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Nurturing the Forest: Strategies of Native Amazonians

Emilio F. Moran

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Anthropological Center for Training and Research on Global Environmental Change
Indiana University, Student Building 331, 701 E. Kirkwood Ave., 47405-7100, U.S.A.
Phone: (812) 855-6181, Fax: (812) 855-3000, Email: act@indiana.edu, internet: www.indiana.edu/~act

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Berg. 1996.

Ohtsuka, R., *Oriomo Papuans: ecology of sago-eaters in lowland Papua*, Tokyo: University of Tokyo Press, 1983

——, 'Fertility and mortality in transition', in R. Ohtsuka and T. Suzuki (eds), *Population ecology of human survival: bioecological studies of the Gidra in Papua New Guinea*, Tokyo: University of Tokyo Press, 1990

——, 'Changing food and nutrition of the Gidra in lowland Papua New Guinea', in C.M. Hladik, A. Hladik, O.F. Linares, H. Pagezy, A. Semple and M. Hadley (eds), *Tropical forests, people and food: biocultural interactions and applications to development*, London: Parthenon, 1993, pp.257–69

——, T. Kawabe, T. Inaoka, T. Suzuki, T. Hongo, T. Akimichi and T. Sugahara, 'Composition of local and purchased foods consumed by the Gidra in lowland Papua', *Ecology of Food and Nutrition* 15, 1984, pp.159–69

——, T. Kawabe, T. Inaoka, T. Suzuki, T. Akimichi and T. Suzuki, 'Inter- and intra-population migration of the Gidra in lowland Papua: a population-ecological anlaysis', *Human Biology* 57, 1985a, pp.33–45

——, T. Inaoka, T. Kawabe, T. Suzuki, T. Hongo and T. Akimichi, 'Diversity and change of food consumption and nutrient intake among the Gidra in lowland Papua', *Ecology of Food and Nutrition* 16, 1985b, pp.339–50

—— and T. Suzuki (eds), *Population ecology of human survival: bioecological studies of the Gidra in Papua New Guinea*, Tokyo: University of Tokyo Press, 1990

Stanhope, J.M., 'Patterns of fertility and mortality in rural New Guinea', *New Guinea Research Bulletin* 34, 1970, pp.24–41

Chapter 19

Nurturing the Forest: Strategies of Native Amazonians

Emilio F. Moran

Introduction

Our scientific understanding of the relation between people and their habitat has gone through a number of phases. In this century, many of the debates over the causal priority of nature or culture which have been dominant in anthropological analyses generally have used Amazonia as a testing ground. In this chapter, I will examine these shifting views, focusing on recent and ongoing studies that seek to discover folk and native Amazonians' cognitive and behavioural treatment, and transformation, of the environment within which they live. For a very long time the nature/culture debate was dominated by a view that privileged a single directionality of causation. Most important among these was the view which privileged the environment as a determinant force in human-habitat relations [see reviews in Ellen 1982; Moran 1979, 1993; Thomas 1925]. Cycles of rejection of this view privileged human culture and dismissed environment as a significant influence on the course of human affairs [Boas 1911; Goldenweiser 1937].

A more interactive approach followed, most impressive among which was the cultural ecological approach proposed by Julian Steward [1938]. Steward broke with both determinism and possibilism, focusing instead on the interaction of social organization with those features of the environment cognized by a cultural group. The crucial element to Steward was neither nature nor culture but the *process* of resource utilization, and how this process reflected features of given environments (e.g.

dispersed resources) and historical processes such as local market demand for animal furs or rubber.

Steward has been faulted by some scholars because he seemed to neglect a number of variables dear to anthropologists, ritual, political economy and demography among them [Geertz 1963; Rappaport 1968; Vayda and Rappaport 1976]. On the other hand, Steward privileged neither environment nor culture, and he gave particular analytical significance to the culturally defined, or 'cognized', environment. Unfortunately, it was to be several decades before a number of scholars pursued this balanced, processually oriented agenda [Lees and Bates 1990; Orlove 1980] that is the central interest of this volume.

The international concern with the environment in the 1960s led to a period of interest in the role of environment, not only in how it shaped culture but, by focusing on larger scales than before, using units such as the ecosystem and the biosphere. Vayda and Rappaport [1976] advocated the use of biological units (such as population, community and ecosystem) as units of study that were more analytically inclusive that culturally-defined ones. Vayda [1974, 1976] related changes in man/resource ratios, population fluctuations, and competition for gardens and pigs to cycles of warfare. Rappaport, working in the same region, showed how the ritual cycles regulated the size of pig herds, the frequency of warfare, the availability of horticultural land, the length of the fallow cycle, and the dynamic equilibrium of the system through time [1968].

These views have led to a vigorous critique since the mid 1970s that has sought to underprivilege the environment and to place causal priority on individuals' cultural constructions. In its more extreme forms, post-modernists negate the possibility of studying how people relate to their physical and social surroundings using scientific methods capable of leading to generalizations – given that each cultural construction is unique and non-comparable. In its less extreme forms, it privileges individual constructions above the social, cultural and population levels of analysis. The post-modern approach has merit in so far as it brings attention to the decision-making processes of individuals – but it reduces the understanding of how individuals, as members of social units, produce and reproduce themselves, how they make decisions about the use of what they call nature or natural resources, and how they are transformed by such use into given kinds of social beings who seek to maintain access to familiar resources.

Research in recent years has brought to the fore the importance of history and politics to an understanding of human-habitat relations. At the nexus between society and habitat stands the individual. It is the individual who makes decisions that affect the habitat and the society of which he or she is a part. However, individual decisions are not taken in isolation. To understand human decisions one must understand the historical traditions of individuals within a society. What forces have brought them to this historical moment? What past forms of resource use are customary to different segments of this society? What is their historical demography? Are they just coming out of a period of decimating mortality due to epidemics, or are they at a point of high demographic density and unparalleled health and nutritional well-being? Is it sustainable? The questions could go on, but the point is that individuals do not make decisions about the environment in a decontextualized historical setting. They come to the present with customary ways of behaving toward the physical environment that may, or may not, reflect current conditions. This human dilemma requires a capability to study both cultural constructions and physically observable realities such as soil chemistry, if we are to understand human situations in which cultural knowledge is out of phase with current physical environmental conditions, population growth rates and other noncognitive phenomena. Individuals decide whether the cost of changing customary behaviour exceeds the return – a calculus which is daunting in its complexity and evolutionary in its implications (Boster, this volume). The information coming to the individual from the environment may or may not be about the need to change strategies. Historical experience informs the individuals and affects their decisions in a highly variable manner, depending on the individual's gender, age, social class and current access to resources.

