In: Sustainable Harvest and Marketing of Rain Forest Products F1
Mark Plotkin and Lisa Famolare eds
5 Island Press, 1992, Washington DC.

The Use and Cultural Significance of the Secondary Forest Among the Wayapi Indians

PIERRE GRENAND
ORSTOM, Paris

Because so much of the world's tropical forest has already been disturbed, any attempt to develop these regions must look at the potential utility of secondary vegetation. This chapter looks at the use of this type of forest by the Wayapi Indians of French Guiana and Brazil.

Scholars have pointed out that forest people rely to a significant degree on small game that is concentrated in disturbed forest (Vickers, 1980). Other authors (Linares, 1976) have even shown that some populations systematically adjust their hunting strategies toward gardens (in other words, slash and burn gardens and/or secondary forest). Moreover, Balee (1987) has demonstrated that garden lands and disturbed forest areas act as reserves that are not depleted due to the periodic hunting in the distant primary forest.

Few available works combine a faunal and floristic approach to the study of the utility of the secondary forest. Anderson and Posey (1985) have demonstrated that the management by the Kayapo Indians of forest plots in the savannahs have two aims: 1) to maximize the botanical diversity of useful plants; and 2) to attract game.

This chapter will present a different situation demonstrating that, with practically no mangement, the secondary forest plays an important role in the optimal foraging strategy of the Wayapi Indians.

ETHNOGRAPHIC BACKGROUND

The Wayapi Indians are Tupi-Guarani speakers divided into three groups: the first two are located in French Guiana, on the middle and

in French

the upper Oyapock River; the third is in the watersheds between the Amapari and the Jari rivers (Amapa, Brazil). The present estimate of the Wayapi population is 835 people.

Fleeing the Portuguese, the Wayapi migrated from the lower Xingu region of southern Amazonia to the Amapa region and to French Guiana in the eighteenth century. During the first three decades of the nineteenth century, there was a catastrophic decline in the population because of introduced diseases. To reduce contact with the outside world, the main groups remained isolated until the late 1940s. Today, the southern group lives under the control of the National Foundation for Indigenous People (FUNAI) on a reservation of 543,000 hectares, granted by the Brazilian federal government.

The French Wayapi are full French citizens, living on national lands and protected by a regional decree. Federal control prohibits any penetration of their territory by outsiders. The upper Oyapock River group, on which our work is based, grew from 197 in 1977 to 309 in 1990.

Geologically, the region is considered part of the Guyana shield. The average elevation is 150 meters and has an annual rainfall of between 2,200 and 2,500 millimeters, most of which occurs from mid-December to early July. The territory is composed of *terra firme* forest with some bare inselbergs. The major river is the Oyapock, which has numerous affluents broken by numerous rapids.

From an ecological perspective, the situation of the high Oyapock river group is the most interesting because of the lack of encroachments by gold prospectors and professional hunters. There, the Indians are surrounded by forests free from human occupation.[1]

METHODOLOGY

Field research for this paper is based on data collected in three Wayapi settlements between 1971 and 1982, combined with other data gathered during more recent fieldwork (1985, 1989, and 1990). The quantitative data about hunting and fishing yields were collected daily between April 1976 and May 1977 in the Zidock settlement, whose population was 125 at that time. During a year cycle (365 days), all game animals bagged and all fish taken by males above the age of 15 were identified and noted. Only selected samples of the catch (young and mature individuals) were weighed to obtain an average weight for all species. A parallel ethnozoological study was conducted with the help of the Paris National Museum. A complete map with a good set of indigenous typonyms had

been established to locate all capture sites in terms of distance, and every evening, foragers were asked where they caught each animal. In this chapter, I will focus only on a part of this data, comparing principally the disturbed areas' production (including gardens and secondary forests) with the undisturbed primary forest's.

The research on the secondary forest's botanical importance is a cross-comparison between my personal ethnobotanical qualitative data[2] on the uses and environment of the species collected year by year among the Wayapi Indians, with the secondary vegetation forest inventories conducted by phytoecologists, J. P. Lescure (1986) and M. F. Prevost (unpublished). Plots' ages and areas are summarized below:

Plot's age (years)	Area	Scholar/date
2.5	100 m^2	Lescure, March 1975
3.5	100 m^2	Lescure, March 1975
4	150 m^2	Lescure, October 1975
6	1000 m^2	Prevost, August 1980
10	200 m^2	Lescure, October 1975
23	200 m^2	Lescure, October 1975
33	900 m^2	Lescure, March 1975

DEFINITIONS

In the present chapter, we are concerned with two approaches.

