

NOT FOR QUOTATION.

ECOLOGICAL ANTHROPOLOGY AND VALUES IN AMAZONIA *

by

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INTRODUCTION

Amazonia is a stimulating region for ecological and anthropological research, given the richness and diversity of its natural and cultural life. It offers an ideal place to explore the role of values in tropical ecology. The indigenous cultures and natural ecosystems of Amazonia are increasingly threatened by Western civilization and development. A fundamental conflict is evident between the values of the so-called "primitive" and "civilized" worlds. Cultural ecology can contribute to the improvement of this situation by documenting the adaptive role of indigenous culture and knowledge, and by evaluating the influence of Western civilization and development in this light. But first it must examine its own values.

This paper explores these and related problems. To provide a background, it describes first the Amazonian ecosystem as a whole, and gives some of the highlights in the study of its cultural ecology. Then, the paper turns to an examination of the role of values in the cultural ecology of Amazonia in the contexts of indigenous adaptations and economic development.

* Expanded and edited version of paper delivered to the Conference on Cultural Values and Tropical Ecology, Environment and Policy Institute, East-West Center, Honolulu, Hawaii, June 3-10, 1983.

CEDI - P. I. B.
DATA 31, 12, 86
COD K1D00000

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AMAZONIA

In geographical terms, Amazonia refers to the tropical lowland region of South America which is dominated by rain forests (hyllaea) and bounded by the Andean, Brazilian, and Guiana highlands. Amazonia extends over 7,050,000 km² (Crist 1982:653). Politically, the region includes substantial portions of Venezuela, Colombia, Peru, Ecuador, Bolivia, and Brazil. To this list some authors would add Guyana, Suriname, and French Guiana (Tocantins 1974:22).

The Amazon is one of the longest navigable rivers in the world. Estimates of its total length range up to 6,771 km (Sioli 1975:461). The width along most of its course is more than eight km, increasing to 320 km at its mouth. Near Manaus, Brazil, the river is 110 m deep (Bates 1964:178). The Amazon River and its more than 1,000 affluents drain the Amazon Basin, a hydrographic region which covers 40% of the continent of South America. About 20% of all the water that runs off the Earth's surface is transported by the Amazon River (Crist 1982:653). Over 5,000 species of fish are known from the Amazon Basin (Ravin 1981:28).

Amazonia is the product of 60 million years of geological and biological evolution (Meggers 1971:8, Richards 1973:59). It accounts for six out of the eight million square kilometers of moist forest in tropical America (Myers 1979:130). Indeed, Amazonia is the largest continuous area of tropical forest on earth, composing 54% of that biome (Grainger 1980:11). It is also probably the richest biological area on earth (Myers 1979:23, 131). Of the planet's five to ten million species of plants and animals, possibly one million are

Amazonian (Myers 1979:23). Yet, at present, at least one species becomes extinct every day through deforestation and other disturbances by humankind (Myers 1979:5; Myers and Ayensu 1983:72). Nearly 30% of Amazonia's forests have been destroyed, much of it within the last 25 years. In this region, even if the present rate of deforestation does not increase, the forest will be eliminated in about 50 years (Myers 1979:132-133; cf. Hecht 1980).

Archaeologically, South America is one of the least known regions of the world, and this is especially so for Amazonia. The earliest pottery appears by 980 B.C. on the island of Marajo in the mouth of the Amazon River. However, there is no direct evidence of human occupation in Amazonia during the preceramic period (Meggers 1982:485). Lynch (1978:473) interprets the absence of evidence as indicating that Amazonia had not been inhabited by the palaeoindians. In contrast, Meggers (1982:488-489; 1979:124) attributes this absence to a combination of factors such as indigenous reliance on perishable materials for tools because of the rarity of stone resources, the transitory nature of sites, unfavorable conditions for preservation (tropical climate and soils, fluvial geomorphology), unfavorable conditions for fieldwork (e.g., dense cover of vegetation), and the very limited amount of archaeological research in the region. Meggers (1979:124) thinks that it is quite reasonable to suppose that food collectors may have occupied parts of Amazonia long before the introduction of pottery, as was the case in adjacent biomes which paleoindians colonized by 12,000 B.P.¹

Although Homo sapiens is relatively new to Amazonia, and the environment appears to be, at least superficially, rather homogenous,

the region is linguistically and culturally one of the most diverse in the world. Today, ^{more than 325} several hundred indigenous cultures survive in Amazonia with varying degrees of acculturation; many more existed at the time of European contact (Dostal 1972; Ribeiro 1967). Despite the diversity of languages and cultures, there have been several attempts to characterize Amazonia as a single culture area, in contrast to the Andean and Circum-Caribbean areas (Weiss 1980). Common elements are especially evident in the material culture, technology, subsistence and economy of the cultural system, while other aspects of culture are more variable (Steward 1948:885-886; Zerries 1968:378). At least on a general level, the different cultures appear to be variations on a complex set of basic themes. Each culture exhibits some combination of the following traits. The principal source of food, especially carbohydrates, was slash-and-burn cultivation which centered on the raising of root crops, mainly manioc. The chief source of proteins in the riverine zone was fishing, but aquatic game was also hunted. In the interior forest, hunting was more important than fishing. There, the common prey was wild pig, deer, tapir, rodents, monkeys, and birds. Gathering of insects, turtles and other small game as well as plants, especially palm fruits, supplemented the diet. Domesticated plants include manioc, maize, yams, sweet potatoes, beans, peanuts, avocado, papaya, pineapple, peach palms, bottle gourds, cotton, and tobacco. No animals were domesticated. Each village was self-sufficient as the unit of resource ^Cacquisition, processing, distribution, and consumption. In most areas trade was very limited, and usually more important for social and political than economic functions. Craft specialization was absent. Manufactured items were

hammocks, waistbands, loincloths, and baby slings of woven cotton, pottery, basketry, wooden stools (frequently in zoomorphic shapes), drinking and eating containers cut from gourds, ceramic griddles and basketry presses (tipiti) for processing manioc, blowguns, bows and arrows, and dugout canoes. Metallurgy was absent prior to contact. Many drugs were used for various purposes such as barbasco to "poison" sections of streams to harvest fish, curare for the tips of arrows and blowgun darts, tobacco, hallucinogens, and medicinal plants. Beer brewed from manioc in hollow log drums was taken during festivals and rituals which often lasted several days. Most people wore little if any clothing, but meticulously decorated their bodies with paint, feathers, and/or flowers. Village size varied from about 100 to 1,000 persons, and most villages were relocated every few years. The smaller villages were often single, large, circular buildings with a conical roof, and constructed from poles and palm thatch. A single building housed several nuclear or extended families, or lineages. Polygyny was fairly common. Most of these societies were egalitarian and social relations were based on kinship. There were, however, exceptions: some societies showed incipient stratification, and some practiced slavery. Usually, each village was politically autonomous with a prominent personality serving by consensus as headman. Warfare was endemic in many areas. Religion centered on the shaman communicating with animal-like spirits through chanting, smoking tobacco and/or consuming hallucinogens, sometimes being assisted by gourd rattles and other paraphernalia. Rituals focused on major subsistence events such as garden clearing, planting, and harvesting,

and on the life events of birth, puberty, marriage, sickness, and death.²

Estimates of the size of the total pre-Columbian population of Amazonia range from 2,188,970 (Steward and Faron 1959:53) to 5,100,000 - 6,800,000 (Denevan 1976:232-234). Denevan (1976:226) estimates aboriginal population densities in precontact time at 28.0/km² for large floodplains and 0.2/km² for lowland interior forests. Although such statistics may be based on careful research, they entail many speculations, assumptions, and tenuous data and can, thus, only suggest an order of magnitude.³ More certain is that most indigenous societies experienced demographic collapse as a result of contact with European civilization (Ashburn 1947; Crosby 1972), a process which still continues (Bodley 1982). Microbial shock is a major component in this depopulation and the ensuing social disruption (Neel 1982). Thus, although Amazonia is the largest area of tropical rain forest in the world, it has today the lowest population size and density for this biome. Djalma Batista estimated the current total population (including non-indigenous persons) at 4,841,000. He calculated a density of 0.7/km² based on the area of 6,288,000 km² (Tocantins 1974:22-23). On the basis of such statistics, some refer to the Amazon as if it were a demographic vacuum, with the implication that the region is open for the taking, i.e. ripe for colonization and development.

