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ETHNOSCIENCE, SUSTAINABILITY AND ETHNOECONOMICS: What the patterns of traditional resource use can teach us

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1 Opening remarks

According to received theory, growth (an enlargement in the size of an economy) and development (the realization of a potential) should not be confused. But the fact is that economic development has been interpreted, first of all, as a persistent increase in income per head of a country or economy. This is how, precisely, it is perceived in a place like Brazil (and Amazonia) or Latin America.[1] It is in such a context that a discussion has been generated concerning the need to reconcile material progress with a sound management of the environment. To that effect some sort of *consistency* must be attained between the conflicting tendencies of the increasing demand for resources caused by the expansion of the economy and by population growth, and the unavoidable constancy of the ecosystem (meaning ultimately the invariance of the amount of matter and energy at the disposal of humans). Such is the essence of the idea of sustainability,

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1 "Western industrial societies are often called 'consumer societies', presumably because it is perceived that in these societies consumption is the most important contributor to human welfare. Certainly the principal objective of public policy in these societies is the growth of the gross national product (GNP)" – Ekins, 1995:5.

no matter how it is defined, either on theoretical or operational terms. The question is that we need to maintain indefinitely the potential productivity of the system that supports not only the economy, but life itself. It is evident now that the model of economic development (or growth, for that matter) which is practised in the modern, westernized world does not lead to the required compatibility of the ecological base with the goals set for the economic system. It is said that growth is necessary so that we can eliminate or sensibly reduce extreme poverty. Nature is simply asked in this context to provide the resource layer which can sustain the expansion of the economy. Almost no one discusses to what extent nature can soundly fulfil this function ascribed to her. Some people even contend (see, *e.g.*, Simon 1987:19) that material progress must not be stopped because all our modern life-support system is composed of artifacts made by man.

But that perception is not the only one which has existed, even in the world at the present time. People living in distant, far-removed areas (traditional and native populations like some Amazonian *índios* or Indians"[2] today), in fact, have known for a long time that natural resources can be used without jeopardizing the ability of future generations to employ them to their own benefit. Certainly, this is a very different understanding of the problem raised by the modern money, consumer economy. It is the possibility of existence of a "natural economy" (Binswanger, 1996:65) based on recycling, whose study illustrates the need of a discipline which we may call *ethnoeconomics*. Lionel Robbins (1932:15) is well known for defining economics, appropriately, as "the science which studies human behaviour between ends and scarce means which have alternative uses". His approach, however, deals with "different ratios of valuation" in money terms (market prices). A different situation arises in a natural, self-sustaining, self-regenerating economy based on exchange (Binswanger, 1996). Different ratios of valuation must be considered with a very distinct shape in a natural (traditional) economy utilizing, for instance, the knowledge of shamans for decisionmaking concerning the use of resources (see Reichel-Dolmatoff, 1976). This is one more justification for the field of ethnoeconomics, whose objective should be to understand how primitive societies have learnt to exploit nature sustainably, allocating resources (their means) "efficiently".

2 The natives of the Americas have been called by the Europeans, mistakenly, "Indians" since the "discovery" of the continent. The ambiguity in the English idiom is avoided in Latin America by the Portuguese word *Índios* (*indios* in Spanish). The word for people from India is *indiano* in both languages.

We should accept here the remark of Sachs (1992:102) that "[a] global monoculture spreads like an oil slick over the entire planet" leading us to admit the inevitability of economic development as preached since the start of the cold war. To develop, therefore, one would have to follow the guidelines established by the experience of the industrialized countries, allowing oneself to be sucked into the homogenizing pool of cultural traits (market, state, science, technology) peculiar to the Occident. This is what is expected from a world which in turn consists of multifarious cultural elements and traditions, some of which are simply incompatible with the idea of growth. Furthermore, the modern understanding of truth, which is not, as pointed out, for instance, by Faber, Manstetten & Proops (1994:7), the only understanding of truth which is possible, constitutes the sole framework of ideas that is adopted to rule decisions related to technological progress, economic performance and social change. We are led to think that the options for a decent survival of man on Earth are reduced to the paradigm offered by the first world, the OECD countries, and some exceptional cases of high economic achievement (Asian tigers no longer...). However, although somehow incipient, the findings of research in the field of anthropology, and especially, ethnobiology, reveal indigenous perceptions about ecology and the utilization of natural resources (Posey, 1992a:17) that show that "[t]here are options for the survival of Man in the Biosphere" (Posey, 1990:57). These options can be found in the lifestyles of native peoples, serving to caution against the tendency to promote economic development at such a pace that it cannot be halted in time to prevent the sometimes irreversible destruction it is about to cause (see Posey, 1992a:17).

