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TROPICAL FORESTS, PEOPLE AND FOOD: AN OVERVIEW

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INTRODUCTION

The evolution of scientific ideas is currently marked by dynamic interactions among fields of knowledge that were considered largely independant until now. Cooperative ventures by researchers working in multidisciplinary projects are now very much in vogue. Perhaps the most spectacular of the disciplinary encounters is that of planetary sciences and particle physics. An all-encompassing vision of the history and structure of our universe, from the formation of quarks, atoms and molecules, to the most complex organisms some 15 billions years later, has emerged from this meeting of minds. The idea that all physical and biotic parts of the universe have a common origin has fired the lay imagination through such best sellers as those of Hawkins (1988) and Allègre (1992). They have provided the basis for a more philosophical and humanized vision of all the living organisms and abiotic components of our environment.

It might seem over-ambitious to begin from such a global vision when our concern is with tropical forests, their food resources and the strategies developed by forest-dwellers. But there is a similar need here to lift current conceptual barriers in order to seek a deeper appreciation of complex phenomena. Indeed, the nature of the links between ecosystems

and social groups has been discussed in recent works such as *Les Passeurs de Frontières* (Jollivet, 1992). The frontiers to be breached are those of scientific disciplines that developed independently of each other, so that the exchange of information and ideas has proven difficult.

The possibility of building upon new concepts resulting from the fusion of different scientific approaches is by no means universally accepted. Certain social anthropologists, for example, have taken up arms against what they perceive as the reductionism inherent in the natural sciences, arguing for the complete autonomy of the social from the biological domain. They insist that notions such as "cultivated" versus "wild" plant species are culturally specific; they have quite different meaning for a European versus a Kayapó Indian (Posey, 1992). On the other hand, biologists would argue that plant characteristics, and their genetic bases, can be fully understood without the need to grasp the exact connotations of the Kayapó concept. There is truth on both sides. It is therefore essential to respect the conceptual integrity of each discipline while at the same time recognizing that "folk" plant and animal classifications and use may be useful in refining modern taxonomies – and the reverse.

This volume contributes to this synthesizing effort. We seek to analyze relations between human social behaviour and "natural" biological phenomena so as to better understand their reciprocal effects. The attempt to explore *biocultural interactions* in the context of tropical forest habitats has provided the *raison d'être* for bringing together representatives from a wide range of disciplines whose results would otherwise be published in specialized scientific journals in either biology or the social sciences. Hopefully, out of this interdisciplinary experiment, a more enriching and useful vision of both tropical forests and their inhabitants will emerge from the papers included in the six major sections that follow this one:

Section 2: *Evolution and history of tropical forests in relation to food availability*

Section 3: *Food production and nutritional value of wild and semi-cultivated species*

Section 4: *Adaptive aspects of food consumption and energy expenditure*

Section 5: *Feeding strategies in relation to environmental variation*

Section 6: *Cultural factors in food choices*

Section 7: *Food and the future of the tropical forest: management alternatives*

THE TIME DIMENSION

Biocultural interactions, seen in the context of evolutionary processes and of the history of human use of forest resources (this volume, Section 2), explain the existence of productive edible species (Section 3), and the reasons why some species are inedible. Together with the evolutionary forces that underlie the formation of extremely complex tropical forest ecosystems, prehistory and recent human history provide keys to understanding the variety of strategies existing today (Section 5). They encourage us to predict and manage economic and ecological changes (Section 7) in order to improve life chances for future generations.

Human impact on tropical forests in times past has been studied through new methodologies, as well as old ones applied to new problems, from palynology to comparative linguistics. These studies have opened up new vistas (Section 2); the image of immutable tropical forests as "stable environments" *par excellence* has been definitively laid to rest.

It might be assumed that food procurement practices are "the product of selection working on both biological and cultural variation" (Harris, 1989). The transition from dependence upon wild foods, to dependence on domesticated plants and animals, took place in different regions of the world, at different times and at different rates. In fact, the line between foraging and farming is a thin one. As Balée (1992) reminds us, some present-day foragers are "regressed" agriculturalists. Human beings have been manipulating the forest in order to enhance the growth and propagation of favoured food plants for many millennia. Although hunter-gatherers may not have domesticated plants or animals, they domesticated the environment in which these species grow (Yen, 1989). Contrary to a tenacious hypothesis (Bailey and Headland, 1991) that considers the forest as uninhabitable for people without access to cultivated products, "there is some archaeological evidence of the presence of hunter-gatherers in rain forest habitats (Eggert, 1992: 5, referring to the Central African rain forest; see Sections 3 and 6).