1. With the floristic approach, I am considering forest succession after the first year of garden utilization until the forest is high enough (generally around 35 years old) to be considered "true forest" (ka'a e'e) by the Wayapi. All the successional phases are known by the Wayapi as "koke" (ancient garden).

2. In the faunistic approach, I do not rely so heavily on indigenous representation. In a united area, forest (ka'a) has been opposed to productive gardens (ko), successional phases of secondary forest (koke) and the highly disturbed forest areas entangled between the first ones. In fact, these areas are no longer true primary forest because of human pressure (cutting down fruit trees, trees for canoes, manioc beer troughs, small trees for hen shelters, or barbacots, and so on). Disturbed forest is full of gaps whose succession is similar to that of secondary forest.

This chapter uses categories that have been adapted from Prance et al. (1987) and from Balee (1986, 1987) as follows:

a = edible plants
  a1: major
  a2: minor
  a3: insignificant
b = construction material (houses, shelters, wharf, canoes)
c = technology (lashing material, glue, pottery temper, dye)
d = remedy, poisons, hallucinogens, stimulants
e = game animal food
f = others (magic, ritual, perfume, toys, fuel, and so on)

The environment divisions were defined as follows:

F.I = primary forest
F.II = secondary vegetation
  $F.II^1$: young swidden, 1–3 years old
  $F.II^2$: old swidden, 3–7 years old
  $F.II^3$: young fallow, 7–20 years old
  $F.II^4$: old fallow, above 20 years old

We note that the presence of a species in a type of vegetation only if it is usable at this stage of growth.

Finally, the following morphological categories were considered:

e = epiphyte
h = herbaceous
Tr = treelet
p = palm tree
l = liana and climber
t = tree

ETHNOBOTANY OF THE SECONDARY FOREST AMONG THE WAYAPI INDIANS

In 1980, for the three communities studied, gardens under production and secondary forest were only 2 km^2, divided in 1.5 km^2 around the present communities and .5 km^2 around recently abandoned communities. Basically only .25 percent of the territory foraged by the Wayapi was secondary forest.

Nevertheless in this small area, Wayapi were (and still are) able to find numerous useful species, as shown on Table 5-1.

Comparing the second line to the last line of Table 5-1, we can see

TABLE 5-1 *Wayapi Useful Species in Different Types of Environment*

	Epiphytes	*Herbaceous*	*Trees*	*Palms*	*Lianas Climbers*	*Treelets*	*Total*
Cultivated	0	17(10)[1]	7(3)	1(1)	5(3)	4(2)	34
Secondary forest[2]	0	26	111	2	33	20	192
Secondary forest and anthropized areas	0	22	35	0	15	8	80
Common to primary forest and secondary forest	0	4	76	2	18	12	112
Primary forest	20	51	311	27	82	40	531
All environments	20	90	353	28	102	52	645

[1]Numbers between parentheses indicate the number of plants able to survive in the two first stages of succession, F.II[1] and F. II[2].
[2]Surviving cultivated plants are discounted.

that 28.8 percent of the herbaceous, 31.4 percent of the trees, 32.3 percent of the lianas and climbers, and 38.4 percent of the treelets used by the Wayapi can be found in secondary forest; roughly 32 percent of the useful wild plants also occur there. But if we look at the third line, where *purely* secondary species are indicated, we find only 12.4 percent of useful species.

The difference between the two figures is emphasized by the fourth line, where the species common to secondary and primary forest are indicated.[3]

Clearly many species, in fact the majority of the species growing in the secondary forest, are also found in the primary forest. The comparison between secondary forest plot inventories and primary forest plot inventories done by the botanists (Lescure, 1986, Prevost, pers.comm.) shows that ll of these species have higher densities in the first environment than in the second; we can predict that many useful species will be collected from secondary forest. And in fact, they are: high densities and short distances are very decisive factors for interest in those species. But these figures permit us to evaluate both the occurrence of useful species in plots and their utility.