It is my contention that the approach to economic issues supposing the existence of real ecological boundaries (*i.e.*, the fact that the planet is a nongrowing entity; the constancy of matter and energy, etc.) is something that can be conducted with the support of traditional knowledge and the practices of indigenous peoples, like some of those we still find in Amazonia. In other words, the received ecological treatment of economic problems grounded on modern western thinking tends to elide important perspectives, and to see nature from a Cartesian, less holistic perspective of dominance by man. Traditional knowledge – it is being more and more widely accepted now – offers sound alternatives of resource use and management based on experience and close monitoring of practices by native peoples over very long periods. It can supplement modern

science and open new horizons of understanding. The solution of ecological-economic problems has a lot to learn from it, chiefly because to some extent it is the only source of alternative models of development that can be ecologically and socially sound (see Museu Goeldi, 1987:33). It is here apparently that we can find a firm place for ethnoeconomics.

The purpose of the present paper is to delve into the question of sustainability employing evidence from anthropology and ethnoscience that help comprehend how a society can live within the limits of the possible, and still have a joyous life. The support for this task is provided by an anthropological literature which is not specifically (or even occasionally) destined to the study of sustainable features of given social groups. This is a problem because the evidence is sparse, and there is no systematic way of showing how sustainability is achieved. On the other hand, as an economist I am not well trained to deal with either the issues or the methods of study of anthropologists and ethnoscientists. I am aware, however, of the tricks that exist when we enter fields of inquiry different from our own. As a tentative practitioner of ecological economics, and as an apprentice of ethnoeconomics, I also think that we cannot avoid doing inter- and transdisciplinary work within these new areas of study. I esteem that we should follow here Georgescu-Roegen's advice that "venturing into territories other than one's own" is a project "definitely worth undertaking" (Georgescu-Roegen, 1971: 4). When he set out to undertake (successfully, by the way[3]) the project of analysing the relationship between the entropy law and the economic process, what he did was "to build on the writings of the consecrated authorities" in the field of Physics he was diving into. "Even so", he added, "one runs some substantial risks" (*id.ib.*). I face the same risks and challenges in invading anthropology and ethnoscience. But I find the task worth carrying out, not less because I judge that economists in general have much to learn from ethnology.

I will use here research undertaken mainly in the Amazon concerning Amerindian tribes still living there, whose lifestyles are worth examining. It is not my intention to convey a picture of the Brazilian Indians – despite the admiration they provoke on me – as a counter-cultural utopia in the face of progress depicted as a straightjacket, but to call attention to a form of knowledge which can

3 See Cleveland & Ruth (1997).

be extremely helpful in devising a sustainable future for humanity. The Indians exhibit a harmonious way of life in terms of man-nature relationships and thermodynamic thrift. As such, in my view, they deserve much more attention than has been given them up to now.

2 Ascribing ratings of sustainability

The Economist regularly publishes a chart of country-risk ratings for 26 "emerging markets" showing a summary of national credit-risk indices based on strictly economic and political factors. What if it charted those countries in terms of global environmental soundness or ecological sustainability, or if we tried to list countries in the world according to the latter parameter, ascribing a rating to different lifestyles? I have been trying to compare two different life paradigms (two very different ones, actually) in relation to this point (Cavalcanti, 1992). One extreme paradigm (see Figure 1, whose meaning is simply to offer an order of magnitude) is found in the US, with its high rates of per capita resource consumption. The other (extreme) paradigm is the opposite of the former in terms of frugality: it is the lifestyle of the Brazilian Indians who, in the wild state, still inhabit portions of the Amazon, and whose consumption needs are satisfied with much more austere, unchanging standards. Ecological sustainability is naturally much higher in the case of the Indians, who live within what we can call "the limits of the possible", without causing social or ecological stress. This is a situation which seems to fulfil the condition of a steady-state economy (Daly, 1980), slowing down the energy flow or the throughput of matter and energy.

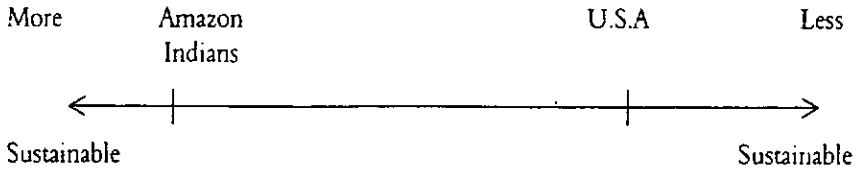

Figure 1. Paradigms of Sustainability Measured in Terms of an Hypothetical Scale of Degrees of Sustainable Lifestyles

