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#### *About the Institute*

The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.



# COUSTEAU SOCIETY

930 WEST 21st STREET NORFOLK, VIRGINIA 23517



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Angel Falls

La Gran Sabana

Pacaraima

Serra do Apiaú

Serra do Mucujai

Caracarai

RORAIMA

Boa Vista

Caracarai

Vista Alegre

Manaus

Manaus

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SURI NAM (DUTCH GUIANA)

Wilhelmina Geb.

Frederik Willem IV Vallen

Lucie

Kaysers Geb.

Asoenangka

Maraxó

Paia

Maloca

Cachoeira Grande

Trombetas

Sauia

Tiago

L. do Erepecu

Trombetas

De Sapucaia

Terra Santa

Piratuco

Faro

Nhamunda

Albano

Urucurituba

Parintins

Barreirinha

Ariau

Maués

Sapucaia

Catauara

Granboji

Tapanahoni

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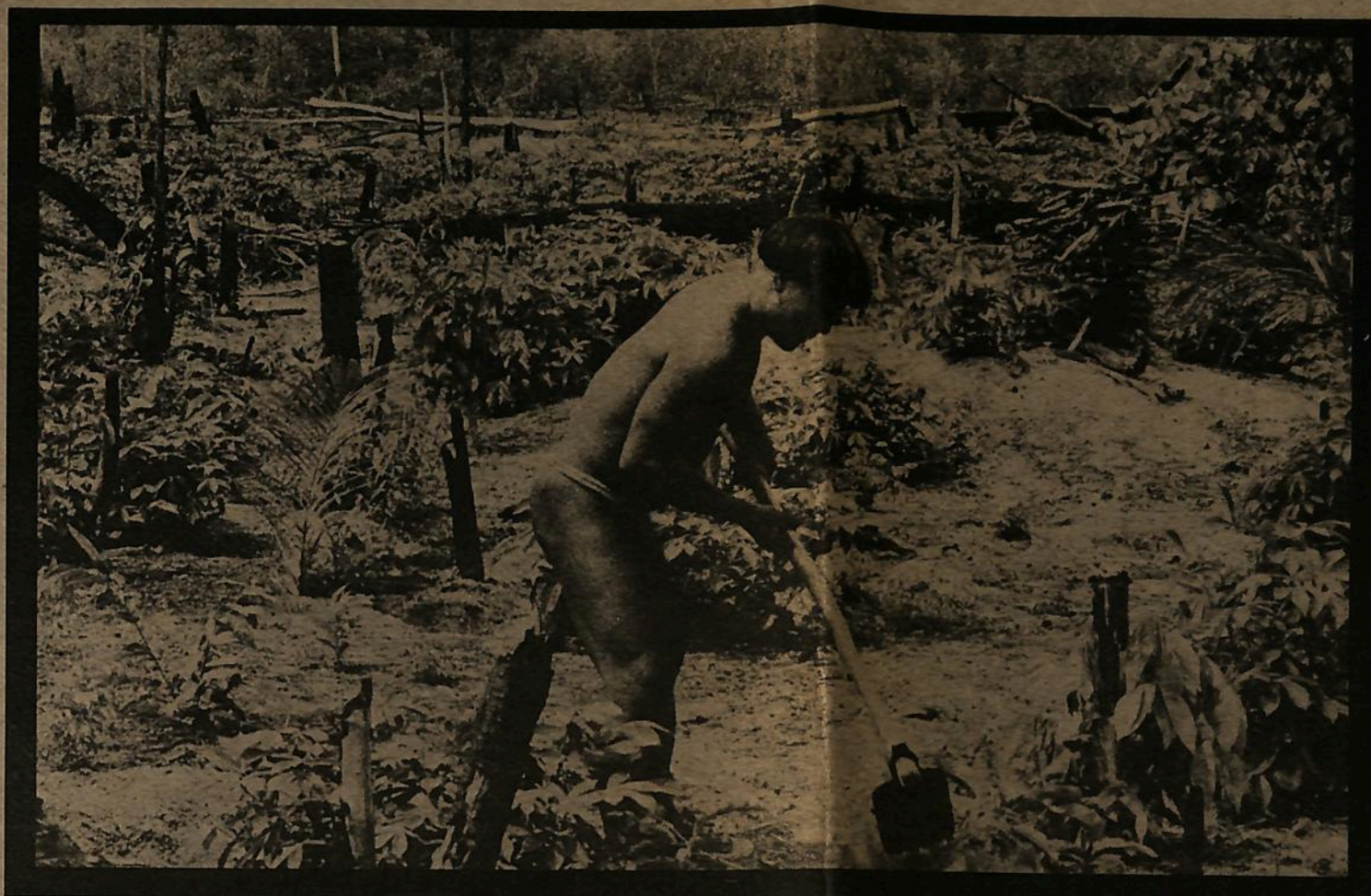
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RELIEF DATA UNRELIABLE



Brazilian Indian farms with traditional methods—i.e., local crops on small plantations—which cause minimal damage to the forest. Photo: Anthropology Resource Center, Boston.

Interview with Jose Lutzenberger

## Brazil's Leading Environmentalist

*Lutzenberger*

by Herman E. Daly

Brazil occupies half the continent of South America and is therefore responsible for the administration of a large share of Earth's ecosystem. The current Brazilian regime seems to have seven basic modes of dealing with the environment: (1) dig it up (2) cut it down (3) fill it in (4) dam it (5) burn it (6) plant it with monocultures and spray it with chemical biocides (7) overwhelm it with massive concentrations of people.

This repertory is partly an inheritance from the Portuguese who came for rapid, temporary exploitation rather than permanent settlement. It also partly derives from the imported modern ideology of growthmania and the consumer society, avidly exported by the United States. There are today, however, many Brazilians who are outraged at the unprecedented environmental destruction occurring in their country and are making an effort to stop it. Their leader and guru is Jose A. Lutzenberger, a Brazilian agricultural engineer of German descent who lives in Brazil's southernmost state of Rio Grande do Sul.

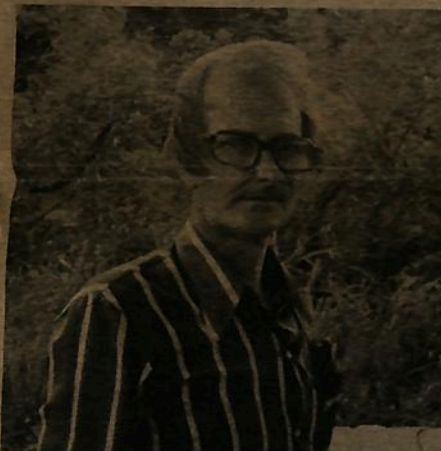
"Lutz," as he is called by his many friends, is playing the same role in Brazil today as Rachel Carson played in the US in the early 1960s. It might be more accurate to say that he is the combined Rachel Carson, Paul Ehrlich, Amory Lovins, and

David Brower of Brazil because he fights pesticides, overpopulation, energy waste, nuclear power, and in addition founded Brazil's strongest association for protection of the environment, AGAPAN.

Lutz began his career working for a multinational firm as technical adviser on chemical fertilizers and biocides on three continents. Gradually over a period of 14 years, with repeated visits to the same places, it dawned on him that the net result of modern agriculture was to reduce the long-run capacity of the Earth to support life, and he was shocked by the mafiosi methods of multinational agri-chemistry. For someone who subscribes to Albert Schweitzer's "reverence for life" as a basic ethical principle, this was a painful realization.

Instead of rationalizing, making excuses, and looking only on the positive side of things, Lutz, ten years ago at age 44, quit

his lucrative job, returned to his native city of Porto Alegre and began making his living as a landscape architect. Later he founded a small consulting firm called "Convivial



Jose Lutzenberger

Technology" after the phrase of Ivan Illich. These activities earn him only a modest living because he devotes most of his time to unpaid environmental defense work. His inside knowledge of the pesticide industry and his personal experience with organic agriculture have made him the nemesis of the agri-industrial-chemical complex in Brazil, which is the world's third largest user of biocides.

I first met Lutz in January of 1976 while giving a course in economics and ecology in Rio Grande do Sul. Some of my students told me about him and took me to meet him in the seaside town of Torres, where he was making a state park and a demonstration organic garden. It turned out that he knew of me from having read my book (*Steady State Economics*), and, since that is the fastest way to an academic's heart, we became instant friends.

Lutz speaks excellent English, as well as German, French, Spanish, and of course Portuguese. His library contains hundreds of books in numerous languages on ecology, agronomy, chemistry, physics, philosophy, theology, economics, and nearly everything else under the sun. He has the kind of broad knowledge and confidently imaginative intellect that today's universities seem to stifle rather than encourage. He is also an emotional man and tears

come to his eyes when he contrasts the organic farmer's loving care and appreciation of subtle harmonies and animal psychology, with the brutal and insensitive deprivations of the monoculturalists. He can get angry, but his emotion is always backed up by scientific understanding. Indeed, it is precisely because he understands better than others what is really happening that he feels the pain more.

Our friendship was renewed in November 1980 when I spent several days with him in Porto Alegre, after giving a short course there. I urged Lutz to write something in English for American environmental magazines. He said he had no time. Even his books in Portuguese (*Fim do Futuro?* and *Pesadelo Atomico*) were edited by friends from speeches and short articles. I offered therefore to reconstruct our conversations and correspondence in the form of a written interview. He agreed to read it over and edit it. This is the result. *Daly—When I was here five years ago you were known locally as a somewhat quixotic figure with an exaggerated affection for trees. Today you are famous all over Brazil and receive ten times as many invitations to speak as you can possibly accept. What happened?*

*Lutzenberger—*Since you were here we succeeded in creating a great amount of ecological consciousness, much more than we could have expected, especially in my profession, among agronomists. Back then I was still considered a fool among my colleagues; today I am a kind of guru for almost the totality of agronomy students in all Brazil and among most of the agronomists active in their profession.

In Europe, the US, Australia, Japan, and Canada there is today a good and healthy, burgeoning movement of organic [biologically rather than chemically oriented] agriculture, but the average agronomist is unaware of it or fights it. Here we now have the opposite situation. There is almost nothing to show in practice, but most agronomists are anxious for change and frustrated for not knowing how.

By the way, the US Department of Agriculture in an official publication has now urged the development of organic agriculture in the US. That is an encouraging event [see NMA, September 1980—ed].

I remember that beautiful demonstration garden you made in the park at Torres where you created a rich soil on top of pure sand, and had everything so well balanced that insects were automatically controlled. Did that serve as an example and convince some people?

My park in Torres is in the process of decay. Our state government did not renew my contract a year ago. Of course they don't like me. I attack them viciously for their stupid aggressions on the environment, but that is the only way to talk to that mafia and I have to pay the price of their retaliation. They spend almost nothing on the park. It hurts me to see it now. But they have plenty of money for a petrochemical center right next to Porto Alegre, upriver on the Jacui, where we will get all the pollution into our drinking water.

But while the government was sabotaging your park, your colleagues elected you "agronomist of the year." How did that come about?

It came about in spite of a bitter backstage fight by ANDEF [an agri-chemical lobby that includes some 20 multinationals]. I was elected "agronomist of the year" in 1978. Then ANDEF tried to annul my prize. A new election was held and this time I won by even more, 414 to 6, with most of the agronomists employed in the chemical industry voting for me too.

That is very encouraging, but have things in general really improved by as much as your fame has increased?

No. It is a small victory and doesn't mean that anything has changed in Brazil regarding the wholesale destruction of nature. You know what is going on in the Amazon basin. In the rest of the country the last remains of other ecosystems are now being obliterated. There has never been a biological holocaust such as this one in the history of life. Thousands of species disappear every year without anybody's noticing. If tomorrow the zebra, the elephant, the giraffe, or any other spectacular creature were to vanish forever that would be in all the papers, radios, TVs of the world. But every time a unique ecosystem is wiped out, and we had thousands in Brazil, uncounted endemic species go with it, mostly the small, less conspicuous forms of life, small vertebrates or invertebrates, insects, spiders, rare plants. Nobody registers their passing out, nobody is interested. The universe is poorer for every species that goes. Every lifeline in the Symphony of Evolution is a unique, irreversible historical process that can be cut off but can never be resumed. Whether increasing ecological consciousness will in time provoke a reversal of tendencies remains to be seen. I can only hope so for our children's sake, for life's sake!

Just what is going on in the Amazon basin?

The most complex and wonderful of biomes is being burned, knocked down by dragging great chains between huge tractors, defoliated with Agent Orange, et cetera. Entire communities of plants and animals are being irrevocably lost, some before we have even catalogued them. In their place are being planted vast monocultures, which are inherently unstable. Most don't last five years, and require massive doses of biocides and fertilizers that pollute rivers and lakes and kill wildlife.

Indian cultures are being wiped out. We think that "the Indians have no right to hold back progress." But what right, other than that of brute force, allows us to invade the Indian's world with heavy machinery, chain saws, and chemical defoliants sprayed by airplanes? Who is the real barbarian? North Americans might get some idea of the cost of this meretricious progress from the current film "Bye, Bye Brazil."

We have enough land in Brazil that we

could postpone exploiting the Amazon until we learn enough about the marvellous patterns of life to do so intelligently and sustainably. We must restrain both our own greed and that of foreign companies. We have much to learn from the remaining Indian tribes.

With the bust of the "Brazilian Economic Miracle" and the worsening economic situation that will be difficult.

Yes, the economic situation has never been worse in Brazil. Some few members of the military, which in 1964 had the greatest chance ever to create order, chose instead to become henchmen for multinational business. Inflation is now over 140 percent annually, and we owe more

**We have enough land in Brazil that we could postpone exploiting the Amazon until we learn enough about the marvellous patterns of life to do so intelligently and sustainably.**

than \$60 billion, while earning only \$13 billion annually from our exports, more than half of which goes to service the debt, with the remainder being insufficient to pay for petroleum imports. So the debt will likely grow and inflation get worse. Nevertheless the mafia plans to build 60 nukes by 1995! Never before has one seen such madness! Fortunately they will not succeed. I put some hope, ironically, in the world depression that has already been triggered.

Within this generally bleak picture many people are placing all their hopes on Brazil's alcohol fuel program, PROALCOOL. What do you think of PROALCOOL?

The alcohol program is another calamity. It will be in the hands of the international petroleum, automobile, and chemical companies, a political disaster for Brazil. It will spread over the rest of Brazil the kind of feudal landholding system that disgraces the Northeast.

If today the Northeast is poor, if millions of nordestinos are forced to migrate to the stinking favelas of Rio, São Paulo, and Brasilia, it is because in their own region they were pushed out by sugar cane monoculture. In its current conception PROALCOOL threatens to extend this process of displacing people from the land and displacing food crops with more profitable, but less necessary, fuel crops. Of course it all has a kind of diabolical logic to it, it is all so rigged with subsidies, fiscal privileges, and free credit that it is difficult for normal folk to see through it. So you have a lot of good people, even some ecologists, favoring the program.

Usually the migration of poor nordestinos is blamed on the periodic drought.

The key word there is periodic. Sure, a drought might be the proximate cause of migration, but the periodic droughts are a condition of nature to which traditional cultivation was well adapted. In the very few areas where a peasant culture was allowed to develop, in wet years they farmed the land distant from river beds, and in dryer years moved closer and closer to the river beds. Now with monoculture that intelligent system was destroyed. The technocrat can't accept the wisdom of tradi-

tional restraints, and so he blames the drought and calls for great hydraulic projects, or more industrialization.

Getting back to alcohol—can't it be made by small producers employing people in the interior, and ultimately substituting a renewable resource for diminishing petroleum?

Of course, but it all depends on scale



"A sugar-cane monoculture is implicit in PROALCOOL" (Brazil's alcohol fuel program), Lutz says. Photo courtesy Engenharia Sanitaria.

and rate of development, and beyond that on the structure of power in society. One could imagine a system of small scale independent distilleries producing for local use, converting the vinhoto or slop into a good organic fertilizer. One could avoid large scale monoculture, and keep the population of cars below the level that could be fed on a sustainable basis, one could substitute public transport and bicycles for automobiles to a large degree—in short we could live within an ecological budget. And we have plenty of other energy sources: low-head water power, wind, and biomass in direct combustion or through biogas or pyrolysis.

If our basic paradigm were the ecologically inspired one of a steady-state or homeostatic economy, then we could make good use of biomass energy. But in Brazil as in all other countries the basic paradigm is that of the ever-expanding economy that rides roughshod over ecological limits and tends to centralize power and promote only those technologies that are themselves centralizing. PROALCOOL, for example, although it permits small distilleries to produce, requires them to sell to a centralized distributing agency.

I want to return to this general question of power and technology, but let's stick with PROALCOOL for a minute. What other effects will it have?

The sugar cane monoculture implicit in PROALCOOL is one of the many threats to the Amazon, and also to the Pantanal, the great swamp in Mato Grosso, one of the last natural paradises on Earth. Of course alcohol production displaces food crops. Brazil already imports its staple food, black beans.

What will be the effect of PROALCOOL on the distribution of income? Food will be more expensive than it otherwise would have been and auto fuel might be less expensive than it otherwise would have been. The poor spend a large percentage of their income on food and nothing on auto fuel. The middle and upper class spend a smaller percentage on food and a significant amount on auto fuel. On the consumption side the effect on income distribution is regressive.

On the production side we have similar concentrating effects already mentioned—feudal landholding patterns, large scale

distilleries, and centralized distribution. It is hard to see how PROALCOOL can avoid worsening an already unjust distribution of income and wealth. Unless we can break out of the paradigm of growthmania and megatechnology even potentially good ideas, like exploitation of solar energy via biomass, become corrupted to serve the ends of growth and concentration of

power, rather than permanence, independence, and justice.

One further point about alcohol is that it is not the most efficient way to get energy out of biomass. Methane gas and pyrolysis technologies convert more of the energy in the plant into final usable energy and we can use more abundant plant material. Furthermore, we all know that modern agricultural methods are highly energy intensive, and I know of no study which shows that the complete energetic balance of megatechnological production, distillation, and distribution of alcohol is positive. And even if it should turn out to be positive the surplus will certainly be small compared to fossil fuels. So it is totally irresponsible to treat PROALCOOL as a new lease on life for the auto industry.

OK, let's consider now this relation of power and technology.

We have a vicious circle between technological sophistication and concentration on the one hand, and economic power on the other. The more complex and integrated the technology the greater the demand for capital and the greater the need for bureaucratic management; the technocracy, in its turn, demands and promotes only those sophisticated and large scale technologies that further concentrate economic power. That is why nuclear power or gigantic hydropower projects like Itaipu [12,000 MWe] are the favorite.

As a concrete example of this process, even on a lower technological level, consider the caboclo in the Amazon. Living on the river bank, he lives in plenty. From the river he gets all the fish he can use or dry for later consumption, the forest gives him an incredible variety of fruit the year round and there is plenty of game. He has all the free fuel he needs. He complements his diet from small plantations of manioc, sweet potatoes, beans, corn, some vegetables. He has a few chickens, sometimes a cow or two. The harm he causes the forest is minimal and well within the capacity for natural recovery. Now, some agricultural extension schemes, among other lunacies, are teaching him the methods of "modern" chicken farming, actually chicken or egg "factories." The "scientifically balanced" rations are formulated in Manaus, one thousand kilometers away, by big firms

Continued on page 23

class I), but has otherwise had little effect. (David Hawkins, who ran air programs at the EPA under the Carter Administration, argues that PSD classes II and III, governing areas with clean air but needing less protection than parklands, will be useful in the future and should be retained.)

- The states lack the research capacity to set standards and are unable to handle interstate problems such as acid rain.
- Research cannot yet link pollutant reductions with decreased acid rain, but any pollutant reduction should help.

- Hazardous pollution regulations are vague out of fear that real controls might be too sweeping.

- Cost-benefit analyses would be exceedingly difficult to apply to Clean Air programs.

- Current strict emission standards for new plants in areas with dirty air have helped reduce pollution and should be reduced.

- Many regulations need to be streamlined.

to command six dinners, not the actual six dinners. Money represents this abstract power which, unlike the real wealth for which it stands, can be accumulated indefinitely and made to grow exponentially. Abstractionism, not materialism, promotes the concentration of power. GNP is an abstraction. If we thought of wealth in concrete material terms we would realize the absurdity of an economy based on unlimited devastation.

Anyone in Brazil who criticizes the government as strongly as you do is likely to be called a communist. What do you say in reply?

How could anyone with ecological understanding advocate communism? In capitalism you have a lot of little or large bandits, and you can play them off one against another and find some living space in the gaps and the system can evolve. In communism you have one big centralized, all-powerful, unified mafia and nowhere to hide. Communism lacks the stabilizing negative feedback of a parliament, and of an independent conservationist movement.

The communist countries are even more dedicated to megatechnology and growth than are the capitalists. The Soviet Union financed the Aswan Dam and builds nuclear power plants and supersonic airplanes to save a few minutes of the precious time of their elite class. In short, they do all the things that the Brazilian technocrats and their government want to do—I should be calling them communists!

We need something better than either communism or modern capitalism—namely an ecologically sane, homeostatic, steady-state economy. No system that depends on continuous growth can be ecologically viable. The fact that communism is worse should be cold comfort to those of us in capitalist countries. All centralization of power is bad.

Lutz, we have yet to consider the most fundamental and controversial environmental issue in Brazil: population. Twelve years ago I wrote an article on population in Brazil and I am amazed to see how little the debate has progressed since then. Certainly there has been no major policy change such as took place in Mexico.

We desperately need birth control and a serious effort to reduce population growth. This is just elementary arithmetic, and if in Brazil we still have bitter debates about the need for birth control that is due not only to lack of knowledge of the facts, but also to ideological commitments and the crassest kind of class interest in maintaining an unlimited supply of cheap labor to promote ever-increasing concentration of power.

The upper and middle classes already practice birth control, but not the lower class. This incomplete democratization of birth control reinforces the inequality in the distribution of per capita income—or as the saying goes “the rich get richer and the poor get children.” But historically the population explosion was almost always the result of the destruction of traditional culture by the conqueror. It's the alienated who give up demographic controls. For twenty or thirty thousand years the Indians lived in harmony with nature, and even though the forest must have seemed unlimited to them, they were very conscious of the demographic problem and applied deliberate controls, including infanticide, when a tribe grew too large. Today, when you visit the villages of the “civilized” Indians you see a tremendous population explosion and devastation of the environment.

Given its actual style of living and level of consumption, Brazil is already overpopulated in the sense that the current situation is unsustainable. In that sense the US is even more overpopulated than Brazil, especially so if you count the depredations and waste of the suicidal armaments race with the Soviet Union.

That's a good point. And the US has yet to make any official effort to limit either its population or per capita consumption. Nor have the US and the USSR agreed to eliminate a single bomb or missile from their arsenals. Until we do something ourselves our preaching on population will not be taken very seriously.

Exactly!

Before we leave the subject of population, what role does the Catholic Church play?

The official attitude of the Catholic Church is truly retrograde, even though there are some enlightened individuals who are trying to change the Church's position. In other respects, however, the Church has recently become a force for social justice with its “option in favor of the poor.” It may be, however, that all their efforts to help the poor are largely cancelled out by the population growth that might be mitigated if they would just include access to birth control in their definition of social justice. Even if the government wanted to launch a birth control program now they probably would hold back because they are already in a bitter fight with the Church on human rights.

Many people today say that environmental concern is an elitist hobby and that it distracts attention from Brazil's more pressing problems of poverty and injustice, which require rapid growth for their solution. How do you answer these people?

I say that on the contrary it is the growth mythology that has allowed us to put off questions of distributive justice. As long as faith in the myth of eternal growth of the cake persists, we can say that those with the smallest proportional slices are getting better off absolutely even if not relatively, and that they should patiently wait for the cake to grow bigger before we redivide it more fairly, because premature redistribution would hurt the poor by slowing down the rate of growth of the cake. Simple people believe this. Today in Brazil we are constructing a consumer society for 20 million people on the backs of the other 80 million or more.

But, when we finally realize that the cake is not growing and cannot continue growing, and that in fact it is even shrinking, then no longer will we be able to avoid facing up to the demands for at least minimum justice in the distribution of income. For this reason the myth of perpetual growth is assiduously maintained by those who no longer believe it themselves, but find it in their interests that everyone else should believe it. Ecological concern and social justice are as inseparable as are the two faces of a coin.

Last question, Lutz. What principles must we build upon if we are ever to reverse this destruction and arrive at a sustainable homeostatic society?

First, we must arrest the process of desecration of nature and the exclusion from our code of ethics of all concern for anything not related or useful to man. We must adopt Albert Schweitzer's fundamental ethical principle of reverence for life in all its forms and all its manifestations. Second, we must accept a symphonic vision of organic evolution where man is only one instrument in the orchestra. The idea of a symphony emphasizes cooperation, harmony, and mutual adjustment. In an orchestra no instrument is insignificant, every instrument is complementary and indispensable to all the others. It's in this complementarity that resides the greatness. Third, we must rethink our technology. Today's hard technology, conceived in the interest of the powerful, must give way to soft technology conceived in the interest of man and nature. Man may be predestined to become conductor of the symphony, but only if he learns to obey its rules.

## ★ How to Get Involved

WITH THE SHIFT to a Republican majority in the Senate this year, Senator Robert Stafford (R-Vt.) will chair the Environment and Public Works Committee. A strong defender of the Act in the past, Stafford has indicated he intends to streamline, but not undermine, existing air quality protection.

In the House, the bill falls into the realm of the Energy and Commerce Committee, chaired by John Dingell (D-Mich.). The Subcommittee on Health and the Environment, chaired by Henry Waxman (D-Calif.), will do most of the work on the bill, though.

Both the Senate Committee and the House Subcommittee have tentatively planned hearings for the end of March. There is also the strong possibility that field hearings may be scheduled for key cities nationwide. Please make an effort to testify at any hearings in your area—it is critical that we build a strong record of public support for keeping our communities clean, healthy, and pollution free.

Write your congressional representative today and ask them to support a strengthened Clean Air Act in 1981. Better yet, go visit them when they are in your area. Mention areas of particular concern such as acid rain, hazardous chemicals, and health standards.

If you are interested in working more on the Clean Air Act, please contact us so that

we can put your name on a list to receive legislative alerts. Write Friends of the Earth, 530 Seventh Street, SE, Washington, DC 20003.

