruna, and Matis, used the blowgun. Romanoff (1984) likewise commented that the Mayoruna used the blowgun prior to the rubber boom. My Marubo informant stated that the Marubo and Mayoruna no longer used the blowgun because "they'd forgotten how to make it" and it was "a lot of work to make it." The same informant also told me that in the past the Marubo were far more oriented toward hunting and forest collecting for subsistence than is the case today, a comment I also heard when I lived with the Mayoruna. Though the Matis still make and use blowguns intensively, especially when hunting monkeys, they currently have a new motivation for continuing to manufacture them: blowguns are very valuable items for trade with the outside world.

These comments on dietary prohibitions, horticultural practices, and weapon manufacture are provocative, for they suggest that conditions that anthropologists (speaking for myself) have taken as the "traditional" condition for a fairly isolated forest culture (and all four of these societies are quite isolated, even today)—for example, "the Mayoruna hunt with the bow and arrow while the Matis use both the bow and arrow and the blowgun" (Milton 1991)—may not, in fact, rep-

resent "traditional" reality but rather a more fluid reality based on the degree and type of exposure a given indigenous group has had with outside influences. Romanoff (1984) stressed this point in his monograph on the Matses (the Peruvian name for the Mayoruna), noting that many ecological characteristics of indigenous groups in this region of Amazonia, groups he designates "border Panoans," altered dramatically during the rubber boom (1880–1920). Such observations further emphasize the dynamic nature of these societies while heightening the need for caution in accepting current ecological practices even of very remote groups as long standing—which they may or may not be.

ILLNESS, MEDICINE, AND MAGIC

The Mayoruna have long been known as raiders for women (CEDI 1981; Romanoff 1984). Mayoruna warriors would attack other indigenous societies to steal women (Tika Mayoruna, personal communication) and also carried out extensive attacks on colonists on and along the Javari River and other nearby tributaries (CEDI 1981). In Mayoruna villages today, various women are either captives or descendants of captives. The Matis, on the other hand, do not have a history of raiding other societies for female captives nor, as far as I could tell, with one exception, was anyone in their village a non-Matis.

Romanoff (1984) has provided a vivid and detailed account of what is known of the historical background of the Mayoruna. Because of their association with the Javari River, a river with a turbulent past both because of its border status and its centrality in the rubber boom, the Mayoruna have had a highly disturbed history, one filled with strife, danger, and death (Romanoff 1984). Less is known about the past history of the Matis, but they appear sufficiently removed from the Javari region to have been less affected.

The different social ambiance I noted between the two groups—the Mayoruna appearing far more taciturn, guarded, and suspicious and the Matis more relaxed and open—seems reflected today in the respective attitudes of the two groups toward illness and its treatment. The Mayoruna at Lobo Creek showed me more than a hundred different medicinal plants that covered an extensive array of health problems including toothache, swollen testicles, diarrhea, headache, eye infection, back pain, neck pain, stomach pain, tumors, breast pain, leishmaniasis, penis pain, and even chicken pox, in addition to remedies for snake bite, ant bite, scorpion bite, and the like. Medicinal plants were routinely collected, generally by men. Most of the medicinal plants shown to me were to be used topically; leaves, for example, were to be bound onto afflicted individuals at the site of the problem or, in the case of small children, were to be used with water to bathe the child. In a few cases, however, the medicinal leaf, bark, or sap was to be taken internally or placed in the afflicted area. For example, some barks were rasped into water

and the concoction drunk for headaches or toothaches or bark or sap was placed directly into a wound.

In contrast, among the Matis, actual illness and its cure, other than snake bite, did not seem to be a topic of particular interest, and in forest inventories few medicinal plants for any ailment such as those of the Mayoruna were pointed out. A few plant species were identified as useful for some ailment—toothache or scorpion bite, for example. However, almost all *remedios* (medicines) shown to me by the Matis were prophylactic, i.e., they were a remedy to prevent a condition from occurring, not to treat an existing condition. Furthermore, almost all medicinal plants shown to me pertained to the treatment of small children: the leaves of particular trees were used either to bathe a child before it got sick because of some activity of the parent—generally overeating of a particular game animal by the parent—or to ward off possible bad luck that might affect the child.