If one thinks about the need to find a path leading to the understanding and the sound management of sustainability, then the Indian paradigm cannot be neglected in terms of what it teaches. It is precisely this point which is underlined by the late Colombian-born anthropologist Gerardo Reichel-Dolmatoff (1990:14) when he says that "the Indians' way of life reveals to us the possibility of an *option*, of a separate strategy of cultural development", which are in his view "*alternatives* on an intellectual level, on a philosophical level" or alternative cognitive models that "[w]e should keep in mind". The fact is that the Amazonian natives try to copy the patterns of nature, assimilating the principles they observe in the natural ecosystems. Their lifestyle thus reflects the basic systemic wisdom (Bateson, 1972) inherent in nature (Branco, 1989). The Indians' cosmovision is based upon their knowledge, whereas the Americans' relies on modern science. Sustainability is observed by the natives of Amazonia insofar as they plan according to the needs of future generations and take care of the living conditions of other species, thus assuring the preservation of biodiversity. With a strong sense of community, the interests of the individual among the Indians are not pursued unrestrictedly. This contrasts with what happens in the American paradigm where man-nature relationships are defined following traditional western thought, from an anthropocentric standpoint. Reichel-Dolmatoff (1976:318), referring to the Tukano people's world view, says that their cosmological myths "do not describe Man's Place in Nature in terms of dominion, of mastery over a subordinate environment". He also remarks (p. 308) that the primitive tribes of the Amazon Basin, which, to some people, are "fossil societies", which would not have anything to teach us, are not incomplete in the sense that they have not evolved, but rather developed highly adaptive behavioural rules for survival "framed within effective institutional bodies". The set of ecological principles elaborated by the Indians are combined with a system of social and economic rules leading to "a viable equilibrium between the resources of the environment and the demands of society" (*id.ib.*). It is worth noticing here that Reichel-Dolmatoff, whose study of the Tukano exceeds fifty years, has found that there is little concern among them for maximizing short-term gains or for obtaining more food or raw materials than are actually needed. In the Indians' view, "man must bring himself into conformity with nature if he wants to exist as part of nature's unity, and must fit his demands to nature's availabilities" (Reichel-Dolmatoff, 1976: 311; *cf.* also B. Commoner, *apud* Tiezzi, 1988:9). This is simply the

opposite of Aristotle's *pleonexia*, to have and to wish to have always more, which is "the driving force of modern productive work" (Faber, Manstetten & Proops, 1996:88). Other anthropologists have arrived at similar conclusions, as for instance Viveiros de Castro (1992:168), alluding to the Araweté in Pará state, Brazil, whose contacts with the white man occurred only in the late seventies, and whose culture he found to be wholly, strong, gay, original, and imaginative. The focus of the Indians' interests is conservation of their territory. This was clearly expressed by a Yanomami tribesman in a letter to Brazil's President José Sarney dated September 1st, 1989: "Our thought is our land. Our interest is to preserve the land, not to create diseases for the people of Brazil, and not only for the Indians" (CCPY, 1990:43).

Contrasting with modern perceptions, and the American paradigm as well, the dominion of concepts and fundamental aspects of our civilization by the Indians, like money, ownership, the State, sexual taboos, division of labour, misery, domination, and so on, is extremely precarious (Viveiros de Castro, 1992:166). In the Yanomami's letter to Presidente Sarney, referred to above, it states explicitly: "We do not know anything about money, shoes, clothes [...] The government does not know our custom, our thought" (CCPY 1990: 43). When these elements of modern civilization are introduced into the Indian society they provoke serious disturbances, as indicated by Betty Mindlin, who has studied tribes in the Amazon state of Rondônia. The results of her findings show that "[t]he use of money modifies food habits, reduces the rhythm of agricultural work, causes undernourishment, not because of scarcity properly [...] but for a new utilization of time, new behaviours [... and] money is not distributed with the same fairness, according to the village's laws of reciprocity. It prevails over kinship, over the previous rules for a good living: and our society knows well about it" (Mindlin, 1994:248). Similar disturbances following the contact with the white man tend to increase inequality between man and woman (*id.*: 246).

Ecologically sound land-use planning is a common feature of Indian societies in Amazonia, although, on occasions, the natives might have contributed to the degradation of their lands. The Indians, for instance (see Reichel-Dolmatoff, 1976:312), submit birth rates and harvest rates (namely, the exploitation of the physical environment) to adaptive rules to ensure individual and collective survival and well-being. This task is conducted by the shamans, who manage the use of resources. Some measures traditionally undertaken by the Amazonian indigenous peoples, like the protection of forests on the

banks of a river as a resource for fish subsistence, which the Wanana, for instance, have since long practised (see Chernela, 1986:75), have only recently been considered scientifically sound. All this is implemented with a sense of profound respect for nature, from which the Indians copy their methods of environmental management. Viveiros de Castro (1994:157), speaking of the Araweté, comments on the Indians' simple technology and high capacity for improvising. It is not surprising then to discover that local communities and tribal groups are "the most cost-effective managers of the resources" available to them (Panayotou, 1991:357). They know how to live in the limits of the possible, taking care also of socially disruptive behaviour (aggression in interpersonal relations), which among the Tukano (Reichel-Dolmatoff, 1976:312) is regulated by norms that serve to counterbalance it.