Table 5-2, based on my colleagues' results, provides a vivid but fragmentary view of the presence of useful species at different stages of forest regrowth. Methods of counting species introduce inconsistency if we compare plots four years old and ten years old, based on DBH, to plots six years old, based on diameter. But all in all, we can see the high

TABLE 5-2 *Occurrence of Useful Species at Different Stages of Regrowth*[1]

Plot Age (years)	*Plot Area (sq. m.)*	*Number of Species*	*Number of Species Known by the Wayapi*	*Number of Species Used by the Wayapi*
2.5[2]	100	27	22	11/40.7%
3.5[2]	100	16	16	13/80.2%
4[2]	150	20	17	16/80%
6[3]	1000	45	45	30/66%
10[4]	200	24	24	17/70.8%
23[4]	200	24	24	22/91.6%
33[5]	900	39	38	37/94.8%

[1]In every plot, usefulness has been considered at the specific level of growth.
[2]Individuals over 2 m high.
[3]Individuals over 5 cm diameter.
[4]Individuals over 5 m high.
[5]Individuals over 10 m high.

number of species used after the third year of regrowth, the average percentage of useful species between year 3.5 and 33, standing at 80.8 percent; thus, this figure is lower than the percentage obtained for a 100-hectare plot inventory of primary forest (93.8 percent) but with higher concentrations by species on a smaller area.

Table 5-3 gives a complementary view of all plants used by the Wayapi Indians based on their statements and my own observations. In this table, one can see that it is only after year 6 (stages 3 and 4) that secondary forest is a rich environment at specific levels. But we have to keep in mind that some species specific of stages 1 and 2 are also very important, due to the fact that they are irreplaceable.

We must also consider important use by categories. Cultivated species surviving in stages 1 and 2 are not included in this discussion. First of all, let us look at the useful species by large categories as defined at the beginning of this chapter (see Table 5-4).

THE FOOD CATEGORY

Out of the 192 species used by the Wayapi, 51 are major or minor food plants (26.5 percent). The most important species are *Lacmellea aculeata, Tetragastris altissima, Inga paraensis, I. bracteosa, I. edulis, I. alata, Pourouma*

TABLE 5-3 *Wayapi Useful Species by Stage of Regrowth and Morphological Categories*

	1 to 3 Years	*3 to 7 Years*	*7 to 20 Years*	*Above 20 years*
Herbaceous	16	12	9	5
Lianas	6	14	17	19
Trees	3	34	75	94
Treelets	3	11	12	13
Palms	0	1	2	2
Total	28	72	115	133

TABLE 5-4 *Number of Species by Specific Use Category*

Uses	*Code*	*Number of Species by Use*
Edible plants	a	15
major	a1	14
minor	a2	19
insignificant	a3	18
Construction materials	b	22
Technology	c	40
Remedies and poisons	d	59
Game animal foods	e	126
Others	f	39

bicolor, P. mollis, P. tomentosa, Perebea guianensis, Eugenia patrisii, and *Physalis pubescens.*

It is noteworthy that major sources of edible wild plants such as Sapotaceae and Palmae are not present in secondary forest: but *Inga* and *Pourouma* species rank at the fourth and fifth places of the wild fruits gathered by the Wayapi.

CONSTRUCTION MATERIALS

Secondary forest is an important source of construction material (22 out of 192 species, in other words, 11.4 percent) due to the fact that Wayapi

cut rot-resistant trees between 10 and 20 cm—a relatively young stage of growth. Thus, this is not true for canoe wood, which is cut from adult trunks. The main species used for shelters and house construction, especially rafters and beams are *Tapirira guianensis; Guatteria chrysopetala; Trattinickia demerarae; Tachigali paniculata; Casearia javitensis; Qualea coerulea; Xylopia longifolia; Guatteria discolor; Tetragastris* spp.; *Sapium ciliatum; Eugenia patrisii.*

Except for *Eugenia patrisii,* hardwoods suitable for house posts are found in primary forest.

TECHNOLOGY

A myriad of uses are covered by the term technology. Forty out of 192 species are found in that category (20.8 percent).

The secondary forest provides material for dyeing not found in primary forest including *Miconia punctata, Myriaspora decipiens, Henriettea succosa, Licania heteromorpha,* and *Inga* spp.