To find out if your Senator is on the Environment and Public Works Committee, see the list on page 00.

The members of the House Health and Environment Subcommittee are:

### Democrats

John Dingell, Mich.  
James Scheuer, N.Y.  
Henry Waxman, Calif.  
James Florio, N.J.  
Anthony Moffett, Conn.  
Thomas Luken, Ohio  
Doug Walgren, Pa.  
Barbara Mikulski, Md.  
Phil Gramm, Texas  
Mickey Leland, Texas  
Richard Shelby, Ala.  
Ron Wyden, Ore.

### Republicans

James Broyhill, N.C.  
Clarence Brown, Ohio  
Edward Madigan, Ill.  
William Dannemeyer, Calif.  
Bob Whittaker, Kans.  
Don Ritter, Pa.  
Cleve Benedict, W. Va.  
Thomas Bliley, Jr., W. Va.

—Cathy Smith

## Brazil *continued from page 13*

using imported corn, wheat, or soybeans from the US and powdered milk from the Common Market. The broilers and laying hens are hybrid, of course, which means he cannot reproduce them himself. He remains dependent on the stock of some multinational firm in the US. Soon he will give up his traditional, locally adapted chickens that are immune to disease. In his factory he uses imported medicine, hormones, antibiotics, et cetera. The buyer of his product is the same one who furnishes all the raw materials. The little chicken raiser has absolutely no influence on price either way. All the advantages are with the big companies or multinationals, all the risks are his. Of course this is not a scheme of improving food production, it is a scheme of creating dependence, an infrastructure for domination. This is really what “development” is all about.

The same is true when the *caboclo* is taught to grow tomatoes under plastic foil, with tons of soluble synthetic fertilizer, of course imported, and downpours of synthetic poisons, also imported. But most of the time he is simply displaced by immense agri-business schemes that totally extinguish his paradise, send him to the slums in big cities far away, or use him, as cheap labor, under labor camp conditions. In not-so-rare cases the big guy uses the machinegun on the “squatter” or the “ferocious” Indians.

This situation is representative, and what it means is that independent individuals who decide their own destiny are becoming an extinct species. They don't fit

the pattern of megatechnology and the imperative of growth. The crowning irony however is that the energetics of chicken farming make it a net absorber of food energy available to humans whereas the traditional system, using local inputs not competitive with human food, was a net provider of food energy.

Another example of insanely centralized technology is project SANEGRAN which will provide sewage treatment for the 20 million people expected to inhabit São Paulo in the year 2,000. The plan calls for one enormous central primary treatment station, the effluent of which will be carried by a single pipe, three meters in diameter, to Billings Lake, one of the few areas near São Paulo with any recreational value left. Can you imagine concentrating the crap of 20 million people into a single treatment plant? What happens when that plant breaks down? The pollution of Lake Billings and the waste of organic matter are problems that our technocrats just refuse to take seriously. This crazy project has been approved because in addition to concentrating shit, it concentrates power.

Do you think this tendency to concentrate power is connected with a philosophy of materialism?

No, I do not think we are materialistic at all—if we were we would treat matter with more respect. Material things impose their own limits. The materialist wants his dinner, he may want a better dinner, but he has no desire for six dinners at once. Alan Watts said we are abstractionists, not materialists. We want the abstract power

# ence: New ound

GOLEMAN

us simply can't track ver  
the real message is that l  
us, let alone what our ne  
a child is."

Irritability becomes  
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rather than when it o  
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that there is any  
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disruptive  
more than  
display irritability to  
their children than were the parents  
of the other children. He said he has

Continued on Page 18

N

## Research

CHINGER

repackaged form. These packages  
ere often called "teacher-proof,"  
mplying that even the least compe  
ent teacher could not mess them up.  
After all, experts had designed them.  
t was not surprising that many  
eachers rejected them as insulting.  
Imagine a manufacturer trying to  
sell physicians an instrument labeled  
"doctor-proof."

Mr. Myers cites several examples  
of sound research turned into poor  
classroom practice. He shows how  
useful research on what came to be  
known as "direct instruction" — les  
sons led by a teacher for a whole class  
or small group, followed by drill,  
short quizzes and limited choices for  
students — fell victim to a critical  
mistake: The researchers started  
writing lesson plans for teachers.  
Such plans recommended precise al  
locations of time to specific activities,  
such as 9 percent of a period on oral  
reading, 2 percent on drill and prac  
tice, 10 percent on review and discus  
sion, and 25 percent on "silent written

Continued on Page 20

# Hole in Ozone Over South Pole Worries Scientists

By JAMES GLEICK

**A**TMOSPHERIC scientists are struggling to explain one of the strangest mysteries ever to confront them: a widening and potentially dangerous hole in the ozone layer over the South Pole.

Putting forward a series of theories, and unsatisfied by all of them, the scientists are now making final preparations for a rare research ex-

pedition that will fly into the dead of the Antarctic winter in three weeks. At the same time, biologists are reporting heightened concern over the possible dangers to humans and ocean life from even small increases in ultraviolet radiation, which ozone blocks.

Concern has intensified steadily since last fall, when scientists were stunned by satellite data showing the magnitude of the hole, which ap-

pears each September and October. The depletion is many times worse than has been predicted over the last 15 years amid concern over the global effects on ozone of manmade gases, such as fluorocarbons.

By flying four teams with advanced instrumentation into the American base on McMurdo Sound — ordinarily closed to traffic in winter except for maintenance flights — the scientists hope to distinguish between two extreme possibilities.

The hole could be a transient climate phenomenon that will go away by itself. Or it could be caused by manmade pollution, in which case it could continue to widen, reaching populated areas of South America, Australia and southern Africa, and appear at the North Pole as well.

"It's like rolling dice," said Michael B. McElroy of Harvard University's Center for Earth and Planetary Physics. "The big money question is if what's happening in Antarctica is likely to be a foretaste of what might happen in the northern region."

The mystery has renewed worldwide interest in the overall ozone problem, which began in 1971 with fears over gases released by supersonic jets and spray cans. The United States banned fluorocarbons in spray cans in 1978, and a few European countries followed suit, but global production for uses ranging from air-conditioners to foam has continued to grow.

All the predictions assumed that such gases in the stratosphere would result in a steady, gradual, global depletion of ozone. Now scientists find themselves forced to confront a sudden, highly localized hemorrhaging of ozone that none of their calculations or computer models predicted. Instead of declining a few percent over decades, the Antarctic ozone has plunged 40 percent since 1979.

"On the one hand, it's very exhilarating and challenging, and on the other, it's frustrating and scary — scary because it's hard to place your bets with any confidence," said Ralph J. Cicerone of the National Center for Atmospheric Research.

Ozone is an unstable form of oxygen with molecules of three atoms instead of the usual two. In the upper atmosphere, it forms and breaks down continuously in chemical processes that have proved sensitive to the presence of other rare gases. These gases often serve as catalysts to hasten the breakdown.

The Antarctic hole appears at the end of winter as the spring sun rises briefly over the horizon. By the end of November, the ozone, at altitudes of 8 to 16 miles, recovers. Each year, though, the hole has expanded, in 1985 reaching a size equivalent to the area of the United States.

When the ozone is thin, the ultraviolet radiation reaching the ground in Antarctica would produce a tan even in the low, pale October sun, a level that over populated areas would sharply increase the incidence of skin cancer. And some scientists believe that it would wipe out some vulnerable plankton and fish larvae floating near the ocean surface. The latest studies confirm that light in the short ultraviolet wavelengths acts as a "stress," killing aquatic life, diminishing crop yields and producing cancers.

The initial report of the hole by British scientists in March 1985 caused little excitement,

Continued on Page 18

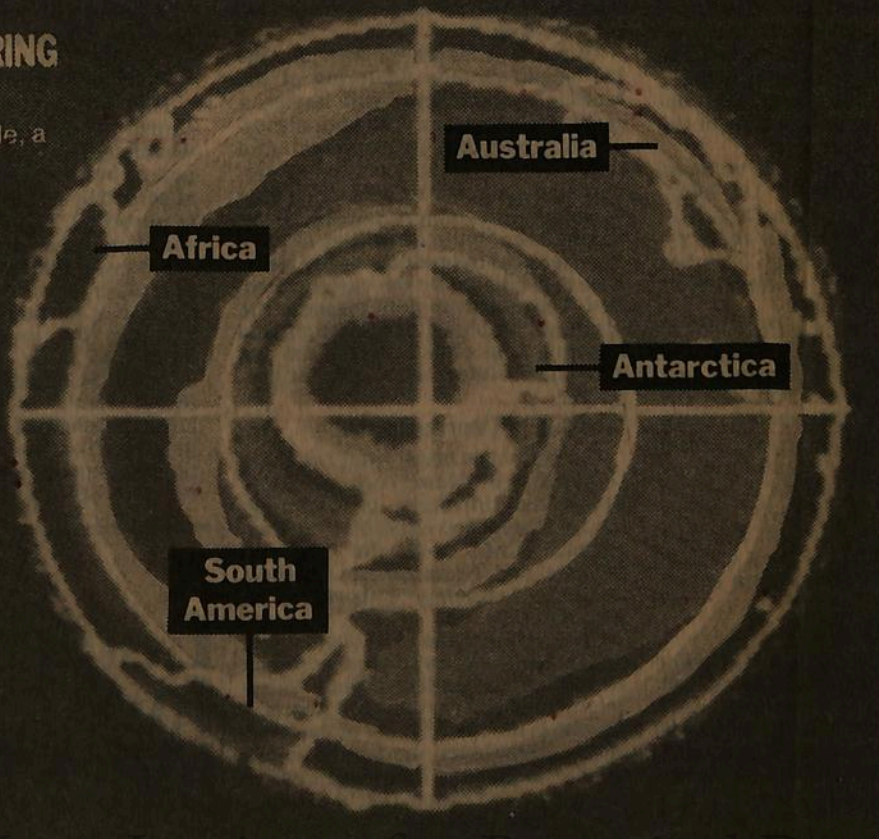


"This is one of the most challenging things that we've ever come across in atmospheric chemistry."

Susan Solomon, leader of Antarctic expedition.

## DISAPPEARING OZONE

Over South Pole, a hole in stratospheric ozone has expanded to cover an area as large as the United States. It is ozone that protects the earth from harmful ultraviolet radiation.



The NASA Goddard Space Flight Center

Desmodium ascendens [Fabaceae]

= Barra do Rio Negro

[RS at Manaus: 10-XII-1850 - 14-XI-1851]

R.S. 1855. in Trans. [Proceedings] Bot. Soc. Edinburgh 15.

> Hepatics of the Amazon and the Andes of Peru and Ecuador.  
(43 genera, 7700 spp.) (400 sp. nov.!)>

> R.S. 1872. Geographical Mag. On some remarkable  
marcators of the Amazon Valley, Orinoco.>

R.S. Notes on the Valleys of Puruc and Chica in  
Northern Peru, and on the cultivation of cotton  
therein. (81 pp.) London. Eyre & Spottiswoode.  
1864.

mosquitos [RS I: 404]

> R.S. ~~And~~ Note on the India-Rubber of the Amazon.  
Hooker's Journal Bot. VII: 193 (1855) &  
Jour. Pharmacy 28: 382.>

casá (cajú) = Anacardium occidentale

castanheira = Bertholletia excelsa = ~~casá~~ Brazil nut

quararâ [RS I: 297] = Paulinia urana they carried off as much  
saibas [RS I: 293. In São Gabriel in 1 night farinha as I could eat  
in a month.]>

eclipse of moon. [RS I: 278]

Mauritia carinata Humboldt [RS I: 268]

Guzapa = Guzipa macrophylla [RS I: 263] black dye (fr.)

Picapaá = woodpecker Urucú = Bixa orellana

Siphonia Struceana Benth. [RS I: 153] = Harua

mandioca = Maihot utilisissima

Sapopama = butters [sapo = root; peima = flat. RS. I: 40]

Sipó = liana [Tupi. R.S. I: 28]

caxoeira = water falls ubá = small canal = curiera

Ypadú = Erythroxylon coca ... chewed by Indians

Throughout the Rio Negro. [R.S.]  
I: 217

Pupunhe = Guilielma speciosa. "It spadix laden with

ripe fruit, is one of the most beautiful sights the  
vegetable world can show." [R.S. I: 223]

Official attitudes toward Indians  
compare Darwin! (p. 76) 49

vast industrial developments are under way in or being planned for many of the few remaining unspoiled areas.

Why are these forests—the richest, oldest, most complex ecosystems on earth—being cut down at such a rate? Why destroy a forest? To sell its timber, to get at the gold and iron underneath, to get more land for agriculture. There are psychological motives, too: the wish to conquer nature; fear of the unknown; nationalistic and strategic desires to occupy uncontrolled regions. Overpopulation is usually cited as the main cause of deforestation. Rain forests are often used as safety valves by governments to defuse pressure for land reform. The safety-valve theory is misguided. Rain forests are not empty; small groups of people are already living wherever the forest can support human life. Nor is the intact forest idle. It conditions the soil, regulates rainfall, and maintains the water cycle far beyond its own borders. Most attempts to turn rain forest into farmland have failed disastrously, damaging the forest, disrupting the soil and water balance for other farmers, and leaving the settlers even more desperate for land.

The true cause of agricultural settlement in rain forests is often inequitable land distribution rather than simple overpopulation. Among the rain-forest countries, only Haiti, India, Sri Lanka, Puerto Rico, Jamaica, and El Salvador have a population density higher than four hundred people per square mile; Japan, Great Britain, Belgium, the Netherlands, and West Germany all have more than six hundred. Brazil, which has had a policy of moving settlers into the Amazonian rain forest, does not need that land for agriculture. Leaving aside the Amazonian forest, it has roughly the same population density as the United States—about sixty-two people per square mile, compared with

sixty-five in America. Western Europe averages more than four hundred people per square mile. The Netherlands is prosperous with more than a thousand people per square mile. Brazil has two and three-tenths acres of farmland per person—more than the United States, which is the world's greatest exporter of food. Taking potential farmland into account but still leaving aside Amazonia, each family in Brazil could have ten acres. Instead, four and a half per cent of Brazil's landowners own eighty-one per cent of the country's farmland, and seventy per cent of the country's rural households are landless. In Java, eighty-five per cent of the families have no land at all, but of the island's landowners just one per cent own a third of the land. In India, more than half the arable land is owned by eight per cent of the rural population. In El Salvador, whose population is five million, fewer than two thousand families own forty per cent of the land. And, when it comes to farmers who rent land from others, the picture isn't much better. In most

developing countries, less than ten per cent of the rural population farms more than half the land. In Peru, one per cent of the population farms more than eighty per cent of the land.

Common though it is for government officials, businessmen, and international agencies, like the United Nations and the World Bank, to attribute deforestation to masses of poor people searching for land, there are many areas in which that pressure is not the main cause of forest destruction. Land hunger is not even the prime motivation in many government-sponsored settlement schemes. Some of the largest ones—in Indonesia and Brazil, for example—are intended mainly to secure national sovereignty by establishing a civilian presence in frontier regions. In the words of one member of the Brazilian junta, "When we are certain that every corner of the Amazon is inhabited by genuine Brazilians, and not by Indians, only then will we be able to say that the Amazon is ours."

In Latin America, cattle ranching for the export trade is the chief culprit in rain-forest destruction. According to Brazilian government figures, thirty-eight per cent of all deforestation in the Brazilian Amazon between 1966 and 1975 is attributable to large-scale cattle ranching, thirty-one per cent to agricultural colonization, and twenty-seven per cent to highway construction. The government gave fiscal incentives to ninety per cent of the ranches, and more than half the agricultural clearing was done under a government-sponsored peasant-colonization program. That program has now ended, in favor of investment in large-scale logging operations, hydroelectric dams, mines, and industrial development—activities that do not result from population pressure. "Those countries in which current forest harvesting is of great



"Oh, my goodness, here's another picture of me in today's paper! Make sure they all get pasted in my scrapbook."

# A REPORTER AT LARGE

## THE RAIN FORESTS



ITS lands are high; there are in it many sierras and very lofty mountains. . . . All are most beautiful, of a thousand shapes; all are accessible and are filled with trees of a thousand kinds and tall, so that they seem to touch the sky. I am told that they never lose their foliage, and this I can believe, for I saw them as green and lovely as they are in Spain in May, and some of them were flowering, some bearing fruit, and some at another stage, according to their nature." This is how Columbus described to Ferdinand and Isabella the forests of Hispaniola—the island that is now divided into Haiti and the Dominican Republic. The description contains the seeds of two different but not incompatible views of the rain forest—the romantic and the scientific, each of which still has its adherents.

For four centuries after Columbus's discoveries, travellers and scientists had no special name for tropical rain forests. They contented themselves with calling them forests or tropical forests. The great Victorian naturalist Alfred Russel Wallace, in his 1878

book "Tropical Nature," wrote of them, more precisely, as "the primeval forests of the equatorial zone." In 1898, the German botanist A. F. W. Schimper coined the phrase "*tropische Regenwald*"—"tropical rain forest." Schimper defined such a forest as "evergreen, hygrophilous in character [growing in wet places], at least 100 feet high, but usually much taller, rich in thick-stemmed lianas and in woody as well as herbaceous epiphytes." Botanists now distinguish, or try to, among thirty or forty types of rain forest, including evergreen lowland forest, evergreen mountain forest (subdivided into broad-leaved and needle-leaved), tropical evergreen alluvial forest (subdivided according to the degree of flooding), semi-deciduous forest (lowland and mountain), and so on. Because nature is continuous and science seeks clear-cut categories, these definitions are rarely wholly satisfactory, and each brave attempt to impose order on a complex and poorly understood ecosystem leads to revisions and adjustments and new tries.

The defining characteristics of tropical rain forests are temperature and rainfall. At one end of the spectrum are forests with high rainfall (a hundred and sixty to four hundred inches a year) and a high average temperature (eighty degrees), and without pronounced cold or dry spells. These are the equatorial evergreen rain forests. North and south of the equator, the climate gradually becomes more seasonal, with increasingly pronounced cold and dry spells. The second main group of tropical rain forests (more properly called tropical moist forests or tropical semi-deciduous forests) is marked by this seasonality. These forests get less rain (forty to a hundred and sixty inches a year), their temperature varies more, and during their dry season many or all of the trees lose their leaves. Generally, these seasonal forests are not as rich in species as the equatorial forests, but because for at least part of the year their canopies are more open they have a more luxuriant understory. Two-thirds of the world's rain forest is the wetter, richer, equatorial type. Its

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our plan is to try instead to minimize the damage. Maybe we can find a way for them to develop a stable agriculture. Maybe we can subsidize a cash crop, or . . ." He shrugged and sighed.

One cash crop is already having a drastic effect on the whole region. On the other side of the mountains, coca, the raw material of cocaine, is an increasingly popular, though illegal, crop. The Indians of the Pacific Coast have long grown coca for their own use. It is native to these rain forests, and also thrives on steep, eroded slopes on which almost no other plants can survive. The new spate of road-building has opened the forest to settlers—and buyers—and given coca-growing a big boost. Coca is already the main crop on about twenty-five thousand acres of former forest around the small town of Puerto Naya, on the far side of the western range.

Much to the worry of C.V.C. officials, the Department of Public Works is building two roads from Naya east across the mountains to the Cauca Valley. García and Varela fear that coca will spread to the eastern side of the western range, with disastrous consequences for the forest. "People here are hardworking, but coca is a very easy way to make money. Almost every kid in Naya has ten thousand pesos"—about two hundred dollars—"in his pocket. Already, people are stealing things from here to sell for two or three times as much over there. Two weeks ago, six horses were stolen. They'll fetch four or five times as much in Naya as they could here."

Such fears are not unrealistic. In the nineteen-sixties, the United States government helped Peru "develop" the rain forest of the upper Huallaga River, along the eastern Andes, by building roads into the forest. The idea was to move in landless peasants who would convert the forest to agriculture. What the authorities did not foresee was that coca would be the principal crop, and the upper Huallaga would become one of the world's major coca-growing regions, dominated by international drug syndicates and immune to government interference.

There were two main landowners along the road we were travelling. One, a businessman in Buenaventura, a hundred miles away, had commandeered a large area of flat land, a plateau amid the mountains. Except for a few scraggly trees and charred stumps, the land was bare. A stream wound through the rough grazing



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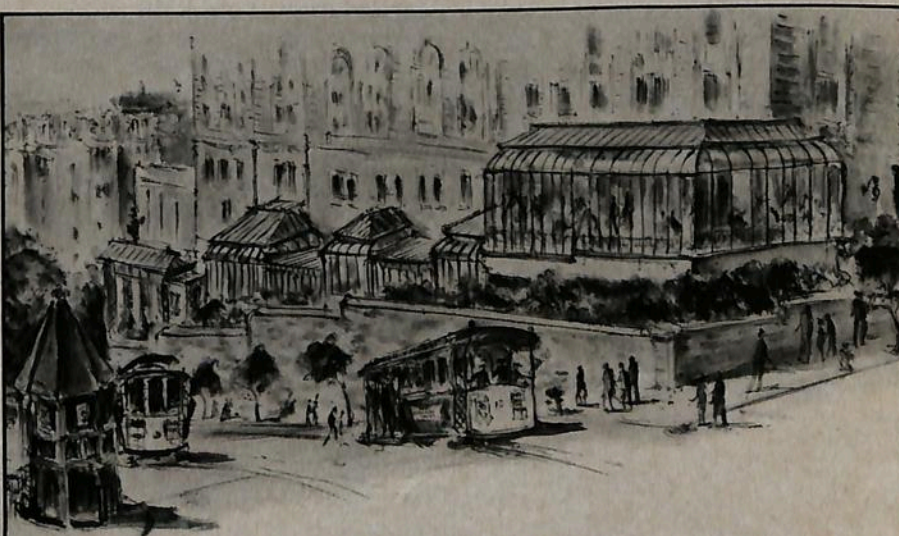
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land, and a rough ranch house stood near a small water hole, but I could see no more than twenty cattle on a pasture of perhaps a hundred acres. For the owner, this ranch is a profitable investment in the short term, a tax deduction, and a status symbol. For the C.V.C., it is the forest destroyed, the watershed threatened. The second big landowner controlled the surrounding uplands. He, too, was an absentee landlord; employing peasants to clear and work his land, extending his holdings to the west as the road progressed in that direction, and abandoning his earlier pastures as they became useless.

As we went on, we saw more forest and fewer signs of human interference. Around one bend, however, we overtook a barefoot man carrying a large scythe. A sunburned, wrinkled face and a bony frame made him look old and frail, but his voice was robust. He was on his way to weed his plot—a hilly piece of land above a landslide bordering the road. He had only recently cut and burned the forest to plant his crops. Did he intend to stay and cultivate the land he had cleared? "No, this land is not so good," he said. "When the road goes farther, I will follow it to better land." Dr. Varela looked at me in despair.

Where the road petered out to nothing at the top of a ridge, about six thousand feet above sea level, we found a solitary house—mud-caked walls topped by a corrugated-iron roof. Samuel Herrera, his wife, and their four children—three girls and a boy—had come here a year ago. From his vantage point, Herrera could look down on the property of the businessman from Buenaventura, for whom he works. He was clearing land for this man and at the same time was trying to grow crops for his family on an incline too steep for even the apparently goat-footed Colombian cattle to graze upon. Though Herrera was in the middle of his chores when we pulled up, he stopped working to answer our questions. Señora Herrera gave us coffee—weak and very sweet, as the local people take it. The house, neater and more comfortably arranged than I would have imagined possible in the circumstances, had a separate kitchen and an outdoor scullery with running water, ingeniously diverted from a mountain stream by means of a system involving rubber tubing, wooden troughs, and an old gasoline barrel. Two of the girls, aged about eight and eleven, helped their mother

with the coffee and then played on the bare red clay that was both floor and garden. Before coming here, Herrera had been working for a large landowner to the south. He had left because, although there had been no violence as yet, tension was rising between the Páez and Guambiano Indians and the settlers who were invading their traditional lands. He was now growing maize, some coffee, and a few other vegetable crops. The nearest market was in the valley, a seven-hour walk away, he said, but he didn't go there. Instead, a middleman made the trek uphill, bought his produce, and loaded it on a horse for the long journey back to market. Life was clearly hard here: the soil was not favorable to agriculture; the land was so steep that simply moving around the small family plot was tiring; the closest thing to a village was a hard day's walk away; the weather was hot and humid; landslides were common; and the water supply was erratic. What, I asked Herrera, could anyone do to make his life better?

"Build the road farther," he said quietly.

FOR a thousand years, while Western Europe groped through the Dark Ages, the magnificent Mayan culture flourished in the rain forests of Central America. The Mayans were the only people in the Americas to develop an original system of writing. Their mathematics was many centuries ahead of the European system. The Mayan calendar was more accurate than the Gregorian calendar we use today. Mayan ceremonial buildings, with their frescoes, sculptures, and bas-reliefs, are still admired for their grace and harmony. At its height, in the eighth century, the Mayan civilization supported fourteen million people. All this took place in the fragile and difficult rain-forest environment. The key to it was the Mayans' system of agriculture.

The heyday of classical Mayan culture ended around the tenth century. The great stone cities of Palenque, Tikal, and Piedras Negras, having apparently been made redundant by changes in trade patterns, were then abandoned to the creeping vegetation of the forest that surrounded them. Their inhabitants dispersed—some to farm on the savannas, some to lakes and riversides, and some to the forest, where they and their descendants farmed, fished, and hunted until the coming of the Spanish conquistadors,

in the sixteenth century. For two hundred years, the Spaniards raided Mayan forest settlements to get slaves for their ranches and plantations. Much of the Mayan system of knowledge was lost. The Spanish deliberately destroyed almost all the Mayans' writings and suppressed their religious practices. The skills and knowledge by which they had managed the forest fell into desuetude.