The legacy of centuries of balanced environmental management by the native societies was appreciated by the first Portuguese to come to Brazil in 1500 (see Cortesão, 1943). What they found was a magnificent, beautiful country (Ribeiro, 1987:11) with abundant vegetation, pristine water and plentiful game and fruits (Gandavo, 1924:43-48, 82), the same environment which can be encountered even today in parts of the Amazon. The primitive inhabitants of Brazil were in 1500 good-looking, healthy, and strong (Cortesão, 1943), the same attributes noticed by anthropologists who have done research among Indians in this century. Talking about the Araweté, Viveiros de Castro (1992:155) points out that they were in 1981 "visibly well nourished". Seeger (1980) arrives at the same conclusions in relation to the Suyá, stressing their adequate diet. Baldus (1971:440) comments that the Tapirapé (both men and women, adults and children) were used to endure long journeys of 40-50 km through the forest and savanna, without anyone getting exhausted. This, he remarks, is proof of the Indians' vitality, in spite of their average short life span. Writing in the 16th century, Gandavo (1924:124) made similar observations. The Tupinambá, according to Sousa (1971:313-314), also a 16th-century writer, were excellent divers, swimmers, runners, rowers, showing great ability to climb trees and to jump.

Besides being strong and healthy, the Indians seem to be very happy with their lifestyle. This is stressed, for example, by Viveiros de Castro (1992:154), who has studied the Araweté for over 14 years. In his words, "To live with the Araweté is a fascinating experience. Few human groups, I imagine, are so easy to deal with, so joyful in

their daily life [...] absolute in giving and asking, unrestrained lovers of the pleasures of life". An equivalent state of affairs was found among the Tapirapé by Baldus who, in 1935, came upon a constant atmosphere of joy in the village where he lived. "All the environment is tenderness. No one yells at anyone and even the dogs which bark at me on my way are taught discreetly to respect me. Everywhere I find gladness and laugh" (Baldus 1971:449). He adds in the same passage that "Courteousness [...] manifested itself in various degrees as a general pattern of behaviour", concluding on p. 464 that the Tapirapé "were the most joyful people" he found in his life. Bruce Albert, an anthropologist doing research with the Yanomami (see also Chagnon, 1992, whose book, *Yanomamö: The Last Days of Eden*, has a title which speaks for itself) reproduces an interview with the Indian Davi Kopenawa after the invasion of their territory in which says the latter (CCPY, 1990:14):

> Now you tell the other white men [...] how we were, with good health [...] How we did not die easily, we did not have malaria.
>
> Tell how we were really happy. How we hunted, how we gave parties [...] You saw that [...] Today the Yanomami do not build their big houses anymore [...] they live only in small shanties in the woods, under plastic sheet. They do not even grow crops, they do not go hunting anymore, because they become ill all the time.

This is in stark contrast to the situation of the still isolated Araweté, about whom Viveiros de Castro (1992:168) could conclude: "This is not a desperate, culturally demoralized people, composed of sick, alcoholic, hungry and fearful persons – up to now".

Other characteristics of the Indians who inhabited Brazil in 1500 and who inhabit portions of Amazonia today suggest not only that they were well adapted to the environment, enjoying good health and a joyous life, but that they are peaceful and courageous (Baldus, 1971:440), that they do not accumulate anything (Gandavo, 1924:130), that they do not worry about locking their belongings and are not familiar with stealing (Cardim, 1939:112), that they are hospitable (Sousa, 1971:316), having a strong sense of community, generosity and communion (*id.*:313). Sousa (1971) sums up his observations saying that the Indians he described, the Tupinambá, were like

Franciscan friars in their propensity to give away their possessions. The dissimilarity to a lifestyle conceived around the craving for all kinds of gadgets is striking. We face here two very different perceptions of life with serious implications in terms of environmental health and social equilibrium. It is no surprise then that a question can be asked as the one raised by Faber, Jöst & Manstetten (1994:16): "Are not the increasing problems of social disorder, violence, drugs etc. consequences of the level of our present standard of living?" I do not intend to resuscitate the Rousseauesque myth of the *bon sauvage*, but indigenous experiences deserve to be seriously considered by research on sustainable development, for the Indians are "a diligent, intelligent and practical people who have adapted successfully for thousands of years in the Amazon" (Posey, 1992b:43), making their livelihood in many different ways according to local constraints. In a word, it is fair to ascribe to the Amerindians' lifestyle, as we have done here, the highest marks of environmental sustainability: their living patterns accumulate enough evidence over a very long period (in opposition to an insufficient historical evidence offered by modern, industrialized countries) to demonstrate the truth of that ordering. This also seems to demonstrate a clear understanding by the Amazonian natives of principles of ethnoeconomics.

