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By Darrell Addison Posey

Keepers of the Campo

Recent studies show that "primitive" Amazon Indians do not merely inhabit grassland, they establish and maintain complex eco-zones in it

Up until recently Westerners viewed the cerrado and campo (savanna) as wild and unproductive lands. And no one imagined that Indians managed the savanna in any way, except, perhaps, to have created or perpetuated it with fire.

Recently, however, scientific research has validated what native populations have long known: that campo and cerrado are biologically diverse. Evidence now suggests that Indians like the Kayapó have a sophisticated understanding of the ecological diversity of savanna, classify it into a complex variety of folk ecological zones, and take from it a wealth of natural resources. And the most significant discovery is that the Indians actively manage and manipulate savanna, creating in it patches of forest and so increasing its ecological diversity.

A group I have studied over the last eight years is the Gorotire Kayapó, one of several groups of Amazonian Indians linked linguistically (in the Jê language family). The Kayapó once inhabited a territory the size of France between the Araguaia and Tocantins rivers. Today these people live on an enormous (five-million-acre) proposed reserve that includes a variety of tropical ecosystems, ranging from high forests to vast grasslands. The group is divided into 13 villages, the largest of which is Gorotire, with roughly 600 inhabitants.

The Kayapó still rely partly on hunting and gathering throughout the year, with periodic treks away from their villages. Their agriculture is well developed and is based upon the management of domesticated and semi-domesticated plants in a variety of forest zones — including forest openings, trailsides and house gardens (see *Garden*, January/February 1982).

Attending to the savanna

While the Kayapó devote much of their energies to their forest gardens, new evidence suggests that they also manage and use open grassland.

The Indians' grassland environment consists of cerrado, savanna-type vegetation dotted with trees or woody patches, and campo, open grassland. Western observers have tended to consider grasslands as homogeneous, because they are characterized by soils of low fertility and low productivity potential, supporting species of little economic value. The forest islands of campo and cerrado have of course been known by scientists, but never studied from an economic botany viewpoint and never considered to have been influenced by human activity.

Some of the evidence for the Kayapó attention to the campo is linguistic. The Kayapó have at least nine terms for campo, reflecting their recognition of great ecological variability

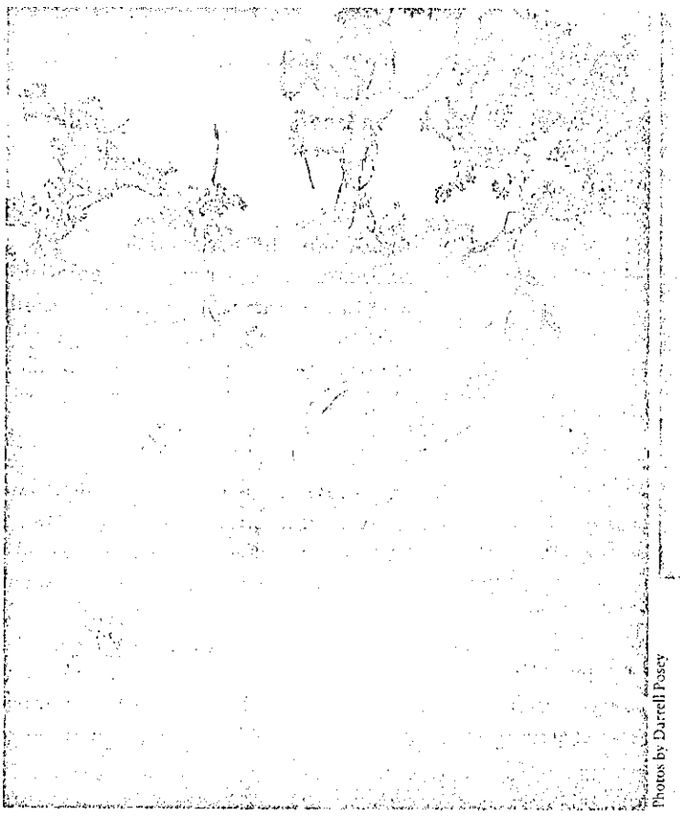
Moreover, the Kayapó recognize five transition zones as being areas of greater productivity and resource variety. These range from campos at the base of mountains to cane brakes. The Kayapó give these more highly productive areas considerable importance.

In addition, the Kayapó classify the types of forest islands that occur in campo and cerrado—these are the forest types that the Kayapó most frequently manage and exploit. The classification is apparently based on size and form of the forest "island" and the dominant species in it. Types range from *apêt-nu,* newly formed vegetative clumps, to true *apêtê,* with shade from tall trees, and on to categories of increasing tree size and land area.

More direct evidence of Indian influence is revealed by the differences in the ecosystems in the vicinity of villages. For example, the number of *apêtê* forest patches near the Kayapó village of Gorotire is much greater than in campo areas distant from the village. Although cursory examination suggests that these *apêtê* are natural, closer scrutiny reveals that a sizable proportion (an estimated 75 percent) are indeed manmade, the direct result of Indian activities.