Technology includes other uses, ranging from arrow points (*Eugenia patrisii, Calyptranthes amshoffae, Myrcia saxatilis*) to polish (*Pourouma guianenis*) and lashing material (*Trema micrantha,* various Annonaceae, *Merrimia macrocalyx,*various Lecythidaceae), materials for making spoons (*Ambelania acida, Hirtella bicornis*), and even basketry material, furnished by *Ischnosiphon obliquus* and *I. arouma,* which are more commonly found in undisturbed areas.

MEDICINES

With 59 out of 192, medicines account for 30.7 percent of all useful species registered for the secondary forest (Grenand et al., 1987). With the species found near the village perimeters, 52 percent of the medicinal species occur in areas directly affected by the Indians. Important remedies found there include *Mansoa* alliacea, *Guatteria discolor, Vismia cayennensis, Killinga pumila, Potalia amara, Bellucia grossulariodes, Inga alba, I. alata, Vataireopsis surinamensis, Piper oblongifolium, Sabicea glabrescens, Fagara* spp., *Petrea kauhotiana, Justicia pectoralis, Aristolochia* spp., *Gurania huberi, Omphalea diandra, Stigmaphyllon splendens, Abuta sandwithiana, Siparuna guianensis, Eugenia* sp., *Crotalaria retusa, Securidaca pariculata, Geophila tenuis, Solanum crinitum,* and *Costus* spp.

Therefore, half of these plants are important for the Wayapi.

GAME ANIMAL FOOD

This subject will be discussed in the second part of this chapter. At the moment, we have to keep in mind that 126 out of 192 species (in other words, 65 percent) are eaten by game animals.

Other uses: Species in this category account for 20 percent of species used (39 out of 192 species). Many are used as sources of fuel, including *Cecropia obtusa, Inga edulis,* and *I. bracteosa.*

Other uses are perfumes or incenses (*Burseraceae, Pharus* spp.); depilatory; bark mask (*Couratari guianensis*); fishing baits (*Phytolacca rivinoides* and *Cissus erosa*); or magic (*Caladium bicolor, Mansoa standleyi,* and *Xyphidium caeruleum*).

In using the Prance et al.(1987) method, counting major uses as 1.0 and minor uses as .5, Table 5-5 shows the most important species for the Wayapi, with values of 2.5 and more. This ranking reflects multiple uses of the prominent species.

TABLE 5-5 *Most Important Species for the Wayapi*

Eugenia patrisii	3.5
Hirtella bicornis	3.5
Inga alata	3.5
Cecropia obtusa	3.0
Inga alba	3.0
Inga edulis	3.0
I. paraensis	3.0
Tetragastris altissima	3.0
Protium glabrescens	3.0
Trattinicki demerarae	3.0
Ambelania acida	2.5
Bellucia grossulariodes	2.5
Cupania spp.	2.5
Fagara spp.	2.5
Hyeronima laxiflora	2.5
Inga bracteosa	2.5
Lecythis corrugata	2.5
Pourouma guianensis	2.5
Phytolacca rivinoides	2.5
Tapirira guianensis	2.5
Tetragastris hostmannii	2.5

HUNTING STRATEGIES AND PLACE OF SECONDARY FOREST AMONG THE WAYAPI

Clearly the Wayapi have a well organized schedule for using secondary forest. The data compare primary forest yields and those obtained in disturbed areas. In the first case, foraging activities are conducted on an estimated territory of 740 square miles; in the second case, on only 30 square miles.

From Figure 5-1 one can see a general trend in the Wayapi's foraging strategies with a high reliance from December to June on mammals (with a noticeable exception in March); a peak for birds in July (particularly, hunting of parrots and toucans); and, finally, three months (September to November) when Wayapi diet relies heavily on reptiles (iguanas and caimans) and fish.

To avoid game depletion, the Wayapi use different strategies that are not mutually exclusive. Their strategy optimizes hunting success by concentrating hunting pressure at the time each species is available. This availability of each species is linked with food and reproduction habits.

The optimization is achieved by the Wayapi exploring all the ecotones encountered in their territory with noticeable exception of inselbergs, which are said to house bad spirits and monsters.