Not only are individuals informed by history, but the freedom of individuals to choose is influenced by the political system within which they exist and by external political and economic forces with which they may be more or less articulated. No individual acts alone. Each one is a member of a household, whose internal structure of social relations and distribution of power affects what different individuals may or may not customarily do, without experiencing sanctions. Moreover, individuals belong to families, lineages, clans, moieties and other forms of kinship group, whose inherent allocation of rights and duties affects individuals differently. Individuals are also part of local communities whose relative structure of rank and stratification provides differential access to the resources of the physical environment. Perhaps most often forgotten in the past has been the role of external political forces coming from world economic transformations. The individual who may be inclined to plant manioc, for example, may find herself influenced by the role of the state who, for its own reasons, decides to give a certain region or certain types of farmer access to capital if, and only if, they plant rice. Depending on the authority of the state, and the attractiveness of the credit terms, the individual may very well choose to plant rice rather than manioc against their own best ecological judgment if the external incentive, or threat, is large enough.

Thus, the most recent views on human ecology no longer talk about adaptation to physical environment as the most important dimension of ecological analysis, thereby assuming that this is always the case. Nor do they focus on nature or culture to determine which is causally prior. Rather, the ecological behaviour of individuals is taken to be a product of multiple sources of information and influence: history, demographic experience, the cognized physical environment, social membership and political forces. The individual takes all these into account in making a decision which, if consistent and effective, may become 'an adaptive strategy'. Adaptive strategy does not in itself imply 'success'. It refers to the development of a plan of action which attempts to balance the conflicting forces pushing and pulling on the individual-as-member-of-a-social group. It represents a 'best', but still contingent plan for dealing with these competing influences as a member of a given kin group, of an ethnically identifiable population, within often fractious nation-states composed of competing ethnicities and social classes.

Amazonian Landscapes

Research in Amazonia has reflected many of these trends in the discipline. Disagreement over the influence of environment on

cultural development has been frequent and has focused on simple environmental limitations. Lathrap [1968] brought attention to the influence of finding enough animal protein. Over the years, this insight grew into what came to be known as the 'protein debate' which pitted a large number of scholars against each other as each sought to prove or disprove the role of low animal biomass on the size of settlements, their warfare practices, and the development of political units above that of acephalous villages [see reviews in Sponsel 1986]. Meggers [1954, 1970] pointed out that it was soils rather than protein that were most likely to serve as a limiting factor to the development of complex polities. She argued that the poor soils of Amazonia could not support cultivation by means other than slash-and-burn techniques and that this doomed the populations to politically acephalous societies and to materially simple conditions. This view was faulted quickly by Carneiro [1957] and Ferdon [1959]. Carneiro pointed out that weed invasion, was more likely to lead to field abandonment than declining soil fertility. Ferdon, on his part, showed that most soils can be managed if costs are justifiable. Thus, tropical soils, while poor, were shown to be cultivated intensively and successfully when populations have seen the necessity to invest the labour required for their sustainable cultivation.

These views giving causal priority to one or another environmental feature have been followed in recent years by more comprehensive views that see not single but multiple patterns of causality. Moreover, they have been informed by the research of those who have pointed out the significance of cognition in the use of the environment [Boster 1983]. In giving emphasis to the knowledge of native Amazonians one should beware of 'noble savage' or 'conservationist' assumptions that one might impose on these populations [Johnson 1989]. Like us, they differ widely in their attitude towards the physical world. Different ethnic groups have different ideologies, social structures, and concerns with their environment. If they are conservationists, they practice an utilitarian version of it, rather than a romantic or 'liberal' version such as may be common in our own society.[1] Most groups conserve because they still interact closely enough with their physical environment to understand that they have to be concerned with the impact of their actions upon the long-term productivity of their habitat. Unlike us, they have not become entirely dependent on imports from distant regions to support their current levels of consumption, a procedure that allows us to overlook the impact that consumerism may have on those distant habitats from which we get our materials.[2] Most indigenous groups are still able to see the cutting of the forests beyond their current needs for what it is – a loss of future farm land, a loss of future wild game, a loss of wood and vine products for house construction, a loss of medicinally valuable plants, loss of a comfortable place through which to move in search of other resources, and an aesthetic loss of wild landscape. Thus, if they clear less land, it may be because they do not yet share our consumerist assumptions, our access to capital, and our distance from ecosystem production and regeneration.

Despite the virtual explosion of research in Amazonia over the past fifteen years [cf. Barbira-Scazzocchio ed. 1977; Hames and Vickers eds 1983; Hemming ed. 1985; Moran 1981, 1983; Prance and Lovejoy eds 1985; Schmink and Wood eds 1984; Sioli 1984; Wagley ed. 1973, to name some recent collections of research reports], few advances have been made in our ability to compare human ecologies. Findings from one site are viewed as generalizable to the entire region, or conversely, findings are presented as having unique site-specific characteristics that defy comparison. Most anthropological colleagues accept the *terra firme/varzea* dichotomy as expressive of the important differences to focus on, and place data from areas as ecologically different as the Xingu Basin, the Rio Negro Basin and Central Brazil in the same category – i.e. that of *terra firme*, or the even more aggregating 'lowland South America'. Thus, evidence from ecosystems with widely different soils, above-ground biomass and water regimes are used to support radically opposing views explaining cultural development, village size and population mobility. The distinction between *terra firme* and *varzea* glosses over important differences, especially within the vast *terra firme*.

The first thing to note about Amazonian landscapes is that they are far more complex than has generally been acknowledged in the anthropological literature. The simpler dichotomies of nature versus culture and the division of Amazonia into two habitat types (*terra firme* and *varzea*) have persisted long after their usefulness has expired. The Amazon Basin, a region the size of the continental USA, is extremely varied (see Figure 19.1). It includes areas of montane rain forest, lowland rain forest, moist