In a preliminary study in November 1983, Dr. Anthony Anderson of Brazil's Museu Paraense Emílio Goeldi and I collected, botanically identified, and determined use and management of 140 different plant species growing in *apêtê* near Gorotire. We found that only two were not considered useful by the Kayapó. Equally astonishing is

Ahead of a lone Amazon hunter (right) are apêtê*—forest patches not established by nature but deliberately planted. Indian techniques of forest establishment include creation of new soils in the savanna hospitable to forest species, and careful planting in it of tree cuttings and seedlings (below). Amazon Indians actively manage forest-savanna ecological zones.*



Photos by Darrell Posey

that the Kayapó told us that approximately 60 percent of the plants we collected in ten forest islands were actually planted. Many occur naturally in the campo and have been transplanted to increase their concentration; more than half, however, are species brought from open forest to the *apêtê*. The islands, therefore, were initially formed, and later maintained, by the Indians.

Establishing a forest island

Actual observations of Indians' *apêtê*-creating activities contribute to our understanding of campo management. The Kayapó begin an *apêtê* by first preparing compost heaps, in nearby forests and in existing *apêtê*, from sticks, limbs and leaves. These are allowed to rot, then are beaten with sticks to produce a mulch, which is subsequently taken to a selected spot elsewhere in the campo and piled onto the ground. The Indians usually pick slight depressions in the campo land surface because these are more likely to hold water during the rains. The mulch is mixed with soil from the mounds of the termite *Nauciternes*, and also sometimes with smashed-up bits of the nest of an ant of the genus *Azteca*. Living ants and termites are included in the mixture.

The Indians use several ant and termite nests to prepare this special mixture. They believe that if only one nest were to be used, the ants or termites would attack any young plant cultivated in the resulting rich soil. The mixture, however, causes the ants and termites to fight among themselves and leave the plantlings alone, while the dead insect bodies furnish additional nourishment for growth.

The resulting mounds of earth, called *apêt-nu,* are generally three to six feet in diameter and one and two-thirds to two feet deep. The Indians create their *apêt-nu* in August and September, between the first rains of the wet season; they then carefully observe and nurture them as they pass along the savanna trails to their gardens. Each extended family generally has its own forest island.

The Kayapó continue to plant around the edges of the islands, then allow "natural" reforestation and regeneration processes to further enlarge them. As the islands increase in size and plants begin to repopulate on their own, the percentage of plants introduced by the Indians declines, although the absolute numbers planted and transplanted may increase. Over the years the *apêt-nu* grow into *apêtê*, and finally into large *apêti,* forest islands five acres or more in size, with many large trees. Within their new islands the Kayapó create small clearings, which maintain ecological diversity.

How long a period of time is required to create forest islands is still under study. Since there are *apêti* of ten acres in Gorotire, which is known to have been permanently inhabited for at least 40 years, it is possible that *apêti* growth is in the range of two or three acres per decade. A study of planting sequences and the process of *apêtê* maturation is under way.

The Kayapó lexicon of eco-zones

Grassland zones	
kapôt kêin	"clean" campo with few trees
kapôt kumrenx	open campo with many forest patches
kapôt metx	low, grassy and open campo
kapôt punu	closed campo with scrub (campo fechado)
kapôt jajôre	open campo with small scrub patches
kapôt imôk krê pôk re	small open areas surrounded by scrub forest near large campos
kapôt kam imô	seasonally inundated campo
kapôt imõ nôi pôk	campo openings on top of mountains
kapôt krã nhi mók	campo rupestre
Transitional grassland zones	
krã nhi nok ã´ kapôt	campo at top of mountains
krã nhi kratx ã kapót	campo at base of mountains
kapôt nô kà	transition zones between savanna and forest
pô'ê kô	cane brakes
pô'ê te	very closed forest with cane
Forest island zones	
apêt-nu	newly formed vegetative clumps
apêt	small, low vegetative patches
apêt kryre	larger forest patch, with small trees and shrubs
apêtê ngri	forest plot with some trees and large shrubs
apêtê (kumrenx)	"real apêtê" with shade from tall trees
apêti rhynh	long corridors of forest (for defense)
apêti	large forest islands with many tall trees (five or more acres)

The Kayapó create *apêtê* for a variety of reasons. The Kayapó prefer to locate village sites in campos, which are considered healthier than forest, and near a variety of eco-zones. Campo villages, however, are hard to hide and defend. Until fairly recent times, the Kayapó were still at war with other Kayapó and non-Kayapó groups; after the arrival of the Europeans, their history seemed to be continually punctuated by wars, raids and disease epidemics.

The *apêtê*, therefore, were utilized as shelters in the event of raids or epidemics, when it was safer to temporarily abandon the village site. The ideal *apêtê* is one in which all the necessities of life are close at hand, to afford self-sufficiency to families dispersed from their homes during emergencies, even—as with epidemics and periods of warfare—prolonged ones.