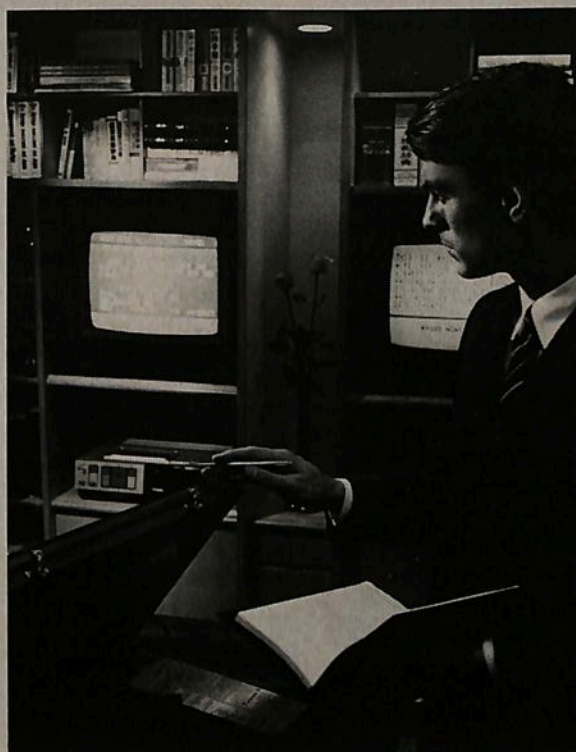
Most Mayans of the Chiapas rain forest, in southern Mexico, were captured by slave traders, and their lands were eventually settled by Mayans fleeing west from European contact in Guatemala. Ignored by the Spanish rulers, the refugees, known as the Lacandon Maya, were able to practice a variation of the highly productive Mayan agriculture in peace. Thanks only to their guarding the knowledge of their ancestors, we know today something of how the ancient Mayans managed tropical forest resources so as to feed large numbers of people without destroying the forest. The Lacandon are gentle people who wear their hair long and dress—both men and women—in plain white cotton homespun tunics. They farm more successfully and more efficiently than any of the businessmen, colonists, or agricultural experts who have also tried to farm in the forest.

At the beginning of the year, the Lacandon clear small plots in the forest, from two to three acres each. They leave the felled trees and the cut vegetation to dry. In deciding where to clear a plot, the Lacandon distinguish among seven types of soil, only three of which they consider good for farming. The vegetation of an area provides clues to the nature of the soil. Mahogany and tropical cedar are avoided, because the soils that support them are too wet for agriculture, whereas ramon and ceiba trees grow on rich, well-drained soils. In April, the Lacandon clear a firebreak around each plot and set the plot ablaze. Since in a rain forest most of the nutrients are stored in the living vegetation, burning the forest creates a nutrient-rich ash, in which the Lacandon crops flourish. But with the forest cover gone there is a danger of erosion. To prevent this, the Lacandon at once plant fast-growing trees, such as banana and papaya, which provide shade, and root crops like taro and sweet potato, which anchor the soil. A few weeks later, they plant their staple crop, maize. Along with the maize, they cultivate as many as eighty other

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crops in a two-to-three-acre garden plot, including onions, garlic, pineapples, custard apples, chili peppers, watermelon, limes, lemons, grapefruit, oranges, coriander, squash, lemon grass, yams, fennel, cotton, peanuts, tomatoes, manioc, mint, tobacco, rice, avocados, parsley, beans, plums, guava, sugarcane, cacao, and ginger, and also many plants unfamiliar outside the tropics. In order to decide when to plant certain crops, Lacandon farmers watch certain "indicator" plants in the nearby forest. When the wild tamarind tree flowers, for example, farmers in the northern part of the Chiapas rain forest know that it is time to put in their tobacco plants. This ingenious system, which depends on the existence of the natural forest, works better than a fixed planting schedule, since it automatically corrects for annual fluctuations in rainfall and temperature.

A Lacandon *milpa*, or garden plot, is successful partly because it mimics the forest in its density and diversity. The Lacandon do not plant their crops in tidy straight rows, separating each variety. On the contrary, they make a point of not putting two clumps of the same plant within ten feet of each other. The effect is to make the best use of the available nutrients and to prevent the spread of plant-specific pests and diseases. There are no spaces between crops; every inch of a *milpa* is covered with growth—several layers of it. Papaya trees shade maize, tobacco, rice, sugarcane, and other medium-height crops. The ground is carpeted with vines, and underneath, in distinct subterranean layers, are the root crops—sweet potatoes, manioc, and yams. The arrangement is not random. Each crop has specific soil, water, and light requirements, and each has its own response to proximity to every other plant. The Lacandon have learned through centuries of trial and error which of the thousands of possible permutations are best on a given plot.

Productivity is high on a *milpa*. Measurements made by the American ecological anthropologists James Nations and Ronald Nigh in the mid-seventies showed that a plot of two and a half acres could yield as much as six metric tons of shelled corn each year, before losses to animal pests, and the same quantity of root and vegetable

crops. The average annual yield is somewhat lower, Nations and Nigh reported, but it is still significantly higher than the quantities harvested by recent immigrants to the area.

Using their traditional agricultural system, the Lacandon cultivate the same garden plot for between three and seven years, depending on how frequently they weed. As long as weeds are kept out, the Lacandon can get two crops of maize a year without significant drops in yield. Lacandon farmers reduce weed invasion by making sure that their plots are surrounded by mature forest, which is naturally resistant to introduced weeds. They also burn plant debris after each maize harvest—a practice that kills insect pests and recycles unharvested nutrients. But, inevitably, weeds encroach on the *milpa*, and sooner or later it is easier to clear a new forest plot than to weed the old one. At that point, the members of the family start to clear a new *milpa*. They do not, however, entirely abandon their old plot but plant rubber, citrus, cacao, and other trees on it. The plot is left fallow for between five and twenty years, during which the Lacandon harvest wild plants, such as balsa wood; old crop plants; and the useful species they have planted there for food, fibre, and construction materials. Perhaps more important, in this stage of their cycle the "orchard-garden" plots attract wild animals, which the Lacandon depend upon for protein. The plots are, in a sense, the Lacan-



don game preserves. Scientists have found that certain animals—especially deer, squirrels, pacas, peccaries, and agoutis—are more common in regrowing garden plots than in pristine forest. They are apparently attracted by the young vegetation and the planted food crops, though most of them still need the mature forest for certain critical phases of their life cycle. The Lacandon also hunt in and collect wild plants from the surrounding undisturbed forest. By the time Lacandon children are ten years old, they can distinguish hundreds of edible and otherwise useful plants from those that are harmful.

Lacandon prefer to clear their *milpas* from regrown plots, because that is much easier to do than clearing mature forest. It takes forty man-days of hard work to clear two and a half

acres of virgin forest, whereas clearing the same area of secondary growth takes only eight man-days. By restricting their cycle of active and fallow *milpas* mostly to secondary-growth forest, the Lacandon maintain a productive agriculture without encroaching inexorably further into the forest. But today the system is under pressure as never before, and is beginning to break down. Only a few scientists have studied the Lacandon system, and no one except the Lacandon themselves knows how to practice it. The Lacandon now number more than four hundred, but only twenty per cent of the families still practice their traditional agriculture. The rest have abandoned it in favor of easier production systems—the purchase of canned goods and corn flour in nearby roadside stores, for example—and have begun living in permanent settlements. Meanwhile, the Chiapas rain forest continues to be colonized by poor peasants who do not know how to farm in the forest and by cattle ranchers who do not care.

In the nineteen-forties, the Mexican government's agrarian-reform law put an end to the isolation that the Lacandon had enjoyed. The law reclassified the Chiapas lowlands as national territory. Landless people were encouraged to find land there—a policy intended to reduce pressure for land redistribution in the more fertile agricultural areas of the country. The traditional use of the land the Lacandon had lived on, farmed, and hunted for centuries was overlooked. Since the forties, more than a hundred and fifty thousand peasant farmers have migrated into the forest. Some are descendants of the original Mayans—the ones who were enslaved by the Spanish—but, unlike the Lacandon, they have not retained their ancestors' techniques for farming successfully in the rain forest.

The new migrants have achieved disappointing yields with the monoculture agriculture encouraged by the government, and are destroying the forest in the process. In addition, many businessmen and prosperous farmers have started cattle ranches in the Chiapas region, taking over and consolidating cleared forest plots. Because the peasants lack the skills of the Lacandon, clearing forestland and then selling it to ranchers is the only way many of them can make a living from the difficult rain-forest soils—although doing so violates the spirit of the agrarian-reform law, which was intended to give poor people farmland. Already,

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the northern third of the Lacandon forest, an area of five thousand square miles, has been burned and converted into vast cattle ranches. And the Lacandon forest is one of only three large lowland rain forests left in all of Central America.

Under pressure from waves of immigrants, the Lacandon moved deeper and deeper into the interior of the forest, but in 1971 the Mexican government coerced them into moving onto three small reservations, with a total area of less than twenty thousand acres, where they find it more difficult to continue their self-reliant way of life. Now that the Lacandon live in concentrated settlements, in areas disrupted by logging roads and far from their gardens—each family no longer in its own *milpa*—they are less willing to keep their *milpas* clear by daily weeding. As a result, the *milpas* become overgrown much more quickly than before, and the Lacandon are forced to abandon them for new plots much earlier. This situation is exacerbated by the increased use of machetes. Previously, the Lacandon weeded by hand, uprooting the plants. Now, as they swing machetes through the weeds, the seeds are scattered across the ground, and the weeds become ever more deeply entrenched. Missionaries and government officials urge the Lacandon to “improve” their standard of living by depending more on manufactured goods, such as canned foods and battery-powered record-players, which not only undermine their traditional way of life but also encourage them to become acculturated to modern ways.

The Lacandon system is threatened, but it can be saved, and even improved. No modern agronomist has a better understanding of the workings of the forest than these farmers, yet there is room for still more efficiency. The Lacandon do not possess all the skills of the early Mayans. According to historians and anthropologists, the Mayan civilization depended heavily on now lost techniques of irrigation, terracing, and intensive aquaculture, appropriate versions of which could be reintroduced. Lacandon farmers would also benefit from the cooperation of modern crop breeders, experts on agricultural pests, specialists in irrigation and water control, and marketing advisers.

THROUGHOUT the world, farmers have practiced shifting agriculture, which is based on field, rather

than crop, rotation and is appropriate where the soil is poor and there is adequate land. In Amazonia and Southeast Asia, shifting agriculture is at least two thousand years old. Well into the twentieth century, parts of Europe and North America were farmed by shifting cultivation. In England before the Second World War, for example, many farmers in East Anglia, the Lake District, the South Downs, and the Chilterns rotated their fields, cultivating each for two or three years, then leaving it to return to woodland for as long as twenty years before cultivating it once again. This system ended when land prices rose so high that farmers could not afford to leave any of their land uncultivated, and the availability of inorganic fertilizers at government-subsidized prices made continual cultivation possible. In many parts of England now, greater amounts of fertilizers are needed simply to maintain existing levels of production.

Shifting cultivation is often more efficient than permanent-field agriculture; that is, it takes less labor to produce a specific unit of food by shifting cultivation than by any other method of farming. For this reason, some civilizations have returned to shifting cultivation when the pressures that forced them to adopt settled agriculture have eased. After the Mayans dispersed, in the tenth century, the Lacandon retained those elements of intensive Mayan agriculture which enabled them to feed themselves most efficiently. They lost some practices, such as fish farming and field irrigation, that were unnecessary—and too expensive in terms of labor and resources—for a small population with access to plenty of land and to “free” food in the form of the wild plants and animals that could be gathered and hunted there.

Purely as a hunting and fishing ground, the rain forest can support from five to seven people per square mile. Shifting cultivation increases the over-all carrying capacity of the forest to a hundred people per square mile. If one ignores the large areas that are fallow at any time, and takes only the cultivated areas into account, the figure rises to three hundred people per square mile, or even more. Intensive modern agriculture, where it can be practiced, can support higher densities, but the productivity of shifting cultivation compares well with the productivity of all other forms of agriculture which do not rely on expen-

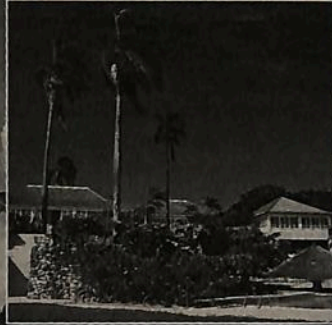
sive machines and artificial fertilizers.

The more "primitive" a farming system is, the more knowledgeable and skillful the farmer must be. Shifting cultivators and those farmers who have permanent "gardens" on forest soils traditionally create in their fields a partial replica of the complexity of the forest—its diversity, its several layers, its mixture of plants and animals. The opposite is true of "modern" agriculture, in which uniformity is the key. Vast fields are devoted to one crop—often, indeed, to a single variety of one crop. The modern farmer possesses powerful tools—year-round irrigation, machinery, ample supplies of power, and insecticides, herbicides, and fertilizers—that have a homogenizing effect on the land. He relies not upon his skills but upon his tools.

Successful systems of shifting agriculture and permanent home gardens are the result of many lifetimes of experience and trial and error. Each generation carefully teaches the next the accumulated knowledge and skills. But the newcomers who are flooding the forest today don't bring with them any such experience. They treat the forest as if it were the grasslands with which they are familiar. Their agricultural advisers frequently make matters worse by encouraging them to treat tropical soils like the temperate soils on which their training has been based. Almost by definition, the settlers are ill equipped for the difficulties and complexities of forest farming. There are three victims of their inexperience and the bad advice they receive: the settlers themselves, the forest, and the indigenous people—whose knowledge might have saved the first two.

The record of colonization in rain forests is a dismal one. The World Bank has supported many rain-forest-colonization projects, and continues to do so, yet it admits that "successful examples of colonization by nationals"—by non-forest-dwelling groups—"are exceedingly rare." After years, colonists in a project financed by the Peruvian and Swiss governments, in Angamos, in the Peruvian rain forest, are still unable to grow enough food to feed themselves. During the colony's regular food shortages, according to a World Bank document, the settlers survive by buying or, more usually, stealing food from the Matses—indigenous forest dwellers who are their neighbors. The Matses are looked on by the colonists and the project officials as primitive people. They have only

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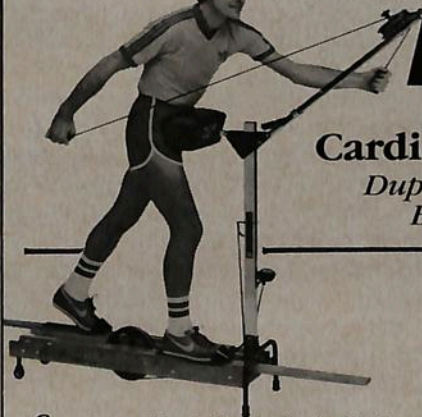
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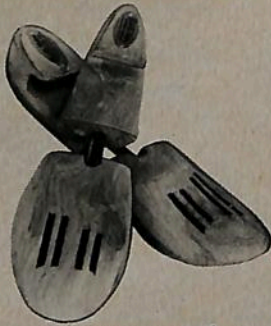
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simple tools, while the colonists have more complex ones, and fuel oil, pesticides, and fertilizers as well. Nonetheless, the Matses grow enough food to feed themselves and survive the predations of their subsidized neighbors. In spite of this situation and similar ones elsewhere, colonists have not been encouraged to adopt the local agricultural methods, or even modifications of them.

According to the research of Emilio Moran, an agricultural and ecological anthropologist at Indiana University, settlers imported into the Brazilian Amazon in the early nineteen-seventies in a government colonization scheme associated with the newly built Trans-Amazon Highway invariably chose to establish their farms where the trees were thick-trunked and gave the impression of vigorous growth; in reality, these areas were always associated with clay-poor red earths—the typical nutrient-poor soils of the rain forest. Traditional shifting cultivators in the area, however, looked for certain thin-trunked species that—as scientists later discovered—indicated well-drained, clay-rich soils. The local shifting cultivators also grew a different mixture of crops. After one year of farming, the chemical composition of the native farmers' soil remained superior in every respect to that of the newcomers' soil. The income from the native farms was twice that from the settlers' farms, and much of the difference had to do with how the two groups used available government resources. While the native farmers did use credit to buy certain labor-saving equipment, they continued to plant their traditional root crops, whereas the settlers took the word of government agricultural advisers and planted seeds—rice, corn, beans—that had not been tested for the locality and did not perform well.

Immigrants like the Brazilian settlers are practicing a distorted kind of shifting cultivation, which is called slash-and-burn agriculture, to distinguish it from the balanced shifting cultivation of the true forest dwellers. Most of the two hundred million or so people farming in or on the fringes of rain forests are slash-and-burners, who are used to conventional agriculture and don't have the knowledge and skills of the indigenous forest farmers. About half of the primary rain forest that is destroyed each year is ruined by slash-and-burn farming.

The worst loss is in Southeast Asia, where slash-and-burn farmers now

clear thirty-three thousand square miles each year, although much of the land has been logged or cleared before. Almost two-thirds of the twelve million square miles of land thus farmed is in the hills, where forest cover is most crucial. It is estimated that Africa's slash-and-burn farmers clear fifteen thousand square miles of rain forest every year. Ghana, for example, has virtually no rain forest left. At one time, more than a third of the country—thirty-five thousand square miles—was rain forest. Today, apart from about seven thousand six hundred square miles of ill-protected forest reserves, less than two hundred square miles remains, and slash-and-burn is the main cause of the destruction. In South America, the large government-subsidized cattle ranches, not landless colonizers, are the main cause of deforestation, but colonization schemes have hit certain areas hard. Worldwide, according to a 1980 National Academy of Sciences study, slash-and-burn destroys forty thousand square miles of rain forest each year.

THE most important thing at present is to enable slash-and-burn farmers and those shifting cultivators whose system is breaking down to have a stable, long-term agriculture on forest soils. This would mean the disappearance of still more forest, but at least the deforested areas could be productive, instead of being, as now, simply degraded beyond redemption. Even so, though stable rain-forest agriculture could take pressure off other parts of the forest, it will not protect the forest from exploitation by businessmen or other settlers.

There are a number of things that could be done to help slash-and-burn farmers. They need crop varieties that give higher yields and contain more protein. They need to understand better what nutrients their soils lack and how and when to add them. They need well-designed and cheap tools. They need better ways of protecting their crops against pests. They need advice and help in establishing markets for their produce. They need better ways of controlling soil erosion. They would benefit from knowing how farmers in similar environments elsewhere manage their farms. They would benefit if scientists understood the principles that make mixed-cropping schemes so effective, and explored ways of improving them.

Many scientists are discouraged by

what seems the hurly-burly of tropical agriculture in comparison with the relative order of temperate agriculture. Dealing with a simpler environment, and one that is made more nearly uniform by the use of fertilizers and pesticides, gives researchers the satisfaction of knowing that their work will be widely applicable. This is less likely to be true with traditional tropical agriculture, one of whose strengths is its variety—its adaptation to local ecological and cultural conditions. But the variety means that field work is all the more important in tropical areas, where, unfortunately, climate and logistical problems make it particularly difficult. For most rain-forest regions, the basic studies of soil, wildlife, weather, and sociological conditions on which agricultural research should be based have not been done. Some researchers are daunted by the fact that science alone will not solve the problems of traditional agriculture; agronomists will have to give up some of their sovereignty and work with anthropologists or sociologists to avoid the familiar pitfall of promoting technical solutions that for cultural reasons are ignored or have unintended effects. These factors and the tendency of governments, big businesses, and even international aid agencies to concentrate their resources on the cash economy have combined to leave research on traditional subsistence agriculture on the sidelines.

Nonetheless, some progress has been made. At Yurimaguas, in Peru, a team of Peruvian and United States researchers, many of them associated with North Carolina State University at Raleigh, have experimented with continuous cultivation in an area of the Amazon Basin where shifting agriculture is the traditional method of farming. They grew three crops a year, rotating in various combinations rice, maize, soybeans, and peanuts. In twelve and a half years, the researchers have produced about thirty harvests in each of several fields. When the fields were not fertilized, yields dropped to zero after the third consecutive crop, but with "complete fertilization"—when lime and other fertilizers were applied at about the same level that is required to grow these crops on similar soils in the southeastern United States—yields stayed up. Several shifting cultivators participated in the experiments, following the researchers' system on their fields. They obtained similar yields—six to ten times as high as their usual aver-



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The trouble with this system, besides the fact that it depends on expensive chemicals that may not always be available, is that it ignores both the cost of building twelve hundred miles of road across the Andes, in order to make fertilizer deliveries possible, and the cost to the government of subsidizing the fertilizer. Even though, according to the calculations of the research team, every dollar borrowed to buy fertilizers increased a farmer's profits by from a dollar and twenty-nine cents to four ninety-five, few of the local farmers could afford to borrow money in the first place. Most of those who tried the new methods for the experiment have gone back to their original way of farming. To address the problems, the researchers are now experimenting with low-cost natural fertilizers and with ways of reducing the need for fertilizers. Growing crop varieties whose tolerance for acid soils is high—either naturally or due to selective breeding—"is expected to substantially decrease" the amount of lime and phosphorus fertilizer needed, according to the researchers. Rice and cowpeas are yielding good results in this respect. Another low-cost technique being tried is the use of kudzu, a fast-growing nitrogen-rich plant, as a natural fertilizer. Elsewhere, this "has often resulted in crop yields similar to those following complete fertilization," they said, though growing, transporting, and applying the kudzu requires more labor than applying inorganic fertilizer. Other promising experiments include fertilizing the soil with compost made from crop residues, and planting kudzu on worn-out cropland as a quick way of restoring its fertility. It appears that two years of growing kudzu has the same restorative effect on old cropland as twenty-five years of forest fallow.

Among the other useful discoveries that the Yurimaguas team has made is that soil quality actually improves under continuous cropping with fertilizers. After eight years, the soil was less acid, and the result was a doubling of its ability to retain artificial fertilizers. Levels of toxic aluminum decreased, and levels of nutrients, including calcium, magnesium, phosphorus, copper, and zinc, rose. The fields used were cleared from a seventeen-year-old secondary forest, and trials showed that clearing the vegetation manually and then burning it was better than removing the trees with machines. The

burning returned forest nutrients to the soil, while bulldozers compacted the soil and often pushed the topsoil off the field.

The researchers tried growing one crop continuously in the same field, but found that yields fell, because of a buildup of pests and diseases. These were not a problem when three crops were rotated, but the researchers have warned that rotated crops are likely to develop more pest problems as time goes on. A rotation of rice, peanuts, and soybeans was the most successful regimen, yielding an average of three and a half tons per acre per year. Because the experiments were conducted on nearly level land, serious problems with erosion and runoff were avoided. Nonetheless, the scientists warn that even on flat terrain crop fields should be surrounded by forest reserves in a mosaic pattern to protect the watershed.

Under a United Nations research program in Mexico, scientists in the early nineteen-seventies began reintroducing an ancient Mexican system of farming, still practiced in the Valley of Mexico, into four rain-forest areas where shifting cultivation was breaking down into slash-and-burn agriculture, and they extended it to other areas. The system, called *chinampa*, is based on raised fields built up from soil containing organic debris, which is usually dredged from lakes or swamps. The *chinampas*, or plots, are separated by a network of artificial water channels, which are used for transportation, fishing, and irrigation. Trees line the channels, keeping the *chinampas* in place, and the soil of each plot is regularly replenished by more nutrient-rich dredgings. The farmers grow a wide variety of crops, and also hunt and gather plants in the adjacent



rain forest. They plant seeds in special fertilized beds. When seedlings are ready for the main fields, they are planted in the little cubes of earth in which they were grown, thus taking their own fertilizer supply with them. In 1976, having found that the *chinampa* system worked in the four rain-forest areas and in all the other regions where it had been tested, the scientists handed one site, in Tabasco state, over to local farmers, who have since constructed more. As a low-capital, labor-intensive, self-sufficient system, *chinampa* could have applications in other countries and on other continents.

A number of other small-scale field experiments are under way, aimed at enabling slash-and-burn farmers to stay in one place permanently. In Papua New Guinea, researchers at the Wau Ecology Institute are working with local women, who do most of the farming, in an effort to find a way of fertilizing fields with readily available materials. Most Papua New Guineans keep pigs, but the pigs are free-ranging, so it is not feasible to collect their waste for manure; nor do families produce enough kitchen waste to fertilize their fields. Instead, the Wau system relies on coffee plantations, which are common in Papua New Guinea, and whose waste is usually just dumped into a river. Using composted coffee waste, the women build up rows of mounds that follow the contour of the land. The compost mounds provide nutrients to the crops—usually a staple root crop grown in combination with an early crop to shade out weeds and a legume plant to add nitrogen to the soil. The contour mounds also give protection against soil erosion. This is just one aspect of a system that might eventually include growing trees to reduce erosion, provide food, fuel, and other useful materials, and add organic matter to the soil by shedding leaves and twigs. But there is a cultural hitch. In Papua New Guinea, men clear new garden plots, although women do the planting, weeding, and harvesting. So while the system makes sense in theory, it may fail in practice, because it requires a change in the balance of work between men and women.

In Brazil, scientists at the National Institute for Amazonian Research are experimenting with "food forests"—tree crops that provide food for subsistence-farming families. David Ark-coll, one of the scientists, explains, "The only successful advanced agri-



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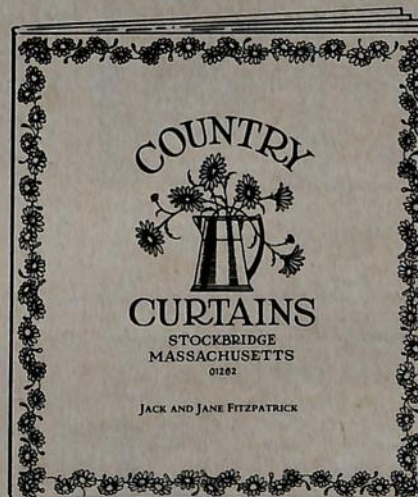
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cultural systems in the tropics are tree-crop plantations—oil palm, rubber, cocoa. They've worked because they are, one, ecologically stable, viable, sustainable, and, two, profitable, so their farmers can afford to fertilize the soil. But they don't feed anybody, you see." Not only do trees give shade and protect the soil from erosion but their roots can go deeper, looking for nutrients, than the roots of ordinary farm crops.