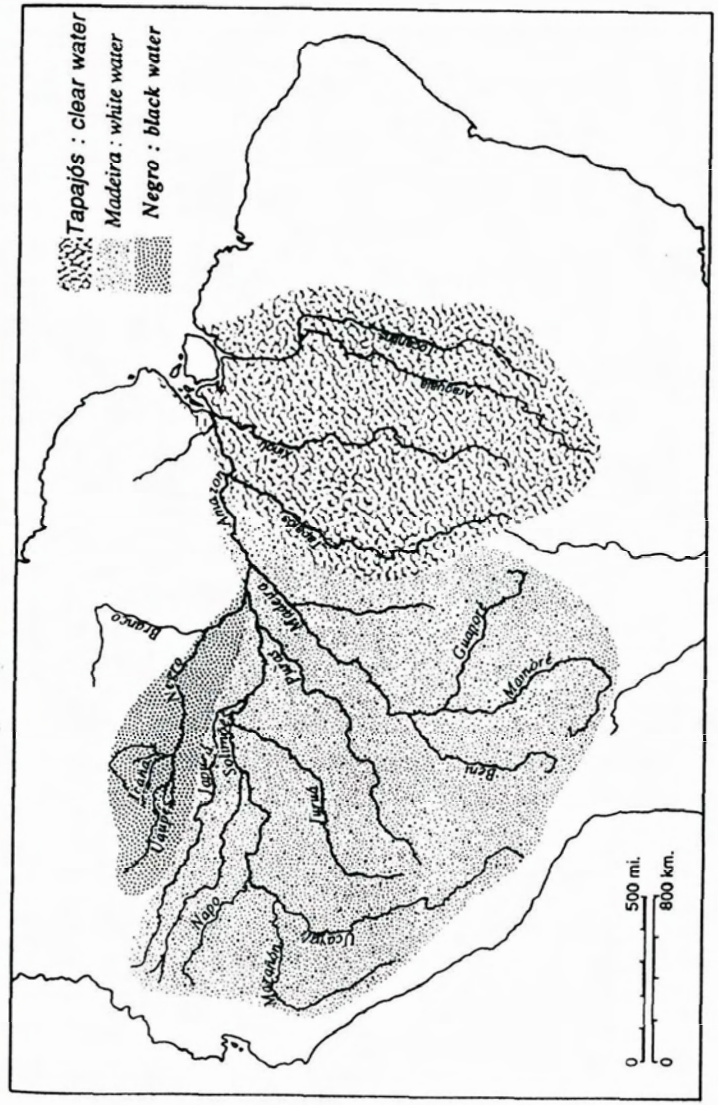


Figure 19.1. Amazon-Basin habitats

forest, vine forest, palm forest, bamboo forest and seasonal forest. It also includes both poorly drained and well-drained savanna, xeromorphic vegetation (i.e. *Caatingas amazonicas*) and species-dominant regions. The image most people still hold – of heterogenous forests with hundreds of species per hectare – is not wrong, but it fails to describe adequately most of the Amazon Basin. The Amazon is as diverse as one should expect an area of continental size to be.[3] This diversity appears to be both 'natural' and humanly induced. Some of these extant vegetations are increasingly suspected of being the product of long-term human activities – e.g. the vine forests of eastern Amazonia, some of the savannas on better soils, much of the transitional area between forest and savanna in Central Brazil [Balée 1989; Moran 1993].

Indigenous Alteration of Amazonian Landscapes

While it is attractive to think of the Amazon Basin as pristine or virgin forest, such a view says more about our need to have pristine landscapes to establish a link with a long-lost ecological past than it describes the Amazon. Balée [1989] contends that at least twelve per cent of the *terra firme*'s interfluvial forests are anthropogenic. This is not to say that such humanly-induced forest came about through conscious design. The issue of indigenous management is whether alteration of plant communities led to the establishment of plant communities markedly different from 'naturally occurring' communities – and whether such changes in plant frequencies resulted in greater net returns to human communities in terms of usable plant products such as vines, fruits, medicines, thatch and construction materials, to name but some economic uses.[4] A great deal of research is needed focusing on this issue. A recent attack by Parker [1992] on the existence of managed forests among the Kayapó, the now well-known *apetê* [Posey 1985], serves to remind us that until such time as one can demonstrate a statistical difference in the plants growing in 'managed areas' vis-à-vis the naturally occurring adjacent secondary successional forests, acceptance of the role of people in nurturing the forest can be brought into question.

To date, interpretation of vegetation types in Amazonia using

radar and satellite images aggregate most of the ground-level diversity which is found in the Basin – most of the region being lumped together as 'high forest' [RADAM 1973]. In part, this reflects a problem of scale [Moran 1990b] and also an 'epistemological problem in the interpretation of what is pristine and what is not' [Balée in press: 6]. Clearly, what is needed are detailed studies of plant communities related in time and space to remotely sensed images and to cognitive studies of how local peoples conceive of these diverse plant communities.[5]

Although distinguishing between anthropogenic forest and 'natural' forest is difficult from satellite and aerial platforms at this time,[6] it is possible to use ground-level criteria to differentiate between them [cf. Anderson, May and Balick 1991]. Of particular value are differences in basal area, floristic composition, species richness, and the presence of pottery in the soil profile. Balée finds that old fallows are typically within the range of 18 to 24 square metres, whereas high forests are in the 25 to 40 square metre range [Balée, in press: 13; Balée and Campbell 1990; Boom 1986; Pires and Prance 1985; Saldarriaga and West 1986: 364].

Notable differences between old fallows and 'natural' forest may be seen in the coefficient of similarity between the two. Balée found that when comparing the thirty ecologically most important species (i.e. as measured by frequency), that the two forest types shared but a single species – *Eschweilera coriacea* – yielding a coefficient of similarity of only 1.7 per cent as compared with a coefficient of 16.4 per cent when comparing high forest plots and 11 per cent when comparing fallow plots [Balée, in press: 17]. Moreover, it is important to note that of the thirty most frequent plants in a plot of fallowed forest, fourteen were significant food species for indigenous populations of the area, as compared with only six in the high forest plots. This difference in the frequency of economically useful plants suggests human-induced alteration of forest composition, a feat achieved without significantly affecting the heterogeneity of the forest (139 spp. vs 199 spp. in high forest).[7]

The range of indigenous alteration of forest species composition is probably quite large. Some populations may be engaged in conscious planting of species that concentrate resources into 'forest islands' [Posey 1985], managing their fallows so that they concentrate fruits of economic value (see Figure 19.2), while