Important too is their policy of big hunting expeditions. They have established camp sites in every corner of their foraged area, most of them accessible by canoe, from which radiate out 5- to 10-kilometer

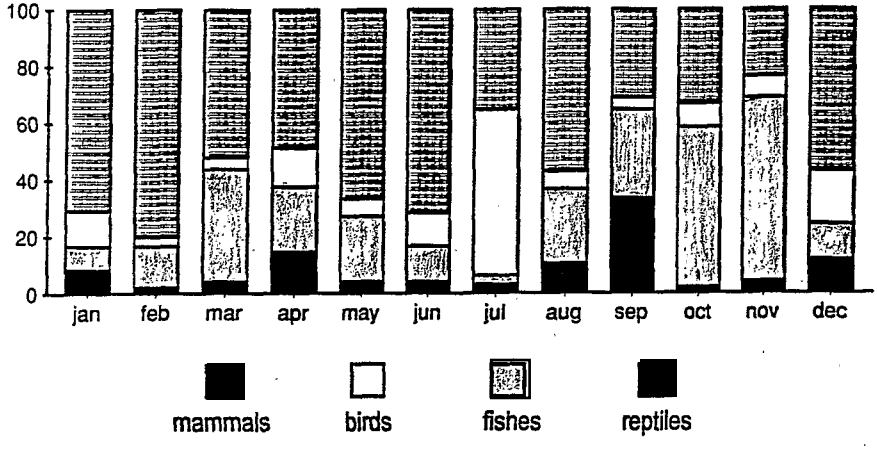

FIGURE 5-1 MONTHLY REPARTITION OF ANIMAL PROTEINS SOURCES (PERCENT).

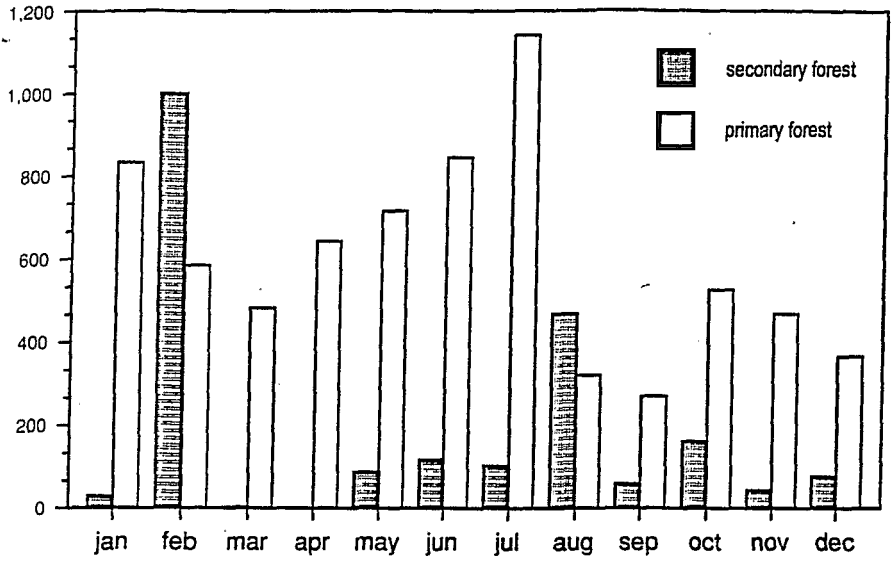

FIGURE 5-2 MONTHLY GAME PRODUCTION (MAMMALS AND BIRDS) IN PRIMARY AND SECONDARY FORESTS.

paths. This strategy differs from the trekking strategy observed by Smole (1976), Werner (1983), and the few days' travel strategy from the main villages depicted by Hames and Vickers (1982).

What then is the value of secondary forest? In Figure 5-2, we compare the monthly total production of birds and mammals (not counting fish and reptiles). It appears to have low productivity, except for two months and complementary level for six other months. In term of species, diversity is very high: we have noted 15 species of mammals (the same number as in the primary forest) and 70 species of birds (among them, a lot of small birds that are hard to see in primary forest).

What about the two most high yielding months?

In February, the high yield rate results from a collective hunt of white-lipped peccaries; this figure is random and could appear in any other month during another year. However, such a hunt is predictable every year, because peccaries are attracted by manioc and sweet potatoes surviving in the forest.