The contemporary circumstances of indigenes in Amazonia may be appreciated from Ribeiro's (1967:96) study of Brazil. In that country, from 1900 to 1957, 80 tribes came into contact with the national society and perished. During the same period, the country's

Indigenous population declined markedly, from about 1,000,000 to 200,000. In other Amazonian countries, the situation is similar to varying degrees (Dostal 1972; Bodley 1982).

After 60 million years of geological and biological evolution, and after three thousand years of cultural evolution, Amazonia's tremendous richness and diversity in biological and human (genetic, cultural, and linguistic) terms, is now being rapidly depleted in the course of a few centuries, often for the quick profit of a few transient individuals and organizations. This background helps one to appreciate the role of cultural values in the tropical ecology of Amazonia. The region provides a tragic example of the conflict between the cultural values of the so-called "primitive" and "civilized" worlds, the human and environmental consequences of that conflict, and the roles of anthropology and ecology (v. Bodley 1976; 1982) in understanding the changes going on.

THE AMAZONIAN ECOSYSTEM

For over a century, the biological ecology of Amazonia has been explored by naturalists, some of the stature of Humboldt, Bates, Wallace, Agassiz, Spruce, and Beebe (Goodman 1972). Yet, even in the last decades of the 20th century, Amazonia remains largely a mystery. Only recently have biologists started to unlock the secrets of the region (Farnworth and Colley 1974:2). However, their studies are usually very technical treatments of narrow topics, and it may be ^e years before any comprehensive synthesis is available.⁵ Nevertheless, a few tentative generalizations can be offered at this stage. Amazonia

shares many features of the structure and function of other regions of tropical rain forest, even though it differs in terms of species composition, in terms of latitudinal and altitudinal characteristics, and other aspects (National Research Council 1982:38-39; UNESCO 1978). In particular, its geology, hydrology, and limnology are distinctive.

For centuries, Amazonia has been viewed as a tropical paradise, an idea which persists to this day, except among specialists. The notion reflects the luxuriant plant growth of the forest. Like other tropical rain forests, Amazonia has provided optimum conditions for plant growth. Insolation (2,900 kcal/cm² annually at canopy level), temperature (+24° C mean monthly), rainfall (+2000 mm annually), and humidity (+60% mean daily relative) are all very high (National Research Council 1982:53-54). The tropical rain forest is usually so moist that Odum (1971:401) referred to it as the only major terrestrial biome where fire is not a significant ecological factor. Because of such an ideal climate, the tropical rain forest may be seen as the norm for vegetation, and anything else as a deviation in response to stresses such as seasonal drought or frost (Walter 1971:72).

The tropical rain forest is one of the most productive biomes on the planet, producing annually at least three times as much organic matter as a rich temperate forest (Lieth 1975:205). Tropical rain forests account for 50% of the biomass of the earth (Longman and Jenik 1974:120), although they cover only 10% of its land surface (National Research Council 1982:39).

High species diversity is another index of the luxuriance of this biome. Typically, there are 100 plant species/ha, but as many as 400

species/ha would be found (Longman and Jenik 1974:68). This high species diversity means that, except under very special edaphic and/or hydric conditions, tropical rain forests do not have dominant species, unlike their temperate counterparts (Billings 1970:96). In any area there are few members of each species (low population density), and the distribution of members is highly dispersed (Richards 1973:60-61).

Yet, there is a paradox: while the climate is ideal for plant growth, it is also ideal for weathering and erosion. Especially active is chemical weathering which leaches nutrients from the soil to great depths. High temperature and rainfall are also optimum for the destruction of humus. The great geological antiquity of Amazonia has allowed ample time for these processes to operate to their full extent. The geological stability of this region has not produced fresh parent material for soil enrichment, and the vast majority of soils derive from parent material of Tertiary age (Meggers 1971:8-15). These conditions have led to "deminalization," the impoverishment of the very ancient soils of long quiescent land masses, where climate and time have allowed extensive leaching of minerals (Schwabe 1968:121, 127). By comparison, floodplain soils are relatively fertile, since they are derived from Quaternary parent material and annually rejuvenated by inundation. However, floodplains represent at most only 10% of Amazonia (Sponsel 1981:128).

In Amazonia then, most soils are poor in nutrients.⁶ The forest grows in spite of the soils which serve for little more than physical support. The forest has evolved numerous mechanisms to maintain itself under such conditions, acting as a giant sponge to maximize nutrient capture and minimize nutrient loss (Barrera, *et al.* 1978;

Jordan 1982). The forest is a tight, closed system of nutrient cycling, deriving nutrients mostly from litter and rainfall. The ground water reflects this cycling in that, unlike the rain water, it is nearly as pure chemically as distilled water (Sioli 1975:475). Such considerations led Meggers (1971;1973:7) to label Amazonia a "counterfeit paradise."

Red soils (oxisols and ultisols) are the most common type in Amazonia, where they cover proportionally more area than they do in Africa and Asia (National Research Council 1982:49). "Their main limitations are chemical: high soil acidity; aluminum toxicity; deficiency of phosphorus, potassium, calcium, magnesium, sulfur, zinc, and other micronutrients; and low effective cation-exchange capacity, which last indicates a high leaching potential" (National Research Council 1982:44).

The counterfeit nature of Amazonia is reflected in the impoverishment of the fauna as well.⁷ Several factors are involved. As with plants, the diversity of animal species is very high in Amazonia, compared to rich temperate forests. Thus, there are few members of each species in any given area, and the distribution of members is dispersed. Yet, when species diversity is compared within the same biome for different regions, Amazonia is lower for at least some taxa than similar regions of the Old World. For example, there are nine species of ungulates in Amazonia while there are 27 species in African forests (Bourliere 1973:281). Moreover, the species in Amazonia are smaller in body size than their African counterparts (Hershkovitz 1972:372). These differences may be related to the very

low nutrient value of litter in Amazonia compared to other tropical rain forests (Fittkau and Klinge 1973:2).