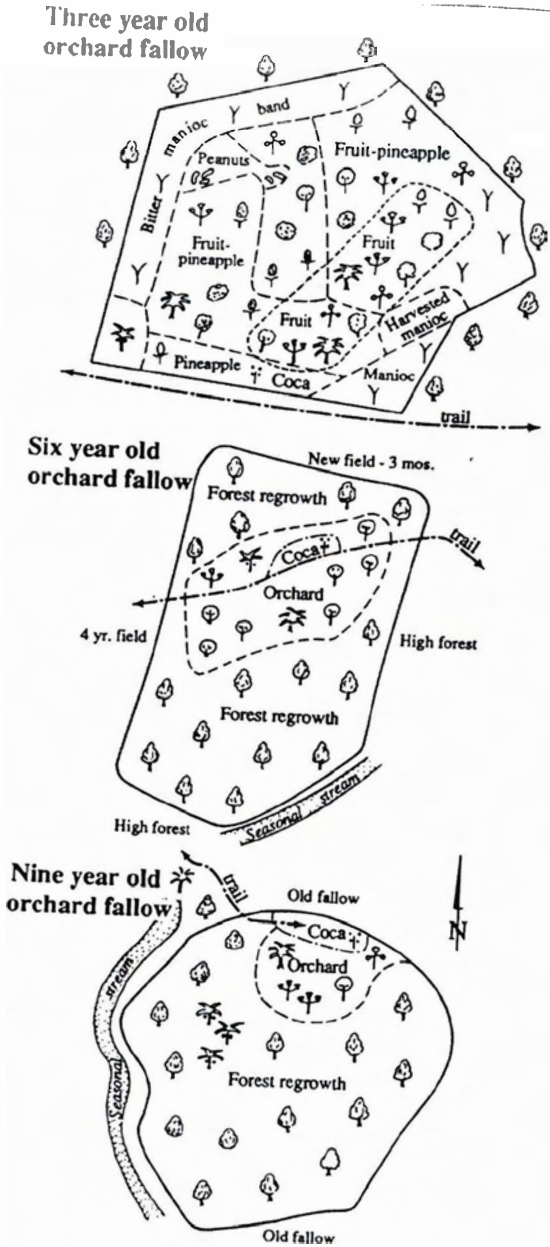


Figure 19.2. Stages of Bora 'graded fallows' [source: Denevan et al. 1984]

others may plant forest species minimally or not at all, aware that a consistent result of making gardens is that seed dispersers will bring certain favoured species into the garden and thereby concentrate species of value. The planting of certain plants in the gardens attracts given animals to them which have food preferences among forest species, as well as in garden crops. Thus, by manipulating the planting density in gardens it is possible indirectly to influence the re-seeding of a garden with forest species of economic value.

Human populations of Amazonia have not only influenced the species composition of contemporary forests, they have also altered the soils upon which plants grow. Anthropogenic black soils or anthrosols [Kern 1988; McEwan 1983; Smith 1980] drain well, are dark in colour and relatively fertile. They have an abundance of potsherds, are reported to be coincident with areas of relatively dense pre-Columbian settlements, and have been reported as occurring over large areas of the Amazon [Falesi 1974]. Phosphorus concentration, sometimes used as an indicator of former human habitational sites [Eidt 1977], is high in these soils. While Amazonian soils tend to average about 5 milligrams per 100 grams (mg/100 g) of phosphorus, the black earths average 40.1 mg/100 g and in one case reached 315 mg/100 g [Smith 1980; Sombroek 1966]. Ash from fires, bones from fish and game, turtle shells, and even human bones might account for the high levels of phosphorus and calcium in anthrosols. The superior quality of black earths is recognized by Amazonian populations [Frikel 1959, 1968; Smith 1980]. Sites tend to occur within easy reach of water sources and average 21.2 hectares along the major tributaries.

Indian black earths have been found overlying a variety of soil types and on a range of geomorphological surfaces. This suggests that they are formed as a result of human activity rather than as a product of geologic processes [Smith 1980: 555]. As some layers are as deep as two metres, it is unlikely that they represent burning of garden areas or the accumulation of organic matter in gardens. Thus, while these soils are excellent for agriculture, once formed, there is no evidence that they are the product of agricultural activity [Eden, Bray, Herrera and McEwan 1984: 137]. There is some controversy over what minimum degree of blackness and what physical or chemical properties constitutes an unambiguous black earth. This judgment must await more competent descriptions of soils and complete sets of analytical data. Eden et al. [1984: 127] note that few archaeologists, ethnologists or geographers offer such data in their reports of black earths. Black earths are not only evidence of prolonged settled life in both *terra firme* and the floodplain in prehistory, but constitute today an important high-quality soil estimated to cover some 50,000 hectares in the Brazilian Amazon alone. When located, Amazon populations commonly give them priority for their most nutrient-demanding crops.

Despite widespread appreciation of the contribution made by Conklin [1957] in describing indigenous systems of soil-plant interrelations and their cognitive dimensions, it is remarkable how very little has been published on the ethnopedology of indigenous populations worldwide, including that of native and folk Amazonians. Only four articles to date have both examined the cultural categories and verified by soil analyses the accuracy of Amazonian systems of naming soils [Behrens 1989; Hecht 1989; Hecht and Posey 1989; Moran 1977].

Behrens [1989] reports that Shipibo distinguished between soils used for making ceramics and those used for gardens. Six different types of named soils were used for gardens (see Table 19.1). An important vegetative indicator of good soils for them seemed to be the presence of *Heliconia* and its association with soils good for growing plantains, the major staple. The preferred soil was 'sandy', probably an Entisol, of silt-loam texture that had a pH of 7.5, whereas the other soils had a pH of 5.4 to 5.8. The better pH and texture of **mashimai** made it suitable for all crops, particularly for plantains and bananas which only did well on this soil.

Moran [1977] found that local Amazonian peasants along the Transamazon highway used vegetation indicator species to identify high base status soils with pH above 6.0, virtually no aluminium saturation, and relatively high amounts of phosphorus, potassium, calcium and magnesium. These soils contrasted with surrounding soils with pH around 4.5, 70 to 85 per cent aluminium saturation, and low levels of macronutrients (see Figure 19.3 and Table 19.2).

Recent studies of the Gorotire Kayapó [Hecht 1989; Hecht and Posey 1989] suggest the active manipulation of soils by some groups. They apply termite and ant nests, bones and leaf mulches to crops to enhance their growth. Fallows are managed to favour

Table 19.1. Cell Means on nine soil characteristics for forty-five topsoil samples taken near Nuevo Edén, Peru, during 1981*

Dependent variable	Cell									
	Nii/ máshimai (n = 5)	*Nii/ maikon* (n = 5)	*Nii/ mapumai* (n = 5)	*Huai/ máshimai* (n = 5)	*Huai/ maikon* (n = 5)	*Huai/ mapumai* (n = 5)	*Nahuë máshimai* (n = 5)	*Nahuë maikon* (n = 5)	*Nahuë mapumai* (n = 5)	Grand mean (N = 45)
SP	80.40	72.20	84.40	46.80	60.60	50.20	42.40	60.80	63.60	63.39
pH_s	7.52	5.34	5.50	7.66	5.86	5.14	7.38	5.54	5.58	6.17
EC_e	0.89	0.73	0.46	0.70	0.72	0.37	1.09	0.73	0.42	0.68
p**	10.34	6.78	18.13	10.56	13.40	8.40	6.74	5.26	2.32	8.79
K	119.0	180.8	209.8	91.6	354.80	94.6	80.8	143.6	134.4	156.9
Ca + Mg	9.82	5.66	3.56	6.42	5.88	2.22	9.78	6.20	2.72	5.81
Na	1.18	1.00	0.83	1.26	1.34	1.14	2.24	0.90	0.93	1.21
Cl	1.22	1.10	0.82	1.24	1.34	1.87	2.74	1.05	0.96	1.20
NO_3N	19.20	35.60	15.32	6.20	23.82	0.30	9.00	35.00	12.30	18.33

* ***Nii*** = primary forest, ***huai*** = garden, and ***nahuë*** = fallow garden.
** Two outliers were eliminated from the phosphorus data, a ***huai/maikon*** sample with a value of 35.0 and a ***nii/ mapumai*** sample with a value of 74.0.