In August, the situation is quite different. The male population starts new gardens and can spend only a small amount of time hunting and fishing. Garden and secondary forest hunting appears to be the only response that fits in the work schedule. The good yields and the diversity of the catches during this month, ranging from white-lipped peccaries and red brocket deer to agoutis (mammals) and toucans, doves,

and parrots (birds), show that secondary forest is considered game reserve during the rest of the year. Furthermore, the yields are increased by the trees, lianas, and treelets fruiting only in secondary forest at this time.

This is clearly an optimal foraging strategy because in September the same pattern of fruiting which would increase hunting yields in secondary forest is disregarded by the Wayapi, who turn to a new foraging strategy (that is, timbo fishing).

Eventually, to evaluate the role of secondary forest, we have to weigh up the total production of the two environments, comparing it with the areas foraged.

One view is provided by the pie charts of Figure 5-3. We can see that 27.5 percent of the game (only birds and mammals are counted) bagged by the Wayapi come from 3.8 percent of their hunting areas. If we include the boys' production (males between 9 and 14 years of age) which have not been computed here, without a doubt we can assert that over a third of the birds and mammals caught come from the secondary forest with little effort during short hunting trips.

Finally, I assume that without the high pressure that exists during August, very good yields are obtained in secondary forest.

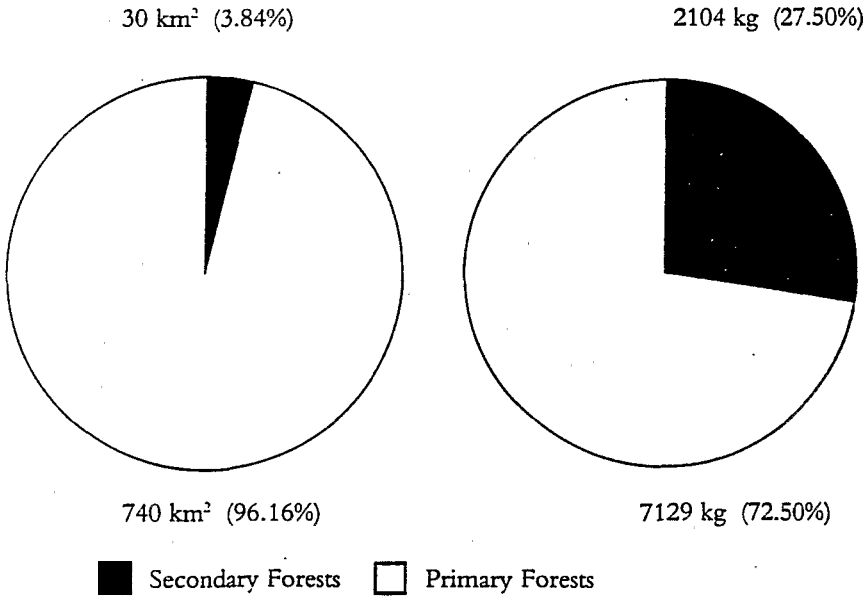

FIGURE 5-3 COMPARED AREAS (LEFT) AND GAME PRODUCTION (MAMMALS AND BIRDS) (RIGHT) IN PRIMARY AND SECONDARY FORESTS.

CONCLUSION

What is the place of secondary forest? We know this type of forest is increasing every year in all forested regions of Central and South America. I hope that the data presented here answer this question and prove that secondary forest is not a poor environment.

Briefly, I will sum up the main points that have been made. Except for the first stage of regrowth, secondary forest contains a majority of useful plants. This is a very important fact if some are irreplaceable, useful species that cannot be found in primary-forest. We can also stress that the concentration and easy access of some primary forest species in secondary forest alleviate the human encroachment on primary forest.

The term "useful species" does not have the same meaning for all cultures; however, it was pointed out by Prance et al. (1987) that the species used by indigenous people "are far more diverse than the uses to which these species are put in western society."

Another very important aspect of the secondary forest is its place within the adaptative strategies of indigenous peoples of neotropical forests. More quantitative and qualitative data still need to be collected, since, as Balee (1985) pointed out, "There are not one, but many forests in lowland South America." This is also true for secondary forest. Our results show that secondary forest plays an important role in an optimal foraging system. It is yet another example of the in-depth indigenous knowledge about fauna and flora, demonstrating hunting practices that are clearly opportunistic, yet at the same time concerned with game conservation.