Arkcoll points out that in fertilizing annual crops you are doing the soil little good, because most or all of the added nutrients are pulled out each year with the mature crops. Yields for perennial crops are much higher, but, by a cruel twist of fate, most food crops are annuals, and hardly any are trees. However, there are a few tree crops that could be the basis of a stable subsistence farm—plantains, jackfruit, breadfruit (seedlings of which Captain Bligh was carrying aboard the *Bounty* as he sailed back from Tahiti), and peach palm, among others. For many centuries, Indians throughout Amazonia have cultivated peach palms. By selecting plants with the characteristics they desired, they "bred" more than two hundred distinct types of peach palm. "The Indians made the peach palm," Arkcoll's colleague Charles Clements told me. "In Bolivia, they developed it for oil. In Yurimaguas, they eliminated the spines on its trunk, so that they could get heart of palm out of it. In the region on the borders of Colombia, Peru, and Brazil, they grew peach palms with high levels of carbohydrate, so they could use the peach palm as a staple food. Some other 'food varieties' are as much as fifteen per cent protein—much more than manioc, which is the staple diet of Amazonia now."

Arkcoll and Clements' experiments indicate that peach palm is easy to grow. ("It's practically a weed," Clements says.) A small farmer could grow from ten to thirty trees and get a good yield (about a hundred and thirty pounds per tree per year) using just household waste for fertilizer. It takes from three to five years for the trees to produce fruit, and during that time farmers could grow annual crops in between the trees. Peach palms, according to the variety selected, can be either a subsistence crop or a cash crop, producing hearts of palm or oil. They are said to be competitive with African oil palms as oil producers; in fact, in France in the eighteen-nineties

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the first diesel engine ever made ran on palm oil.

Arkcoll and Clements have devised an interesting way of supplying a peach-palm field with the extra nutrients it needs. "We have been experimenting with shallow transportable outhouses set over holes from twenty to thirty inches across," Arkcoll told me. "These can be moved a few yards every few weeks or months, and a food tree planted in the old position. In this way, a small orchard can be produced around the house in the poorest of soils. The system is comparatively effortless and is also hygienically satisfactory." In spite of the tree's appealing name, the fruit of the peach palm is not particularly delicious. It is not distasteful—merely bland, with the texture, when cooked, of a somewhat mushy potato. Whether the peach palm becomes a staple food in Amazonia or anywhere else will depend on kitchen trials as much as on field trials.

In some areas where the land cannot support a high population density, settled agriculture will always be out of the question. Those who insist that shifting cultivation is an unaffordable luxury because it takes up too much land should answer the question "Compared to what?" In many areas of the tropics, shifting cultivation is the only kind of farming that works.

WORLDWIDE, logging is the main cause of degradation of rain forests. It is also the most lucrative way to exploit them. In 1980, timber sufficient to provide roughly three billion cubic metres of wood was felled throughout the world. More than half of that was burned to provide heat and power. The rest, about fourteen hundred million cubic metres, was "industrial wood," used for construction or converted into paper and cardboard boxes. Only twenty per cent of the world's industrial wood comes from rain forests, but more than half of that is exported to the richest nations: virtually all the hardwood logs and more than half the hardwood sawn timber in world trade comes from rain forests; and in 1979 fifty-eight per cent of the world production of hardwood logs and seventy-five per cent of all hardwood-log exports came from Malaysia and Indonesia alone. The developed countries produce eighty per cent of the world's industrial wood, but they keep almost all of it and import much of the rest of the world's harvest as well. Japan takes

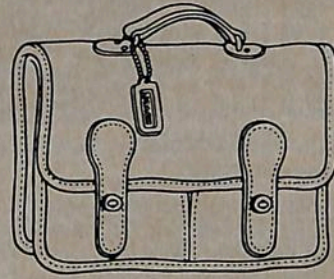
more than half and Europe more than a quarter of all wood exports.

The rain-forest countries of Asia and the Pacific export seventy per cent of their industrial wood—half to Japan and most of the rest to countries (mainly Korea, Singapore, and Taiwan) that process logs and immediately reexport them to North America, Europe, Africa, and the Middle East. West Africa exports just over half its harvest, largely to the nations of the European Economic Community. Latin America exports less than ten per cent of its harvest, mostly to North America and the E.E.C.

Twenty-five years ago, the world trade in wood presented a very different picture. Between 1961 and 1975, developing countries more than doubled the amount of industrial wood they harvested each year. They also exported more and more of what they produced—a third in 1961, half by 1977. In some countries, the leap was much more spectacular. Indonesia, for example, in 1979 exported a hundred and sixty-seven times as much wood as it did in 1961. The industrialized nations now use sixteen times as much tropical hardwood as they did in 1950, but tropical countries use only about three times as much hardwood as they did in 1950.

Nearly all wood must be processed before it can be used—turned from raw logs into lumber, plywood, veneer, or pulp. The industrialized countries process their own wood. Few developing countries have the equipment and skills needed to process more than a tiny fraction of their annual log harvests. Three-quarters of their exports, therefore, are logs, which are less valuable than processed wood. In 1961, half the wood exported from Latin America was in the form of raw logs; now all of it is processed. Africa and Asia and the Pacific region, however, are still exporting the same low proportion of processed wood—thirty-five per cent and twenty per cent, respectively—that they exported in 1961.

Wood exports bring around eighty-seven hundred million dollars a year to the developing countries. Asia and the Pacific get seventy per cent of that; most of the rest goes to Africa. Indonesia gets more than twenty per cent of its gross foreign-exchange earnings from wood, and so do Gabon, the Congo, and Burma. In Malaysia, Cameroon, and the Ivory Coast, wood exports provide from ten to twenty per cent of the gross foreign-exchange



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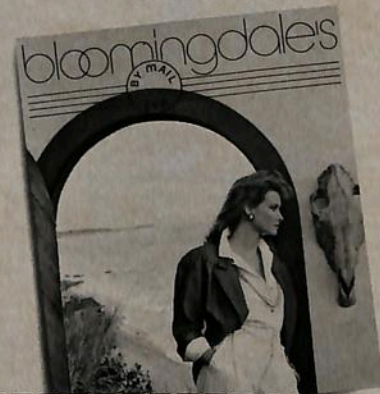
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
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earnings. But the net foreign earnings are often much lower. Deducting the cost of imported equipment, the income that foreign workers send home, and the profits that foreign companies transfer to sister companies elsewhere often cuts wood-export earnings in half. Indonesia's net earnings from timber exports in the early nineteen-seventies, for example, were only a quarter of its gross earnings, though by the end of that decade, when loopholes had been tightened, net earnings had doubled, to fifty per cent of gross earnings.

Since 1973, JANT, a subsidiary of Japan's Honshu Paper Company, has been clear-cutting a two-hundred-thousand-acre area of rain forest in Papua New Guinea. The entire area will be deforested before 1990. According to the JANT prospectus, "Every day, one hundred various types of heavy vehicles and their operators are working and making their presence known in the green jungles of the Gogol area." The company was supposed to reforest as it cleared the area, but it is logging ten times as fast as it is replanting. When this area is logged out, JANT can exercise an option on a hundred and sixty-five thousand acres nearby. Every month, it ships twenty thousand tons of wood to the Honshu paper factory in Japan. As of 1981, JANT had declared no dividends and had not paid any income taxes in Papua New Guinea, because it sold the wood to its parent company at such low prices that it never made a profit. That practice, called transfer pricing, is said by some economists to cost Papua New Guinea eleven million dollars a year.

In any case, for all but a few countries the income from exporting mostly unprocessed wood is eaten up by the need to import sawn timber, plywood, and paper. Many tropical-rain-forest countries import, mostly in the form of paper and paperboard, more than they export. Nigeria was once a major timber exporter. It is now on the verge of complete deforestation, and its wood-import bill is a hundred times its earnings from wood exports. Exporting unprocessed wood at low prices and paying high prices for processed imports is so wasteful that some countries—notably Malaysia, Indonesia, and the Philippines—have tried to ban the export of logs. None, however, have succeeded in imposing a complete ban, partly because Japan and Europe, the major importers of tropical wood, prefer to buy logs cheap and process

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them themselves. They tax processed wood in order to discourage its import. The E.E.C., for example, which buys seventy per cent of Africa's wood exports and forty per cent of Asia's, allows free trade in unprocessed logs but puts an eleven-per-cent tax on processed tropical timber from Asia.

Timber operations and other forms of rain-forest development, such as mining, ranching, and drilling for oil and gas, should contribute to the economies of the rain-forest countries by paying taxes and royalties and by providing jobs. But they may contribute very little, or even cost a country money, while making a profit for the developers. One study of American subsidiaries in Latin America found that over a three-year period they financed seventy-eight per cent of their investments with money borrowed locally, and thus reduced the amount of money available to local borrowers. The same companies sent fifty-two per cent of their profits home instead of investing them in new projects locally. In 1974, a survey by the Brazilian government of a hundred and fifteen multinational companies revealed that they imported products and equipment worth two billion one hundred million dollars more than those they exported. A United Nations study showed that a total of four hundred and thirty-four million dollars invested by multinational companies in Indonesia's logging and timber-processing industry between 1968 and 1976 created only seven thousand jobs for Indonesians. One of the most common criticisms of foreign companies is that they do not train local people for senior positions.

Brazil encourages companies to invest in Amazonia by offering them a fifty-per-cent income-tax rebate on their investments elsewhere in Brazil, tax holidays of up to ten years, loans with negative interest rates (in real terms), and exemptions from sales taxes and import duties. That has proved to be an expensive way of making jobs. Each industrial job created costs the government thirty-four thousand dollars, each ranching job sixty-three thousand dollars. As for bringing in foreign capital, almost half the cost of the industrial projects and seventy per cent of the cost of the livestock projects were covered by fiscal incentives and other subsidies; that is, they were paid for with money diverted from the national treasury. Much of the rest was borrowed from



Brazilian banks. Since 1979, new ranches in the Brazilian Amazon have not received such support, because, in the words of the Environment Minister, Dr. Paulo Nogueira Neto, "to ranch in the rain forest is a disaster." But the incentives continue for existing ranches.

In business negotiations with developing countries, the two hundred or so giant multinational corporations enjoy a decided advantage in financial resources, technology, managerial expertise, and influence. In 1981, Exxon, the biggest of these multinationals, had an annual revenue larger than the gross national products of at least sixty-four countries. Unilever, the twenty-fourth-largest company in the world that year, had a

total revenue of twenty-four billion one hundred and nine million dollars. The Solomon Islands had a gross national product that year of ninety-five million dollars. In that year, Unilever employed three hundred thousand people directly and fifty-one thousand through associated companies. The population of the Solomon Islands is around two hundred and fifty thousand. Unilever's logging operations are carried on through Lever Pacific Timbers, which is a subsidiary of Unilever's United Africa Company International; these operations employ four hundred and fifty people and account for fifteen per cent of the value of all the country's exports. Lever's contract with the government of the Solomon Islands does not require it to reforest logged-over areas. The contract between JANT and the government of Papua New Guinea obliges the government to pay half the cost of reforestation, which is estimated to be a hundred and eighty dollars an acre, but JANT pays chip royalties of only about forty dollars an acre.

While reforestation is a normal part of the logging cycle in North America and Europe, many of the companies that operate in rain-forest countries feel that replanting is the job of the countries' governments. Concession holders say that their leases, usually for fifteen or twenty years, are too short to offer an incentive to replant. As a rule, they prefer to take their quotas as quickly as possible rather than establish long-term operations in a climate of political and economic uncertainty. United Africa Company International's divisional director for forestry and the Solomons, Donald



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McNeil, says, "Governments have—or should have—the right people to do the job. They should be doing reforestation on the ground close behind the commercial extractor. It is in everybody's long-term interest to grow more trees."

Many countries are now trying to attach stricter conditions to the logging concessions they grant—conditions that will encourage reforestation or domestic processing. Since 1979, Indonesia has required its concession holders (of whom there are at least five hundred) to deposit four dollars for every cubic metre of wood they export, the money to be refunded as they reforest the logged-over area. However, only a handful of companies have begun a reforestation program. The rest are forfeiting the deposit and passing the problem back to the government. Unfortunately, reforesting logged-over rain forest is still in the experimental stage, and neither the government nor private contractors have the resources or the experience to plant even a small part of the huge area cleared every year.

In Papua New Guinea, local enterprises have only a fifth of the forest-concession area; the rest is leased to foreign companies. According to the United Nations Center for Transnational Corporations, "Transnational corporations or their affiliates account for more than half of the international commercialization of the hardwood resources of Asia and the Pacific." But in many countries local investors dominate forestry and ranching in rain forests, though the relatively few large multinational companies are usually more visible. Even local investors, however, can be outsiders in terms of the forest, the Brazilian ecologist José Lutzenberger argues. "What's happening in the Amazon is just another form of imperialism, whether the people going there to exploit have a Brazilian passport or a foreign passport," he has said. "They are exploiting the local resources at the expense of the local population. Brazil is so large that we can afford to leave the Amazonians in peace, at least for the next several decades."

Generally, the trade in rain-forest products is more important to the sellers than to the buyers, partly because, in the case of most items, tropical rain forests provide the industrialized world not with essential supplies but with extras that are worth having only if the price is right. As a rough rule of thumb, the richest twenty per cent of

the world's people consume eighty per cent of the world's resources; each additional unit acquired is worth less to the consumers than the preceding unit, since it represents a progressively smaller proportion of the whole, but as the raw materials are depleted extracting each extra unit becomes progressively more disruptive to the producing country.

In the industrialized world, the average person uses three hundred and thirty pounds of paper a year. In the United States, where a single copy of the Sunday New York Times may weigh more than ten pounds, each person uses six hundred and fifty pounds. The average person in a developing country uses only eleven pounds. Japan, which imports more wood than all other countries combined, nevertheless has two-thirds of its land under forest—more, apart from the Scandinavian countries, than any other industrialized nation. Its forests contain enough wood to replace its imports from Southeast Asia and the Pacific for a hundred and fifty years, at current rates of consumption. But the Japanese harvest their own timber at a rate far below what their forests could support. In fact, their annual harvest today is only two-thirds of what it was in 1966. During the same period, imports of tropical logs have more than doubled. "Japan has a very clear strategy," according to Professor Hans Steinlin, a forestry expert at Albert Ludwig University, in Freiburg, which is "to protect its forests for as long as possible, although it means overexploitation of Southeast Asia and the Pacific region." Still, Japan is now worried enough by the imminent depletion of the Asian and Pacific rain forests that its pulp manufacturers have established a fund to finance plantations of fast-growing timber species, such as Caribbean pine, in selected countries. Plantations, if they succeed, may provide a reliable supply of timber; in terms of wildlife, useful plants, and ecological protection, they will not replace the lost rain forests.

INTERNATIONAL aid agencies pay lip service to conservation but provide very little money for it. According to Marc Dourojeanni, the former director of Peru's National Park Service, there is not a single conservation project in Peru in which Peru is not paying eighty per cent of the costs. "The South is asked to conserve genes, while the other fellow, in the North, is con-

suming things that force us to destroy the genes in the South," Emil Salim, Indonesia's Minister for Environment and Development, said to me. "Who is going to pay for this protection? We should strive for an equitable share in the benefits of our genetic resources and an equitable share in the costs of safeguarding them."

"Genetic resources"—the very phrase implies that plants and animals exist to serve mankind. The American biologist Michael Soulé warns against trying to "sell" conservation by promising new industries and wonder drugs. Thomas Lovejoy, of the World Wildlife Fund, agrees that not everything can be given a price. He says, "Sometimes I'm asked: What difference does it make whether there's one species or ten species less in some tropical forest? My answer is that I probably can't tell them what an individual species is doing, but I can say that it's making an incremental contribution to maintaining the stability of global chemistry and climate."

Richard Spruce, the traveller and botanist, addressed the question in a letter to a friend in 1873: "It is true that the Hepaticae have hardly as yet yielded any substance to man capable of stupefying him, or of forcing his stomach to empty its contents, nor are they good for food; but if man cannot torture them to his uses or abuses, they are infinitely useful where God has placed them, as I hope to live to show; and they are, at the least, useful to, and beautiful in, themselves—surely the primary motive for every individual existence."

—CATHERINE CAUFIELD

**MOST FASCINATING NEWS STORY OF THE WEEK**

[The following item, reprinted in its entirety, is from the *Morgantown (W. Va.) Dominion-Post*]

SALT LAKE CITY (AP)—When Utah Jazz coach Frank Layden was named Coach-of-the-Year in the National Basketball Association, he naturally felt great. Minutes later he was brought down to earth by his wife.

Mr. Korneluk, noting that a number of doctors have video games in their reception rooms, urges his clients to put TV sets in their examination rooms. "While the patient is sitting there naked he can watch the TV," he said. "I know a doctor in St. Louis who has color sets in all his exam and reception rooms. That's class."—*The Times*.

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# A REPORTER AT LARGE

## AMAZONS

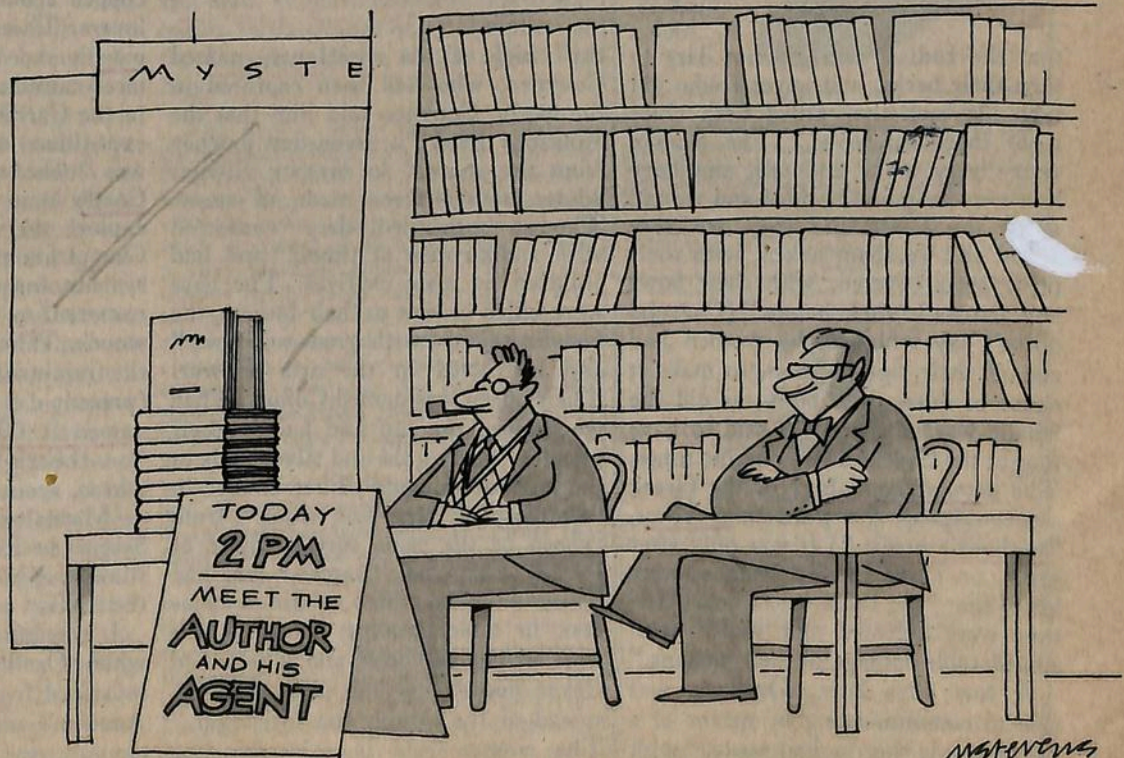
**T**HE Nhamundá River rises in the mountainous terra incognita of northern Brazil below the Guyana border and, flowing southeast, enters the Amazon River about three-quarters of the way down its four-thousand-mile length. Compared with some of the Amazon's other tributaries, seven of which are over a thousand miles long, the Nhamundá is minor-league—only around four hundred miles long. Because there is no abundance of gold, bauxite, iron, uranium, rubber, or commercial hardwoods to attract people to the Nhamundá Valley, it is virtually uninhabited. You can paddle for days in its watery wilderness without meeting a soul. There are three towns on the river's lower reaches—Terra Santa, Nhamundá, and Faro—but the only way to get to them is by boat; no airstrips or roads link them to the outside world. Many of the scientists working in the Amazon Basin today can't exactly place the Nhamundá. But the river does have a claim to fame: it is thought to have been the home of the legendary Indian tribe that consisted only of women and children—the Amazons.

The first Europeans to travel the length of the Amazon River maintained that they had been attacked by female warriors. An account of the engagement appears in the chronicles of the Dominican friar Gaspar de Carvajal, who on December 26, 1541, with the Spanish conquistador Francisco de Orellana and about sixty countrymen, set out in a jerry-built brigantine down the Napo, an Ecuadoran tributary of the Amazon. None of the travellers knew where they were going or what awaited them. They had separated from a large expedition led by the recently appointed governor of Quito, Gonzalo Pizarro (a half brother of the more famous Francisco). Pizarro's plan had been to explore the unknown lands to the east

—El Dorado and La Canela, the Land of Cinnamon. By the time the expedition had crossed the mountains east of Quito and descended into the jungle, all two thousand hogs brought along for food had been eaten, most of the four thousand bearers had died of fever and maltreatment, and weakness and despair had set in. Pizarro sent Orellana and his party on ahead to find food, with orders to return within twelve days. But, floating down the Napo, they did not find any food. As Carvajal relates, the men were reduced to eating "leather, belts, and soles of shoes cooked with certain herbs." Several went mad after eating some unidentified roots. Unable to return because of the strength of the Napo's current—or so he later claimed—Orellana kept on going, figuring that eventually he would reach the Atlantic. On February 11, 1542, he came out into the Amazon.

After travelling five months and some fifteen hundred miles, fighting Indians and falling on their food stores along the way, the Spaniards, still nine hundred miles from the Atlantic coast, passed the mouth of a large, dark river. They named it the Rio Negro. Three days later, on June 5th, they met some Indians who said (Orellana, according to Carvajal, was

a gifted linguist and was able to understand what they were saying) that they were "subjects and tributaries of the Amazons" and that "the only service they rendered them consisted of supplying them with plumes of parrots and macaws for the lining of the roofs of the buildings that constitute their places of worship." As the expedition moved downstream, the villages became more numerous. On the twenty-fourth of June, Carvajal recorded, "We came suddenly upon the excellent land and dominion of the Amazons. These said villages had been forewarned and knew of our coming, in consequence whereof they came out on the water to meet us, in no friendly mood. . . . Orellana gave orders to shoot at them with the crossbows and arquebuses, so that they might reflect and become aware that we had wherewith to assail them." Then the Spaniards continued on. But they had not gone half a league before they encountered, "along the edge of the water, at intervals, many squadrons of Indians." They debarked, and a "very serious and hazardous battle" ensued. Among the Indians, "there came as many as ten or twelve" Amazons, "fighting in front of all the Indian men as women captains, and these latter fought so courageously





"Touché, Roy. A snappy riposte will be winging its way to you as soon as possible."

that the Indian men did not dare to turn their backs, and anyone who did turn his back they killed with clubs right there before us." The women were "very white and tall, and have hair very long and braided and wound about the head, and they are very robust and go about naked, with their privy parts covered, with their bows and arrows in their hands." (Carvajal doesn't say whether the women had cut off their right breasts, to make it easier to draw their bows, as did the female warriors who are said to have fought the Greeks during heroic times. The popular etymology of the Greek *amazon* traces the word to *a-mazos*, "without a breast.") It was only after seven or eight of the women were killed that "the Indians lost heart, and they were defeated and routed with considerable damage to their persons."

A few days later, Orellana was able to communicate, "by means of a list of words that he had made," with

the chief of his assailants, named Couynco, who had been captured in the battle. Couynco told him that the Amazons lived "a seven-day journey from the shore," in seventy villages whose houses were made of stone. Though unmarried, they "consorted with Indian men at times," and had children by male captives. The boys were killed or sent to their fathers, the females raised "with great solemnity" and instructed in the arts of war. Their queen was named Coñori. They worshipped the sun and had in their temples "many gold and silver idols in the form of women." They dressed in "clothing of very fine wool," from "sheep of the same sort as those of Peru." They rode "camels" and had "other animals, which we did not succeed in understanding about, which were as big as horses and which had cloven hooves and hair as long as the spread of the thumb and forefinger." The women held in subjection the

tribes living on their borders, made war on others to get male captives, and were visited by the men of yet other tribes, from hundreds of leagues up the Amazon. Couynco warned that "anyone who should take it into his head to go down to the country of these women was destined to go a boy and return an old man."

SCHOLARS who have tried to reconstruct the journey of the Spaniards from Carvajal's account have placed the engagement with Couynco's tribe on the left bank of the Amazon, most likely in the delta of the Nhamundá. But how much of this extraordinary story is true? Like El Dorado and the Fountain of Youth, the Land of the Amazons was a definite, if undiscovered, place on the Europeans' still largely blank map of the New World. The women were out there somewhere, and every explorer versed in the classical myth of female warriors, or in the medieval romances that retold or embellished the myth, was on the lookout for them. In February of 1493, Columbus, eager to find proof that he had arrived in the Orient, and wondering if he had sailed near the Island of the Female, which Marco Polo had reported was in the Indian Ocean, wrote to Ferdinand and Isabella of Spain that he had heard that on the island of Matremonio—present-day Martinique—there were women who lived without men, wore copper armor, and took cannibals as lovers. Then, in 1502, Amerigo Vespucci's expedition supposedly encountered cannibalistic women on an island in the Caribbean; two members of the expedition disappeared, and a third was clubbed to death. In 1524, Hernán Cortés sent his cousin Francisco to explore the Pacific coast of Mexico. One of his instructions was to keep an eye out for the Amazons, who were rumored to be in that neck of the woods. When it came time to name the peninsula the Spaniards found (present-day Baja), Hernán Cortés named it California, after an island "on the right hand of the Indies," where, according to Garci Rodríguez de Montalvo's popular romance "Las Sergas de Esplandián," black women ruled by a queen named Califia "live in the fashion of Amazons."

It is reasonable to assume, then, that when Orellana and his companions separated from Pizarro they, too, had Amazons on their mind; and, sure enough, two weeks after sailing out of

the Napo and into the Amazon they were told by an Indian named Aparia "of the Amazons and of the wealth farther down the river." One can't help wondering, especially in view of the immense linguistic and cultural gulf that existed between the Spaniards and their Indian informants, whether there wasn't a strong element of projection in Carvajal's report, and later ones, about warrior women. Even trained anthropologists have been guilty of unconscious projection—of clothing the subjects of their research in theories brought with them into the field. So it is probably unfair to conclude that Carvajal deliberately made up his report. It would be surprising if the members of Orellana's expedition, passing through natural and cultural landscapes in which so little was familiar, didn't to some extent cling to preconceived notions of what was supposed to be there, however fantastic those notions were.