This is somewhat similar to Romanoff's (1984) description of the Matses (Mayoruna) of Peru at the time of his fifteen-month study between 1974 and 1976. He noted that the Mayoruna believed that spirits could cause illness, and for each illness there was an appropriate leaf. Leaves from forest trees were gathered, boiled, and used to bathe ill people. Romanoff (1984) also pointed out that all men knew some medicinal leaves but old men knew more. This situation is similar to the one I describe among the present-day Matis, except that I did not witness the boiling of leaves and cannot comment on beliefs in spirit illness.

In my survey of uses made of more than 350 different trees in the forest occupied by the Parakaná of Bom Jardim, only four trees in the entire inventory were stated to have medicinal use—one for malaria, one whose sap could be used to heal cuts, one "a medicine you drink," and one "medicine for the stomach." This suggests that medicinal treatments from trees did not play much role in the life of the Parakaná during my visits in 1986 and 1987.

There is debate today about the prevalence of ethnobotanical practices such as ethnomedicine among relatively uncontacted indigenous groups, as contrasted with the prevalence of such practices in societies with a longer history of acculturation (Davis and Yost 1983; Telban 1988; Balée 1994). Some data suggest that groups with little outside contact lack both extensive lists of physical ailments and extensive pharmacological inventories associated with their cure (Davis and Yost 1983; Telban 1988). Balée (1994), on the other hand, based on his intensive work with the Ka'apor of Maranhão (Brazil), takes the view that the great majority of Ka'apor medicinal plants are used to treat human diseases of pre-Columbian origin. Telban (1988) has discussed the dichotomy that exists between plants that *heal* (plants that relate to illnesses associated, for example, with the breaking of a taboo or with illness that are due to spirits or sorcery, and that are psychosocial in nature) and plants that *cure* (plants that have direct pharmacological effects and are used to treat a physical condition such as a toothache, snake bite, or malaria).

As a result of my own fieldwork in Amazonia, and independent of their work, I had reached much the same conclusions as Davis and Yost (1983) and Telban (1988), that is, I do not believe that prior to contact with and exposure to outside influences, forest-based indigenous peoples in Amazonia possessed highly elaborated pharmacopoeias of medicinal plants used to treat specific physical conditions—plants that cure. I am not suggesting that they had *no* plants of this nature, only that they had far fewer than became the case after contact. Thus, I view an interest in "curing" medicine and "curing" plants as perhaps induced to a large extent by contact with outsiders (or their diseases). Outsiders generally not only bring in new diseases that can be harmful or fatal to indigenous peoples, but they also tend to have elaborate medicine kits that contain very effective remedies since these medicines are used to treat the very diseases the outsiders have brought in—not only colds or coughs (which can kill indigenous peoples), but also serious malarias and other tropical diseases representing strains common in urban areas that tend to be far more virulent than the more benign strains in distant forests.

In 1986, I was able to talk to a Brazilian doctor involved in examining individuals in several indigenous societies in Pará at the time of first contact by the FUNAI. This doctor told me that generally at contact such forest groups were largely free of any obvious diseases. Malaria tended to be a low-grade, relatively benign forest type, not the often virulent malarial strains associated with areas of higher human habitation and large rivers. Parasite loads were also stated to be low, and, generally, in this physician's view, most individuals of all ages appeared to be in excellent health. For example, at contact the Bom Jardim Parakaná were stated to have no malaria and no ascarids, giardia, or amoebae, and little hookworm; their teeth were stated to be in beautiful condition. Individuals in excellent health are unlikely to need a large "medicine cabinet" full of medicinal plants that cure though they or their shamans might well utilize medicinal plants that heal.

Based on such reports as well as my own observations, and in keeping with Telban's (1988) remarks, I would predict a continuum of medicinal plant use vis-à-vis plants with actual pharmacological properties for treating specific physical ills, with groups farthest from outside influences showing the lowest number of "curing" medicinal plants and a gradual increase in interest in and knowledge and use of chemically active curing plants as groups experienced more contact with outside influences.