2 Characteristics of the Amazon Indian's Ethnoeconomy

Using evidence provided by anthropology and ethnoscience, Table 1 lists some of what in my view are the chief characteristics of Indian societies still living in Amazonia. It is a summary of what one finds occasionally in the literature, where the subject of sustainability springs up mostly in an implicit, unsystematic way, and mixed with such topics as kinship, material culture, rituals, descriptions of daily life, customs, traditions, native knowledge, myths, and so on. The picture offered by Table 1 seems to contradict the evidence deployed by Lewis (1992) showing that pre-modern peoples do not live in harmony with their surroundings. But it fits with the remark of the late anthropologist Berta Ribeiro (1987:9) that the Indians treat their surroundings with respect, love and care to ensure the permanence of nature as a source of resources for food, human welfare and the cure of their illnesses. It also reflects what enthnobiologist Darrell Posey and other researchers have discovered in their important work at Belém's Goeldi Museum, that the basic aspect of the natives'

management of natural resources is "a long term perspective, with emphasis on preservation, and not on the destruction of native resources of Amazonia" (Museu Goeldi, 1987:65). It reflects moreover recent findings of prehistoric archaeology that the Amerindians' health conditions got much worse after the conquest, demonstrating that living patterns deteriorated as a result of a subsequent lesser concern for the environment in the Amazon (Roosevelt, 1991:127).

TABLE 1. The Amazon Natives' Living System – Some Chief Characteristics

Very clear man-nature relationships
No energy problem; no use of fossil fuels; basic source of energy: the sun
Ignorance of money and ownership; no wealth accumulation
Complete observation of the laws of nature; nature not used, but revered
Simple, soft technology; no use of inorganic chemical products of any sort
Satisfaction of basic needs
Daily consumption of materials per person remaining constant over time
Life supported by the biological product of photosyntesis, water, forests, clearings
Populations held within given limits
Inexistence of income inequalities (idea of poverty ignored); intergenerational equity
Respect for biodiversity; maintenance of environmental quality
No economic development in the modern sense (no growth, of course)
Itinerant agriculture; nomadism; dispersion
Simple material culture; extreme thermodynamic thrift
Small villages, small production units
Sustainable and efficient use of natural resources, preserving productive ecosystems
Scale of activities within the carrying capacity of their territory
Absence of technological improvements
Long-run perspective
Holistic, integrated view of life, reality, the environment
Apparent enjoyment of life

Sources: see list of references.

In fact, the knowledge gained from anthropological sources is that the beliefs and attitudes centered on life which the Indians exhibit in combination with hundreds of little things they do, think or avoid, their perception of the universe, and so forth, "form a highly structured order" (Reichel-Dolmatoff, 1990:13). In the case of the Kayapó – who call themselves Mebêngôkre –, their knowledge constitutes an integrated system of beliefs and practices, such that,

for instance, "[e]ach and every *Mebêngôkre* believes that he or she has the ability to survive alone in the forest for an indefinite time" (Museu Goeldi, 1987:15). One aspect of the Amazonian Indians' view of nature, noted in relation especially to the Tukano, is its "remarkable semblance to modern systems analysis", according to Reichel-Dolmatoff (1976:310), who points out that the Tukano's ecological theory "conceives the world as a system in which the amount of energy output is directly related to the amount of input the system receives". Energy in such a scheme should never be used without being restored as soon as possible. The restitution to nature of the energy potential utilized involves complex rules, practices, and rituals "whose totality corresponds to a way of life, to an integrated system" (Reichel-Dolmatoff, 1990:12-13). This represents a sharp distinction to a lifestyle dependent on the ever increasing consumption of goods and nonrenewable energy sources.

It is worth noting that the Amazon native peoples showed a very different geographical distribution before their conquest, when human occupations of large dimensions ("paramount chiefdoms") were established. With the arrival of the first colonizers, the natives were dislodged to soil-poor, inter-river forests of the Amazon Basin (Roosevelt, 1991). These soils, in effect, are some of the world's most nutrient-poor (Posey, 1992a:15). But the Indians adapted their techniques for living in harmony with nature, obtaining favorable results without degrading or exhausting the environment (*id.*: 17), a pattern of behaviour which is still witnessed among present-day remnant groups. The paramount chiefdoms which existed in Amazonia developed intensive food production, urban-scale settlements, and monumental earth constructions, "including the earliest pottery-age cultures in the hemisphere" (Roosevelt, 1991:134). Dispersion and the formation of smaller communities occur after the 16th century. This find of recent archaeological work reaffirms the enormous ability of the Amazonia's natives to relate in appropriate ways to their natural surroundings, applying rules of conduct which have sustained life without disturbing nature. The ability of the Indians to take advantage of the possibilities at their disposal is demonstrated through their diet based on protein-poor manioc. One might have expected the natives to have acquired diseases provoked by improper protein consumption. This does not happen, however, and what one finds among the Indians is an example of vigorous physical strength (Ribeiro, 1987:35).