And it could be that the Indians simply told the Spaniards what they wanted to hear. This problem was encountered by the British naturalist Alfred Russel Wallace, who spent the years from 1848 to 1852 in Amazonia. He wrote, "In my communications and inquiries among the Indians on various matters, I have always found the greatest caution necessary, to prevent one's arriving at wrong conclusions. They are always apt to affirm that which they see you wish to believe, and, when they do not at all comprehend your question will unhesitatingly answer, 'Yes.' I have often in this manner obtained, as I thought, information, which persons better acquainted with the facts have assured me was quite erroneous." As for the origin of the myth, Wallace said he could "easily imagine it entirely to have arisen from the suggestions and inquiries of Europeans themselves. When the story of the Amazons was first made known, it became of course a point with all future travellers to verify it, or if possible get a glimpse of these warlike ladies. The Indians must no doubt have been overwhelmed with questions and suggestions about them, and they, thinking that the white men must know best, would transmit to their descendants and families the idea that such a nation did exist in some distant part of the country. Succeeding travellers, finding traces of this idea among the Indians, would take it as a proof of the existence of the Amazons; instead of

being merely the effect of a mistake at the first, which had been unknowingly spread among them by preceding travellers, seeking to obtain some evidence on the subject."

There are other possible explanations for the prevalence of the myth among the early explorers of the New World. It may be that Couynco's description of the Amazons is a mangled, thirdhand account of real contact with the Incas or one of the other central Andean civilizations. Certain features of the description—the woollen clothing, the stone houses, the cloven-hoofed animals, which sound like llamas, the sun worship, the gold and silver—strongly suggest a mountain people. The sun is much less important in the forest cultures of South America than it is in the highland cultures. The Incas even believed that their emperor was descended from the sun. Some scholars contend that the Amazon legend stemmed from cloistered communities of women that the Incas maintained. These women, called *ma-maconas*, were sacred. They belonged to the emperor and the sun. They devoted themselves to weaving. Some took vows of chastity. There may have been a lot of these nunlike women at Machu Picchu, to judge from the ratio of female to male skeletons found there—three to one.

Another possibility is that the "ten or twelve Amazons" who joined the fight against Orellana's forces were in fact men. Wallace proposed this explanation in the course of a description of the Uaupés Indians, of the upper Rio Negro:

The men... have the hair carefully parted and combed on each side, and tied in a queue behind. In the young men, it hangs in long locks down their necks, and, with the comb, which is invariably carried stuck in the top of the head, gives to them a most feminine appearance: this is increased by the large necklaces and bracelets of beads, and the careful extirpation of every symptom of beard. Taking these circumstances into consideration, I am strongly of the opinion that the story of the Amazons has arisen from these feminine-looking warriors encountered by the early voyager. I am inclined to this opinion, from the effect they first produced on myself, when it was only by close examination I saw that they were men; and, were the front parts of their bodies and their breasts covered with shields, such as they always use, I am convinced any person seeing them for the first time would conclude they were women. We have only therefore to suppose that tribes having similar customs to those now living on the river Uaupés, inhabited the regions where the Amazons were reported to have been seen,

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and we have a rational explanation of what has so much puzzled all geographers.

A final, albeit remote, possibility is, of course, that a tribe of women without men did live on the Nhamundá.

NEWS of a clash with Amazons in the unknown country east of Quito reached Europe in 1543, when Orellana had to defend himself against Pizarro's charge of desertion before the Council of the Indies. The more discriminating analysts of Orellana's account were skeptical. Denouncing it as "full of lies," the historian Francisco López de Gómara wrote in 1552:

Among the extravagant statements that [Orellana] made was his claim that there were Amazons along this river with whom he and his companions had fought. That the women there should take up arms and fight is no novelty, for in Paria [a peninsula on the Venezuelan coast], which is not very far off, and in many other parts of the Indies, they used to do that; I do not believe, either, that any woman burns and cuts off her right breast in order to be able to shoot with the bow, because with it they shoot very well; or that they kill or exile their own sons; or that they live without husbands, being as they are very voluptuous. Others besides Orellana have proclaimed this same yarn about the Amazons ever since the Indies have been discovered, and never has such a thing been seen, and never will it be seen, either, along this river.

Some accused Orellana of inventing the encounter as a cover-up for his desertion of Pizarro and his discovery of no gold and very little cinnamon. But the vast majority of the Europeans who heard about the Amazons wanted to believe in them. Since 1512, the river that Orellana descended had borne two names, both given by explorers sailing along the coast of Pará, who had encountered its torrent of café-au-lait-colored water flooding the ocean many miles from shore: Mar Dulce, or Freshwater Sea, and Marañón (a name that one of its main source tributaries in Peru still bears). By 1552, these names had been superseded by two new ones: the Orellana River and the Amazons' River. The former never caught on; it was the latter, the leap of faith—or "imposture," as López de Gómara called it—that took.

Once the door had been opened, it was impossible to close it again, and the centuries that followed were full of sightings of the women. The next Amazons to be heard about sound almost like characters in Spenser's "Faerie Queene." In 1595, a cacique, or Indian chief, who claimed to have personally visited the Amazons "not

far from Guiana," described them to Sir Walter Raleigh, who also was in search of the elusive El Dorado. The Amazons, Raleigh wrote,

doe accompany with men but once in a yere, and for the time of one month, which I gather by their relation, to be in April: and that time all kings of the borders assemble, and queenes of the Amazones; and after the queenes have chosen, the rest cast lots for their Valentines. This one month, they feast, dance, and drinke of their wines in abundance; and the Moore being done, they all depart to their owne provinces. If they conceive, and be delivered of a sonne, they returne him to the father; if of a daughter they nourish it, and retaine it: and as many as have daughters send unto the begetters a present; all being desirous to increase their owne sex and kinde: but that they cut off the right dug of the brest, I do not find to be true.

In 1620, six months before the Pilgrims put ashore at Plymouth Rock, a hundred and twenty less famous colonists, English and Irish, led by one of Raleigh's captains, Roger North, sailed a hundred leagues up the Amazon, with the intention of growing tobacco and harvesting spices and rare woods. The local Indians were extremely hospitable—they helped clear them food, told them about the Amazons—and all "for a small reward and price, either of some Iron worke or glasse beades and such like contemptible things." One of North's men, Bernard O'Brien, whom the historian John Hemming, in his 1978 book "Red Gold: The Conquest of the Brazilian Indians, 1500-1760," describes as "a charming young Irishman," canoed, with five musketeers and fifty Indians, hundreds of miles deeper into the valley and "finally reached a land where he claimed, with perhaps a touch of blarney, to have contacted the Amazons." Their queen was named Cuña Muchu (the Inca for "great lady," and highly suggestive of Carvajal's Coñori). These women, O'Brien reported, "had their right breasts small



like men's, artificially stunted in order to shoot arrows; but the left breasts are broad like other women's."

In 1639, a Portuguese expedition under the conquistador Pedro Teixeira repeated Orellana's descent of the Napo and the Amazon. The voyage took ten months. No female warriors were encountered this time, but the chronicler of the expedition, a Jesuit priest named Cristóbal de Acuña, picked up many stories about the Amazons and enthusiastically bought them all. "The proofs of the existence of the province of the Amazons on this river are so numerous, and so strong, that it would be a want of common faith not to give them credit," he contended. "There is no saying more common than that these women inhabit a province on the river, and it is not credible that a lie could have spread through out so many languages, and so many nations, with such an appearance of truth." The Indians told of "manlike women" who lived in "great forests" and on "lofty hills" high up the Cuñuris River, as the Nhamundá was then called. "Cuñuris" also sounds like Carvajal's Coñori, but the Portuguese were told that it was the name of the first tribe that lived up the river. Beyond the Cuñuris were the Guacaràs, who, for a few days at a certain time of the year, were received by the women and invited to share their ham-mocks. Beyond the Guacaràs were the women themselves.

In 1735, the French scientist Charles Marie de La Condamine was sent to South America by the Académie des Sciences to measure the meridian of an arc of a degree of latitude at the equator, as part of a project to determine the shape of the earth; the scientific community was divided over whether the earth was an oblate spheroid or a prolate one. La Condamine's nine years on the continent were climaxed by a rather brisk descent of the Amazon, starting from the Peruvian Andes, during which—it goes without saying—he asked about the celebrated tribe of women. "We questioned everywhere Indians of diverse nations," he wrote in his "Relation Abrégée d'un Voyage Méridional l'Intérieur de l'Amérique Méridionale," "and we informed ourselves with great care if they had knowledge of the bellicose women Orellana claimed to have seen and combatted, and if it was true that they lived far from the commerce of men and received them but once a year, as Acuña reports. They all told us the women

had withdrawn deep into the interior to the north." Observing the "unhappy condition" of many of the Indian wives he met, La Condamine decided that the community had probably been started by a group of women who had run away. "The vagabond lives of the women, who often follow their husbands to the wars, and are not a lot happier when at home with their families, might naturally put it into their minds, and at the same time afford them frequent opportunities to escape from the hard yoke of their tyrants, by endeavoring to provide themselves a settlement, where they might live independently, and, at least, not be reduced to the wretched condition of slaves, and beasts of burden," he reasoned. He compared their defection to that of the "maltreated or malcontented slaves" in the European colonies who "went in bands to the woods and sometimes alone, when they found nobody to go with them, and there passed several years and sometimes their whole lives in solitude."

On August 28, 1743, the La Condamine party passed "on the left hand the river Jamundas, which Father Acuña called Cuñuris and maintained was where the Amazons lived." This seems to be the first appearance in print of the name Jamundas, which eventually became Nhamundá. According to one source, La Condamine got the name from some missionaries who lived up the river, among a tribe of Indians whose chief's name was Jamundá. La Condamine doesn't tell us where he heard the name, or whether it was in general use. At any rate, it appears on maps from then on, and the name Cuñuris disappears.

La Condamine continued downstream and, around the mouth of the Tapajós, he encountered the few Tapajó Indians who still lived there. (The rest had fled into the forest, or had been enslaved or herded into missions or killed by diseases introduced by the Portuguese.) They showed him their most precious possessions: green stones carved in the form of animals, which they said they had inherited from their fathers, who, in turn, had got them from none other than the cougnantainsecouima—the Tapajó word for "women without husbands." Many of the chiefs' wives whom Raleigh met in Guyana a century and a half earlier had been wearing green stones that "they esteem as great jewels," and that Raleigh understood to have been acquired in trade from the Amazons. The stones that the Tapajó

brought out were "no different in colour or hardness from Oriental jade," La Condamine reported. "One can't imagine by what artifice the ancient Americans could have cut and shaped them."

The prestige of green stones in the eighteenth century was, in fact, almost global. Tribal peoples in Asia and in North and Central America had long prized them as fetishes and ornaments. Some tribes in Amazonia traded them for women. According to La Condamine, in Europe they were called pierreries divines and were worn around the neck as a treatment for colic, epilepsy, and "nephritic pains." (One kind of jade, in fact, is called nephrite, from the Greek for "kidney.") The green stones of Amazonia are often carved into frogs.

While their origin is still unknown, these amulets, which are called muiraquitás, have so far been found mainly in the Nhamundá-Trombetas-Tapajós region. (The Trombetas is the next large left-bank tributary of the Amazon below the Nhamundá.) Today, muiraquitás can be seen in museums and in private collections, although it is sometimes hard to see the ones in private collections, because of a superstition that showing them brings bad luck. They are probably the most highly prized archeological objects in Brazil, and are an important element of the story about the women without husbands that is told in Amazonia today. The story has many versions but is basically this: The women live on a sacred body of water called the Lake of the Mirror of the Moon. Once a year, at a certain phase of the moon, men from a neighboring tribe travel to the lake by canoe. When the visit is over, the women present their lovers with the male offspring born of the previous year's visit, and with muiraquitás, which they have obtained—by diving into the lake—from an aquatic spirit called the Mother of the Muiraquitás. The stones bring the men good luck in hunting.

THE myths about tribes of women are very ancient. In classical Greek mythology, the Amazons were formidable warriors. "Battle with them is considered a severe test of the hero's valour and . . . as warriors they are ranked with the monstrous chimaera, the fierce Solymi, and picked men of Lycia," the classicist Florence Mary Bennett writes in a 1912 monograph called "Religious Cults Associ-



ated with the Amazons." The ninth labor of Hercules was to capture the girdle of their queen, Hippolyta. The Amazons were linked to primitive fertility and war rites that involved orgies and the sacrifice of male victims. They may have been votaries or priestesses of the moon goddess, and they may have possessed the powers of enchantment attributed to the moon. They may have worshipped the mother goddess Rhea. They were superb horsewomen and are credited with being the first warriors to ride horses. They were considered beautiful, as surviving statues of them attest. They lived at the edges of the known world: in Scythia near the Black Sea, and in Libya. A population of Amazons at the foot of the Caucasus Mountains

was visited once a year by men from a neighboring people. Robert Graves, in his compendium of the Greek myths, wrote, "On an appointed day every spring, parties of young Amazons and young Gargarensians meet at the summit of the mountain which separates their territories and, after performing a joint sacrifice, spend two months together, enjoying promiscuous intercourse under the cover of night. As soon as an Amazon finds herself pregnant, she returns home. Whatever girl-children are born become Amazons, and the boys are sent to the Gargarensians who, because they have no means of ascertaining their paternity, distribute them by lot among their huts." The Amazons met their defeat when they attacked Athens, whose king, Theseus, had abducted and married Antiope, their queen. A festival, known as the Greater Eleusinian Mysteries, was held every year to commemorate Theseus' victory and his destruction of the matriarchal system.

The medieval romances about the Amazons, from which the conquistadores' idea of them was derived, focused primarily on their warlike and "voluptuous" aspects. Always in the next valley, always just beyond reach, the Amazons became a symbol of the conquest. The hope of finding them, vanquishing them, and taking them to bed was one of the fantasies that drove the conquistadores on. "The Amazon is a dream that men created . . . to flatter themselves," the feminist Abby Wettan Kleinbaum argues in her recent book "The War Against the Amazons." "The conquest of an Amazon is an act of transcendence, a rejection of the ordinary, of death, of

mediocrity—and a reach for immortality. . . . Men told of battling Amazons to enhance their sense of their own worth and historical significance.”

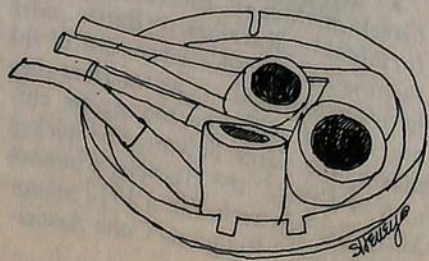
Like their Greek counterparts, the women without husbands of Amazonia were thought to live at the edge of the known world, in faraway mountains at the headwaters of cataract-filled rivers. They got together with men from neighboring tribes. They were associated with the moon and with water. They were seductively beautiful but, unlike the Greek Amazons, were not warriors (except for the women who allegedly attacked the Orellana expedition), nor did they remove their right breasts to enhance their skill as archers. These variations, where they occur, are almost certainly European injections. At least two Amazon-women motifs seem to be native to the Amazon Basin, however. According to a myth that occurs sporadically among some Amazonian tribes, like the Uaupés and the Mundurucú, which possess flutes they believe to be sacred, the women of the tribe once had control of the flutes. They sat around playing the flutes, and it was the men who had to carry the firewood and fetch the water, cook, and submit to sexual demands. This period of female supremacy ended, however, when the men tricked the women into surrendering the flutes. Today, in some tribes of the Upper Xingu region, in southern Amazonia, women who even look at the flutes are gang-raped. In another myth, quite widespread in the basin, women lived with men but also had animal lovers—caimans, tapirs, or perhaps porpoises. The men found out and killed the animals, and the bereaved women left the men and went off to live by themselves in the forest, where they practiced male infanticide. In some versions, they killed the men before leaving.

Many societies have a story about a time when women were dominant. Then something happened, the matriarchy was overthrown, and the women were repressed. Early anthropologists tended to accept the stories about an original matriarchy as historical fact. The nineteenth-century Swiss philosopher Johann Jakob Bachofen wove an entire theory of cultural evolution around it. He hypothesized that the first human societies were promiscuous hordes that evolved into matriarchies, but after the women introduced the institution of marriage as a “mother-

right” the men became concerned about the paternity of their children and took over the descent system and, eventually, everything else. Few modern scholars take the stories about an original matriarchy literally—no self-perpetuating matriarchy or exclusively female community has ever been authenticated—but there is still disagreement about what the stories mean. Female scholars’ interpretations tend to differ from those of male scholars; for example, Anna Roosevelt, an archeologist who digs in the Amazon and Orinoco Basins, sees the myth as “a rationalization of male-supremacist society,” while Robert Murphy, the ethnologist of the Mundurucú, taking a more Freudian view, says, “It is a parable, a statement in mythic form about the current relations between men and women. Men issue forth from women and for several years are dependent on their milk.” He adds, “To become a man, a man must overcome his dependency on his mother.”

Perhaps there is a more straightforward interpretation. Myths are attempts to explain how things got to be the way they are, and one way to do this—a common and effective storytelling device—is to say that things were not always so, that once, in fact, the opposite was the case. What this myth seems to explain is a basic truth that exists today not only in Amazonia but in every known society: that men are politically and economically dominant.

IF, as all the evidence suggests, the Amazons, or women without husbands, never existed except in the various guises of a universal myth, a few questions remain: Why do so many of the stories about them in Amazonia say that the women live on the Nhamundá? What could be up there? Could the stories have an undiscovered basis of truth? My curiosity about the myth and the river was originally piqued by a book called “The Lure of the Amazon,” published in English in 1959 by an Amazonian explorer named Eduardo Barros Prado, who



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claimed to have landed in a pontoon plane on the Lake of the Mirror of the Moon, “at the foot of some hills, lying parallel to the course of the Nhamundá.” The women there handed him a “fiery” love potion, and he spent several days with them, studying their habits and resisting their advances. A close look at Prado’s geographical and ethnographic information revealed that his account belonged to the blarney tradition started by O’Brien—that it was nothing more than a pastiche of stories that had been circulating about the Amazons since Carvajal, with convincing details about the daily routine of Indian women throughout the Amazon region thrown in. What also emerged from the close look, however, was that there existed almost no information of any kind on the Nhamundá, although a populous and rather advanced culture seems to have been occupying its lower reaches when the first Europeans blundered into the region. That a river longer than the Hudson should still be wild and unexplored seemed astonishing. (Actually, I have since learned, dozens of rivers in the Amazon system remain in this category.) Maybe the women without husbands were no more “real” than the bearded gnomes in “Rip Van Winkle,” whose ninepins games were responsible for thunder in the lower Hudson Valley, but there was only one way to find out.

One afternoon in the spring of 1984, not long after I had decided to go up the Nhamundá, a good friend of mine, the Belgian ethnomusicologist Benoit Quersin, looked me up in New York. He was between planes, on the way from a daughter’s wedding in Phoenix to Kinshasa, Zaire, where he heads the oral-traditions section of that country’s Institut des Musées Nationaux. We had met two years earlier in Zaire, while I was doing some ethnological research. A slender, deeply tanned man with short gray-blond hair (he was now fifty-six), a large Gallic nose, and half-framed glasses hanging from a chain around his neck, he was cultivated but cool; fifteen years earlier, he had been touring Africa with a jazz band (he plays bass and once backed up Lena Horne) when an anthropologist introduced him to tribal music and persuaded him that it should be recorded. UNICEF came through with funding for an anthology of Zairian tribal music, and he was now nearing the end of the project: he had got to and recorded most of the country’s tribes. I told him that I

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was going to the Amazon in the summer to chase a legend up a river called the Nhamundá. Then it occurred to me how nice it would be to have Quersin along; with his understanding of rain forests and their people, he would be the perfect companion. He wouldn’t be put out by the inevitable foul-ups and delays, and his African perspective would be stimulating. I asked him if he would like to join me, and, to my delight, he said that he had always wanted to see the Amazon and had been waiting for an opportunity, and sure, he’d love to. We both had about a month to spend. I suggested that he take care of the audiovisual end of the expedition—the tape-recording and picture-taking. This would be my fourth trip to the Amazon, so it made sense for me to handle the negotiating and get us from place to place. He was only too happy not to have to worry about logistics for the first time in years.

On June 30th, Quersin flew west from Africa, I flew south from New York, and we met in Rio de Janeiro. Quersin picked up Portuguese with amazing rapidity, improvising, when necessary, with an entertaining repertoire of sound effects and gestures he had perfected in the field for communicating with people he couldn’t converse with. We went to a money changer in the Centro and exchanged two thousand dollars for four bricks of crisp, mint five-thousand-cruzeiro notes—three million four hundred thousand cruzeiros in all. In the Museu Nacional, we saw some fine green jade *muiraquitãs*, carved into frogs and other creatures; one seemed to represent a cicada. The pieces had been acquired long ago, and the only information about them was that they were from the Trombetas Valley. We flew to Brasília and spoke with anthropologists at FUNAI, the National Indian Foundation, about the tribes of lower-middle Amazonia—the Mundurucú, the Sateré-Maué, the Hixkaryana, the Wai-Wai, and the Tirio. The anthropologists told us that, as far as they knew, none of these tribes had green amulets or a myth about Amazon women, or had ever had either. They said that the Hixkaryana, who live on the Upper Nhamundá, above the rapids, had been thoroughly worked over by missionaries and had forgotten many of their legends. In the anthropologists’ opinion, chartering a bush plane to visit them wouldn’t be worth the effort and

expense. The Sateré-Maué Indians, who live up the Andirá River, across the Amazon from the mouth of the Nhamundá, were the most traditional Indians in the vicinity, and were accessible by boat; if anybody knew anything, they would. We were given permission to visit the tribe for a month (Brazil’s tribal Indians, who number roughly two hundred thousand, are legally wards of the state, and permission to visit them must be obtained from FUNAI), to ask them about the women and the stones.

From Brasília, we flew to Manaus, twelve hundred miles northwest, and from there took a plane east to Santarém, the largest city between Manaus and Belém, at the mouth of the Tapajós River. We were now a hundred and fifty miles downriver from the Nhamundá. In Santarém, we discovered that a duffelbag containing ninety per cent of our gear, which we had checked through at Brasília, hadn’t been put on the second plane. The dispatcher assured us that the bag would come tomorrow, on the next plane from Manaus—or, if not tomorrow, maybe the day after. We did our best to impress on the dispatcher how badly we needed it, then took a taxi into the city, with the driver blaming the potholes on the mayor—as Brazilian taxi-drivers always do.

Santarém, with a population of around two hundred thousand, had become a lot more modern since my last visit, seven years earlier. A luxurious tourist compound, the Hotel Tropical, had sprung up outside the city, but instead of going there we checked into a cozy two-story wooden affair, with slowly turning overhead fans, called the Camino Hotel, overlooking the market and, beyond, the Tapajós, which just above its confluence with the Amazon seems as vast as an ocean. By seven the next morning, a Sunday, the square below us was seething with life. Stalls brimmed with fruit; a Baptist with an accordion was singing hymns into a microphone. We bought machetes and cotton hammocks, which are probably the two most useful pieces of gear for travelling in the Amazon. Quersin didn’t see why he needed a hammock—he never used one in Africa—but by the end of the trip he would be raving about its virtues. A hammock is like a portable cocoon—it can be set up and settled into anywhere. It can serve as a chair, a bed, and a burial shroud.

I wanted to revisit a village called



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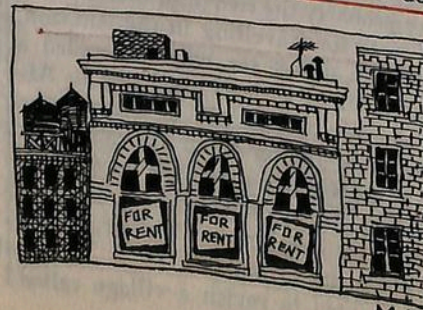
Alter do Chão, an hour or so up the Tapajós, where I had spent a memorable afternoon in 1977, swimming and drinking cashew liqueur. The village had consisted of a square with a church and a few dirt streets lined with thatch huts. The river, a couple of miles wide, had been warm and clear blue, with banks of clean white sand. Below the village, a large, limpid green lagoon had sat at the foot of a lone hill clothed with grass and small, contorted trees. The spot had been sacred to the Tapajó Indians: they had told La Condamine that most of their green stones came from the lagoon at Alter do Chão.

We caught a bus and pulled into Alter do Chão at about one in the afternoon. It was unrecognizable. It had been "discovered" and developed into a weekend resort for people from Santarém. Thatch huts were interspersed with stucco villas along many new streets, and thousands of young people—among them the copper-skinned, high-cheekboned, rather small descendants of the Tapajó—were on the beaches. (The next generation, Quersin predicted, would be inches taller.) Coca-Cola, water skis, speedboats, jeeps with roll bars—all the standard American consumer items associated with summer fun—were in evidence. It was the year of Michael Jackson. He was the new myth, the new universal culture hero. Children were break-dancing and moon-walking on the beach to tapes of his music. We met no one who knew the old legends of the place; the only bit of information we picked up was that somebody there was supposed to have a boat called the Muiraquitã. A regional salesman of bluejeans told us that the market around Santarém was "fantastic." Settlement of the fringes of the Transamazon Highway during the seventies, followed by a gold rush in 1980, had brought progress to the south side of the Amazon almost overnight, and nobody seemed to be looking back.

When we returned to Santarém in the evening, we found that we were in luck: our duffelbag had arrived, and there was still time to catch the boat across and up the Amazon to the city of Óbidos; we hadn't been delayed after all. The boat had two open decks with railings and was called the Vitória Régia III, after the gigantic Amazonian water lily. We hung our hammocks among those of dozens of other passengers, and soon we were chugging through the warm, insect-filled darkness. At about three

in the morning, we reached Óbidos. Not many travellers came to the north side of this stretch of the Amazon—the modernity that was making over the Santarém area was still perhaps fifteen years off—and the only lodgings in Óbidos were private homes that took in guests; staying in one was like becoming a member of the family. Our homey little pension was called the Hotel Braz Bello. The ten-year-old daughter of the house made up our beds and served us some breakfast. Later in the morning, we walked around the city. It had originally been a fort, built by the Portuguese, in 1697, on a strategic bluff overlooking the "throat" of the Amazon—a spot where the river is little more than a muddy lane by the harbor, thousands of Brazil-nut shells suddenly slid out of a second-story chute to our right and landed in a heap on the ground. We went up some rickety stairs and looked into the room from which they had been discharged. It was like a nineteenth-century sweatshop. Four rows of women were sitting at lever-operated nutcrackers, cracking open the nuts one by one. Nobody was talking, which was unusual for a group of Brazilians. These were second-quality Brazil nuts, the foreman told us, destined for Belém, where they would be used in making soap. The women were paid about fifteen cents a kilo, and they put in a six-day week. On Saturday evening, the average sheller took home twenty-five thousand cruzeiros, or about fifteen dollars.