Species composition is a closely related factor. The ratio of animal to plant biomass is very low in Amazonia. A study in one area found that animals compose only 0.02% of the total biomass (Fittkau and Klinge 1973:8). This figure is even more striking since 78.6% of the animal biomass consists of soil fauna, mostly invertebrates. This situation probably reflects the limited availability of edible plant material. Most of the plant biomass is wood, which herbivores cannot consume. Leaves account for only 2% of the living plant biomass, most of it accessible only to arboreal herbivores like primates, sloths, and some birds. About half of the animal biomass feeds from the litter on the forest floor (Fittkau and Klinge 1973:9, 11-12). Another complication is presented by the numerous antipredator defense mechanisms that plants have evolved, such as the presence of toxic substances in leaves (Janzen 1974:277-278; 1975:35-44).

Even if animals were fairly abundant, they would not necessarily be readily available for exploitation by indigenous hunters. A survey of the common prey species for indigenous hunters reveals that the majority are arboreal (43.9%), solitary (53.6%), small in body size (less than five kg) (39.4%), nocturnal (73.2%), and well camouflaged. Most have a low frequency and small litter sizes (Sponsel 1981:156-197).

The peak of the wet season is a period of food scarcity for many indigenous communities. Wet season inundation of extensive areas of the floodplain far into the forest results in widespread dispersion of fish and game, rendering them less available for indigenous

exploitation. This flooding is a product of the almost negligible gradient of the Amazon River (only 2m above sea level 1,000 km from its mouth), combined with annual fluctuations of 5 - 20 m in its water level (Sioli 1975:467, 471-472). Agassiz (1896:256) aptly described the scene: "Its watery labyrinth is rather a fresh-water ocean, cut up and divided by land, than a network of rivers."

In some regions, especially the Rio Negro of the northwest Amazon, so-called "black water" predominates. These waters are very low in productivity because of such factors as high acidity and dark, tea-like color, the latter limiting light penetration for photosynthesis. Floating vegetation mats ("floating meadows") are absent, in contrast to other water types ("white" and "clear waters"). Even aquatic insects are negligible (Sioli 1975:473-475; Janzen 1974). As a consequence, the productivity and diversity of fish species are both very low (Goulding 1980:16). Likewise, the flora and fauna of the adjacent terrain are impoverished in these oligotrophic ecosystems. Black water areas are notoriously ~~for human population~~ and are, therefore, known as "hunger" or "starvation rivers."

In conclusion, in spite of the luxuriance of the Amazonian forest, as determined by such measures as high productivity and high species diversity, the soils and fauna are impoverished. Wet season flooding and, in some areas, black waters, also contribute to the counterfeit nature of this apparent paradise.

Recently, Jordan and Herrera (1981) among others have challenged such stereotypes, as for example Meggers' view of Amazonia as a counterfeit paradise. These authors argue that there is a continuum from eutrophic to oligotrophic ecosystems in the humid tropics.

Nevertheless, regardless which side one follows, the foregoing discussion indicates clearly that Amazonia presents serious challenges to human adaptation.

CULTURAL ECOLOGY

While occasional discussions of the cultural ecology of Amazonia can be found in the writings of the early naturalists, not until the 1950s does the subject really begin to take shape. Sauer (1958) delimited many of the major perennial issues in the study of the cultural ecology of the neotropics. First, he pointed to soils and the riverine habitat as limiting factors in Amazonia. Second, he was concerned with human impact on the environment: the aboriginal alteration of plants, animals, and habitats, especially through fire and shifting cultivation. A third, but closely related issue, was whether savannas are of natural and/or human origin. Finally, he noted the resemblance between the subsistence economy and ecology of indigenous cultures in the rain forests of the neotropical and oriental biogeographic regions.

Following Sauer's lead, the issues of limiting factors and carrying capacity, have become the dominant focus for anthropological studies of the ecology of indigenous cultures in Amazonia. This topic will be reviewed shortly. Only a few studies have directly addressed indigenous environmental impact. Savanna formation is discussed by Scott (1977) and Snole (1976). The relationship between game depletion and the introduction of Western hunting weapons is considered by Hanes (1979) and Saffirio and Scaglione (1982). I know

of no study which has concentrated on the fourth issue, a comparison of the cultural ecology of indigenous societies of Amazonian and Asian rain forest ecosystems. Such research would likely produce stimulating insights into convergent adaptations.

During the 1950s, and the immediately preceding decades, Steward was pioneering in the development of cultural ecology (Steward 1955; Steward and Murphy 1977) and in a synthesis of existing knowledge about South American Indians (Steward 1946-1959; Steward and Faron 1959). Steward was the major stimulus in the study of cultural ecology in Amazonia and elsewhere. He was largely responsible for the use of cultural ecology as a means to the end of cultural evolutionism (Anderson 1973; Hanc 1981). Thus the theoretical framework for the study of the cultural ecology of Amazonia was constructed around (1) the ecological concepts of carrying capacity and limiting factors, and (2) the anthropological concepts of cultural complexity and cultural evolution.⁹ The logic of the cultural evolutionists assumes, but does not demonstrate, a causal link between carrying capacity and cultural complexity.¹⁰ That is, carrying capacity is taken to restrict the level of cultural development by limiting the size, distribution, and permanence of the indigenous population.

Since the 1950s, Meggers (1954; 1957; 1971; 1979) has been one of the most outstanding proponents of this evolutionary view for Amazonia. For example, Meggers (1954:814) writes:

"... the level to which a culture can develop is dependent upon the agricultural potentiality of the environment it occupies. As this potentiality is improved, culture will advance. If it can not be improved, the culture will become established at a level compatible with the food resources."

Hegggers (1954:809) did not restrict her argument to the aboriginal situation, but applied it to criticize contemporary economic development:

"Even modern efforts to implant civilization in the South American tropical forests have met with defeat, or survive only with constant assistance from the outside."

At question here is the very nature of the Amazonian ecosystem, the human niche in it, and its influence in determining the evolutionary level of complexity which indigenous societies could achieve. Lessons are also drawn from this for modern economic development.

Carneiro (1956:230-232) pioneered a quantitative approach to test empirically cultural ecological hypotheses through fieldwork in Amazonia. Using a formula to calculate carrying capacity (in reference only to agriculture), he refuted Hegggers' hypothesis that soils are the limiting factor in Amazonia. Carneiro (1961:77) also anticipated the "protein hypothesis":

"Among tribes for whom hunting still constitutes an important part of subsistence, the depletion of game animals in the vicinity of the village may dictate moving long before other conditions would warrant it."¹¹

From the mid-1970s to the present, the major focus of research on cultural ecology in Amazonia has been on protein capture. The turning point was a comprehensive analytical review of the ethnographic and ecological literature pertinent to the subject by Gross (1975). Gross explicitly articulated the hypothesis that animal protein is the chief limiting factor concerning the size, distribution, and permanence of indigenous populations in Amazonia. He argued that the staple plant foods, especially manioc, are very low in quality protein; indigenous

societies lacked domesticated animals as an alternative source of protein; and hunting is difficult elsewhere, but especially in the interior of the forest. While this hypothesis met considerable criticisms, it has yet to be invalidated on theoretical or empirical grounds. It seems quite plausible that animal protein is at ² least one major limiting factor challenging human adaptation in many ecosystems of Amazonia (Sponsel 1981: 304-321)¹²

This hypothesis about animal protein as a limiting factor has become the foundation for a number of secondary hypotheses which attempt to offer cultural materialist explanations for such Amazonian institutions as warfare (Harris 1974; 1977; 1979a; 1979b; 1979c; J. Ross 1980), faunal taboos (McDonald 1977; E. Ross 1978; 1979; 1980; E. Ross and J. Ross 1980), and intravillage sexual politics (Siskind 1973). Of these secondary hypotheses, the one that has received the most attention, both in theoretical debate and field research, is the explanation of the origins and functions of Yanomama aggression.¹³