Elsewhere in New Guinea, human beings were manipulating the forest "by judicious trimming, canopy-thinning, and ring-barking" in order to increase the natural stands of taro, bananas and yams, as far back as the Late Pleistocene, some 30 – 40 000 years ago (Groube, 1989). In contrast, horticultural activity in Papua New Guinea dates from only 9 000 years ago and was centered upon taro (Golson, 1989). In Sri Lanka, wild bananas and wild breadfruit were being gathered, in conjunction with the hunting of wild animals, during the Mesolithic, 10 –12 000 years ago (Kajale, 1989).

In much of the rest of Southeast Asia, for example Sumatra and Luzon, caves and rockshelters containing the so-called Hoabinhian complex indicate that people were hunting an enormous variety of animals: rhinoceros, cattle, wild pigs, porcupines, monkeys, bears, tigers and dugongs (Hutterer, 1988). At Spirit Cave, in northern Thailand, its human occupants, dated to between 14 000 and 8 000 years ago, gathered a remarkable number of plants: nuts of several species, mango, berries, caster and broad beans, bottle gourd, cucumber and the betel palm (Gorman, 1973). The foraging way of life continued in northeast Thailand until recently, partly based on several species of wild yams (*Dioscorea* spp.), and wild rice (*Oryza* spp.), stands of which were densely clustered (White, 1989). In mainland Asia itself, rice was domesticated in a wide belt stretching from the Himalayas to the east about 10 –15 000 years ago (Chang, 1989).

Archaeological evidence on African foragers and early horticulturalists is scantier than evidence of prehistoric forest dwellers of Southeast Asia and the Far East. The origin of many widely used species in the African forest is a relatively neglected subject. In naturally swampy areas, the wild African rice (*Oryza barthii*), the precursor of the cultivated species (*O. glaberrima*), was gathered in large quantities (Harlan, 1989). Plants such as the cola nut, akee apple (*Blighia sapida*), guinea millet (*Brachiaria deflexa*), are thought to be "true" forest species. But it is widely believed that the forest-margin agricultural complex – which includes the yams, cowpeas and the oil palm (*Elaeis guineensis*) – evolved along the savanna/forest ecotone and only later invaded the forest (Harlan, 1992). However, this may be a reflection of our poor knowledge about the prehistory of the African forest. For example, evidence is beginning to accumulate that yams, *Dacryodes edulis*, *Aframomum* spp. and other species, may have evolved within the forest itself (Section 2).

In west Africa, cultivated yams currently constitute the staple food for a large fraction of the population. Miège (1954) and Coursey (1972) have even proposed the idea of a "yam civilization". Recent excavations in central Cameroon have uncovered deposits described as "yam pits" (Atangana, 1992). These may corroborate the hypothesis that various yam species were widely utilized in the past. Wild yams could have supported populations of Aka Pygmies before exchanges were voluntarily set up with farming villagers (Bahuchet *et al.*, 1991). Moreover, new data presented in this volume (Sections 2, 3 and 6) show that, even today, there is a form of wild yam "paracultivation"; this is a technical and cultural way of truly managing wild food plants.

The record for wild plant gathering and early horticultural activities is shorter for the New as compared with the Old World tropics, for the obvious reason that humans are relatively recent newcomers to the American continent. Climatically and phytogeographically distinct groups of

root crops – from manioc in the lowland tropics, to potatoes in the cool-temperate regions of the high-Andes (Hawkes, 1989) – developed in a range of environments. It has been assumed that the storage mechanism in tuberous tropical plants is related to long seasonal periods of dryness. However, the existence of tubers in the midst of the rain forest suggest that light gaps caused by tree falls, unpredictable in time and space, also explain this opportunistic storage mechanism (Hladik *et al.*, 1984).

One of these tubers, "cassava" or "manioc" (*Manihot esculenta*) – the subject of several essays in this volume – has about 100 wild species (Hawkes, 1989: 486). Where and when these were first gathered, and later purposefully propagated, is still a matter for speculation. Were the first gathered species "sweet" (non-toxic), and the more poisonous cassava varieties a later selection by people? The motivation for such a selection is thoroughly discussed by McKey and Beckerman (Chapter 8).

It should go without saying that these natural plant distributions have been greatly altered by contacts and diffusions all through the history of human movements and trade routes. For instance, after European contact, America was the centre of dispersion of important food species – maize, manioc, tomato, avocado, peanuts, chile pepper, papaya – towards Africa (Harlan *et al.*, 1976).

FOREST FOODS AND FEEDING STRATEGIES

The contrasting histories of different continents and their tropical forests thus provide the basic context in which the diversity of feeding strategies observed today was developed. These strategies form a continuum, from subsistence foraging to commercial farming (Groube, 1989; Harris, 1989). They typically also necessitate a conceptual approach that focuses on *biocultural interactions*.

Densities of animals and plants result, at one and the same time, from natural selection, as well as from social preferences guiding human extractive practices. For instance, hunting is practised selectively, whereas some plants are preferentially gathered, and others tended. "Garden hunting", is widely employed in the tropics, as a way of profitting from man-made concentrations of game (Linares, 1976).