American rock hits were gushing from municipal loudspeakers at most corners, but Óbidos, with a population of roughly forty thousand, was still basically a traditional Amazon town. Its general layout was similar to that of the next four towns we would visit (and to what Santarém's had been until recently), although, as we discovered, the personalities of these communities were quite different. In each place, the commerce was on the water, and the houses went up a hill behind—the stucco houses of the well-to-do,



with red tile roofs, giving way to tin-roofed shacks and finally to thatch huts. The population was young and mostly female, many of the men having gone elsewhere in search of work.

In Óbidos, we called at the parish house of some Franciscan monks, who also have a mission in a Tirió Indian village near Suriname. A young Tirió man we met in the courtyard told us in broken Portuguese that the Tirió didn't have an Amazon-women legend, but a mulata schoolteacher we interviewed in the library said she had heard that "near the Tirió" there was a tribe of tall, fair, blond, blue-eyed Indians who were "the remnants of the Amazons." She had recently assigned her students to ask around the community for stories about the women. A fisherman interviewed by a seventeen-year-old girl in the class had said that once when he was fishing along a creek several leagues upriver from Óbidos he had felt the tail of a horse graze his cheek from behind. He had fallen to the ground and hidden his face, because he knew it was the Amazons, and he didn't want to look and be enchanted. "To us, the Amazons are horsewomen, female cavaleiros," the schoolteacher explained.

Quersin and I talked with one of the monks, Brother Angelicó, who was seventy-three and had a flowing white beard. He told us that he had lived for twenty years with the Tirió and had never heard about this fair-skinned tribe but that the Tirió esteemed fair skin. "Their chief, Yururé, says he is white, but he is Indian," Brother Angelicó said. "The darkest of his four wives told me when she was expecting her first child that if the baby came out dark she would kill it." Among the Tirió, he went on, there was a group of Kaxuiana Indians, who had originally lived on a tributary of the middle Trombetas called the Rio Cachorrinho ("little dog" in Portuguese, and perhaps an attempt to approximate the tribe's name). They had been befriended by a missionary named Protásio Frikel. Brother Angelicó showed us a paper that Frikel had written on the Kaxuiana, which explained that they were the Rio Cachorrinho because they were dying of diseases caught from neighboring Brazil-nut gatherers and descendants of fugitive slaves. By 1968, only seventy-one were left, of whom many were suffering from tuberculosis and venereal disease. There weren't enough marriage possibilities in the new generation, so sixty-four of them

had gone to live with the Tirió. The seven others, I read with interest, went up the Nhamundá. I wondered if they were still there.

After we left the parish house, we met a woman who said that not far above the mouth of the Nhamundá there was a lake called the Mirror of the Moon. She hadn't been there, but she understood that that was where the muiraquitãs came from and where the Amazons had lived. The woman removed the right breast, she said. They would come down to the Amazon, visit men from the tribes there, and go back pregnant. The male children would be sacrificed and thrown into the lake or would be turned over to the men.

"Good news," I told Quersin. "It looks as though the actual lake where the women are supposed to have lived exists."

OUR next destination was a place called the Costa do Parú, on the southern shore of a large island in the Amazon, eighteen miles above the mouth of the Trombetas. (The Trombetas comes in about ten miles below Óbidos.) In the early eighteen-seventies, the Brazilian botanist, explorer, antiquarian, and Indian pacifier João Barbosa Rodrigues, who looked deeply into the Legends of the Amazon women, visited the Costa do Parú, and found there a jade muiraquitã and "an infinity" of pottery fragments. He concluded that he had found the village of the tribe that attacked Orellana and his men, and he argued that these "inappropriately named Amazons" must have been the ancestors of the Uaupés Indians, whom he had visited on the Rio Negro several years earlier, because the Uaupés still made muiraquitãs, of cylindrical quartz, and had told him that they originally lived on the Amazon itself, along a lake inhabited by the Mother of the Waters. One day, they said, the Mother of the Waters took the form of an animal and was accidentally killed by an Indian hunter, causing a "revolution of the waters," which forced the Uaupés to move. Barbosa Rodrigues eventually came to believe that there had been a devastating flood in the Amazon not long after 1580, and this fitted neatly into his theory, explaining to his satisfaction "what to this day was unexplained"—the disappearance of the Amazons.

On our second morning in Óbidos, we went down to the harbor and asked the men lounging around gaily painted

boats if any of them were interested in going to the Costa do Parú. By noon, we had found a boat to take us there. It was a very sturdily built cattle boat made of itaúba, or stonewood, and, with a capacity for maybe a dozen head of cattle, was a good deal larger than what we needed, but nothing else had been available in Óbidos. The boat was a typical Amazonian motor, as this type of craft is called: flat-roofed, open-sided in front, a temperamental African Queen-like rig in continuous need of love and understanding from its crew of two—the motorista, who sat at the wheel, in the bow, and the mecânico, who tended the thirty-horsepower diesel engine, enduring the din with the help of cachaça, the raw white Brazilian rum.

Although the river was receding from its high-water mark, of a month earlier, it was still up, and much of the várzea, or floodplain, was still under water. At this time of year, the only way the people who lived in the várzea could get around was by canoe. Most of them raised cattle, and we could see that their main business now was to paddle around and gather grass to take to the marombas, the elevated corrals, built on pilings, where the animals were penned. After several hours, we reached the little settlement of Núcleo Sagrado Coração de Jesus Costa do Parú, which was still flooded except for a small strand, on which a group of muddy children were playing. We walked along the immense, amazingly buoyant trunk of a floating maçaranduba tree to the elevated frame house of a man named Antonio Gomes, who brought chairs and coffee to the porch. There were almost a hundred people on the island, he told us, and they were all kin. The oldest was his Uncle Amerigo, a man of about seventy with a mouthful of gold, who soon joined us. He said, "My grandfather told me that when he came here as a boy there were Indians living here"—Maué Indians, from across the river, he guessed. And Antonio said that in October, when the water was down, the children would pick up all sorts of vestígios—little things made of clay in the shape of fish and other animals—especially along the big lake in the interior of the island. I asked if he had any he could show us, and a boy brought a fish made not of clay but of stone—a faithful enough representation so that the assembled company recognized it as a cará (the popular name for several related predatory fish). "This was made long before



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your grandfather's time," I said to Amerigo. Two holes had been drilled through it, possibly so that it could be strung and worn around the neck. It would have made a handsome gorget, but the boy's only interest in it was as a skipping stone, for which it was also admirably suited. Antonio gave it to me as a memento, and I reciprocated with a postcard showing, in triptych, the World Trade Center, the Statue of Liberty, and the Empire State Building.

We spent a pleasant hour on Antonio's porch but learned nothing that either supported or sank Barbosa Rodrigues's theory; whatever evidence there may have been either was under water now or had washed away in the century since his visit. If the Amazons had lived here, it was news to Antonio and his family. This was pretty clearly a blind alley. We got on the boat and chugged back to the mouth of the Trombetas, and there we were caught in a fantastic storm, with gale-force winds and high waves that forced us to tie up to a tree for an hour. Then we went up the Trombetas about twenty miles, and were dropped off at the city of Oriximiná in time for a late supper.

The municipality that includes Oriximiná (also called Oriximiná) contains sixty-eight thousand square miles of mostly unexplored wilderness that extends up to Suriname and the Guianas. It is the fourth-largest municipality in Brazil. About fifty miles upriver from the city, one of the world's largest deposits of bauxite is being mined by the government and an international consortium. Oceangoing freighters have become a common if startling sight on the Trombetas. Above its rapids the modern world stops. About a thousand Wai-Wai Indians live on one of its tributaries, the Mapuera, and other Wai-Wai live on the north-flowing Essequibo, over the Guyana border. At the Oriximiná headquarters of some Catholic missionaries working with the Wai-Wai, we met a member of the tribe, a twenty-year-old named Rocinaldo, who spoke a little Portuguese. Eager to be of help, he kept saying yes to my questions until he finally understood them, and then he said that the Wai-Wai don't have an Amazon-women legend or *muiraquitãs* but that women of the tribe wear yellow necklaces called *eletânos*, which bring luck.

The town had a tiny branch of the Federal University of the State of Rio de Janeiro, and there we met a young dental interne from Rio who had been

studying the local superstitions in his spare time. Fear of the *bôto*, the freshwater dolphin of Amazonia, was very strong, he told us (as it is throughout the animal's range in the valley), among both *caboclos* and Indians. (*Caboclos* are the *mestiço* peasants and backwoods people of Amazonia.) The *bôto* is believed to be a kind of merman, who comes ashore and seduces women or penetrates them in the water. In Oriximiná, this belief was used to explain awkward pregnancies. It was so generally accepted that women registering the birth of a child sometimes gave the *bôto* as the father. A woman who had slept with a *bôto*, it was believed, never slept with a man again. There was a stall in the market where dolphin perfume and amulets made from dolphins' genitals were sold to men who weren't having success with the opposite sex. A female counterpart of the *bôto* was the *matitaperê*, the striped cuckoo; at night it became a woman, who dressed in black and seduced men, and sometimes provided a convenient explanation for venereal disease.

On the right bank of the Trombetas is a big lake, the Lago de Sapucua, whose shores were thickly populated in late prehistoric times. Several frog *muiraquitãs* and many potsherds have been found there. We called on the mayor of Oriximiná, Raimundo Oliveira, and told him of our interest in visiting the lake. He told us that his people were from there, and promised to arrange a boat and a guide for us. There was a bizarre, ancient-looking ceramic object on Mayor Oliveira's desk, which he said was from the Lago de Sapucua. It had four protuberances, each with a round hole at the end, that were suggestive—to me, at least—of bulging frog eyes. It seemed to represent something that lived in the water



Julio Pezco-Dover

—or perhaps the general concept of things that live in the water, rather than a specific organism. Noticing that I was fascinated by it, he gave it to me. All told, I collected twenty-one such pieces, mostly animal figurines, from local people, who attached no value to them (and, in fact, though they are pre-Columbian and wonderfully imaginative, they have almost no monetary value, because no market has been established for them) and simply gave them to me as a gesture of friendship, as I handed out postcards. They called them *caretas* (contorted faces); archeologists refer to them as *adôrnos*. I wrapped them in tissue and packed them carefully in a rusty kerosene can. After my trip, I showed them to Anna Roosevelt, and she dated all but perhaps one from somewhere between 500 and 1500 A.D.

THE Lago de Sapucua is the largest expanse of open water in the soggy maze of lakes, islands, and interconnecting channels between the Trombetas and the Nhamundá, and one of the largest lakes in the state of Pará. Mayor Oliveira told us that the name Sapucua comes from *sapo* (Portuguese for "frog") and *qua* (the sound of a frog croaking). The boat that was waiting for us at six the next morning was a lot smaller than the cattle boat. Its crew consisted of two withdrawn young brothers, Orlando and Francisco, with whom conversation during the next two days was minimal; our guide was an old fisherman named Antonio Gado. Our plan was to tour the *terras pretas do índio*—the ancient dwelling sites along the lake, capped with a foot or so of rich, black soil, which are now inhabited by scattered families of *caboclos* but until about the sixteenth century had been the sites of substantial settlements of the Uaboi or Conduri Indians, about whom very little is known. Similar black-earth districts, the former dwelling places of the Tapajó people, are found along the right bank of the Amazon. Bits of pottery, particularly *caretas*, usually litter the black-earth sites. There is even a ditty in the Trombetas-Nhamundá area to the effect that wherever there are *terras pretas* you will find *caretas*. The blackness of the earth is a result of human occupation, of cinders from centuries of fires binding to the soil particles.

At the entrance to the lake, we saw silhouetted against the sky, on the highest branch of a dead tree, a pair of vigilant orange-billed toucans; and for

a moment we were caught in a blizzard of monstrous green dragonflies. Then we went on to the first *terra preta*, a settlement called Uaimy, of about thirty inhabitants, most of them named Sousa. The air smelled of wood smoke mixed with the fragrant black resin of the *breu tree*, which a man was heating up to caulk his canoe with. The history here was as obscure as it had been at the Costa do Parú. Nobody remembered a jade frog *muiraquitã* that a woman at Uaimy named Catita Arara had sold in the twenties to the great Amazonian anthropologist Curt Nimuendajú. I had read about the transaction in a fifty-year-old paper on the frog motif among South American Indians. One old woman, though, remembered Catita Arara, who was long gone; she was amazed when I produced the name. She told us that, according to her mother, the Indians who had lived here stole children. I asked her about the *bôto*. "A woman who has been with the *bôto* slowly grows pale and dies, unless she is treated by a spiritist with the help of certain leaves," she said. "The *bôto* can do the same thing to a man. He can come to you in your dreams." A woman who lived nearby had had a baby who was "spotted like a calf" and was considered to be a child of the *bôto*; the dolphin, it seemed, was also used to explain illness and birth defects. The *matitaperê*, the old woman said, came during the floods, "whistling a seductive tune," but nobody at Uaimy had actually seen her. The old woman gave me a *careta*, which Anna Roosevelt later tentatively identified as the head of a king vulture.

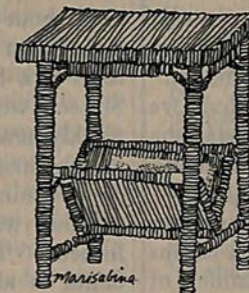
On the north shore of the lake, there was a hill that was of particular interest, because it is called the Serra de Cunuri—a variant of the name that keeps cropping up in connection with the Amazon women. Coñori was the queen in Carvajal's account, and Cunuris was both the first recorded name of the Nhamundá and the name of a tribe that lived up the river in the seventeenth century. In this century, Nimuendajú classified as Conduri not only the prehistoric inhabitants of the Trombetas and Nhamundá Valleys but also contemporaries who lived south of the Amazon and west of Santarém and made the same sort of stippled, amusingly grotesque *caretas*.

The meaning of the name variously written as Coñori, Cuñuris, and Conduri can only be guessed at, because the language of the Conduri was never

recorded, but the sounds are suggestive. A *cunhã* is an Indian or half-breed girl. *Cunã muchu* is Inca for "great lady." The *cunaurú* is an Amazonian tree frog—which is interesting in light of the connection between the Amazons and frog amulets. The croaking of this frog, which figures in many Indian myths, is supposed to sound like *cunhã cunhã*.

The Serra de Cunuri rose a little over three hundred feet. We asked a local *caboclo* to take us to the top. He led us through scrubby pasture, shooing away emaciated zebu cattle, which kicked up black dust as they trotted off. The *terra preta* here was extensive—this must have been one of their main centers. It went back more than a mile from the lakeshore and stopped just below the summit of the *serra*, where it gave way to red upland soil. Here the going got rough. The final rise became steep, and was covered with near-impenetrable grass that towered over our heads. After fifty feet of flailing with machetes in the searing midday heat, we decided to take the *caboclo's* word for it that there was nothing up there. In any case, nothing was going to be learned here without digging, and that required time, training in modern stratigraphic archeology, and permits, none of which we had. No Conduri site has been systematically dug. The best study of Conduri pottery, which was published in 1955, was based only on surface finds, like the *caretas* we had been given. So no one knows what heights the Conduri may have reached in the centuries before the Europeans arrived.

We picked up another *bôto* story from an old man who had planted a grove of rubber trees in his *terra preta*, farther along the lakeshore. "Once, I was turning a *tracajá*"—a large river turtle—"on the beach," he told us as we sat in his outdoor kitchen. "I looked up and saw a man heading into the swamp nearby. My dogs went after him and dragged him down into the water, and he turned into a *bôto* and swam away." The eyes and mouths of his grandchildren, who had crowded around the table, were wide open. "When the *bôto* turns into a man, the first thing he does is stun the woman, so she can't move," he continued. "Then he does what he wants. When the woman revives, she turns yellow.



He takes her blood, the *bôto* does. If you don't kill him while he's on land, as a man, the woman dies. His children are born crazy, writhing, screaming, with a hole on top of the head just like his blowhole."

At dusk, we pulled up to the dock of a friend of Antonio Gado's named João Bente, and asked if we could spend the night. Bente's hut was out on a point at the mouth of a creek. It was idyllic, like the lone-hut-in-the-jungle Amazon scenes that are standard décor in bars and restaurants all over Brazil. As we got out of the boat, the mosquitoes launched a concerted attack, and for several minutes we felt as if we were on fire. Bente had been drinking and was at first belligerent, but, at the urging of his

wife, he gradually became more than hospitable. We ended up sleeping, at his insistence, in their bedroom, while they hung their hammocks in the hall.

In the morning, we made our way over to a smaller lake to the southwest, the Lago de Pirarucua, crossed it, and entered a black-water channel that wasn't much wider than the boat and went on for maybe ten miles. It was lined with flooded *jauari* palms, whose segmented trunks bristled with black needles. In several places, a palm had fallen in the way, and we had to stop until Orlando could hack out a passage. Sometimes grass got caught in the propeller, and Francisco had to dive under the boat and take it off. The brothers' teamwork—with Orlando yanking the bell cord and Francisco accelerating, reversing, or cutting the engine in response—was smooth and tight. At one point, the channel opened into a pool, and we watched an osprey swoop down, snatch a large fish from the water, and fly away with it in its claws. Shortly before noon, we reached the town of Terra Santa, on a beautiful black-water lake.

There had been an outbreak of yellow fever a few months earlier in one of Terra Santa's outlying communities. Six of thirteen confirmed cases had been fatal, and a rash of psychosomatic cases—people with colds thinking they had come down with it—had followed. The Brazilian health agency, SUCAM, had vaccinated the population and sprayed houses to kill the *Aedes aegypti* mosquitoes, which transmit the virus. Several years earlier, SUCAM

had stopped spraying, because yellow fever, which had taken thousands of lives in the Amazon in the last century, was thought to have been eradicated; but this year the virus had reappeared in several remote communities, here and across the Amazon. A specialist had come from France to investigate the outbreak in Terra Santa. He had stayed at the Loureiros' house, the only lodging in town, and had been the last foreign visitor before us, we were told by a short, dark woman in her mid-thirties named Josélia Loureiro, who showed us to a room where we could hang our hammocks.

When we told Josélia that we wanted to go up the Nhamundá, she said it would be hard to find a boat and provisions in Faro or Nhamundá—towns twenty miles to the west, above the point where the Nhamundá begins to break up into the many channels of its delta. We were hoping to get at least as far as the first rapids—about two hundred miles. Josélia introduced us to a man named Emir D'Antona, the son of Terra Santa's pharmacist, who had spent a month the year before exploring the Nhamundá and its tributaries for gold and diamonds. He had taken an outboard instead of a motor, and he said that with three hundred litres of gas we could get to the first rapids and back, no problem. An outboard, he went on, had advantages: you could make side trips up creeks and into oxbow lakes, and you went twice as fast.

Josélia arranged for us to rent the municipal outboard of Terra Santa, which was aluminum, seated six, and had "ADMINISTRAÇÃO DO TEODORO LOBATO" stencilled on the side. Her younger brother João, a currently unemployed gold prospector, was interested in going along. "Fantástico," I said. But João had never been up the Nhamundá, so we would have to find somebody in Faro or Nhamundá who knew the river. D'Antona recommended his guide, a man in Faro named Pregonho.

While João saw to the gas, Josélia took us to a friend who sold provisions, and he fixed us up with eight kilos of rice, four kilos of ground and roasted manioc *farinha*, two kilos of salt, six kilos of sugar, three hundred oranges, a dozen limes, six bottles of *cachaça*, two cans of cooking oil, ten cans of meat-and-bean *feijoadá*, three hundred grams of seasoning, a dozen tins of sardines, two packets of coffee, six packets of tobacco, some thick monofilament fishing line, a dozen

large fishhooks, and two wide-brimmed straw hats. Another man lent us a map of the Nhamundá that he had drawn himself. It was much more detailed than our map, which was based on high-altitude infrared photographs. It named the major bends and creeks along the first hundred miles or so; then it became increasingly sketchy.

After we had got our supplies, D'Antona invited us to a bar. He was thirty and had gone to high school in Belém, then travelled all over Brazil. About a year before, his mother had fallen ill, and he had returned to Terra Santa to take care of her. Sixteen weeks ago, he had started a weekly newspaper called *Solidariedade*, which the local padre let him run off on his mimeograph machine. Its circulation was up to two hundred and fifteen. "The population of Terra Santa is about seventy-five hundred, not counting hundreds of street dogs—they just shot thirty dogs yesterday," he told us. "We have five dancing clubs, and a hundred and twenty-five *festas* during the year—generally three a week. In January, there is the feast of St. Sebastian for two weeks, and then, sometimes in February and sometimes in March, pre-Carnaval and Carnaval. May is the month of flowers. June has the June festival. July is the feast of St. Isabel, the patron saint of Terra Santa. Each outlying community and creek mouth has its saint. There are two cars, four horse carts, four boatbuilders, two soccer fields, one grandstand, six football teams, one youth club, one mothers' club, and about twenty people you can carry on a conversation with in Terra Santa. People with better incomes send their children to Belém, Manaus, or Parintins—the nearest big city, out the delta and across the Amazon, about four hours away by boat—"for high school, and they usually don't come back, so there isn't much influx of new



d. ehrenberg

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ideas. Everybody is a known entity. Because the television reception is unpredictable—and there are only two sets in town, anyway—the main entertainment for grownups is gossip, and for children it's a soccer ball and a fishing line. Sex starts at twelve."

The year before, D'Antona told us, the state telecommunications franchise had installed a telephone in Terra Santa, and it was now possible to call anywhere in Brazil—or, for that matter, the world. When Quersin heard this, he went to see if he could reach his wife, who lives in a village in Vacluse, in France. It was her birthday. (He came back about an hour later, beaming: he had got through.)

D'Antona told me that he had been to the Lake of the Mirror of the Moon. It was under a mountain on the right bank, not far above Faro. "It isn't very big, just a few hundred yards across," he said. "The day I saw it, there was no breeze, and the water was dead calm, full of leaves, and pretty dirty. As I understand it, it was called the Lake of the Mirror of the Moon because the Indians used to make up their faces in it before ceremonies."

THE town of Faro started as a mission for the Uaboi Indians. In 1758, it was secularized and became a town, and in 1798 its authorities began to make frequent use of a pillory; as a result, three years later the Uaboi bolted en masse into the forest. They haven't been heard of since 1840. There is good linguistic evidence that they regressed to hunting and gathering and became the Hixkaryana.

The Faro that Barbosa Rodrigues found in 1878 was so depressed and demoralized that he was moved to compare it with the "campus ubi Troia fuit." He had come up the river in a long dugout manned by ten *tapuios*, or detribalized Indians, and from a distance Faro presented "a most agreeable aspect; its setting, with a view across miles of water to hilly forest on the other side, was spectacular. But when he got there and walked the town's three parallel streets he found that twenty-one of a total of seventy-five houses he counted (all but twelve of which were crudely made thatch huts) were in ruins and many of the others abandoned. The walls of the church were crumbling, and the municipal chambers were in such a precarious state that the local administrators had been holding their meetings in someone's house. There

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were only five commercial establishments. The inhabitants—about a hundred in the town and about thirty-three hundred scattered over the municipality—were apathetic; they lived by fishing and raising cattle, and weren't interested in growing anything.

Barbosa Rodrigues was unable to find anybody on the Lower Nhamundá who remembered the women without husbands, or even recognized the term for them in *lingua geral*—*icamiabas*—and he succeeded in picking up only a few stories about them.

One he heard from a ninety-year-old Indian woman in Faro, who told him that the women without husbands got their *muiraquitãs*, which they gave to the men who fathered their children, from the Lago Yacuaruá, the Lake of the Mirror of the Moon; the *muiraquitãs* were originally alive, she said, swimming around in the form of various animals. When a woman saw a *muiraquitã* that she wanted, she would cut herself and let her blood drip into the water over the creature; that would stun it, and as she brought it up into the air it would turn to stone.

In the century since Rodrigues's visit, Faro has fared little better. At one point, the urban population seems to have dropped to twelve. During the thirties, a family of Germans from São Paulo named Rossy came up to Faro and began to harvest the trees of the Nhamundá Valley—especially *pau-rosa*, a tree in the laurel family whose essential oil is a valuable raw material for some perfumes. The Rossys employed many people at their sawmill, and the town became dependent on them. But by 1970 the *pau-rosa* was gone, and Mario Rossy, one of the sons, moved the sawmill across the Amazon to Parintins, whereupon Faro went into decline again. In the early seventies, a comprehensive survey of the Amazon Valley by a government commission described Faro as "a stagnant town making a comeback."

The following morning, João, Quersin, and I set out for Faro in the municipal outboard. A series of grass-choked channels led from the labyrinthine delta of the Nhamundá into the river's lower section, which seemed like a vast lake and is, in fact, known as the Lago de Faro. Like most of the Lower Amazon's tributaries, the Nhamundá is a "drowned river" for some distance from its mouth. At the end of the last Ice Age, around ten thousand

years ago, sea level rose some three hundred feet, and the Nhamundá's waters backed up and flooded its valley.

On our way up the Lago de Faro, we saw two canoes under sail. The sails were square and red. One man paddled at the bow of each canoe while another, at the stern, held his paddle as a rudder. The Lago de Faro is one of the few places in the Amazon where these craft, which are known as *igaritês*, haven't been displaced by boats with engines. Continuous strong breezes and poverty have delayed their disappearance here. On the left bank, beyond the canoes, was Faro, as austere in its monumental surroundings as an Alpine village.