Serious soil deficiencies, on the other hand, have been

overcome by elaborate systems of agriculture and intensive soil management. It has been demonstrated by Hecht & Posey (1990) that the Kayapó agricultural system, for example, is superior to modern agricultural methods employed in Amazonia, characterized by pasture and short-cycle crops "which are notorious for their lack of sustainability and low rates of return" (Hecht & Posey, 1990:79). The Kayapó system does not need purchased inputs and is naturally much richer. The comparison Hecht & Posey (1990) make of Kayapó, colonist, and livestock production patterns of land use in eastern Amazonia reveals that Kayapó yields per hectare over five years are 183 percent higher than the yields of the colonist system, and *176 times* that of livestock (Hecht & Posey, 1990:81)! In terms of protein yields from vegetable sources over five years, too, Kayapó figures are roughly double those of colonist agriculture and more than 10 times the protein production from livestock (*id.ib*). "In ten years [...] 1 ha of pasture has produced less than a ton of meat, and slightly more than 100 kilos of protein or roughly 5% of the protein generated by the Kayapó system" (*id.ib.*). The conclusion is clear: without damaging the resource base (which modern systems noticeably do), the Kayapó produce many more calories and proteins per hectare than any of the alternatives existing nearby. The irony of the situation is exposed by Hecht & Posey (1990:83): "hundreds of millions of dollars have been funneled into surveys and experiments which have not made colonist's agriculture more stable, or livestock more productive". It seems obvious, therefore, that land uses by Amazonian indigenous peoples must mirror some way or other an assessment of capabilities of soils and practical measures involving all aspects of an endeavor which we might call ethnoagronomics. "Researchers should also recognize that there is a complex intellectual system that underlies the native management of soil resources, the ensemble of which is 'ethnopedology'" (Hecht & Posey, 1990:76).

Thus it is not surprising to discover with ethnoscience that the kind of itinerant agriculture undertaken by the Indians does not constitute a primitive and incipient method; that it is, on the contrary, a specialized technique conceived as a response to specific conditions of climate and soil encountered in the rainforest (Meggers, 1977). Crop diversification, as found in Kayapó territory, equally represents a rational form of land use. The Mebêngôkre have also developed the creation of forest 'islands', which they term *apêtê*, in tropical savannas to modify the ecosystem, increasing biodiversity (Museu Goeldi, 1987:18). This notable ecological engineering is accompanied, for

instance, by precise knowledge of insect behaviour. A case in point is that in gardens and fruit trees that are infested with leaf-cutting ants, the Kayapó deliberately place nests of ants of a genus that repel the former by physical and chemical means (Overal & Posey, 1990).

Indigenous classifications are not aimless. Much to the contrary, they are not only systematic and based on theoretical knowledge, but they are also comparable, from a formal point of view, to those that zoology and botany use (Lévi-Strauss, quoted by Ribeiro, 1987:66). Using again the example of the Kayapó, these Indians classify their natural resources within various ecosystems.

> Each ecosystem is perceived by the Indians to exist with a specific association of plant and animals. Having a profound knowledge of animal behavior, the Kaiapó know which plants attract each animal.
> On the other hand, they associate several species of plants with varieties of soils. Consequently, each ecosystem is a harmonious union of interactions between plants, animals, types of soil and the Kaiapó themselves (Posey, 1992b:23).

Improving soil fertility and productivity is one of the consequences of such a form of classifying ecosystems. When one remembers that modern agricultural practices in Amazonia have exhausted soil fertility and caused serious ecological problems (see Uhl, 1992), the superior ability of the Amazon Indians to deal with their environment must be acknowledged. In the case of the Cinta-Larga, anthropologist Carmen Junqueira (1984:1285) has found that all their productive activities obey complex cultural rules which determine everything from the organization of work teams to the different modes of distribution of the produce. This complex system of rules and institutions is a counterpoint to technological simplicity and constitutes the pillars of the Indian communal organization (*id.ib.*) This same elaborate knowledge is what explains the natives' ability to limit population size, the abhorent practice of infanticide observed in some groups notwithstanding. Plants like *Curarea tecunarum* (Ribeiro, 1987:57), *e.g.*, are used by the Deni as a contraceptive, while abstention from sexual activity over long periods after delivery is found among tribes like the Xamakôko and the Taulipáng (Baldus, 1971:277) as a means for reducing chilbirth.