Source: Behrens 1989

Table 19.2. Forest vegetation indicative of agricultural soils

a. Forest Vegetation Indicative of Good Agricultural Soils

Local Term	Scientific Name
Pau d'arco or ipé (yellow variety)	*Tabebuia serratifolia*
Pau d'arco or ipé (purple variety)	*Tabebuia vilaceae*
Faveira	*Piptadenia* spp.
Mororó	*Bauhinia* spp.
Maxarimbé	*Emmotum* spp.
Pinheiro preto	(unidentified)
Babaçú	*Orbignya martiana*
Açaí	*Euterpe oleracceea*

b. Forest Vegetation Indicative of Poor Agricultural Soils

Local Term	Scientific Name
Acapú	*Vouacapoua americana*
Jarana	*Holopyxidium jarana*
Sumaúma	*Ceiba pentandra*
Melancieira	*Alexa grandiflora*
Sapucaia	*Lecythis paraensis*
Piquí	*Caryocar microcarpum*
Cajú-Açú	*Anacardium giganteum*
Massaranduba	*Manilkara huberi* (or *Mimusops huberi*)

Source: Moran 1977

nitrogen-fixing tree species, like *Inga*, as well as planted-in fruit trees that attract seed dispersers from the forest. The Bora Indians of Peru use ashes to fertilize peanut mounds and a basil-leaf infusion as an insecticide [Denevan and Padoch eds 1988]. The productivity of some native systems is evident in the thirty tons per hectare of manioc reported by Frechione [1981] and the 23.16 tons of plantains recorded by Smole [1976].

Not only is the forest landscape affected by human activities, so is the riverine landscape. The indigenous peoples along the floodplain of the Amazon experienced the brunt of the early contact, with its disastrous epidemiological consequences and mortality from warfare and enslavement [Moran 1993]. Over the centuries, the floodplain was resettled by mestizos, often

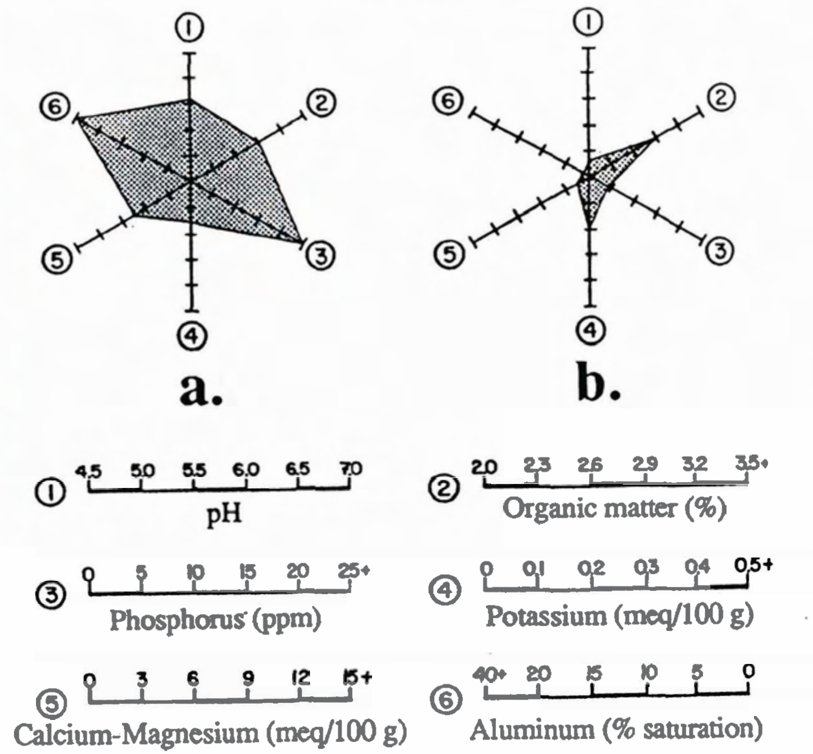
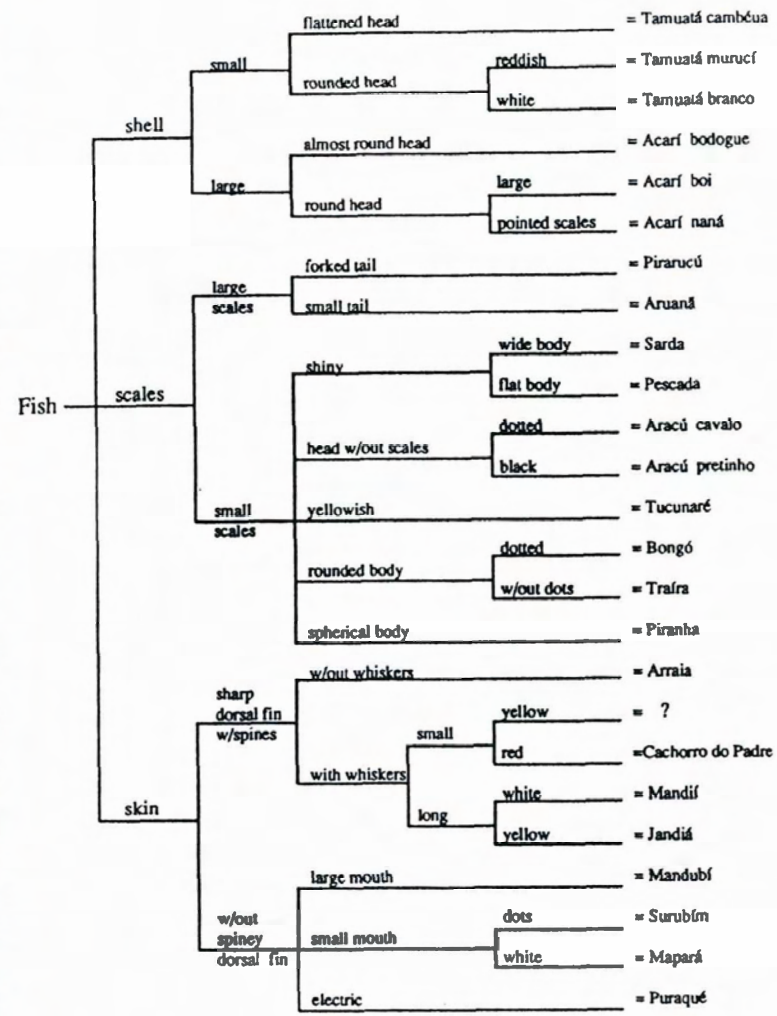