As a crucial component of forest ecosystems, and as potential food for humans, animals are an important focus of this volume. Invertebrates and vertebrates are active agents in past evolutionary processes as well as in present plant population dynamics (Section 2). They are also a major food resource (Section 3). Wild animals – including fish and insects – presently provide most protein in the diet of rain forest populations (Section 4). This is so even if peoples today frequently combine horticulture with

hunting (Section 5). The importance of game meat in collective representations and socio-cultural responses (Section 6) contrasts with the low value generally attributed to most gathered food plants. For sustainable management of forest ecosystems (Section 7), we thus have to take into account the role of animals as well as plant species. Mammalian biomass varies from one forested habitat to another, and many species, particularly those with a high commercial value, are becoming locally or even widely extinct through over-hunting (Robinson and Redford, 1991). Although the neotropics have been particularly privileged for data on wildlife use and conservation, the present volume emphasizes research conducted in Africa.

As for food plants, the rain forest is a cornucopia: a tremendous number of species provide carbohydrates, unsaturated fats, some protein and large amounts of calcium, iron and vitamins (Section 3). In New Guinea alone, 251 tree species bear edible fruits (Myers, 1992). However, there are striking differences in floristic composition between Asia, Africa, and the New World. For example, the monocarpic palms (*Metroxylon sagu* and 15 other species), which accumulate starch before terminal flowering, are abundant in Asia (Johnson, 1992), whereas in South America most available palm foodstuffs comes from the pulp of fruits and from the seeds (Section 3). Although the African forest is poor in palm species, the oil palm (*Elaeis guineensis*), which provides a fatty fruit pulp and is tapped for wine, is intensively used locally, and widely cultivated throughout the world. Forest species, including these palms, plus coconuts, plantains and bananas, many tuberous plants (manioc, sweet potato, yams etc.), together with rice, millet, sorghum and maize, currently feed the tropical world.

Seasonal and spatial variation in food production

Although generally of smaller amplitude, seasonal variation is marked in the tropics as elsewhere in the world. The study of seasonal parameters in food availability, and the biological consequences that ensue, are discussed in Sections 4 and 5. Knowledge about fluctuations in food resources through time, and in their resulting nutritional content, is central to survival. Food security is highly dependent upon detailed acquaintance with the habit and habitats of specific plants and animals. But it is also contingent upon the flexible and opportunistic strategies that individuals and groups develop in the course of the yearly cycle.

Similarly, the uneven distribution in space (i.e. patchiness) and local variations (in both evergreen and semi-deciduous forests) of natural food resources is also of paramount importance to regional food strategies. Morán (1990; 1993, this volume) illustrates these phenomena with refer-

ence to the Amazon Basin. Although human beings may have a particular resource in mind when they set out to trek or gather, they may change their aims when confronted with unforeseen opportunities. As Beckerman (1983) points out, the Barí hunt on their way to fishing spots. This raises their overall meat yield to time invested (Linares, 1984).

However, as P. Grenand (1993, this volume) also emphasizes, one should not underestimate the role of chance in hunting some game animals whose food sources are widely distributed. In order to reduce the factor of chance, groups may cooperate in hunting, invoke the "master of animals" for his assistance, or redouble hunting and fishing efforts.

Biological effects and causes

The spatio-temporal variation of food availability has been studied among non-human primate species (Hladik, 1988). Adaptive responses to this variation obviously preceded those presently observed in human populations (Whiten and Widdowson,1992). Among the latter, biological knowledge, technical skills, and cultural representations mediate between physiological needs and their fulfilment.

We have tended to make false dichotomies, as between "foods" versus "drugs" (Hugh-Jones, 1993, this volume), or between "eating" versus "curing themselves" in the case of chimpanzees (Huffman *et al.*, 1992). There is no real difference in the ingesting behaviour involved: conditioning is "automatically" reinforced through a state of well-being. In real societies of all kinds, where there is a collective memory, a continuum in strategic behaviour puts into the same category actions that we tend to keep apart. This is so for "Man" as well as "Beast" (Robinson and Tiger, 1991).

But particularly for human beings, the perception of different food types depends on the merging of biological responses, mostly taste (Section 2), with cultural attitudes. These can totally change the quality of the perception, as in the case of Aka Pygmies with low taste sensitivity to sugar but a high esteem and motivation for honey (Hladik and Bahuchet, 1992).