The Yanomama are celebrities, thanks to Chagnon (1968; 1977; 1983) who has promoted their image as "the fierce people" in numerous academic and popular writings as well as other media. Most of the other anthropologists who have worked with the Yanomama believe that Chagnon greatly exaggerates the violent aspects of their culture and daily life. However, some armchair writers carried the exaggerations even further. For example, Harris (1974:87-88) characterizes the Yanomama as follows:

"By the time a typical Yanomamo male reaches maturity, he is covered with the wounds and scars of innumerable quarrels, duels, and military raids. Although they hold women in great contempt, Yanomamo men are always brawling over real or imagined acts of adultery and broken promises to provide

wives. Yanomamo women are also covered with scars and bruises, mostly the result of violent encounters with seducers, rapists, and husbands. No Yanomamo woman escapes the brutal tutelage of the typical hot-tempered, drug-taking Yanomamo warrior-husband. All Yanomamo men physically abuse their wives. Kind husbands merely bruise and mutilate them; the fierce ones wound and kill."¹⁴

Although Chagnon has in recent years embraced sociobiology (e.g., Chagnon and Irons 1979), his early explanations of Yanomamo aggression were essentially mentalistic in orientation. Chagnon (1968a:1) begins with the emic explanation of the Yanomamo:

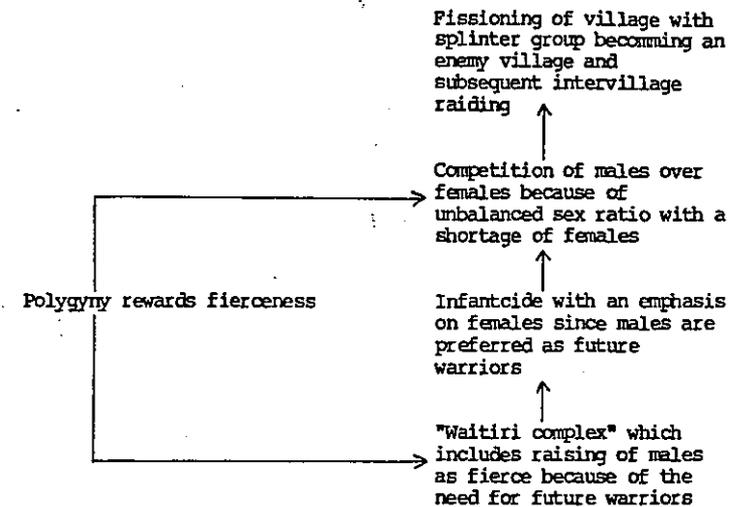
"It is in the nature of man to fight, according to one of their myths, because the blood of "Hoon" spilled on this layer of the cosmos, causing men to become fierce."

This myth, then, is proposed to contain the charter of Yanomamo society, including their ideology of fierceness. Chagnon (1968b:112) summarizes his explanation:

"The hypothesis I put forward here is that a militant ideology and the warfare it entails function to preserve the sovereignty of independent villages in a milieu of chronic warfare. The origin of such a political milieu seems to be the result of the failure of Yanomamo political institutions to govern effectively the conflicts arising within villages, conflicts that give rise to internal fighting and village fission with the ultimate establishment of mutually hostile, independent villages."¹⁵

This explanation follows the position of the ancient Epicureans who believed that the primitive state of humankind was one of violence, and that sociopolitical relations were born of the necessity of alliance for mutual defense and cooperation (Barnes 1923:38). Chagnon's explanation is also culturological in many respects. It contrasts sharply with the cultural ecology of Steward (1955:36) which "... introduces the local environment as the extracultural factor" to counter "the fruitless assumption that culture comes from culture."

Figure 1. Chagnon's Model of Yanomamo Aggression (after Sponcel 1981:323)

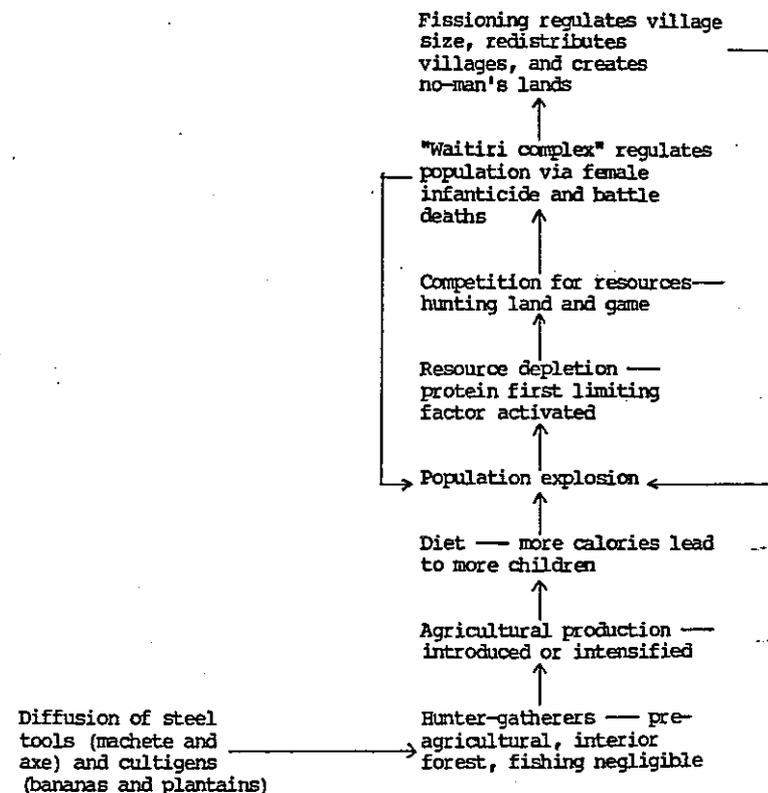


Here is exactly where Harris (1974; 1975; 1977; 1979a; 1979b; 1979c) applies his cultural materialism. He offers an ingenious theoretical explanation of the functional relationship between Yanomama aggression, population, production, and resources. Harris (1977:49) summarizes his thesis:

"I believe that it is possible to show that the Yanomama have recently adopted new technology or intensified a preexisting technology; that this has brought about a veritable population explosion, which in turn has caused environmental depletion; and that depletion has led to an increase in infanticide and warfare as part of a systemic attempt to disperse settlements and to prevent them from growing too big."¹⁵

Unfortunately, Harris' cultural materialism, and the animal protein hypothesis together with the secondary hypothesis it has engendered, are often equated with cultural ecology, as if they were isomorphic (e.g., Chagnon and Hames 1979; 1980). This confusion hardly helps matters. Certainly there is overlap between these arenas. However, not all cultural ecologists are materialists, and the converse holds as well. Not all cultural ecologists accept the materialist tenet of the primacy of the technological and economic components of the cultural system. Most cultural ecologists are simply intellectually attracted to exploring the legitimate question of how culture articulates human populations with their ecosystems (Sponsel 1982; 1983b).¹⁷ Moreover, there is often very little ecology in the materialist approach. Finally, cultural materialists, in contrast to cultural ecologists, tend to offer armchair explanations instead of explanations based on empirical fieldwork.