Unfortunately, I have said nothing of the present situation of the Wayapi Indians nor of other Amerindian populations in the Guianas. Some recent documents (Gallois and Ricardo, 1983; collective, 1990, and so on) have depicted a very bleak future for Amazonian Brazil. For French Guiana, we have recently shown (Grenand and Grenand, 1990) that cultural disintegration is going more swiftly.

M. Plotkin (1988) said for Suriname about its indigenous knowledge and how to preserve it, "There exists an urgent need to expand ethnobotanical research." Scientists do not need to be convinced. But what about our respective governments?

Notes

1. This is true with the noticeable exception of the presence of two small groups who wish to remain free of contact with both the Wayapi and the Westerners.

2. These data are based on 1,600 vouchers deposited in various herbariums (especially Cayenne and Paris) and determined by international specialists.
3. By primary forest, I mean undisturbed rain forest composed of high hill forest (ka'a e'e) and lower wet forest (Ka'a pe).

References

Anderson, A., and D. Posey. 1985. Manejo do cerrado pelos Indios Kayapó. *Boletim do Museu Paraense Emilio Goeldi*. Botânica 2 (1):77–88.

Balee, W. 1985. Ka'apor ritual hunting. *Human ecology* 13 (4):485–510.

Balee, W. 1986. Análise preliminar de inventário florestal e a etnobotânica Ka'apor (Maranhão). *Boletim do Museu paraense Emilio Goeldi*. Botânica 2 (2):141–167.

Balee, W. 1987. A etnobotânica quantitativa dos Indios Tembé (Rio Gurupi, Pará). *Boletim do Museu Paraense Emilio Goeldi*, Botânica 3 (1):29–50.

collective. 1990. *Brésil: Indiens et développement en Amazonie*. Ethnies: Paris.

Gallois, D., and C. A. Ricardo. 1983. *Povos Indígenas no Brasil*. CEDI: São Paulo.

Grenand, P., and F. Grenand. 1990. *Les Amérindiens, des peuples pour la Guyane de demain*, coll. La Nature et l'Homme, ORSTOM, Cayenne.

Grenand, P., C. H. Moretti, and H. Jacquemin. 1987. *Pharmacopées traditionnelles en Guyane: Créoles, Palikur, Wayãpi*. coll. Mémoires. ORSTOM, Paris.

Hames, R., and W. T. Vickers. 1982. Optimal diet breadth theory as a model to explain variability in Amazonian hunting. *American ethnobiologist*, 9 (2):358–78.

Lescure, J. P. 1986. *La reconstitution du couvert végétal après agriculture sur brûlis chez les Wayãpi du haut Oyapock (Guyane Française)*. Thèse de doctorat de l'Université de Paris.

Linares, O. 1976. Garden hunting in the American Tropics. *Human ecology* 4 (4):331–49.

Plotkin, M. J. 1988. Ethnobotany and conservation in the Guianas: The Indians of Southern Suriname, in Almeda and Pringle (ed.), *Tropical rainforest: diversity and conservation*. California Academy of Sciences: San Francisco.

Prance, G. T., W. Balee, B. M. Boom, and R. L. Carneiro. 1987. Quantitative ethnobotany and the case for conservation in Amazonia. *Conservation Biology* 1 (4):296–310.

Smole, W. 1976. *The Yanomama Indians: A Cultural Geography*. University of Texas Press: Austin.

Vickers, W. T. 1980. An analysis of Amazonian hunting yields as a function of settlement age, in Hames, R. (ed.), *Working papers on South American Indians* (N° 2):7–29.

Werner, D. 1983. Why do the Mekranoti trek? In Hames R. and Vickers, W. T. (ed.) *Adaptive responses of Native Amazonians.*: 225–38. Academic Press, New York-London.

CONCLUSION

What is the place of secondary forest? We know this type of forest is increasing every year in all forested regions of Central and South America. I hope that the data presented here answer this question and prove that secondary forest is not a poor environment.

Briefly, I will sum up the main points that have been made. Except for the first stage of regrowth, secondary forest contains a majority of useful plants. This is a very important fact if some are irreplaceable, useful species that cannot be found in primary-forest. We can also stress that the concentration and easy access of some primary forest species in secondary forest alleviate the human encroachment on primary forest.

The term "useful species" does not have the same meaning for all cultures; however, it was pointed out by Prance et al. (1987) that the species used by indigenous people "are far more diverse than the uses to which these species are put in western society."