We have found that plants growing in Gorotire *apêtê* are used as food (tubers, roots, fruits, nuts), medicines (for fevers, bleeding, diarrhea, body aches, dizziness, headaches, toothaches, abortifacients and contraceptives), materials for daily life (for baskets, cords, needles to open wounds, bow and arrow wood, firewood, insect repellents and leaves for containers and wrappings), and body paint and poisons. Certain trees (marmelada, *Alibertia edulis;* araticum, *Anonna crassiflora;* muruci, *Byrsonima crassifolia;* piquí, *Caryocar villosum;* and jurubeba, *Solanum paniculatum)* are even planted to attract game and birds to the forest islands. Various species figure prominently in the inventory because of the variety of uses they afford. Shade trees are also highly valued, and even vines that produce drinkable water are transplanted to *apêtê*.

Apêtê also serve as barriers, parapets and lines of defense. Warriors can hide in the bush, await their enemies, and then surprise them from their verdant palisades. *Apêti-poire* (an oblong *apêtê)* and *apêti-rhynh* (a corridor formed by uniting a chain of *apêtê)* are specifically used for these purposes.

In peacetime, *apêtê* are used as places of rest, to pass the hottest time of day, to paint bodies of relatives with urucú *(Bixa orellana)* or genipapo *(Genip americana),* or for supervised play for children, because of the concentration of valuable resources in *apêtê,* and perhaps also because these forest patches are favored spots for sexual intercourse, children are discouraged from entering them alone. They are told that ghosts hide there and that balls of light appear there in the night. These stories, which protect the *apêtê,* are enhanced and perpetuated by the shamans, who frequently have their medicinal gardens hidden in large *apêti.*

The burn as a management tool

Fire is important in the management of *apêtê,* but not, as current theory suggests, to create larger campos. Generally it has been assumed that "primitive" societies known to frequently burn savanna grasslands were responsible for the spread of such grasslands. Some scientists have even argued that humans have had little effect on the formation or spread of grasslands—they believed its presence to be natural.

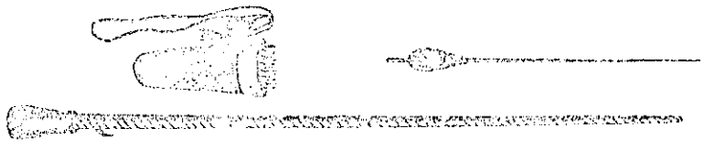
Our evidence indicates that, on the contrary, the Kayapó use campo fire to protect and encourage the forest patches. (Campo burning relates to savanna formation, and should be distinguished from slash-and-burn; the latter refers to the practice, common in many cultures, of burning forest for gardens, then allowing the land to fallow before returning to replant it several years later.)

The Indians say the campo fires produce beautiful effects in the night skies and have a practical effect as well, by keeping down the population of snakes and scorpions and preventing the excessive growth of grasses and thorny vines that makes finding trails and walking in campos difficult.

The Kayapó burn all campos in the range of Gorotire. The time for burning is not random but is decided by the old people and announced by the chiefs. Burning occurs before the "birth" of the August moon and before the flower buds of the piquí tree

where no colony exists. This transplanted colony will then become established, spreading protection against leaf-cutters.

We are seeing vegetation management that is more complicated than we thought. Close to the village of Gorotire, for example, gallery forests and swampy forests were cleared to decrease mosquitoes and lower the risk of malaria, while also nearby but in another direction, forest islands were being formed in campo for protection and production of useful materials. Thus clearings were being formed in forests and at the same time forests were being created in campos.



A sophisticated agriculture

Management of campo and cerrado is more complicated than we yet understand. For one thing, it is impossible to ascertain the true extent of Indian influence in either forest or campo. Today's relatively small Kayapó villages are only remnants; numerous ancient populous villages were once linked by sizable and extensive trails. Multitudinous old village sites and campsites dot the vast area between the Araguaia and Tapajos rivers that was the Kayapó domain.

It is probable, moreover, that many tribes throughout Brazil once practiced campo and cerrado management. Even in areas where Indians have disappeared, botanical evidence of human manipulation and management is still discernible, and we hope that further research will uncover information on the extent of management practices. But even the preliminary data we possess make it obvious that our ideas must be reevaluated to admit the possibility that aboriginal management and manipulation of these ecosystems have been widespread.

Perhaps the most exciting aspect of these new data is the implication for reforestation. The Indian example not only gives us new ideas about how to build forests from scratch, but also how to successfully manage what has been considered to be infertile campo and cerrado.

One must also think of how artificial are our own categories and how they have limited our own investigation of human manipulation of nature. For example, while we distinguish between "campo" and "forest," the Indians recognize the many different proportions, types and configurations of campo-cerrado-forest.

And while our categories include such opposing entities as "domesticated" and "wild," to the Indians manmade *apêtê* mirror forest openings.

Who can say that plants so useful to the Kayapó, so carefully selected, transplanted and nurtured for countless centuries, are truly wild? In campo and cerrado environments, much of the "natural" flora has in fact been planted.

It is time for us to discard our neat categories. We must try to generate new hypotheses, those based on the knowledge, ideas and practices of people who have lived for millennia in the diverse eco-zones of Amazonia. □

Dr. Darrell A. Posey, an anthropologist, is director of the Laboratório de Etnobiologia, Universidade Federal do Maranhão, Sao Luís, Maranhão (Brazil). He is also with the section of anthropology of the Carnegie Museum of Natural History, Pittsburgh, Pennsylvania.