Figure 2. Harris' Model of Yanomama Aggression
(after Sponsel 1981:328)



^{the}
 In case of anthropologists subscribing to the animal protein hypothesis and the secondary hypotheses, some work within the framework of cultural ecology, others within cultural materialism, and still others in the conceptual area where these frameworks overlap. While carrying capacity and limiting factors are pivotal concepts in ecology, it should be clear from this review of the highlights of cultural ecology in Amazonia since 1950 that protein is only the latest candidate for the role of limiting factor, and it is not likely the last. Indeed, a combination of limiting factors may be involved, actually or potentially, depending on the level of the population, and on different local ecosystems. This is quite different from the usual claim of a single factor for the entire region of Amazonia (cf. Vickers 1979; J. Ross 1980:38). In any case, limitations of the intrinsic rate of population increase have been recognized since Malthus, and this notion has been an important principle in ecology from the beginning. The fact that a continuous exponential rate of population growth is not observed in Amazonian societies indicates the operation of intrinsic and/or extrinsic limiting factors, the demographic disruptions of European contact notwithstanding.

Although the controversies over the protein hypothesis and the secondary hypotheses connected with it have often generated more heat than light, one thing has been illuminated, namely the biological and cultural ecology of indigenous hunting and fishing, an aspect which previously had been grossly neglected. A number of researchers on both sides of these controversies have contributed quantified empirical field data on distribution, capture, and consumption of protein, and to a lesser extent on other aspects of the behavior and

ecology of indigenous predation in Amazonia. Certainly, the protein hypotheses and the secondary hypotheses have stimulated substantial progress in our understanding of the cultural ecology of Amazonia. These hypotheses have proven to be of great heuristic utility, regardless of their validity.¹⁸

The debate between Chagnon and Harris, and their respective supporters, exposes a deep and fundamental rift in anthropology between the materialist and mentalist positions. Unfortunately, the extremists on both sides tend to deny each other's position *a priori*, rather than actually grappling with *Homo sapiens* as an integrated organic, cultural, and intellectual being, something which cultural ecology may well achieve by elucidating the relationship between particular cultures and their local ecosystems. While cultural ecology may not be able to reconcile the extremes of materialism and mentalism, it may well render such extremes obsolete. In this respect, Reichel-Dolmatoff's work is most provocative (see pp. 28-29).

VALUES

Most appropriate here is a broad definition of values taken from Pepper (1958:7):

"Values refer to interests, pleasures, likes, preferences, duties, moral obligations, desires, wants, needs, aversions and attractions, and many other modalities of selective orientation."

This definition allows a consideration of the role of values in Amazonian cultural ecology in at least three contexts: indigenous adaptation, anthropological research, and economic development.

One example of the role of values in indigenous adaptation has already been discussed with reference to the Yanomama. Chagnon (1968a:3) writes: "The fact that the Yanomama^{mp} live in a state of chronic warfare is reflected in their mythology, values, settlement pattern, political behavior, and marriage practices.: Clearly, the "waitiri complex," at least as described by Chagnon (1968b:124-139), involves values; the fierceness of males is preferred by the community for its defense and survival. Thus, according to Chagnon (1968a:1), the Yanomama are "the fierce people." He continues: "That is how they conceive themselves to be, and that is how they would like others to think of them."

Faunal prohibitions are a second example of values in the cultural ecology of Amazonia. These taboos dictate which animal species can not be killed and/or eaten by members of a society. General taboos apply to all members of the society, whereas specific taboos apply only to particular individuals therein, depending on their age, sex, social, ^{and} physiological condition (Basso 1973:16). Obviously, such practices involve cultural values as a determinant force orienting behavior. As Eric Ross (1978:2) observed, taboos, like other aspects of myth, ritual, and symbol, have traditionally been the province of the cultural ^{mentalists} materialists. They have seen these phenomena as fortuitous products of human creativity, albeit culturally ^a rationalized (e.g., Kensinger and Kracke 1981). However, since the mid-1960s, various anthropologists working within the framework of cultural ecology ^{and/or} cultural materialism have challenged this mentalistic interpretation. They argue that these phenomena are cultural adaptations within the context of technology, economy,

demography, and natural ecology (Harris 1974; 1977; 1979a; E. Ross 1980). For example, Eric Ross (1978) argues that prey species are not of equal significance for the human predator, since they have ^different behavioral and ecological attributes. Through selective predation, an indigenous society takes these differences into account. Taboos direct predation away from the less accessible and more vulnerable species, and toward those which provide a better cost/benefit ratio combined with a sustained yield in the long-term. In essence, Faunal taboos are part of an indigenous strategy for wildlife management and conservation.¹⁹

Reichel-Dolmatoff (1971) provides the most direct and explicit study relating values to indigenous cultural ecology in Amazonia. He summarizes ² Desana ethnoecology as follows:

"According to the Desana, the goal of life and of all human activities and attitudes is the biological and cultural continuity of their society. This goal can only be achieved by a system of strict reciprocity in all relationships that man establishes in the biosphere, be they in the framework of his own society or with the animals. The paradigmatic model is that of the two sexes, and in their interrelationship sexuality is compared to nutrition: the man fertilizes the woman who, in turn, produces the child, a cyclical phenomenon that implies a smaller and accelerated cycle of nutrition. Man ^{is} the producer of one category of foodstuffs, the proteins, while woman produces complementary foodstuffs, the carbohydrates. Its daily culinary transformation produces new energy in which man participates, thus guaranteeing the continuity of the wider precreative cycle. This reciprocity is based, in part, on the division of labor according to which man are mainly occupied in the masculine sphere of the forest while the women are in the fields. On the social plane this involves exogamic marriage among men identified as hunters and women identified as horticulturalists." (Reichel-Dolmatoff 1971:243).

He concludes (p. 252) by noting that "...the world ^u label 'primitive' contains values we can ill-afford to deprecate."²⁰

While ~~the~~ Reichel-Dolmatoff devotes more attention to ethnecology than to cultural ecology, and very little attention to biological ecology, thus falling short of a true synthesis of these arenas, he does suggest one very significant point. Values are a very important key to understanding the processes whereby *Homo sapiens* adapts simultaneously as an organic, cultural, and intellectual being. Indeed, values may provide the crucial link between ideas and actions of individuals and systemic processes which has been missing in the field research in cultural ecology and in cultural materialism.²¹ Thus Reichel-Dolmatoff's approach is a refreshing contrast to the usual mentalist and materialist studies.