Figure 19.3. Comparison of *terra firme* soils

practicing forms of resource use which approximate that of earlier populations. Along the floodplain, the activities of these populations are synchronized to the complex fluctuations in river level. As soon as waters begin to recede, the population begins to plant on the soggy beaches. In some years, when the floods return due to upperwatershed rains, the crop may be lost. However, the returns can be high if the drop in water level is consistent and ensures a better distribution of labour over the growing season. Rice is the most common crop planted on these beaches, while crops less able to deal with waterlogging are planted on levees. Ecologically, most students of Amazonia agree that the floodplain environment is more resilient than the interfluves [cf. Hiraoka 1985: 245]. The very volume of the floodplain has provided protection from contemporary forms of management that could have altered the habitat. Some signs of coming modification are the growing presence of bauxite plants and other mining concerns, paper-pulp manufacturing plants, and other industrial firms whose potential to pollute could put an end to the rich fisheries of the region. Studies by Goulding [1983] noted that the catch at Manaus had already peaked and that total catch was declining yearly as a result of overfishing.

Fisheries appear to have been protected from excessive human exploitation by the belief that the flooded forests were inhabited by spirits. A rich mythology surrounds the aquatic environment of Amazonia which has had as an indirect effect the conservation of those regions now known to be important natural hatching areas for Amazonian species. Most important in regional folklore is the 'mother of the fish' – a supernatural protector of fish that adopts many guises, among them that of the giant watersnake. She is said to punish overzealous fishermen [Smith 1983] and to be responsible for making them become disoriented so as to lose their way, and even to drown. This is particularly undesirable since according to some local lore those who lose their lives in the water will never get to heaven. The existence of 'supernatural reserves' provides a safe haven for many river creatures, but these beliefs have been eroded in some places as newcomers unfamiliar with such beliefs proceed to use them without adverse effects. However, in other places these beliefs have been reproduced as newcomers experience the unexplainable and local populations share with them explanations which not only give meaning to these experiences but bring back to order the complexities of the Amazonian riverine habitat. Smith [1983] has argued for the creation of fish reserves through legislation coterminous with those areas sanctified by local lore, and biologically verified to represent effective hatching areas.

Use of ethnoecological methods provides a window into the complexity of this riverine world. At Marajó island, at the mouth of the Amazon, preliminary research on the cultural knowledge of the fishermen of the island uncovered a complex taxonomy of the domain fish that we are just beginning to understand (see Figure 19.4). Cultural categorization can vary along many dimensions. It may be concerned with mapping the diversity of the physical world for a non-literate population, or it may be one of many strands that link the physical world to the cosmological one, the social one, and other aspects within our daily lives. The use of physical attributes to put order into an infinitely varying



Source: Fábio de Castro & Emilio Moran, field notes, 1989

Figure 19.4. Ethnoecological fish classification from Marajo

world is one of the important processes in human action which may be tied to action, cognition, or both.

Conclusions

Contemporary deforestation in the Amazon Basin has become a matter not merely of international concern but of alarm: in 1987 alone it is reported that eight million hectares of forest were burned. The Amazon is host to about half of the world's biota and its continental size and high evapotranspiration rates make it a notable influence on world climate. Despite this, relatively little attention has been devoted to how native Amazonians use and conserve their physical environment: Are they conservationists? Are they utilitarians? Are they 'at one with nature', or against it if need be when utilitarian concerns come to the fore?

This paper has tried to show how research in the Amazon has reflected the theoretical debates in the discipline and other trends in Euro-American societies (such as concern with the state of our physical environment). It shows a clear cycling between views which privilege single causal factors to views which are more processual and multicausal. Particular emphasis has been placed on the non-destructive transformation of Amazonian landscapes by native and folk populations. Some 'natural' forests have been changed so that economic species are more dominant, while still maintaining high levels of diversity. Soils which are generally poor have been changed to make them more productive for particular crops, and the rare soils of high fertility have been selected using indicator species as a guide. Even the productivity of the fisheries has been influenced by associating some habitats, like flooded forests, with the presence of supernatural spirits capable of bringing harm to overzealous fishermen.

There are some signs of new versions of old dichotomous debates rearing their simple-minded heads. One of the most insidious seems to be a new form of the old nature versus culture debate. It has taken the form of 'are native peoples of Amazonia conservationists or are they simply decapitalized forest destroyers like ourselves?' Like past nature versus culture debates it imposes a uniformitarianist view on the diverse behaviour of hundreds of cultural groups with widely differing

attitudes towards the physical environment [cf. Redford 1990; Redford and Robinson 1985]. These new versions of old and simplistic generalizations must be rejected. It is all too easy to find one or a few groups in a region that have a certain attitude towards forest mammals. This is not the same as saying that 'indigenous peoples' or pre-capitalist social systems are 'conscious of the sacredness of nature' or 'utilitarian towards their environment'. Both views err in trying to generalize from an insufficient number of cases and in not recognizing the stochasticity of complex systems. As we have seen in this chapter, to date the number of studies that probe into the environmental understanding of native Amazonians have been few. There is evidence for some populations having certain cognitive preferences at the time they were studied. Whether these preferences are inherent in that social system, whether they represent recent adjustments to changes in their political economy and demography, or whether they are undergoing the pains of transitions in modes of production are empirical considerations that must be settled by more inclusive human ecological research than those commonly undertaken.

This paper presents a view which is in stark contrast to that most of us were raised on – dependent as those earlier views were on a static notion of how pre-industrial peoples adapted to environment by accepting the limitations of the areas where they found themselves. Instead, we find that like populations living in more complex political and economic systems, native Amazonians have brought about notable transformations in the regional landscape. Unlike our destructive forms of transformation, however, native systems seem to have been able to transform the environment while preserving some of the features that we all value in tropical rain forests, in particular their rich species diversity. Anthropologists need to focus further on recovering this wealth of knowledge, and how it can be a basis upon which future forms of resource use can be constructed that balance use and conservation, provide dividends to local peoples for their past and current knowledge, rewards their future preservation of germplasm that make infertile areas more fertile, could ensure the sustainability of net yields, and could give local populations economic returns for their labour.