The way the Indians understand nature places man as part of a complex network of interactions including both society and the entire

universe. This is demonstrated by Reichel-Dolmatoff (1976:311) in analysing the meaning of animal behaviour to the Indians. What he indicates is that animal behaviour represents a model for what is possible, for what can be done for successful adaptation to the environment. "Animals then are metaphors for survival. By analysing animal behaviour the Indians try to discover an order in the physical world – order to which *human* activities can then be adjusted" (*id.ib.*). The importance of animals for the natives of Amazonia has deep foundations. Game and fish, together with wild fruits, as food resources, are viewed in terms of the possibility of satisfying protein needs. The approach to this evaluation is done with the help of shamans. The Indians equate environmental degradation not to soil exhaustion but to the eventual depletion of game and increased walking time for obtaining food (*id.*:314). In terms of shamanistic practices, the upsetting of ecological balance, like overhunting, for instance, is what explains disease (*id.*:315). Illness for a Tukano corresponds to a person's interfering with a certain aspect of the ecological order. Incidentally, Reichel-Dolmatoff (1976:317) remarks that the Tukano as well as several other Amazonian tribes "believe that the entire universe is steadily deteriorating", a clear indication of the Indians' sense of entropy. This tendency can be counter-balanced, according to the Tukano, by a continuous cycle of ritual creation and re-establishment of order and purpose. This is done in ceremonial occasions when the universe and its components are "renewed", and links with past and future generations are reaffirmed.

Ribeiro (1990:39), referring to the Desâna, informs that, despite more than 300 years of contact of that group with the colonizers' society and the corresponding loss of cultural goods, symbols and values, they continue to treat subsistence by means of a wise adaptation to an ecosystem they profoundly comprehend. These and other Indian societies, differently from the western consumer socitey, practice austerity in the satisfaction of consumption needs as part of the interaction they perceive between the material sphere and the spiritual world. A close relationship with the principles, cycles, and limits of nature indicates how environmental stress is avoided. In this perspective, nature is not disturbed and the provision of a continuous flow of enough resources for the individuals' well-being is guaranteed. Such complex system of ecological engineering corresponds to planning life in the limits of the possible, involving both present and future generations in this process [intergenerational equity or sustainable development in the Brundtland-report sense

(WCED, 1987:43)]. This attitude, in turn, amounts to a negation of the non-satiation principle postulated by economists as a normal trait of the human character (*cf.* Faber, Jöst & Manstetten 1996: 87-91). It amounts likewise to a holistic way of understanding the world, in acute contrast to the perception of modern man and science. It is interesting to observe that austerity for the Indians does not lead to penury or indigence (poverty is out of the question, because it is not applicable as a sociological category to the analysis of Indian societies). Just the opposite, for an abundance of staples is usually found in the Indian villages. Incidentally, Baldus (1971:232, 448) reports how lavishly he was received at the Tapirapé village when he arrived there for the first time:

> Just to give an idea of the food variety of the Tapirapé in a determined period of the year, I want to list the dishes they offered me when, in June 1935, I arrived for the first time at Tampiitaua [23 different dishes are then listed]. Unwilling to offend anyone, I ate in the same afternoon, in all village's houses, great quantities of each of theses delicious dishes.

This abundance had disappeared in 1947, when Baldus returned to the village, in large measure because of the cultural shock brought about by the contacts with the white man following his first visit, whose effects modified the formerly unlimited Tapirapé hospitality (*id.*:233).

4 By way of Conclusion

In the perspective of Seeger's (1980:15) advice that we should avoid both the evolutionists' ethnocentrism and the romantic view of the noble savage, the Amerindians' economy seems to be a concrete demonstration of how to live sustainably. Certainly, it is an extreme situation of compliance with the rules for a sustainable society, and a very difficult one to be adopted by modern man. However, the other extreme, epitomized by a statement in *The Economist* (v. 329, n. 7838, Nov. 20th, 1993:6), that "to join the rich world means to acquire the ability to grow indefinitely", from this paper's standpoint, cannot be seriously considered as a goal to be reached. Georgescu-Roegen (1971:21) has already demonstrated that no elaborate argument is needed for one "to see that the maximum of life quantity requires the minimum rate of natural resources depletion". To grow forever cannot

thus be a global objective to be attained simultaneously (and healthily) by all countries (*cf.* Furtado, 1974). The question is then how to imagine a kind of development within the context of the Indian paradigm, of developing within the limits of the possible. As already shown, the Indians study animal behaviour precisely as a model for what is possible. Possibilities mean physical constraints. But they also mean the acknowledgement of the second law of thermodynamics, which is an actual limitation even beyond unlimited supplies of resources. The prevailing notion of development associates the pace of natural resources' utilization to progress: the higher the pace, the quicker progress takes place (see Tiezzi, 1988:32). But our way of life, of consumption determines also the speed of the entropic process, the velocity with which available energy is dissipated. Indian behaviour clearly softens the tendency to dissipation. The natives of Amazonia apply naturally, and instinctively, the principles of ecology. These same principles could be at the root of the design "of an economic system that can essentially last forever" (Brown, 1991:354) – last, *not grow*, forever.