While the role of values in indigenous adaptation has been neglected, except in the few studies just reviewed, the values held by anthropologists and their roles in the conduct of anthropocultural research as well as the values held by Western societies engaged in the penetration of Amazonia are even more neglected topics. One of the earliest discussions of how values enter anthropology is by Honigmann (1959:113-117). He asserts that the anthropologist cannot help "valuing" as he/she works; that the ethics of the anthropologist are values; that anthropologists evaluate cultures; that cultural relativity itself may be viewed as a value judgment; and that some anthropologists are moralists. Hatch (1983:92-93) comments on the Yanomama case:

"The moral principle of tolerance that is proposed by Boasian relativism carries the obligation that one cannot be indifferent toward other ways of life — it obligates us to approve what others do. So if missionaries or government officials were to interfere in Yanomamö affairs for the purpose of reducing violence, the relativist would be obligated to oppose these moves in word if not action... The functionalists are led

to a similar conclusion: Harris contends that Yanomamö warfare and infanticide are ecologically adaptive in that they keep the population within the carrying capacity of the land. Approval is warranted on practical grounds, even though the practical value of the institutions is asserted but not proved."²²

Fieldwork is associated with values by anthropologists in numerous, often subtle, ways. The research design is evaluated by academic and granting committees. The first field trip is valued as a rite of passage marking the transition from novice to professional ethnographer. According to Fisher (1969:13), the selection of the region and group, and the final report are evaluated by several criteria:

- (1) distance from the U.S. (both geographical and cultural),
- (2) the degree of cultural shock value of the culture studied from the point of view of Westerners,
- (3) the primitiveness of the culture studied,
- (4) the value of the culture in terms of theoretical problems of interest to anthropologists,
- (5) the number of anthropologists who have done fieldwork in the culture or in adjacent regions (the fewer the fieldworkers the higher the status of the experience),
- (6) the physical difficulties involved in doing fieldwork in the culture,
- (7) the time spent in the field, and
- (8) the comparative excellence of the fieldwork, which may be disguised to an extent by excellence and speed in reporting if no other experts are available to dispute the report."

Amazonian indigenous cultures like the Yanomama fit many of these criteria perfectly. Indeed, this is one of the reasons why the

Yanomama are such celebrities in anthropology. Take culture shock, for example. In the Foreword to Chagnon's (1977:vii) ethnography, Spindler writes:

"Yanomama culture, in its major focus, reverses the meanings of "good" and "desirable" as phrased in the ideal postulates of the Judaic-Christian tradition. A high capacity for rage, a quick flash point, and a willingness to use violence to obtain one's ends are considered desirable traits. Much of the behavior of the Yanomama can be described as brutal, cruel, treacherous, in the value-laden terms of our vocabulary."²³

During much of its ^history, anthropology has been identified closely with cultural evolutionism, an interest in primitive cultures, and salvage ethnography (Barrow and Hicks 1967, Diamond 1974). Gruber (1970:1293) describes salvage ethnography:

"Throughout the century and with whatever theoretical framework, the refrain was the same: the savage is disappearing; preserve what you can; posterity will hold you accountable."

The value that anthropologists place on the traditional in "primitive" culture and on salvage ethnography is reflected in studies of the Yanomama. The first edition of Chagnon's ethnography viewed the Yanomama as significant because, as one of the largest unacculturated tribes remaining in all of South America, they were characterized by cultural purity and active warfare (Chagnon 1963:1). It was only in the second edition of the ethnography that Chagnon (1977:138-164) addressed the question of "the beginning of Western acculturation." Yet the closing sentence of the book refers to the Yanomama as "our contemporary ancestors."²⁴ Other researchers working among the Yanomama have been similarly motivated.

The above discussion dwelled on the orientation of cultural evolutionism, the anthropological focus on primitiveness, and salvage ethnography for one simple reason: it has shaped the anthropological

record of Amazonia. These orientations and their associated values in anthropology resulted in selectively ^{ity} in the descriptive ethnography of the Yanomama. The accounts actually ignore some of the most critical facets of Yanomama culture, ecology, and daily life, distorting the record accordingly.

There is a curious paradox, when one considers the subjects of Yanomama warfare and the problem of limiting ecological factors. While in the halls of academic anthropologists like Chagnon and Harris are battling over the explanation of chronic internal warfare among the Yanomama, the very existence of this society is threatened by another war, the continuing global struggle between the so-called "primitive" and "civilized" worlds.²⁵ The Yanomama have apparently adapted fairly successfully to their tropical rain forest ecosystem for over two millennia (Spielman, et al. 1974), but their culture may not be able to cope with a new environmental hazard, Western civilization. Although warfare accounts for 24% of adult male deaths, malaria and other epidemic diseases result in 54% of all adult deaths (Chagnon 1977:20). Davis (1977a:19) suggests that instead of the causes of internal warfare among the Yanomama, other topics are of greater immediate relevance, given the threat of extinction which they face. For example, he lists the cultural, political, and psychological effects of the encroachment of outsiders such as missionaries into Yanomama territory; the repercussions on Yanomama culture and ecology of introduced Western technology (steel axes, machetes, shotguns, etc.); and disease and epidemics spread through contact.²⁶ As Gross (1982:7) notes, indigenous cultures are adaptations to recent conditions and will continue to adapt as conditions change. (Of

course, this does not apply when a society is faced with genocide or ethnocide). From this perspective, some traditional orientations in anthropology might well be revised. Thus, Scheffold (1982:13) writes:

"All cultures are continuously changing; the practical task of Urgent Anthropology [the modern descendant of salvage ethnography] must be to work against violent, forced upheavals and for conditions which allow an active and conscious development within the framework of one's own cultural identity."²⁷

Here is the relevance of an analysis of values in anthropological research for understanding the cultural ecology of Amazonia. Values which are largely implicit and unexamined bias the design of research; they influence the collection, interpretation, and reporting of data; and, accordingly, they affect our understanding of cultures and their ecology. Traditional research on cultural adaptation is largely irrelevant to the present and future survival, adaptation, and welfare of the people studied!

A third context in which values enter the cultural ecology of Amazonia is economic development. For centuries, the world view of Western civilization has been put to action in the exploitation of Amazonia.²⁸ However, only in recent decades has this process become sufficiently extensive and intensive that the whole of Amazonia including indigenes and their ecosystem, is endangered. More than in any other country, this applies to Brazil. There, in the 1960s the government initiated programs which amount to a technological and economic war to conquer the Amazon. Instead of the spontaneous colonization and exploitation which persisted on a relatively small scale for centuries, the government launched systematic efforts on a massive scale. There are several fronts to this campaign: extraction of resources such as minerals and timber continues, but at a greatly

accelerated rate; agricultural development includes colonization schemes along new highways to resettle peasants from the poverty and drought-stricken northeast, as well as enormous agribusiness developments including ranching; highway construction criss-crosses Amazonia to make the region accessible and integrate it; and, recently, the construction of vast hydroelectric dams has been initiated. Thus, the so-called "civilized" and "primitive" worlds confront one another in Amazonia. The process involves not only markedly different cultures, technologies, and economies, but, more fundamentally, divergent if not antithetical values regarding human relations within society and with the environment.²⁹

Some typical statements from Brazil illustrate the above points. In 1975, General Fernando Ramos Pereira, then governor of Roraima, the northeastern province which includes Yanomama territory, stated to the press:

"I am of the opinion that an area as rich as this — with gold, diamonds, and uranium — cannot afford the luxury of conserving a half dozen Indian tribes who are holding back the development of Brazil." (Quoted in Davis 1977b:103).

More recently, General Democrito de Oliveira who is in charge of the Brazilian agency for indigenous affairs, stated that a large reserve for the Yanomama would take up too much valuable land, and that anyway, they are "physically and possibly intellectually decadent" as a result of "incestuous" practices. He thus implied that the Yanomama would not be worth saving (Maurer 1979:33). Finally, Nugent (1978:102) notes:

"For many, especially in the south of Brazil, the Amazon is a reminder of what is culturally devalued in modern Brazil: the backwoods pestigo, industrial stagnation, Indians, and the

apparent domination of nature over man. Unfortunately, for some Brazilians, success in destroying the Amazon is a straightforward measure of progress."