On the other hand, both Mayoruna and Matis practiced a hunting ritual involving the taking of a powerful skin secretion from the tree frog, *Phylomedusa bicolor*. In this instance, the frog secretion has dual significance (it both "cures" and "heals"); it produces actual physiological effects of great power that enhance strength and stamina as well as the acuity of the hunter's senses, while at the same time providing psychological benefits, since the secretion is also believed to bring

good luck to the hunter (Daly et al. 1992; Milton 1994). It is interesting to note that this frog species is distributed across the Amazon Basin (Daly et al. 1992; Milton 1994), but with one possible exception, only Panoan-speaking peoples use the secretion. This illustrates the fact that key scientific discoveries of considerable significance may not transfer out of their original linguistic matrix, even though the plant or animal species may be found over a wide geographical area and could be used by other indigenous societies if their inhabitants were aware of its qualities (Milton 1994; Balée 1994).

On a related topic, in terms of general ethnobotanical knowledge among the Matis, a tribe so little acculturated that even in 1995 only a few individuals spoke any Portuguese, only two older (> 50 years) men and one older woman (the woman tested with only a small sample of trees) were consistently able to provide the names and uses of the majority of forest trees tagged in my sample plots. Young Matis women (15–20 years of age) appeared to know virtually no tree name unless it was a species that produced edible fruit. Though young men (15–32 years of age) claimed to know tree names, in fact they did not appear to be very certain of their information and finally told me that I needed to get one of the older men to work with me.

Younger Mayoruna, Parakaná, and Araweté appeared to have much more knowledge of forest tree identification than the Matis. Currently, I have no explanation for why younger Matis appeared so unfamiliar with the names of their forest trees. It might be that the very recent contact of the Matis with outsiders, a period beginning more or less around 1985 that would overlap with the childhood and adolescence of most individuals in the range of 15 to 30 years, was sufficiently disruptive so that it caused an actual break in the vertical transmission of ethnobotanical knowledge in this culture. This question too warrants further investigation and study.

OVERVIEW AND FUTURE PROSPECTS

Data presented here illustrate the fact that each of these indigenous societies is quite distinct in terms of many ecological and other cultural practices. Living for hundreds of years in the same geographical region and even speaking languages derived from the same linguistic stock may be reflected in some common aspects of behavior, as, for example, the taking of the frog secretion by Panoan-speaking societies, but such factors often do not appear to play an important role in the way these different societies utilize various other components of their forest environment. The biological richness of the Neotropical rainforest is reflected in the corresponding cultural richness represented by these forest peoples.

Using the recent experiences of larger indigenous groups such as the Yanomami or Kayapó as an indicator, can we predict what the future might hold for

these smaller indigenous groups? Initially, of course, each society speaks only its native language. But the contacting individuals in Brazil speak Portuguese. Little by little some individuals in each village learn Portuguese, and typically these individuals are a few young men (Giannini 1996; Milton, personal observation). These young men then become the voice of the village—they negotiate, translate, explain, and in general achieve high status and considerable influence and power through their dealings with nonindigenous contacts (Giannini 1996; Milton, personal observation). They also draw attention away from the accumulated wisdom of older generations (the village elders), thereby diluting the latter's influence and disrupting the vertical transfer of traditional information from generation to generation. This syndrome is discussed in detail by Turner (1995), Giannini (1996), and others with reference to the Kayapó and Kayapó-Xikrin.

In the small forest-based societies where I work, almost everyone seems to share the view that speaking Portuguese is beneficial. I was frequently asked by both the Mayoruna of Lobo Creek and the Matis of Itui to tell FUNAI personnel in Atalaia or Brasilia to send a school teacher to their village so they could all learn to speak and read Portuguese and thus how to use currency and work with numbers. This has yet to happen for either the Matis or Mayoruna, but it shows what they perceive as their most immediate need. And, of course, when you change your language, you may change your world view—as several contributors in this volume emphasize. If you lack the vocabulary to discuss details of your forest environment, these details will no longer be important.