Another very important aspect of the secondary forest is its place within the adaptative strategies of indigenous peoples of neotropical forests. More quantitative and qualitative data still need to be collected, since, as Balee (1985) pointed out, "There are not one, but many forests in lowland South America." This is also true for secondary forest. Our results show that secondary forest plays an important role in an optimal foraging system. It is yet another example of the in-depth indigenous knowledge about fauna and flora, demonstrating hunting practices that are clearly opportunistic, yet at the same time concerned with game conservation.

Unfortunately, I have said nothing of the present situation of the Wayapi Indians nor of other Amerindian populations in the Guianas. Some recent documents (Gallois and Ricardo, 1983; collective, 1990, and so on) have depicted a very bleak future for Amazonian Brazil. For French Guiana, we have recently shown (Grenand and Grenand, 1990) that cultural disintegration is going more swiftly.

M. Plotkin (1988) said for Suriname about its indigenous knowledge and how to preserve it, "There exists an urgent need to expand ethnobotanical research." Scientists do not need to be convinced. But what about our respective governments?

Notes

1. This is true with the noticeable exception of the presence of two small groups who wish to remain free of contact with both the Wayapi and the Westerners.

2. These data are based on 1,600 vouchers deposited in various herbariums (especially Cayenne and Paris) and determined by international specialists.
3. By primary forest, I mean undisturbed rain forest composed of high hill forest (ka'a e'e) and lower wet forest (Ka'a pe).

References

Anderson, A., and D. Posey. 1985. Manejo do cerrado pelos Indios Kayapó. *Boletim do Museu Paraense Emilio Goeldi*. Botânica 2 (1):77–88.

Balee, W. 1985. Ka'apor ritual hunting. *Human ecology* 13 (4):485–510.

Balee, W. 1986. Análise preliminar de inventário florestal e a etnobotânica Ka'apor (Maranhão). *Boletim do Museu paraense Emilio Goeldi*. Botânica 2 (2):141–167.

Balee, W. 1987. A etnobotânica quantitativa dos Indios Tembé (Rio Gurupi, Pará). *Boletim do Museu Paraense Emilio Goeldi*, Botânica 3 (1):29–50.

collective. 1990. *Brésil: Indiens et développement en Amazonie*. Ethnies: Paris.

Gallois, D., and C. A. Ricardo. 1983. *Povos Indígenas no Brasil*. CEDI: São Paulo.

Grenand, P., and F. Grenand. 1990. *Les Amérindiens, des peuples pour la Guyane de demain*, coll. La Nature et l'Homme, ORSTOM, Cayenne.

Grenand, P., C. H. Moretti, and H. Jacquemin. 1987. *Pharmacopées traditionnelles en Guyane: Créoles, Palikur, Wayãpi*. coll. Mémoires. ORSTOM, Paris.

Hames, R., and W. T. Vickers. 1982. Optimal diet breadth theory as a model to explain variability in Amazonian hunting. *American ethnobiologist*, 9 (2):358–78.

Lescure, J. P. 1986. *La reconstitution du couvert végétal après agriculture sur brûlis chez les Wayãpi du haut Oyapock (Guyane Française)*. Thèse de doctorat de l'Université de Paris.

Linares, O. 1976. Garden hunting in the American Tropics. *Human ecology* 4 (4):331–49.

Plotkin, M. J. 1988. Ethnobotany and conservation in the Guianas: The Indians of Southern Suriname, in Almeda and Pringle (ed.), *Tropical rainforest: diversity and conservation*. California Academy of Sciences: San Francisco.

Prance, G. T., W. Balee, B. M. Boom, and R. L. Carneiro. 1987. Quantitative ethnobotany and the case for conservation in Amazonia. *Conservation Biology* 1 (4):296–310.

Smole, W. 1976. *The Yanomama Indians: A Cultural Geography*. University of Texas Press: Austin.

Vickers, W. T. 1980. An analysis of Amazonian hunting yields as a function of settlement age, in Hames, R. (ed.), *Working papers on South American Indians* (N° 2):7–29.

Werner, D. 1983. Why do the Mekranoti trek? In Hames R. and Vickers, W. T. (ed.) *Adaptive responses of Native Amazonians.*: 225–38. Academic Press, New York-London.