What is progress and development? In contrast to the usual positive view, Appell (1975:31) offers a critical definition

"Every act of development involves, of necessity, an act of destruction. This destruction — social, ecological, or both — is seldom accounted for in development projects, despite the fact that it may entail costs that far outweigh the benefits arising from the development."

Appell (1975:33) goes on to observe:

"A development act is any act by an individual who is not a member of a local society that devalues or displaces the perception by the members of that society of their relationship with their natural and social world."

Development is closely related to what John Bennett (1976:13) calls the ecological transition from equilibrium to disequilibrium societies. Most traditional indigenous cultures in Amazonia were equilibrium societies and many remain so, depending on the extent of their acculturation. These two types of societies are contrasted in Table 1. While this dichotomy is rather simple and has the limitations of any generalization, it also has considerable heuristic utility.³⁰

The key to the maintenance of an equilibrium society is most aptly stated by Kozlovsky (1974:106):

"Live as simply and as naturally and as close to the earth as possible, inhibiting only two aspects of your unlimited self: your capacity to reproduce and your desire for material things."

Although Kozlovsky is an ecologist, he arrives at a conclusion which many anthropologists draw from cultural ecology. His statement is a description of the traditional indigenous culture that still survive in some areas of the planet including Amazonia. Indigenous societies

Table 1. The Ecological Transition
(Modified considerably after Bennett 1976:13).

<u>Component</u>	<u>Equilibrium</u>	<u>Disequilibrium</u>
population	small, controlled	large, expanding, weakly controlled
needs and wants	minimized, limited mostly to satisfaction of physiological requirements	maximized to include culturally defined and promoted needs and wants which are expanding
resource network	self-sufficient exploitation of local environment	dependent on importation from distant environments through an extensive exchange system
technological capacity	limited, based largely on human energy	highly developed, industrial, based on multiple sources of energy including fossil fuels
environmental contact on a daily basis	large percentage of the individuals in society	small percentage
environmental impact	relatively negligible for the most part	high including resource depletion, species extinction, environmental transformation, degradation, pollution

in Amazonia have had millenia to experiment with the development of cultures that are ecologically viable in their ecosystem. The experience and success of Western civilization in the Amazonian ecosystem are both extremely limited so far. Thus, although a nation's right to develop, and many of its explicit goals of development, may not be questionable, it is less clear whether Western civilization has the technological and scientific expertise as well as the values required to develop Amazonia without destroying it.

An increasing number of writers from various fields are embracing this perspective. Journalist LaBastille (1979:101) writes:

"The bottom line is that no matter what development takes place, it should be done by keeping the Amazon in its natural state. This may mean abandoning super-technological types of ranching and farming and sticking with the age-old native systems. This will seem to some like cultural back-stepping. Yet the ultimate goal is not to make millions on quick tradeoffs like pepper, but to achieve environmental health and the self-sustainment of human life in Amazonia."

Ecologists Goodland and Irwin (1975:65) note:

"Amerindians are the only societies with the necessary knowledge, expertise and tradition to prosper in the Amazon jungle. Amerindians not only profoundly appreciate what exists, but also understand ecological interrelations of the various components of the Amazonian ecosystem better than do modern ecologists. Indians perceive specific relationships which biologists are only now discovering to be accurate. and since the Amazon jungle is the most complex, richest and the least understood ecosystem in the world, the Amerindians' knowledge of it is of inestimable value."

Finally, given the almost antithetical nature of equilibrium and disequilibrium societies, and the ecological rationality of the former, it must be asked what leads indigenes to accept elements from Western civilization so readily? Allen Johnson (1978:) offers part of the answer:

"It is characteristic of a developed culture's contact with small, isolated societies that the developed culture is not met

as a whole, but rather in highly selective ways that emphasize manufactured goods and the aura of the great, mysterious power that made them."

The advantages of a steel axe over one made of stone, a shotgun over a bow and arrow, or a boat motor over a canoe paddle, are clear in most circumstances. What isn't so clear is all that is attached to them. They require ^equipment and supplies for operation such as gasoline, oil, spark plugs, etc. To obtain these things the indigene sacrifices autonomy and works to accumulate trade items or cash. In this way, the ecological transition may be entered. Individuals react to civilization rapidly and flexibly in favor of short-term benefits for themselves, their family or community. In contrast, the indigenous cultural system as a ^uhole, which has evolved over centuries or even millenia, is much slower and less flexible in response. The system may actually become ~~maladaptive~~ as it is faced with such changes.³¹

In conclusion, cultural ecology has at least two ~~contributions~~ ^{ions to make} toward the improvement of the situation in Amazonia. It can document the ethoecology and cultural ecology of indigenous societies not only for the scientific record, but also (1) to demonstrate from a relativistic perspective the adaptive nature of these cultures and their knowledge in the ecosystem, and (2) to evaluate and criticize Western civilization and its monolithic model of economic development which assumes universal applicability regardless of cultural and ecological variations.

SUMMARY AND CONCLUSIONS

By any geographical, biological, or anthropological measure, Amazonia is a significant region of the world. Although it shares many of the features of the structure and function of other tropical rain forests of the world, its geology, hydrology, and limnology are distinctive in many ways. Amazonia may be considered a counterfeit paradise. While the forest is high in productivity and species diversity, most of the soils are impoverished. Prey species are not readily available for the indigenous hunter, and seasonal flooding, and black water in some areas, further complicate the situation.

The study of the cultural ecology of Amazonia developed around the concepts of carrying capacity, limiting factors, cultural complexity, and cultural evolutionism. Since the mid-1970's the hypothesis that animal protein limits the size, distribution, and permanence of indigenous populations, has dominated much of the research on cultural ecology in Amazonia. This in turn provided the foundation for various hypotheses to explain phenomena such as warfare, faunal taboos, and intravillage sexual politics. Regardless of their validity, these hypotheses generated advances in theory, method, and data, especially for the previously neglected subject of indigenous hunting and fishing.

Explanations of Yanomama warfare reveal the fundamental split between cultural materialism and mentalism in anthropology. Cultural ecology is not isomorphic with either position. In contrast to these positions, cultural ecology has the potential to develop a holistic

framework that recognizes that *Homo sapiens* adapts simultaneously as an organic, cultural, and intellectual being.

Values may be considered in the cultural ecology of Amazonia in at least three contexts: indigenous adaptation, anthropological research, and economic development. The "waitiri complex", which may contribute to the regulation of the Yanomama population, faunal taboos which may be an indigenous strategy for game management, and the Desana world view which may promote their biological and cultural continuity through reciprocity in social and ecological relationships, provide three illustrations of the role of cultural values in indigenous adaptations. Values might be the crucial link between indigenous ideas and actions and systemic processes which has been missing in cultural materialism, mentalism, and cultural ecology.

The values of anthropology include adherence to cultural evolutionism, this notion of the primitive, and salvage ethnography. These have shaped research and the ethnographic record, sometimes actually distorting cultural and ecological reality through biasing the researcher against considering changes resulting from contact, colonization, and development. Contemporary change deserves much more attention by cultural ecologists, since adaptation is an ongoing process, and since change threatens the survival and welfare of indigenes. Cultural ecology may help indigenes by asserting the value of their culture and knowledge through demonstrating their adaptive functions in the ecosystems of Amazonia. Cultural ecology may also contribute by applying concepts such as the ecological transition to critically evaluate Western approaches to economic development in Amazonia.