With human societies it is always difficult to predict what may happen. But if we take the Matis as an example, and the lack of botanical interest I noted in adolescents in 1995 continues while everyone masters Portuguese and negotiates through the initial problems of continuous contact with nonvillage people, much traditional ethnobotanical and other ecological knowledge of the forest environment may be lost—and there are no other Matis villages that can be sought out to recover it.

Yet cultural devaluation and loss may not come to pass because, as of 2000, conditions favoring the preservation of indigenous knowledge are far different and also more positive than was the case when most forest-based groups in the Brazilian Amazon were initially contacted. For example, the closest Marubo village to the Matis village is made up of a mix of far more acculturated and somewhat more acculturated individuals than is the case for the Matis. (This Marubo village is small, with only about a hundred inhabitants; it should not be confused with the large, long-missionized Marubo settlement located toward the headwaters of the Itui.) In this small Marubo village, one of the young adult men told me that he and his associates were working to ensure that all of their children learned every aspect of their traditional culture. Though these more acculturated Marubo had been living in small family dwellings, they recently had constructed two malocas and many villagers were now living in these malocas again rather than in

individual houses. As expressed to me, the Marubo were happy to learn from the outside world but they were also taking steps to ensure that their children were trained in all Marubo traditions as well.

In recent years, as we know, the pendulum has swung heavily toward public respect for and strong interest in traditional knowledge and the conservation of biodiversity, including linguistic and cultural biodiversity. Indigenous groups contacted and exposed to western ways some 100, 50, or even 25 years ago in Brazil did not have this positive framework of international support and admiration. Rather, emphasis was placed on the need for indigenous peoples to divest themselves of their traditions and take on the language, behaviors, and economic practices of the wider Brazilian society. Unfortunately, there is nothing in the genome of any individual, indigenous or otherwise, about how to utilize the tropical forest environment in a sustainable manner. Rather, each generation has to learn anew the entire information set from preceding generations that hold this knowledge. And once such information vanishes, it is difficult if not impossible to recreate it.

Ironically, however, indigenous groups that have managed to stay deep in the tropical forest, far away from acculturation and outside influences, may now have the opportunity to reflect to some extent on what they want for their future rather than simply be exposed to outside customs and immediately made to feel that their own cultural creations are inferior to what the outside world has to offer. Indigenous consciousness has been raised primarily as a direct result of communication and outreach movements by more acculturated to less acculturated groups in Amazonia, and it extends even into the distant areas where I work. Observational data suggest that even in these very remote societies traditional knowledge is currently being lost. But in contrast to most other indigenous societies in Brazil, which have either disappeared or lost many of their former traditions and skills, today it would seem that indigenous peoples such as the Matis, Mayoruna, Parakaná, and Araweté may be able to determine their future for themselves—if they act now.

It would be a great tragedy if, having successfully resisted all of the many hostile and annihilating forces leveled against them over the past five centuries, forces that have resulted in the extinction of so many indigenous societies in Amazonia, these small forest-based societies could not now successfully enter the twenty-first century still in possession of their own autonomy, languages, cultural traditions, intellectual heritage, *and* their densely forested environment.

NOTE

1. The widespread incidence of pellagra in many populations (both indigenous and non-indigenous) introduced to maize (a New World cultivar) in the past few centuries was due in large part to the fact that the indigenous method of corn preparation in the

Neotropics, which involves leaching maize with an alkaline solution prior to cooking it (an activity that liberates niacin and significantly improves amino acid quality; Katz 1987) did not travel with maize seeds to their new sites of cultivation but rather was left behind—to the detriment of the new societies that tried to use maize as a dietary staple (Carpenter 1977; Katz 1987). Similarly, human groups more recently introduced to bitter manioc but not to the time-tested methods for removing its harmful cyanogenic glycosides suffered and continue to suffer nerve damage and even death as a result of the inadequate removal of these potentially lethal compounds (P. Rozin 1987).

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