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Notes

1. Although it is not inconceivable that we may find some groups with not wholly 'utilitarian' views. Indeed, we may find some with views that approximate 'romantic' and religious ones [cf. Reichel-Dolmatoff 1970].
2. Some indigenous groups have, in fact, moved quickly to adopt consumerist ways and have been noted to be more concerned with their own wealth than with the integrity of their physical environment or with internal social equity. Whether this represents a temporary compromise in their world-view, as in the case of those needing cash quickly to travel to capital cities to lobby for their ethnic group's rights to land, or a wholesale abandonment of their world-view and the adoption of national ideologies will be settled only by long-term study [cf. Clay 1988].
3. The drainage basin is estimated to be about six million square kilometres in extent.
4. Even this requirement may not be necessary, according to Boster in this volume. It may be evolutionarily advantageous to select plants that are physical variants even if they are not better from a productivity point of view. Such an attitude tends to preserve a richer gene pool, while still permitting a narrow portion of the gene pool to provide the bulk of the consumption needs of the population.

5. This is one of the tasks that my current research focuses on, and is also the main mission of the recently created Anthropological Center for Training and Research on Global Environmental Change at Indiana University.
6. Recent breakthroughs in our own research in the Amazon point to the possibility of spectral differentiation between native forests and secondary growth areas up to about fifteen years using Landsat TM digital image analysis when combined with field studies. See paper presented at the Ecological Society of America meeting in Hawaii [Moran, Brondizio, Mausel and Wu 1994].
7. This finding is in contrast to what Parker [1992] claims he found in the areas denominated by apetê, among the Gorotire Kayapó, where no significant differences in frequencies were found.

Bibliography

Anderson, A., P. May and M. Balick, *The subsidy from nature: palm forests, peasantry, and development on an Amazon frontier*, New York: Columbia University Press, 1991

Balée, W., 'The culture of Amazonian forests', *Advances in Economic Botany* 7, 1989, pp.1–21

——, 'Indigenous transformation of Amazonian forests: an example from Maranhão, Brazil', *L'Homme*, in press

Balée, W. and D.G. Campbell, 'Evidence for the successional status of Liana forest, Xingu river basin', Amazonian Brazil, *Biotropica* 22, 1990, pp.36–47

Barbira-Scazzocchio, F. (ed.), *Land, people and planning in contemporary Amazonia*, Cambridge: Centre for Latin American Studies, Cambridge University Occasional Publication, 1977

Behrens, C., 'The scientific basis for Shipibo soil classification and land use, *American Anthropologist* 91, 1989, pp.83–100

Boas, F., *The mind of primitive man*, New York: Macmillan, 1911

Boom, B.M., 'A forest inventory in Amazonian Bolivia', *Biotropica* 18, 1986, pp.287–94

Boster, J., 'A comparison of the diversity of Jivaroan gardens with that of the tropical forest', *Human Ecology* 12, 1983, pp.343–58

Carneiro, R.L., 'Subsistence and social structure: an ecological study of the Kuikuru', Ph.D. Dissertation, University of Michigan, Department of Anthropology, 1957
Clay, J., *Indigenous people and tropical forests*, Cambridge: Cultural Survival, 1988
Conklin, H.C., *Hanunóo agriculture*, Rome: FAO, 1957
Denevan, W. and C. Padoch (eds), *Swidden-fallow agroforestry in the Peruvian Amazon*, New York: New York Botanical Garden Monograph Series 5, 1988
Denevan, W., J.T. Treacy, J. Alcorn, C. Padoch, J. Denslow and S.F. Paitan, 'Indigenous agroforestry in the Amazon: Bora Indian management of fallows'. *Interciencia* 9(6), 1984, pp.346–57
Eden, M.J., W. Bray, L. Herrera, C. McEwan, 'Terra Preta soils and their archeological context in the Caquetá basin of SE Colombia', *American Antiquity* 49(1), 1984, pp.125–40
Eidt, R.C., 'Detection and examination of anthrosols by phosphate analysis', *Science* 197, 1977, pp.1327–33
Ellen, R., *Environment, subsistence and system*, New York: Cambridge University Press, 1982
Falesi, I.C., Soils of the Brazilian Amazon, in C. Wagley (ed.), *Man in the Amazon*, Gainesville: University of Florida Press, 1974
Ferdon, E., 'Agricultural potential and the development of cultures', *Southwestern Journal of Anthropology* 15, 1959, pp.1–19
Frechione, J., 'Economic self-development by Yekuana Amerinds in S. Venezuela', Ph.D. Dissertation, University of Pittsburgh, Department. of Anthropology, 1981
Frikel, P., 'Agricultura dos Indios Munduruku', *Boletim do Museu Paraense Emilio Goeldi*, n.s. Antropologia (1), 1959, pp.1–35
——, *Os Xikrín*, Belém: Publicações Avulsas do Museu Goeldi, 1968
Geertz, C., *Agricultural involution*, Berkeley: University of California Press, 1963
Goldenweiser, A., *Anthropology*, New York: Crofts and Company, 1937
Goulding, M., 'Amazonian fisheries', in E. Moran (ed.), *The dilemma of Amazonian development*, Boulder: Westview Press, 1983
Hames, R. and W. Vickers (eds), *Adaptive responses of native Amazonians*, New York: Academic Press, 1983
S., 'Indigenous soil management in the Amazon basin', in

J. Browder (ed.), *Fragile lands of Latin America*, Boulder: Westview Press, 1989
Hecht, S. and D. Posey, 'Preliminary results on soil management techniques of the Kayapó Indians', *Advances in Economic Botany* 7, 1989, pp.174–88
Hemming, J. (ed.), *Change in the Amazon Basin*, 2 vols, Manchester: Manchester University Press, 1985
Hiraoka, M., 'Mestizo subsistence in Riparian Amazonia', *National Geographic Research* 1, 1985, pp.236–46
Johnson, A., 'How the Machigenga manage resources: conservation or exploitation of nature?', *Advances in Economic Botany* 7, 1989, pp.213–22
Kern, D.C., 'Caracteristicas Pedológicas de Solos com Terra Preta Arqueológica na Região de Oriximina', Pará, MA Thesis, Universidade Federal do Rio Grande do Sul, Department of Agronomy, 1988
Lathrap, D., 'The "hunting economies" of the tropical forest zone of South America', in R. Lee and I. DeVore (eds), *Man the hunter*, Chicago: Aldine, 1968
Lees, S. and D. Bates, 'The ecology of cumulative change', in E.F. Moran (ed.), *The ecosystem approach in anthropology: from concept to practice*, Ann Arbor: University of Michigan Press, 1990, pp.247–77
McEwan, C., 'Amazonian Terra Preta soils: clues to prehistoric population dynamics in the Amazon basin', paper presented at the XI Midwestern Conference on Andean and Amazonian Archeology and Ethnohistory, Bloomington, Indiana, 1983
Meggers, B., 'Environmental limitations on the development of culture', *American Anthropologist* 56, 1954, pp.801–24
——, *Amazonia: man and culture in a counterfeit paradise*, Chicago: Aldine, 1970
Moran, E.F., 'Estratégias de sobrevivencia: o uso de recursos ao longo da Rodovia Transamazônica', *Acta Amazônica* 7, 1977, pp.363–79
——, *Agricultural development along the Transamazon highway*, Bloomington: Center for Latin American Studies, Indiana University, Monograph Series, 1979
——, *Developing the Amazon*, Bloomington: Indiana University Press, 1981
—— (ed.), *The dilemma of Amazonian development*, Boulder: Westview Press, 1983