How do the Indians define the forms of their social life? Not by permitting an idea like growth to occupy the center of their preoccupations. Development is a purely western concept (Esteva, 1992:9) that robs peoples of different cultural frameworks of the opportunity to design their own societal objectives. Sustainable development, on the other hand, can only occur if "productive capacity [can be preserved] for the infinite future" (Solow, 1994:4); that is, if future generations are assured a standard of living not inferior to the present one. Does the Indians' ethnoeconomy preserve productive capacity? Of course it does: the natives of the Amazon have done that for *millenia*, not centuries, as the discovery of the "paramount chiefdoms" in Amazonia has revealed (Roosevelt, 1991). But the economic performance of the Indians has nothing to do with western concepts. This conclusion serves to reveal the absurdity of the choice of methods of exploitation of the rainforest that have knocked down the model adopted by the Indians. With the exception of those contained in the idea of "extractivist reserves", they have all been shown to be unsustainable. For example, "for each cubic meter of wood taken from the forest [with so-called modern methods of production], almost two cubic meters are destroyed" (Uhl, 1992:57-58). This can be explained by the inconsistent configuration of markets and policies that leaves fundamental resources of life outside the market place – "unowned, unpriced, and unaccounted for – and more

often than not it subsidizes their excessive use and destruction despite growing scarcities and rising social costs" (Panayotou, 1991:357). To sum up, in Gérald Berthoud's (1992:81) words, "With money as a supreme value, life counts less". Or, as Gustavo Esteva (1992:18) says, "[e]stablishing economic values requires the disvaluing of all other forms of social existence". The study of the Indians' lifestyles shows how different the whole picture becomes when life is the supreme value. In this landscape, the emphasis that mainstream economics puts on economic growth before everything else, including distribution, cannot be held. One may look with scorn at a primitive way of life like the Indians', and consider that it is simply unacceptable or a utopia in the modern world. Nevertheless, nothing in nature or society demonstrates that a law of transformation establishes that any given society is in a process of evolution towards "ever more perfect forms" (*id.*:22-23). Or, in Georgescu-Roegen's (1971:15) view, "no social scientist can possibly predict through what kinds of social organization mankind will pass in its future".

This sends us to the discussion about the need for a paradigm shift, away from the dominant model of natural resource use (including matter and energy) and environmental management, and towards a system of resource use within the Earth's carrying capacity and in compliance with the principles of ecology. No doubt, the Amazonian Indians' paradigm offers an alternative, a proven one. This is convincingly illustrated by the example of the Kayapó, ethnobiological research on whom has run since 1977 at the Belém's Goeldi Museum, revealing that their "traditional knowledge offers some of the most viable and promising options for sustained resource use in the tropics" (Posey, 1992:19). The commitment of the Indian model to the well-being of future generations is another point to be underlined, in accordance with the accepted notion of sustainability (cf. Taylor, 1989:11). It is also relevant to remember that the Indian paradigm contains an appreciation of practical wisdom – or *phronesis* in Aristotle's terminology (see Faber, Manstetten & Proops, 1996:18) – that is so meaningful in the solution of environmental problems, and the promotion of conservation. It is well known that the market is not reliable in terms of the conservation of natural systems. Nothing in its structure induces real sustainability. But not only is sustainability a requirement of the new concept of development, it is also a general prerequisite of life. Goodland (1990:xiv) remembers that a voluntary return to sustainability is unavoidable "before global selection does it for us at a much lesser steady state value".

Particularly for those who live in the Americas it is extremely important to work with the Amerindian paradigm in mind – and try to grasp the workings of its system of ethnoeconomics. That paradigm, no doubt, offers an alternative (not to be adopted literally, but to be looked at, scrutinized, understood) of living sustainably. It is the opinion of botanists and zoologists doing research with the Indians that the complex relations that primitive cultures have developed with their surroundings will assume a growing significance in the process of devising policies for the preservation of threatened ecosystems like the Amazonian (Ribeiro, 1987:65). The emerging body of ethnobiological information in Amazonia shows that ecological sustainability can be attained with the help of indigenous knowledge. It also serves, in my view, to demonstrate the need for the study and development of ethnoeconomics. Systems of resource management conceived on the basis of such knowledge can promote sustainability and – something not to be neglected – "may generate levels of income that exceed the regional average" (Hecht & Posey, 1990:77). So there is ample justification for paying great attention to the details and intricacies of the Amazon Indians' lifestyle and economy. Theirs is an admirable pattern of co-existence with nature in the very long run.

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