Knowing that the mayor of Faro was away, Josélia had written a letter to the vice-mayor, Roduval Machado, identifying us as researchers and asking him to put us up on the second floor of the municipal building, since there were no lodgings in the town. Machado, a languid young man with a pencil mustache, turned out to be one of half a dozen citizens standing on the dock when we arrived. The floor of the room to which he took us was littered with bat droppings that had fallen through a large hole in the ceiling. "We don't get many foreigners," Machado told us as the custodian swept them up. "Six years ago, I think, two Germans came looking for a tree that flowers blue in October."

When Machado learned what we were after, he said, "I am in doubt about the Amazons." As he understood it, the women had made up their faces in the Lake of the Mirror of the Moon, and, according to an account he had read by a Frenchman who claimed to have been captured by them and held as their sexual slave (earlier in this century, as he recalled), they had gone in for headshrinking. "Old man Rossy had a plantation on top of the mountain overlooking the lake, and he drained the lake to see if there were any *muiraquitãs* in it," he went on. "I don't know if he found any. There is supposed to have been a smaller lake on top of the mountain, but I walked across the mountain one time and didn't find a thing. There is also a story about a spring there that gushes out of a stone and never dries up and has brilliant golden fish in it. I didn't find that, either."

I asked Machado what the population of Faro was, and he sent somebody to get me the most recent census,



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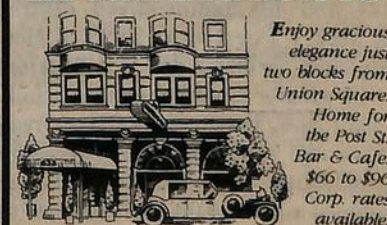
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for 1981. It revealed a total population of 4,635, of whom 2,234 were "urban"—all told, hardly any more people than Faro had had a century ago. The place had stood still economically, too; there was no sign of a "comeback." The fifty registered business establishments were mostly bars; the pharmacy was the sorriest-looking one I had seen in Brazil. D'Antona had said there was a lot of drunkenness, stealing, and prostitution in Faro, and that people there weren't above asking for handouts—something that never happened in Terra Santa.

"Faro is isolated," Machado explained. "It has poor communication with the rest of the world. The municipality itself is broke; what little money comes from Brasília has to be shared with the four other communities in its jurisdiction, including Terra Santa. We are the 'poor father.' The Indian influence is predominant here. Most of the people have no initiative, and for those with initiative there is nothing to do."

João, who had gone to find D'Antona's guide, the man named Preginho, returned with him. Preginho was a carpenter (preginho means "little nail"); he said he was busy and couldn't go with us but had talked to his brother, who was available and would meet us in the morning. Preginho looked trustworthy, so it seemed safe to assume that we would be in good hands with his brother. This settled, we went back down the lake several miles to the town of Nhamundá, to top off the fuel supply (this being our "last chance for gas"), and to see a man named Nogueira, who had a floating store permanently moored at the Nhamundá dock and was said to own a frog *muiraquitã*. Nhamundá is on the Amazonas side of the river—the right bank—and is about the same size as Faro.

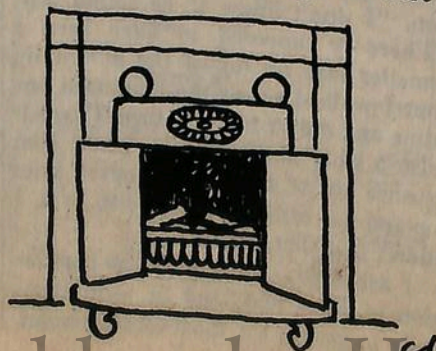
Nogueira's merchandise took up two decks of a large motor and spilled over onto an adjacent barge. (Nogueira and his family lived on the third deck.) There were sacks of rice, beans, and *farinha*; dried and salted slabs of *pirarucu*, an enormous primitive fish; rope, hoses, shoes, hats; fresh eggs, candy; a pharmacy in one cabin with all kinds of colorfully packaged medicines; a restaurant and bar; lots of *mestiço* children running around; a dozen full-time employees; a half-dozen men snoozing on railings with straw or leather hats pulled down over their eyes; two guitarists playing

*chorinhos*, an extravagantly romantic, highly syncopated type of Brazilian music. Life on Nogueira's boat seemed like a continuous party. I bought a kilo of onions, and Quersin bought a black rubber slingshot to drive the pigeons off his roof when he got back to Zaire. We found Nogueira, a blithe-spirited man in the white uniform of a pharmacist, and the mayor of Nhamundá, a sullen young man, sitting in sundeck chairs at the prow. Nogueira told us that he lived on a boat "for philosophical reasons" and that his *muiraquitã* was frog-shaped and smoky gray. He couldn't show it to us, he said, because it was in a safe in Belém.

In the morning, we found Preginho's brother waiting at the dock with a shotgun and a ditty bag. He introduced himself as Edson Carvalho, but, as we later discovered, to everybody up the river he was known by his Indian name, Songa. He was thirty-three, quiet, handsome, and strong-looking. Although he was a Maué on his mother's side and had grown up in one of the tribe's villages, he was no more Indian in appearance than the average *caboclo*.

With a fourth person in the boat, it rode very low, and even when João turned the throttle to full and held it there we went very slowly through the water. We crossed the lake at a diagonal and continued along the Amazonas side. After ten miles or so, we had to stop and transfer gas from one of the large plastic drums to the metal tank that fed the engine. Quersin and I stepped out into the warm black water; it was so inviting that we sank into it. The shore here was clean white sand in which a low, dry type of forest known as *campina*, bristling with branches and festooned with air plants—orchids, bromeliads, ferns—managed to grow. A nearby bird, a trogon, hidden in the trees, kept calling, usurping the silence as completely as the pulsing shrieks of a police car.

After skirting for several hours a series of low, flat-topped *serras* that broke off at the water's edge and were



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spattered with violet-blossomed *Tabeuia* trees, we approached the Serra do Espelho, the Mountain of the Mirror, at the foot of which was the lake that had been the seat of the women-without-husbands myth for at least the last hundred years. From afar, the *serra* looked no different from the others we had been passing; it gave no indication of its legendary importance. On the bank below it, a man who Songa told us was named Chico de Brito was standing before his hut, trying to make us out. Songa shouted to him that we had come to see the lake and would stop to visit him on the way back, and then we entered a channel that came into the river just below the hut.

After about a hundred yards, the channel widened into a pool that doglegged to the right. The pool was maybe two hundred yards in diameter and, as D'Antona had said, it was still, murky, and full of leaves. So this was it. I wouldn't even have called it a lake; to me it was a pond. (The word *lago* can mean "pond" as well as "lake.") The French explorer Henri Coudreau, who went up the Nhamundá in 1899 with his wife, described the lake, with understandable exasperation, as a *mauvais petit lac*, writing in his journal, "If . . . the Amazons discovered or invented by Señor Orellana and cultivated by so many lovers of the marvellous ever manufactured the sacred stone"—the *muiraquitã*—"and invoked the moon from the borders of this *mauvais petit lac*, it must be well recognized that time has completely effaced all trace of their passage." Coudreau asked the local people if they remembered Barbosa Rodrigues, who had visited the lake twenty years earlier and had found no trace of either the women or the stones. They had no memory of him, and they themselves had never seen a *muiraquitã*; they had only heard of the amulets from "people who came from the city."

In the early fifties, a German archaeologist named Peter Paul Hilbert climbed the Serra do Espelho and reported that it was a hundred and twenty-eight metres high and was capped by a small, shallow expanse of *terra preta*, which suggested to him that at one time there had been a settlement there of a few huts—a seasonal farming community, perhaps, occupied at planting and harvest time. For some reason, he didn't investigate the shores of the lake. We discovered more *terra preta*, covered by half-dead bacaba-palm and hardwood forest, on

the north shore. It wasn't extensive; almost immediately it ran up against the flank of the *serra*, which was too steep for settlement, and seemed hardly enough for a matriarchal chiefdom. If any women without husbands had lived here, there couldn't have been more than a couple of dozen of them. The southern shore had been cleared and planted by Chico de Brito. As there was nothing more to be learned without digging, we went to talk to him.

De Brito was a sun-beaten, grizzled man of about fifty. He had been living at Espelho for twenty years. His wife and seven of their children were standing in the doorway of their hut. A metal sign next to the door said, in Portuguese, "MALARIA NOTIFICATION STATION." One of his sons, de Brito explained, had been taught how to draw blood; the samples went to Parintins for analysis. But the results and the medication could take weeks to arrive, he said, by which time the patient might have died.

"When I got here, old man Rossy was already dead," de Brito told us. "He's buried up on the *serra*, where his house was. He wouldn't let anybody up there. They say he had a shortwave radio. During the war, two Germans visited him and left him a boat." (We had heard in Óbidos that a U-boat had gone up the Jarí, a left-bank tributary of the Amazon close to its mouth, and that one of the crew had died of fever and was buried, under a cross with his name and serial number, on a *serra* overlooking the river.)

De Brito took us over to the edge of his yard, where we could see a green pool, maybe fifty yards across, through the trees.

"Is this the spring with the golden fish?" I asked.

De Brito said that it was, but that he had never seen any of the fish himself. "But Rossy found a lot of *muiraquitãs* in there," he said.

I asked de Brito if he had ever found any *muiraquitãs* himself, and he said no.

What about *caretas*? He went into his hut and brought out seven he had picked up on the bank the previous October. Six of the pieces represented animals, among them a catfish and a howler monkey. The catfish was strikingly realistic. The seventh piece was a complete departure in both style and subject: a head of a woman with elaborately coiled hair.

No ordinary woman would have had such a hairdo; this woman must have been important. Her mouth and her eyes (overarched with lightly incised brows) were simple slits. This *careta* looked—more than any native New World art work I was familiar with—almost Grecian. One of the earliest theories about the female warriors in the Amazon Valley was that they were an émigré remnant of the original mythical Scythian Amazons—a theory that can probably be ruled out.

Very little is known about prehistoric Amazonian hair styles, but it is possible that they were similar to or influenced by Inca coiffure. The hair of Inca women is known to have been elaborately braided, as is that of the Quechuan women, who are their present-day de-

scendants. Carvajal, it will be recalled, described the women who attacked him and his companions as having "hair very long and braided and wound about the head." Could the sculptor of this *careta* have been familiar with the Carvajal account or the classical Amazon myth? Back in New York, several experts I showed the piece to suggested that it could have been made after contact with Europeans, and that its design could have been influenced by pictures that the Indians had seen in books or by designs on European armor or weapons. I explored the possibility of having the piece carbon-dated, but it was uncertain whether enough carbon could be extracted from it without destroying it, and whether a reliable date could be obtained, so I decided not to.

To me, the *careta* looked just like the head of an Amazon, and it revived my interest in the myth, which had suffered after I saw the lake. As we pulled away from de Brito's dock, I wondered what had been there. The surface of the lake had been absolutely still. On a moonlit night, it would have made a perfect mirror, offering a rare opportunity, in the centuries before the arrival of silvered glass from Europe, for people to examine themselves. In a way, the fact that the lake was nondescript argued in favor of its being the seat of the Amazons. If the legend had been arbitrarily assigned to a place, wouldn't a more picturesque one have been chosen?

We decided not to climb the *serra*. It was thickly overgrown, and de Brito assured us that we would find nothing. Instead, we crossed the river and examined an old Uaboi burial ground that was still a cemetery for



photo by Antonio Velasco

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the local *caboclos*. In a clearing along the forested bank, there were about a hundred weathered gray wooden crosses, all from this century, some radically tilting. Small waves of warm black water lapped the black-earth shore in quick succession.

TOWARD evening, we reached the Boca do Nhamundá, the "mouth" of the river, where the drowned lower section, the Lago de Faro, gave way to the extravagant meandering typical of a lowland river, with oxbow lakes thrown off at nearly every change of direction. Another lone family who were friends of Songa had settled at the Boca do Nhamundá. Their homestead was called Castanhal, "wild grove of Brazil-nut trees." We arrived at its dock just as the light was failing, and unloaded the boat in choppy, milky water, with Songa urging us to hurry, because stingrays would be moving into the shallows for the night. The head of the family, Casimiro Gomes, a muscular man of about forty-five, with the hairless copper skin of an Indian, came down the bank and helped us pile our things under a large thatched roof on poles—a structure known as a *barracão*, which he had built for the annual festival of Castanhal's patron saint, São Miguel.

The Gomes family consisted of four people: Casimiro; his mother, Rosa, an energetic and strong-willed woman in her sixties; his half sister, Sabena; and Sabena's son, Adenildo. The family had cleared land extending five hundred metres along the river and fifteen hundred metres back, and were growing manioc, two kinds of bananas, soursop, guava, cherimoya, and ingá, but no greens except some onions in a kerosene can. Rosa had a little herb garden in which she grew seasoning for fish, lemon grass for colds, and mint for coughs. Certain wild fruits—*sorva*, *maçaranduba*, *pixuna*—were gathered in season; and in December and January the Brazil-nut trees whose towering crowns loomed in the forest behind dropped their ripe fruit, heavy globes the size of volleyballs, which contained from one to two dozen seeds—the Brazil nuts of commerce. The sale of the nuts provided the family with virtually its only cash. "Money is hard to come by here," Casimiro told us. "I tried lumbering. It was heavy work and got me nowhere. The *regatões* exploit you. You end up always owing." The *regatões* were river traders who came up in *motores*

with kerosene, cloth, shotgun shells, batteries, and other modern items, obtained mostly from Nogueira, and went back down with what the *caboclos* had grown or hunted or harvested in the forest.

Life at Castanhal had an austerity whose like we had not yet seen. The people along the Lago de Sapucaá were better off, João explained, because they could get to Oriximiná in one day and sell their goods there without being ripped off by *regatões*. Casimiro had canoed from Castanhal to Faro in one day, but the wind on the Lago de Faro was often bad, he said, and it was easy to flip. So the family had to be almost completely self-sufficient—almost completely outside the cash economy. Quersin asked Casimiro why the families on the Nhamundá lived so far apart—such independence is unknown in Africa. "Each has its own work," he said.

After it grew dark, Songa mixed us some outstanding *caipirinhas*—the Brazilian national drink, which is made of *cachaça*, sugar, and lemon, and has the taste and the kick of a Margarita—and we lay back in our hammocks and watched the full moon come up over the Lago de Faro, flooding its surface with sparkles of ghostly light. I asked about the rest of the river. Neither Casimiro nor Songa had been above the first rapids, but Casimiro said that it was two days by canoe from there to Kasawa, the main village of the Hixkaryána, and from Kasawa "only three days" on foot to Guyana. The Hixkaryána went up to Guyana all the time, he said. If this was true, we could conceivably trek right over the border—if we could get up the rapids.

Casimiro picked up the faint purr of a motor coming up the lake, listened intently for a moment, and then said, "José." So few boats came up this far that the local people could recognize the sound of each engine from miles away. José was another of Songa's



brothers, who had some business up-river. We didn't see his spotlight; he was navigating by moonlight. Casimiro stood on the bank and blinked his flashlight downriver for several minutes. By the time José arrived, Quersin and I had turned in. I was vaguely aware of a succession of sounds in the night: first, people talking in animated Portuguese; then hundreds of *cunauarú*—tree frogs—croaking in long, staccato volleys; and, at about three o'clock, half a dozen male howler monkeys roaring from a mile or so away, perhaps warning each other to keep back, or defending a fruit tree. The roaring sounded like cold wind rushing through a mountain pass. It is one of the loudest sounds made by any animal.

The next morning, we got off by six-thirty, and, having left the extra gas and the heavy baggage for José to bring up later in the morning, we were finally able to zip along with the bow out of the water, which boosted João's morale considerably. He was worried about our weight and the gas, and was anxious to return to Terra Santa; he was about to go to work for his brother-in-law, who owned several bush planes and supplied mining camps in the jungle up the Tapajós.

At midmorning, we arrived at a settlement on the left bank called Jacamim. The *jacamim* is the gray-winged trumpeter, and one of these birds was strutting around. Trumpeters tame easily and are said to be good at catching snakes. Several *caboclo* families lived there, and some Indians were camped there temporarily, helping the headman of Jacamim, whose name was Almerindo, convert his recently harvested manioc into *farinha*. This was being done in a well-organized operation under Almerindo's supervision. In one corner of a *barracão* set up for the purpose, a black woman and a young Indian man were nimbly nicking the coarse brown skins off the tubers with machetes. The peeled white tubers were soaked for several days, then fed into a gas-powered machine that grated them into pulp. The pulp was stuffed into a long, weighted tube of latticed palm fronds, known as a *tipiti*, which hung from the rafters and squeezed out the poisonous prussic acid. Then the pulp was sifted by hand through a sieve. The big nuggets that remained in the sieve were baked into cakes that looked and tasted like unleavened bread and were called *beiju*, or else they were made into a porridge. The fine bits

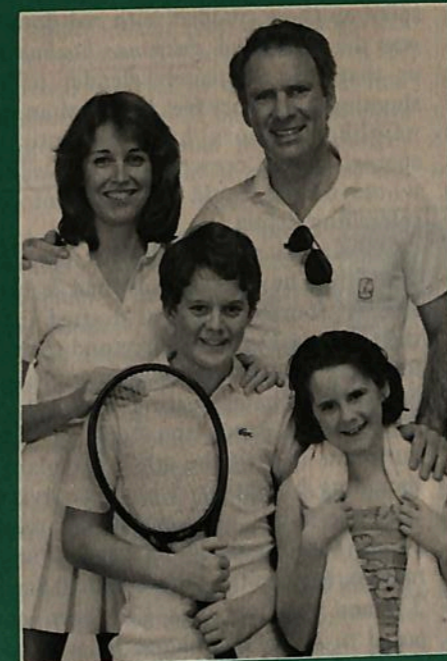
were placed in shallow metal pans four feet in diameter and roasted into golden *farinha*. Almerindo's harvest had been good, and he was hoping to get forty sacks of *farinha* out of it and to take them in his *motor* to Nhamundá and sell them for about seven dollars apiece to a passenger boat that stopped there once a week on its way to Manaus.

D'Antona had told us he met some "nomadic" Indians on the Nhamundá. These must have been the ones. He didn't know what tribe they were—maybe Tirió. I wondered if they could be the seven Kaxuiana who, according to Protásio Frikel, had moved to the Nhamundá in 1968. Their chief, known to the *caboclos* at Jacamim simply as Antonio Índio, wasn't around at the moment but would be back in a few hours, we were told. Maybe he knew some Amazon myths.

Antonio's wife, Temso, was a dignified woman of about sixty. She was sifting manioc pulp; their daughter Maria was bagging the *farinha*. I asked the Indian man peeling tubers if he was a Kaxuiana from the Rio Cachorrinho, and he said, in Portuguese, that he was. His name was Kanati. He was twenty-two, with high cheekbones and a bent nose like a hawk's beak. Rolling himself a cigarette, he told us, "I left the Cachorrinho when I was five years old, with my father and my brother, and we went to live with the Wai-Wai in Guyana, in the village of Caxineu, on the Essequibo River. Eight years ago, I came here to the Nhamundá, where Maria's parents were living. I made love to her, and I've been here ever since." Maria, who was his age, was tall and light-skinned, with long, straight black hair and a large, beautiful face—strikingly different from the *caboclo* women and from Kanati himself. There is considerable phenotypic variation from tribe to tribe in the Amazon Basin. The Kaxuiana, who, except for the ones here on the Nhamundá, had all been absorbed by the Tirió, had themselves been a mixed group. They had come originally from "the high *serras* to the west," which Frikel guessed were the Andes, and had later been joined, in a bloody process of fusion, by two waves of an Amazonian tribe called the Warikyana. Maria was Warikyana, and Kanati said he was half Tikiano, another small tribe of the Upper Trombetas, now also scattered.

Francisca sang a mournful, monotonous song, an "old dance" of the

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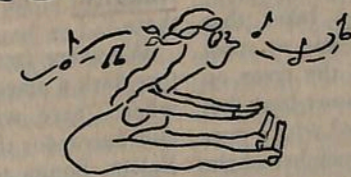
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Kaxuiana, into Quersin's tape recorder, and Maria sang two hymns in Wai-Wai. I asked Kanati how long it took to trek from Kasawa to Guyana. He said from two to three weeks, if you kept moving—he had once spent three months doing it with some Wai-Wai. So that was out. He said that he would go with us to Cafézal, the place upriver where the Kaxuiana lived—there were four couples now, three with children—and see if he could get his brother-in-law, Bernardino, who had a canoe and was a *cachoeirista*, a good man in white water, to take us up to Kasawa.

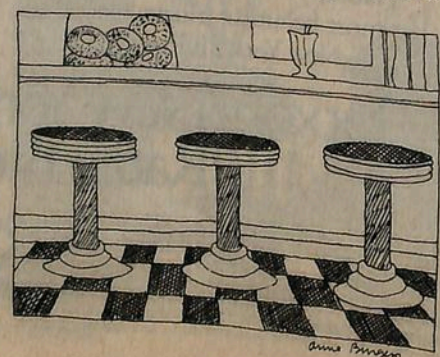
José came up the bend but wouldn't dock at Almerindo's; they were feuding over something—were *politizando*, as Kanati put it. We decided to save gas by hitching our boat to José's motor and riding with him to the Lago Jacytara, just a few miles upriver, which was as far as he was going. There seemed no point in waiting for Antonio; these Kaxuiana were so acculturated that if they had ever had a women-without-husbands myth they had probably forgotten it, I decided. To offset the new weight of Kanati, we advanced him the sack of oranges, and he left it with Maria. We soon reached the Lago Jacytara, and when we were under our own power again Kanati squatted at the bow and, propping his elbows on his knees, stayed there without moving or talking for the next hour or so.

The river was like a smooth black corridor, about seventy-five feet wide, gently insinuating itself between walls of green that rose to a fairly uniform height of about thirty-five feet. The terrain was mostly flat and choked with vegetation. There was a lot of standing water, in large lakes that opened to the right or left at most major bends, and under the trees on both banks. Often, the lower branches of the trees were smothered with a purple-flowering creeper, a member of the pea family, which was everywhere. Over much of the Nhamundá's length for much of the year, there was nowhere you could go ashore, let alone build. No wonder it was so deserted. The only artifacts we saw that afternoon were two makeshift huts that lumberjacks had put up in front of one lake. Sometimes the descending river, as it made one of its gradual swings to the right or left, would collide with a rib of terra firma, and a high, slumped bank of red clay, "created by the weight of the water that throws itself here," as Kanati nicely put it, would

be exposed. Songa didn't know many of the trees by name, and neither did Kanati, and João knew almost none. I knew a few, and it was comforting to be able to put a name to some conspicuous element of the forbiddingly complex vegetation that closed in from every quarter—to know that that long spike up there studded with red florets was the bromeliad *Aechmea huebneri*, or that this exquisitely slender palm shooting up twenty feet higher than its neighbors before bursting into a sparse, wispy crown was the *açaí*, whose berries could be made into a refreshing drink.

As Kanati and I talked, it became clear that he had already had a full life. At fourteen, he was drafted into the Guyana Defense Force and served for three months as a policeman; then, because he "hated beating up people," he left the army and took off for Suriname to visit the other Kaxuiana, including his father, who were living with the Tirió on Xaparwini Creek. From there, he made his way to Paramaribo, the capital, where he had some Tikiano relatives. He had been exposed to seven languages: he was fluent in Kaxuiana, Wai-Wai, and Hixkaryana, which are quite similar; he knew some Tirió, which is quite different; he had learned English from a Protestant missionary at Caxineu but had forgotten most of it; he had a smattering of lingua geral; and now he was speaking Portuguese, in which he had taken a crash course with the padre in Faro for several months when he first came down to the Nhamundá. He had a better idea of the world than Quersin and I were from than Songa or João did. "New York is near America?" he asked. "I will go there."

We were in a hurry to reach before dark a place called Banho (Bath), where there was an abandoned hut and *barracão*; the owner had gone to Belém, Songa told us. When we got there, Songa and João took the boat into a little cove upstream and threw out lines baited with tapir meat.



Kanati got a fire going and started to cook rice, onions, *farinha*, and sardines. As the sky darkened, the fishermen returned with two white piranhas—a disappointing catch. Nighthawks made nervous forays over the river, gliding, flapping, snapping up insects, emitting little nasal sounds, and then night fell. Quersin produced another marvel of Japanese microtechnology, a small nine-band shortwave radio, and tuned in Washington, Paris, Jerusalem—the big time—and a Spanish-speaking country (we couldn't tell which one), where something that sounded like "*la flexibilización del estado de urgencia*" had just gone into effect.

The next morning, Kanati gave us English nicknames: Quersin was Father, I was Chief. We reviewed the lakes and creeks and bluffs we would be going by: Inferno, Casimira, Piriquita, Barãozinha, Barão Grande, Jauari. "From here on up, there is nobody except Indians and the watchman of the *companhia*," Songa told us. The *companhia* was a calcite mine whose operation had been discontinued in the early seventies. We crossed from bank to bank, keeping to the inside of each bend, sometimes having to skirt a tree that, craning out from shore toward the light as the water ate at its roots, had finally toppled, bringing its attendant vines down with it and stretching them taut as cables. The river remained about seventy-five feet wide. Quersin said that this section of it reminded him of the Ubangi. He had found ancient dwelling sites up the Ubangi that looked like *terras pretas*, with beautifully decorated potsherds of a kind that nobody made anymore, and he had recorded a fantastic bird song, of which he gave a tour-de-force imitation. "In fifteen years of going all over Zaire, I never heard it again, and nobody has identified it," he said. "It must have been the Charlie Parker of that species."

Each of us spent much of the afternoon in his own thoughts and projects. Quersin, sitting beside me wearing his straw hat and with two pairs of glasses—reading and sun—perched on his nose, filled page after page of a notebook with swift, meticulous, minute writing. Then he reviewed a French-Portuguese phrasebook he had picked up in Rio, getting a chuckle from the "En Bateau" section, given our present circumstances: "Can you show me the way to my cabin? The sea is rough. I don't feel well." Kanati, at the bow, was feasting his eyes on the

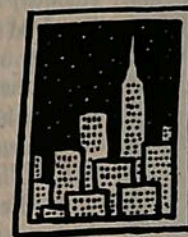
advertisements in a sumptuous glossy magazine I had brought from New York. A lot of the pictures were of things he wasn't familiar with. He asked what an *American Express Gold Card* and a *nuclear submarine* were, and I tried to explain.