——(ed.), 'Levels of analysis and analytical level shifting: examples from Amazonian ecosystem research', in *The ecosystem approach in anthropology: from concept to practice*, Ann Arbor: University of Michigan Press, 1990

——, *Through Amazonian eyes: the human ecology of Amazonian populations*, Iowa City: University of Iowa Press, 1993

——, E. Brondízio, P. Mausel and Y. Wu, 'Integrating Amazonian vegetation, land-use, and satellite data', *BioScience* 44(5), 1994, pp.329–38

Orlove, B., 'Ecological anthropology', *Annual Review of Anthropology* 9, 1980, pp.235–73

Parker, E., 'Forest Islands and Kayapó resource management in Amazonia: a reappraisal of the Apetê', *American Anthropologist* 94(2), 1992, pp.406–28

Pires, J.M. and G. Prance, 'The vegetation types of the Brazilian Amazon', in G. Prance and T. Lovejoy (eds), *Key environments: Amazonia*, Oxford: Pergamon Press, 1985

Posey, D., 'Indigenous management of tropical forest ecosystems: the case of the Kayapó Indians of the Brazilian Amazon', *Agroforestry Systems* 3, 1985, pp.139–58

Prance, G. and T. Lovejoy (eds), *Key environments: Amazonia*, Oxford: Pergamon, 1985

RADAM, *Levantamento da Região Amazônica*, 12 vols, Rio de Janeiro: Ministerio de Minas e Energia, 1973

Rappaport, R., *Pigs for the ancestors*, New Haven: Yale University Press,1968

Redford, K., 'The ecologically noble savage', *Orion Nature Quarterly* 9(3), 1990, pp.24–9

Redford, K. and J. Robinson, 'Hunting by indigenous peoples and conservation of game species', *Cultural Survival Quarterly* 9(1), 1985, pp.41–4

Reichel-Dolmatoff, G., *Amazonian cosmos: the sexual and religious symbolism of the Tukano Indians*, Chicago: University of Chicago Press, 1970

Saldarriaga, J.G. and D.C. West, 'Holocene fires in the northern Amazon basin', *Quaternary Research* 26, 1986, pp.358–66

Schmink, M. and C. Wood (eds), *Frontier expansion in Amazonia*, Gainesville: University of Florida Press, 1984

Sioli, H., *The Amazon: limnology and landscape ecology of a mighty tropical river and its basin*, Dordrecht: Junk Publication, 1984

Smith, N.J.H., 'Anthrosols and human carrying capacity in

Amazonia', *Annals of the Association of American Geographers* 70, 1980, pp.553–66

——, 'Enchanted forest', *Natural History* 92(8), 1983, pp.14–20

Smole, W., *The Yanomama: a cultural geography*, Austin: University of Texas Press, 1976

Sombroek, W., *Amazon soils*, Wageningen: Centre for Agricultural Publication and Documentation (the Netherlands), 1966

Sponsel, L., 'Amazon ecology and adaptation', *Annual Review of Anthropology* 15, 1986, pp. 67–97

Steward, J., *Basin plateau Aboriginal sociopolitical groups*, Washington DC: Smithsonian Institution, Bulletin 120. Bureau of American Ethnology, 1938

Thomas, F., *The environmental basis of society*, New York: the Century Company, 1925

Vayda, A.P., 'Warfare in ecological perspective', *Annual Review of Ecology and Systematics* 3, 1974, pp.107–32

——, *Warfare in ecological perspective*, New York: Plenum, 1976

Vayda, A.P. and R. Rappaport, 'Ecology, cultural and non-cultural', in P. Richerson and J. McEvoy (eds), *Human ecology*, N. Scituate: Duxbury Press, 1976

Wagley, C. (ed.), *Man in the Amazon*, Gainesville: University of Florida Press, 1973

1995 ACT Publications

No. 95-01
Moran, E.F. 1995. Rich and poor ecosystems of Amazônia: An approach to management. In *The Fragile Tropics of Latin America: Sustainable Management of Changing Environments*. Toshie Nishizawa and Juha Uitto (eds.). Tokyo: United Nations University Press. Pp. 45-67.

No. 95-02
Moran, E.F. 1995. Disaggregating Amazônia: A strategy for understanding biological and cultural diversity. In *Indigenous Peoples and the Future of Amazôni.* Leslie Sponsel (ed.). Tucson: University of Arizona Press. Pp. 71-95.

No. 95-03
Moran, E.F. 1995. Amazonian communities: Are forests or people more vulnerable? In *Global Change: How Vulnerable are North and South Communities?* Dennis Conway and James White II (eds.). Environmental and Development Monograph Series, No. 27. Bloomington, IN: Indiana Center on Global Change and World Peace. Pp. 11-31.

No. 95-04
Moran, E.F. 1995. Socio-economic aspects of acid soil management. In *Plant Soil Interactions at Low pH.* R.A. Date et al (eds.). The Netherlands. Kluwer Academic Publications. Pp. 663-669.

No. 95-05
Randolph, J.C., E.F. Moran, and E.S.Brondizio. 1995. Biomass and carbon dynamics of secondary growth forests in the eastern Amazon. Abstracts: *Bulletin of the Ecological Society of America.* 76(2):221.

No. 95-06
Moran, Emilio F. 1995. Introduction: Norms of Ethnographic Reporting. *The Comparative Analysis of Human Societies.* E.F. Moran (ed.) Lynne Rienner Publishers. Pp. 1-20.

No. 95-07
Nicholaides, J.J. III and E.F. Moran. 1995. Soil Indices for Comparative Analysis of Agrarian Systems. *The Comparative Analysis of Human Societies.* E.F. Moran (ed.) Lynne Rienner Publishers. Pp. 39-54.