ACKNOWLEDGEMENTS

I am most grateful to the organizers of this symposium (Terry Rambo, Karl Hutterer, Neil Jamieson, and George Lovelace) for the invitation to participate, and to them and other participants for stimulating discussions. This paper is a synthesis of ideas and information developed through interaction with faculty and students at Cornell University, University of Massachusetts (Amherst), Instituto Venezolano de Investigaciones Cientificas (IVIC), and University of Hawaii. I am particularly indebted to Thomas Gregor (Vanderbilt University) and Nelly Arvelo-Jiménez (IVIC) for their encouragement over the years, and to the Yanomama and other indigenes with whom I had the pleasure to work in Amazonia. Of course only I am responsible for any deficiencies in this paper.

NOTES

1. While earlier evidence is very limited, a few sites beyond Amazonia are dated at $\pm 20,000$ B.P. (Meggers 1982:485).
2. While this description provides some insight into the character of Amazonian culture, it is offered with caution in recognition of the problems and limitations of such generalizations and trait lists. It is synthesized from Lathrap (1970:45-67), Steward and Faron (1959:8-9), Willey (1971:398-399), and Zerries (1969:376-382).
3. Newman (1976) is among those who suggest that actual population size was about ten times higher than usually estimated, because European diseases often reached and decimated indigenous communities years in advance of direct contact, when census records might be made.
4. Heel (1982) argues that epidemiological and psychosocial factors are more important than genetic ones in accounting for the great susceptibility of Amerindians to diseases introduced from the Old World.
5. National Research Council (1980) discusses research priorities for tropical biology.
6. Moran (1981:219-221; 1982:7) argues that large-scale mapping has obscured variation, screened areas of richer soils, and resulted in a gross underestimation of soil fertility in Amazonia.
7. Since Buffon, the fauna of the New World in general, but especially its tropics, have been viewed as impoverished (Gerbi 1971).
8. The literature on the cultural ecology of Amazonia is immense with over 1,000 citations. This discussion will be restricted to

selected highlights for each decade since 1950, with an emphasis on limiting factors, especially the availability of animal protein and allied matters. Criticisms of studies will be referred to only by citations in footnotes. Other important aspects not reviewed here include agroecosystems (Moran 1982; Norgaard 1981), *caboclos*, colonists, and development (Moran 1981; Nugent 1981; Smith 1982). A volume edited by Hames and Vickers (1983) is also of interest. Fairly comprehensive reviews of the cultural ecology of Amazonia are provided by Roosevelt (1980) and Sponsel (1981).

9. Brush (1975), Glassow (1978), and Hayden (1975) criticized the anthropological use of these ecological concepts. These anthropological concepts have been reviewed and criticized by Carneiro (1973), Diener, Noninin, and Robkin (1980), Segraves (1974), Wagner (1977), and Wylie (1971). Williams (1898) remains perceptive.
10. For example, see Cowgill (1975a; 1975b).
11. For criticisms of these matters, see Ferdon 1959, Hirschberg and Hirschberg (1957), and Torres-Trueba (1968).
12. Beckerman (1979), Chagnon and Hames (1979), Hames (1980), Lizot (1977), and Yost and Kelly (1983) are among the critics of the animal protein hypothesis. While animal protein has not been an issue elsewhere in this biome, it is discussed for the Peruvian Andes (Bolton 1975), Polynesia (Beckerman 1977), and New Guinea (Dwyer 1974). Dickinson (1971) sees protein as a problem throughout Latin America.

13. For convenience the term Yanonama is used here following Migliazza's (1972:26) suggestion, since it refers to all variants of this indigenous group.
14. Lindholm and Lindholm (1982) is another example of exaggeration to the extreme (Sponsel 1982; 1983a). Others have questioned the fierce image of the Yanonama (e.g., Davis 1977a, Smole 1976:14-15).
15. Figure 1 (p. 21) diagrams what I believe to be a fair representation of Chagnon's model.
16. Figure 2 (p. 23) diagrams what I believe to be a fair representation of Harris' model. Critics of Harris include Chagnon (1983:81-89), Chagnon and Hames (1979; 1980), Diener and Avery (1979), Diener, Moore, and Mutaw (1980), Hames (1979), Hara (1981), Price (1982), Sponsel (1981:326-349; 1983a), Yost and Kelley (1983).
17. Nietschmann (1972; 1973) and Reichel-Dolmatoff (1971; 1976) are clearly within the realm of cultural ecology but not cultural materialism.
18. A comparison of the literature before and after the landmark studies of Gross (1975), E. Ross (1978), and others, clearly demonstrates this progress. It is noteworthy that Murdock (1968:19), in his global survey of hunter-gatherers, said very little about Amazonia. Today much more could be said.
19. McDonald (1977) developed a similar but less elaborate explanation for faunal taboos of indigenes in South America. Among the critics of these explanations are Eichinger Ferro-Luzzi (1976) and Lizot (1979).

20. A summary of this book can be found in Reichel-Dolmatoff (1976).
21. Jochim (1981:21-31), Moran (1979:17-20, 97-101), and Orlove (1980:245-261) discuss this problem.
22. I do not completely agree with Hatch. A functionalist or ecological explanation of a cultural phenomenon does not necessarily imply approval of the phenomenon. Nevertheless, the issues raised are important (see Bagish 1983).
23. Writers who have played on the cultural shock value of "the fierce people" beyond Chagnon, include Biocca (1970), Harris (1974; 1977), and Lindholm and Lindholm (1982). This practice continues despite Chagnon's (1977:162-164) attempt to balance the image of fierceness.
24. Actually Chagnon (1968a:4) was first introduced to the Yanomama by a missionary who had worked with them for nearly 15 years. Moreover, the Yanomama have experienced sporadic contact with Western civilization to varying degrees since at least 1758 (Smole 1976:15).
25. See Bodley (1982), Davis (1977a; 1981), Kellman (1982), Lizot (1976), and Ramos and Taylor (1979) for descriptions of the plight of the Yanomama.
26. It is noteworthy that in the latest edition of his ethnography, Chagnon (1983) does not bother to update the last chapter on acculturation even though there have been many serious developments in the last 6 years since the last edition and these are well documented.
27. Whitten and Whitten (1977) is an excellent ^mexample of such a new urgent anthropology.

28. See Bodley (1982), Crosby (1972), Hemming (1978), and Parry (1979).
29. Discussions of various aspects of this process in contemporary Brazil may be found in Bourne (1978), Caufield (1983), Davis (1977a; 1977b), Goodland and Irwin (1975), Gross (1982), LaBastille and McIntyre (1979), Maurer (1979), Moran (1981), Ramos and Taylor (1979), Smith (1982), and Wagley (1974).
30. Similar schemes are primitive/consumer (Bodley 1976), paleotechnic/neotechnic (Clarke 1977), and ecosystem/biosphere (Dasman 1976:283). There is some debate as to whether or not traditional indigenous cultures are equilibrium societies (Goldsmith 1973; Guthrie 1971; Heizer 1955; B. Johnson 1977).
31. The introduction of Western technology into the hunting and fishing activities of the Yanomama illustrates some of these points (Hanes 1979; Saffirio and Scaglione 1982).

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