Studies of food consumption and energy expenditure (Section 4) reveal a large range of variation in the consequences that strategies and environmental factors have, both on individual fitness, and (in wider terms) on population growth and maintenance. It is also worth remarking that, in the humid forested region of Africa, the total caloric intake, as well as the quantities of protein and minerals consumed per capita, are generally in line with the norms for "well being" as defined by competent international agencies. Nevertheless, malnutrition in these regions may occur, but it is probably linked to the total parasite load and the resultant anaemia rather than to diet. One important consequence of this debilitating condi-

tion, especially when it occurs in the period following weaning, is stunting of growth – a common characteristic in observed African forest dwellers. However, it should be recognized that the very definition of "growth norms" is the subject of considerable debate. Size and weight may, in fact, not only be biologically advantageous, but may also represent a cultural ideal. Various studies of African forest populations (e.g. Hladik *et al.*, 1990), grouped in this volume with those conducted in the Amazon basin and in the Far East forest area, shed light on these issues.

For the Gidra, a population of Papua New Guinea, Ohtsuka and Suzuki (1990) have focused on problems related to variations in diet as a result of contacts with other societies. Recent changes can threaten the very survival of the population, as in the case of Amerindian and Asian groups discussed in this volume (Section 5).

FOOD IN ITS SOCIO-CULTURAL CONTEXT

The very notion of "feeding strategy" can only be understood as it is embedded in its socio-cultural matrix. It is worth emphasizing that food preferences, and the biological conditions that result, are put into practical action through social institutions and individual choices (Section 6).

Most essays in this volume attempt to address this fundamental question of the nature and working processes of *biocultural interactions*. In so doing, they point to the essentially social and cultural nature of the food quest. They underscore the fact that food selections must be understood in the context of the social, political and economic processes that underlie them. They emphasize that individual decisions concerning food acquisition and consumption are seldomly independently made, or value-free, but are always guided by local cultural perceptions, attitudes and beliefs (Garine, 1990; 1991). The latter, in turn, are constantly being shaped by the total institutional structures in which they occur.

Just as one once thought that the forest was "immutable", similarly traditions were thought to be static. The reality is otherwise. People both use the past and invent the present in order to manage their social as well as their biological environment. As most authors here emphasize, cultural ideals and social arrangements are always changing; groups and individuals meet new challenges and seize new perceived opportunities in dynamic ways. These responses must be placed in terms of "the logic in which the actors are situated" (Friedberg, 1993: 80). In trying to understand this logic, one must go beyond the analysis of time/space variability in natural resource distribution and focus instead on the ways that these resources are put to human use through the creative role of culture in societies.

Past, present and future food practices are seen in the light of natural and cultural selection working together on the astonishing diversity of tropical forest habitats – a diversity maintained, for instance, by limited access to "sacred areas" where animal species find shelter or refuge for reproduction (Pagezy and Guagliardo, 1992). But it is being threatened by the destructive practices of recent newcomers who have not yet learned to live with the forest.

THE FUTURE OF TROPICAL FORESTS: OPENING A DISCUSSION

The future of tropical forest communities is explicitly discussed in Section 7. Vigorous new ideas emerging from interdisciplinary encounters are not only the province of academic disciplines. They also shine through the diverse technical and cultural resource management practices and perceptions developed by different cultures. The contribution of "traditional" ecological knowledge to long-term resource management of forest species is indisputable. A wide array of edible plants enter into the creation of highly productive agroforestry systems in Sumatra (Section 7). Other examples of such knowledge constitute a wealthy bank of ideas that are potentially transferable from one tropical region to another (Hladik and Hladik, 1984). Indeed, exploring such transfers continues the long process of cultural exchange and communication, reinforcing the idea that all "traditions" are dynamic. Recognition that diversity – whether biological or cultural – constitutes a fundamental value and a key concept for insuring the future was one of the driving forces permeating the United Nations Conference on Environment and Development (Rio de Janeiro, June 1992).

It no longer suffices simply to make an inventory of fast-disappearing practices for "museum" collections. Nor is it satisfactory just to catalogue new drugs and food products useful in phytochemical research. In highlighting appropriate knowledge acquired through direct experience, ethno-ecology has a growing role to play in bringing substantial benefits to local communities (Toledo, 1992).

For these ideas to be realized on the ground, suitable economic, legislative and political conditions must exist (Section 7); thus the importance of the *Académie Universelle des Cultures* created in Paris (1993) to promote a thoroughly international appreciation of the human creative endeavour. The links that bind cultures together take one back – metaphorically speaking – to the vision of the Universe evoked at the beginning of this chapter. We learned from Einstein that the gravitational field exerted around planets and stars is a local space-time deformity, which determines orbits and trajectories. Since such deformities also bend light, a very

massive star, after absorbing neighbouring stars, may disappear from view, creating a black hole from which no light escapes. A dominant culture can play an equally stifling role, provoking before our eyes the disappearance of a diversified cultural world. Against this bleak prospect, the present volume seeks rather to emphasize the complex network of *biocultural interactions* which could help insure the survival and wise use of tropical forests for the benefit of all humankind.

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