We passed a succession of lakes and creeks without event: Fúsil, Veado, Focinho da Anta, Chave, Bemtevi, Remanso Grande, Areia, Torre Macaco, Gaviãozinho, Gavião Grande. At last, we came to the Pitinga, on our right, the largest of the Upper Nhamundá's tributaries, which was not much wider than a country road. Two pink dolphins, the first *bôtos* we had seen on the trip, were swimming around at the Pitinga's mouth. We got out at a small clearing on the bank and watched them racing up and down, perhaps alarmed at our presence, perhaps chasing fish. Every few moments, one would surface and blow with a sucking, snorting sound. D'Antona had said that he followed the Pitinga for two days, until he was stopped by a waterfall, at which point he could see a *serra* with a savanna in the distance. We checked our gas: seventy-five litres. It was obvious that that wasn't going to be enough to get us even to the first rapids and back to Faro. I felt dumb and duped. Why had D'Antona said that three hundred litres would be enough? Why hadn't Songa been able to tell us that we couldn't make it? Because, he said, he had never gone up the river in an outboard; he knew the distance only in diesel fuel. "Maybe there's some gas at the *companhia*," he suggested.

An hour later, we arrived at the *companhia*. There were half a dozen small prefabricated buildings there, an airstrip, and a huge gouge in the bank where barges could be run up and loaded. The mine had shut down eight years earlier, but there was a chance that it might resume operation—so we were told by the assistant watchman, who lived in one of the buildings with his wife and four children. He said he had only ten litres of gas, but we were welcome to it.

When we pulled into Cafézal, about an hour later, the whole community came running down the bank, letting out excited, high-pitched yelps—the way Indians greet returning loved ones. Kanati's brother-in-law, Bernardino, shook my hand. His father, Antonio, the chief, had left him in charge until he returned from Jacarim. At twenty-seven, Bernardino was the senior male of his generation.

Kanati, who was younger and a relative newcomer, and didn't have a canoe, deferred to him. Bernardino introduced his wife, who was Kanati's fifteen-year-old sister, Regina. Regina already had three children. Then, there was Bernardino's twenty-six-year-old sister, Karauki, a half sister of Kanati's wife; they were daughters of Antonio by different women. Karauki was married to her paternal first cousin Morituro. They had five children. The compound was not noticeably different from a *caboclo* settlement, except that the huts were sided with slats of split saplings instead of wattle and daub. The usual dogs, cats, chickens, and *jacamins* were in residence. But this place seemed somehow earthier and cozier, and the Indians seemed more alive to their surroundings than the *caboclos* we'd met had been to theirs. I asked Bernardino how he spent his time, and he said, "Here we never stop. We make *farinha*, we sell lumber downriver, we take people on trips when they come." The last such peopled party of German missionaries, a party of three years before. They had had come three years before. They had wanted to go up to Kasawa but had underestimated their gas. Bernardino said that he and the others at Cafézal grew *Cayenne bananas*, a long and especially rich and filling variety. The fishing was poor locally, so they did a lot of hunting. The edges of the clearing were littered with the bones of past meals, including the small but strikingly human-looking skull of a howler monkey. Bernardino asked for some batteries for his flashlight, so that he and Morituro could go shoot something for dinner, and as he went off with his shotgun Regina slapped him lustily on the back and said, "Mata" ("Kill"). Soon we heard two pops in the darkness, and the hunters returned, each with a *paca*—a large brown nocturnal rodent with four rows of white spots running the length of its body. "The *paca* comes at night to the bank to eat a little flower," Bernardino explained, "and there we wait for him." Quersin took a flash group portrait with Bernardino and Morituro holding up the pacas, and then the pacas were turned over to Regina and Karauki to prepare for supper. We contributed some onions. They fascinated Bernardino; he had never seen an onion before. He asked if they grew above the ground or below



can, in whose juices Bernardino said he bathed his dogs, so that they would hunt better.) It looked as if the next generation would be absorbed into the *caboclo* population and would become more or less like Songa. The Kaxuiana population here had probably fallen below replacement level. Being Indian had no prestige in the world below the rapids, but the members of this small group still had tribal solidarity, perhaps heightened by the knowledge that they were the last of their kind.

While we were waiting for dinner, Bernardino showed me some of the things in Antonio's room. There was a wooden club with a vulture's head, carved in masterly fashion by Antonio. "We used to kill people with this fifty years ago," Kanati said. A cotton hammock intricately woven by Temso thirty years ago, and still strong, hung in one corner. Bernardino said that it had taken his mother a month to make. (I wondered how literally to take these time spans.) The knowledge of how to make such things had apparently not been passed on to his generation; nor, apparently, had the ability to tell any of the Kaxuiana myths. The language had—Regina, for instance, spoke very little Portuguese—and so, apparently, had some plant lore. (There was an arrowroot growing in a kerosene

can, in whose juices Bernardino said he bathed his dogs, so that they would hunt better.) It looked as if the next generation would be absorbed into the *caboclo* population and would become more or less like Songa. The Kaxuiana population here had probably fallen below replacement level. Being Indian had no prestige in the world below the rapids, but the members of this small group still had tribal solidarity, perhaps heightened by the knowledge that they were the last of their kind.

We tried the *pacas*, which had been grilled over the fire, and they were superb. I had known that these rodents are rare over much of their wide range, from Mexico to Paraguay; now I understood that the reason wasn't only that their habitat was being destroyed. Kanati belted out, wretchedly off key, a Wai-Wai hymn he had learned in Guyana, for which he gave an English translation: "No smoke, no drink rum, go to Heaven with Jesus." Tens of thousands of feet above us, the blinking red and green lights of a jet plane, headed north, slowly crossed the star-encrusted sky.

"Where is it going?" Bernardino asked.

"Maybe to Caracas, or even the U.S.A.," I said.

"It goes by six times every morning," he said.

As we got ready for bed, Kanati warned us not to leave our bare toes dangling out of our hammocks, because vampire bats might come and suck them.

Just after sunup, Bernardino,

Kanati, Morituro and his oldest boy, Quersin, and I loaded up our gear in two canoes and set out for the rapids. We had paid Songa and João and had left some of the food with them. If the rapids were passable, we would go up them, and the seventeen others above them, in the canoes, to Kasawa, and from there either we would proceed with Kanati and maybe some Hixkaryana to the Wai-Wai on the Mapuera, who could take us down to Oriximiná in about a week, or we would fly out on the next plane. If we didn't come back to Cafézal that night, Songa and João were to wait a few days, as we would try to send back some gas with Bernardinho. Bernardinho said he couldn't tell whether we could make it up the rapids until he took a look at them.

TRAVELLING by canoe (I was in the first one, between Bernardinho and Morituro's son), we were much more aware of the life of the river; the teeming sounds within the trees were no longer drowned out. We moved more slowly and closer to the bank, often right under overhanging branches. All sorts of details that we had been missing presented themselves now: the sound of the river straining against a snag; lots of little brown bats suddenly flying up together from a tree trunk, to which they had been clinging, perfectly camouflaged; the scent of white mimosa flowers; the citronella smell of ants that lived symbiotically in the hollow stems of a *taxi* tree, paying their rent by biting anything that brushed against it (Bernardinho said their bite was very painful but not as painful as that of wasps. "If we get attacked by wasps, jump in the river. That's the only way to survive," he said); a large butterfly mimicking a sunlit leaf, with wings divided in horizontal zones of brown, yellow, and brown; scores of water striders slipping off a branch and sprinkling the water; a black-collared swallow skimming the mirror surface of the river for a distance of maybe fifty yards, then pulling out in a graceful climb; a loud crash back in the woods, which Bernardinho said could only be a *tapir*; dark toucans with white bibs gorging themselves on *acai* berries; a *Carib* grackle, a red-crested *cotinga*, a black-fronted nunbird rustling, darting among branches; a *morning-glory* vine blossoming in lavender trumpets; three blue-and-yellow macaws coming overhead, calling raucously; a king vulture soaring high

up; a small *anaconda*, about five feet long, stretched out along a branch ahead, languid-looking but in fact ready to drop on anything that passed below it. Bernardinho flicked some water at the snake with his paddle, and in one blurred motion it thrashed off the branch and dropped into the river.

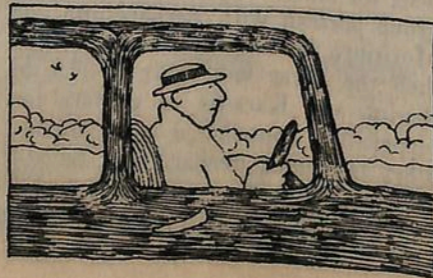
At about one o'clock, we began to hear a loud, dull roar upriver. The water became choppy, opaque, foamy, and full of eddies, and the air became moist with spray. Turning a final left-hand bend, we were confronted by a smooth, solid sheet of water about a hundred yards across, with a drop of ten feet or so—a kind of mini-Niagara—and with a quarter mile of white-water riffles behind it. This was the *cachoeira porteira*, the gateway cataract. There was no need to confer with Bernardinho. The expedition had run up against a literal wall of water.

We paddled over to a large *motor* that was anchored in the flooded bushes below the falls. It was being painted by a young Hixkaryana man, who told us that the boat belonged to FUNAI; when the river was lower, goods were ferried between here and Kasawa by outboard. He said he had nothing—neither diesel fuel for his boat nor gasoline for ours. This was a rather bold lie; he was sitting on a drum of diesel fuel, as I pointed out. He then said that he wasn't authorized to use any fuel or to give any out or to take the *motor* anywhere, and that he didn't even know how to run the engine.

I asked Kanati if it was possible to walk up along the river. He said it was "too ugly," and then, "We are sad. You will come back in August with a *motor* and an outboard and we will go to Guyana. Songa is no good. He ruined your trip. He knew, but he didn't want to tell you."

Quersin was exasperated. "The lack of reliable information here—it's no better than Africa," he said.

To me, the confusion about the gas and the rapids seemed to be related somehow to the confusion about the Amazons—both were part of the



great confusion that prevails in most Amazonian endeavors.

There was nothing to do but accommodate ourselves to the situation. Quersin and I recalled that we hadn't been sure we would get past the rapids in the first place. Kanati remembered that the padre was coming up to Jacamim from Faro in eight days to officially marry him and Maria, so it was just as well that he got back; and Bernardinho said that one of his teeth was hurting and he wanted to go down with us to Nhamundá to get it taken care of. So we headed back for Cafézal. Not far below the rapids, Kanati spotted a *sloth* up in a tree. As we passed under it, it slowly rotated its small, round, crude head and looked down at us.

The next morning, a Friday, a small convoy set out from Cafézal. It was made up of the outboard, with the five people who had come up in it, and in tow, a dugout with Bernardinho and his family in it. The plan was for all of us to go downriver together until the gas ran out—there was now about sixty litres left. Then Kanati, Quersin, and I would take off in the canoe and try to catch Almerindo at Jacamim before he went down to Nhamundá with his *farinha* on Sunday morning. If we missed Almerindo, we would just keep going, and the others would have to paddle the outboard down to Jacamim and make their own arrangements with Almerindo when he got back. João wasn't very pleased with this plan, but as he had to stay with the boat there was no alternative. Songa, passive as ever, said, "Whatever happens is the same to me."

By lunchtime, we were back at the Pitinga. Bernardinho threw in a line, and in less than a minute he pulled out four white *piranhas*. A fifth sliced the line clean. Songa and Kanati skinned, gutted, and spitted a red *howler* monkey that Kanati had just shot, and we ate it, too.

The gas lasted until midafternoon. People and goods transferred crafts, and Quersin, Kanati, and I started off in the dugout just as it began to rain—a local downpour coming from a lone dark cumulus. We were somewhere in the middle of the hundred-mile stretch between the Pitinga and Banho, where nobody lived and there was very little dry ground for even a temporary shelter. Kanati said that we would just have to keep paddling through the night, but Quersin and I valued our sleep, and we kept looking for some-

where to put in. Finally, about half an hour before dark, we saw a little rise in the forest and got out. Kanati said, "Wait here," and went into the forest with my machete. We could hear him running around and cutting materials for a lean-to—poles, vines, palm fronds. Two of the poles he planted firmly in the ground about six feet apart. Then he placed a third pole horizontally against them, about six feet up, and lashed it with vine. At each juncture of the upright poles with the cross pole, he laid two more poles and lashed them together at a slight incline to a tree about six feet away. Then he laid seven saplings across this triangular frame and lashed them down. Then he covered the frame with fronds. Their leaflets were sparse and thin and not the



best roofing, he explained, but there were none of the right kinds of palm around. We added a plastic sheet for extra protection, and it was good that we did because at about two in the morning a heavy rain started to come down, but we kept dry in our hammocks below. The lean-to took Kanati up from scratch. He said that it was called a *rabo-de-jaca*, which means "caiman's tail."

We made a fire, heated up and ate the rest of the monkey, and then lay in our hammocks watching enormous cool-green fireflies streak through the darkness and listening to the dense, pulsing rhythm of frog and insect choruses, which blended together almost like a band, with the frogs on *samba*. I have often wondered whether the night sounds of the jungle helped inspire this infectious music; to my knowledge, the connection hasn't been investigated. (Quersin recorded the concert with a multidirectional external microphone, and six months later a cassette labelled "Nhamundá/nuite" came in the mail, with a note from him that said, "Binary/ternary, like all forest music.")

We went about forty or fifty miles the next day, and stopped in a channel off the river where there was a *barragem* belonging to a family that had gone to work downriver several months earlier. It was as well kept a compound as Castanhal. The dirt floor had been neatly swept, and a stack of firewood, an axe, and a bar of *breu* had been left in the kitchen area. We ate and turned in early, so we could get an early start

and reach Jacamim before Almerindo left. A spider monkey maybe five hundred feet away started to call. Kanati reproduced the timbre and the spacing of the calls with a series of short whistles, which the monkey answered.

The next morning, we were back in lake country. Kanati knew little allées, called *furos*, in the inundated forest that led to the lakes. We took a few, cutting straight across the lakes back to the main channel and avoiding miles of circuitous loop. The entrance to the *furo* leading to the Lago Jacytara, however, proved elusive. At last, Kanati thought he had found it, and, gliding into a dark, flooded forest, we proceeded mainly by pushing off with our paddles from tree trunks, many of which were buttressed to help them stay up. This

*furo* seemed not to have been used in some time. Vines had grown across it, and it was clotted with debris. A hundred yards in, a troop of *squirrel* monkeys passed about thirty feet overhead, too intent on spanning the fifteen feet or so between trees to notice us. Cautiously, one at a time, they would walk out to the end of a branch and then hurl themselves into the air. Small and light, they were spectacular leapers. About fifty of them, some with babies clinging to their backs, passed, flowing through the treetops like a stream with several interwoven channels. Half a dozen *capuchin* monkeys came with the last of them; it was a mixed troop, the hyperactive squirrels stirring up the insects for the larger capuchins, and the capuchins, in turn, with their more powerful jaws, opening up fruits for the squirrels.

Shortly after this, we got hopelessly lost, and eventually we found ourselves right back at the entrance of the *furo*; giving up, we continued down the main channel. I asked Kanati when we would get to Jacamim; it was nine o'clock, and we were an hour overdue. "It's not very far," he said, and then added, "And it's not very near." I leaned out over the water and threw my weight into each stroke, and we started to really move. At nine-thirty, we heard the sound of a *motor* still a good ways below us. That would be Almerindo heading off to Nhamundá. We had missed him. When we finally pulled into Jacamim, two hours later, Antonio Indio, the chief of the Kaxuiana and Kanati's father-in-law, hailed us from shore

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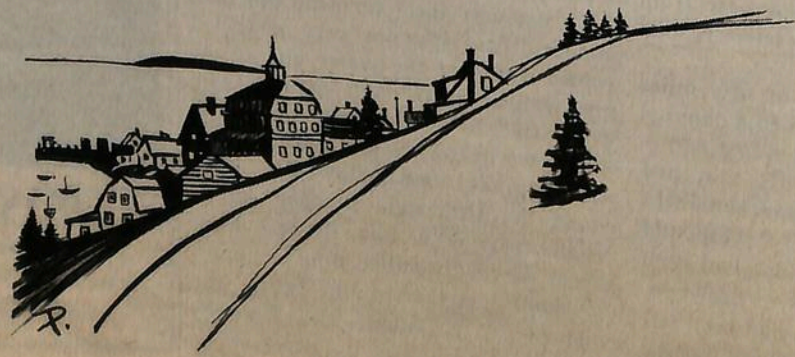
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with what seemed to be the standard greeting on the Nhamundá: "Where are the fish?"

ANTONIO ÍNDIO's real name was Kauka. He was, at six feet, the tallest of his family, and he looked about sixty, with sparse white stubble on his chin, although the skin around his well-developed torso was still tight. "I am from the time when they didn't count years of age," he told me as we sat down together in the *barracão*. He had on a homemade Gandhi cap and projected calm, humility, simplicity, dignity, and wisdom. I asked how it was that he had come to live at Cafézal. "In 1968, Father Protásio came in a boat to our village on the Cachorrinho and took away ten of us at a time. The whole tribe went up the Parú do Oeste to live with the Tirió, near Suriname. We were the last seven to leave: my wife Temso and my wife Augusta, who is dead now, and our children Bernardinho, Karauki, and Maria. Father Protásio told us to wait. He would be back. But we didn't wait. A *cariwa*"—Kaxuiana for "other people;" that is, non-Indians—"gave me a gun and told me to go hunting. But it wasn't good for my wives to be left alone. When I came back, they said the *cariwa* had been bothering them. So we all went up the Mapuera to hunt tapir. We thought we'd be back in two or three weeks. But we have never returned. We canoed up *cachoeiras* and then followed paths we had never seen before, and after fifteen days we came to Kasawa; there were no Wai-Wai on the Mapuera yet, and the only Indians up there were the Hixkaryána. We stayed two years at Kasawa; then Nonato, the chief of FUNAI's post there, told us to go down to the *cachoeira porteira* and be watchmen. He said to work with the *regatão*, moving supplies up to Kasawa, and not to let anybody pass. We did this for a while, but we weren't getting any money for it, so we decided to go off on our own, and moved down to where we are now."

I asked him if he knew any stories about the women without husbands, and he said, after a long silence, "I can't remember any."

Three hours after our arrival, the outboard, with Songa,



Bernardinho, and João paddling full steam, arrived. They were way ahead of schedule, having not stopped either night but taken turns sleeping in the boat. João, eager to get back to Terra Santa, was devastated to hear that we would be stuck at Jacamim until at least Tuesday, when Almerindo was due back from Nhamundá. But we weren't stuck: a few hours later, Bernardinho and Kanati canoed down to the trading post of a *regatão* named Moura and arranged for him to come up that night with his *motor* and tow us down to Nhamundá. As we pulled out of Jacamim at about 2 A.M., I found myself crying in the darkness.

What a beautiful world this was, what a privilege it had been to hang out in it for a while. And, as Quersin put it, what a beautiful cat Kanati was.

Late that afternoon, Kauka and I had sat together in the *barracão* and talked some more. Angled sunlight flooded the clearing. The women and girls had gathered on a log at the edge of the water and were singing softly while combing each other's hair. Several dozen tiny *pium* gnats, whose bite leaves a small blood blister that itches terribly, were trying to feed at my ankles, but a few drops of repellent kept them away. Some of the children were swimming. Almerindo's wife warned them to stay close to shore; the day before, Almerindo had shot a big anaconda from the dock, but not fatally. Kauka had brought out to show me another of Temso's intricately woven cotton hammocks, called a *makira*, and a rectangular *tanga*, or pubic covering, made of red, blue, and white beads woven in a crenellated pattern. They were fine work. He said, "Nobody will ever make these things again. My daughters don't know how to, and you can't get the right cotton or the right beads anymore."

I was ready to conclude that the Amazon-women myth, if it had ever existed among the Kaxuiana, was ex-

tinct, and, trying to find out if Kauka knew any other myths, I asked him, for starters, if the Kaxuiana had any stories about how the moon had got there. But he had been thinking about my earlier question, about the women without husbands, and he had remembered a story about them (or perhaps he had remembered it all along but had not been sure he wanted to tell it). Looking out across the river, he began to speak in a melodious storytelling voice: "My father used to say that the old people said the Amazon women lived on the *serra*. There were five women: Tiaruui, Amacoco, Carawiki, Coyatinu, and Woru. One day while their husbands were sleeping—they had been having a *festa* and dancing all night—the women left. They clutched hot peppers to their breasts and started to dance in a circle. Slowly, they started to leave the ground. Higher they rose. When the men awoke, they were flying. They threw down the peppers. They pelted the men's eyes with a rain of peppers, so that the men couldn't shoot them with their bows. The women went to live on the *serra*."

"What *serra*?" I asked.

"The big *serra* at the end of the Cachorrinho," he said. "All these rivers end in *serras*." He went on, "One of the women had a child, whom she left behind, under a basket. The men turned over the basket and found the child, a girl. One man—the shaman—took the child and cut it into pieces. As when a hunter gives pieces of meat to the people in his family, the father gave the pieces of his child to his companions. Each man took two pieces. The father let the shaman keep the child's ear and vagina. They all hid the pieces in their rooms. Eight days passed. The father said, 'Today we will see our women. Let's go. Each man went into his room'—here Kauka traced a series of adjoining rooms in the dirt with his finger—

"and he discovered that each of the pieces of the child had grown into a fully formed woman. But the shaman went into his room and he found that the ear had become a bat and the vagina a little bird. The shaman cried. 'Give me one of the women,' he said. But no one would. He went walking along

MARCH 24, 1986

THE NEW YORKER

the riverbank with his bow and arrow, asking. He saw one of the birds that sing *lik-wa*"—Kauka imitated its call in falsetto. "I don't know its name. The shaman became the bird, and left. The women who were from the flesh of the child had children at their breasts, but the children had not been made by men. The children were called *imroyana*. They were the founders of the Kaxuiana."

And what about the wives who had gone to live on the *serra*?

"The man in the house on the *serra*, the owner of the *serra*, saw these women and asked how it was that they had got here," Kauka said. "He tried to find out what had happened. The women said, 'Nothing happened. We just flew up here.' And they flew again to make him believe. The women lived there for many years, and they had children, but the children were not made by men. If the child was a boy, they gave it to other Indians."

Kauka continued, "A thousand men went to see the women of the *serra*. They were taken there by the owner of the *serra*. First, they went up the river, then overland. It took three months' walking. The husbands were with them, too. Finally, they got to the big *serra*. The owner said, 'Here I live. On top of the *serra*. Let's go up.' After two hours of climbing, they arrived. They heard noise and conversation. The owner said, 'Here the women live. Let's go see them. Don't be scared. They will offer us supper and something to drink.' They came to a big house. It was about this time of day. Everybody sat down. The women arrived. They were beautiful, *serra* said to the women, 'If you have something to eat and drink, you can bring it now.' Each woman lay down on her bed with her breasts pointing in the air and lifted her *tanga* and said, 'Supper is ready.' The men started to squat over them; they were not supposed to make love to them. But one of the women, could not control himself. He wanted her and put his wood on top of her. Didn't I tell you they women don't like men? For this—because the women don't like men—the men went away. They went away, and none of them. The owner of the *serra* arranged a plane for the men to go away."

Amazonian myths are full of such anachronisms, as in dreams, logic and

historical authenticity are irrelevant. I asked Kauka about the plane existing so long ago, and he said, "They made it themselves. It was small. This plane made no noise. It was like a vulture gliding in the air." Then he went on, "The men got to Belém and with the women who had grown up from pieces of the child founded the Kaxuiana. Belém then was a *maloca*"—a large communal house, containing a whole village—"called Xurutahumu. From there they went to Kurumukuri, which is now Santarém, and to Pauwiti, which is now Oriximiná. And from there they spread out everywhere. Thus all Indians were founded. Each tribe has its own language and its own story of who they first were. But the first Indians were those who came down from the *serra*."

I asked Kauka if the words "Coñori," "Cuñuris," or "Conduri" meant anything to him.

He said, "The Coñori were a tribe around here. It was also the name of my father, who was the chief of the Kaxuiana before me. His name was José Sarubi Coñori, and he called me Coñori."

When Kauka began talking, Maria and Regina had come to the edge of the *barracão*, and they had been standing there, nursing their babies in the gathering darkness and listening. "They sing Kaxuiana songs to their children, but they don't tell the stories," Kauka said. "Only I know this story. Nobody else can tell it anymore. How the Kaxuiana were founded and spread."

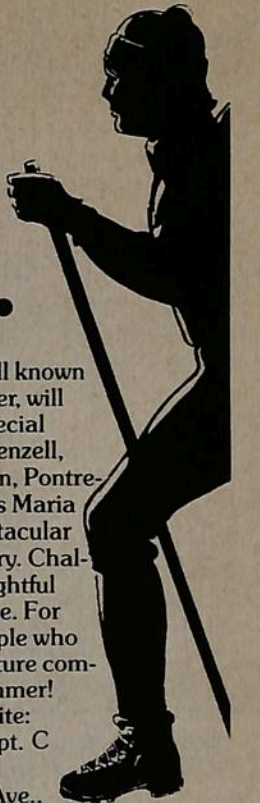
When I told Quersin, who had been shaving at the end of the dock, that the myth was still alive, and that these people were the descendants of the men who had been left behind by the Amazon women, his eyes widened, and he said, "So you see, we had to miss Almerindo's boat."

—ALEX SHOUMATOFF

BC-DAYBOOK—CORRECTION 11-18  
TUESDAY'S 11 A.M. NEWS CONFERENCE AT THE HYATT REGENCY CAPITOL HILL WILL BE HELD BY THE NATIONAL COALITION OF IRS WHISTLEBLOWERS (STED IRISH WHISTLEBLOWERS).—U.P.I. wire dispatch received in Washington, D.C.  
Damn.

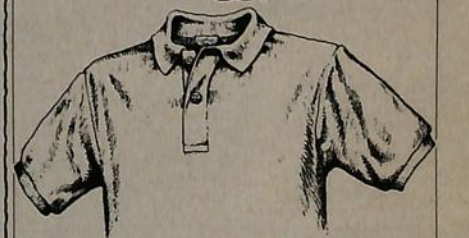
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# JARI: A massive technology transplant takes root in the Amazon jungle

ARTICLE AND PHOTOGRAPHS BY LOREN MCINTYRE

**F**OR JOÃO MELO, the leviathan appeared without warning.

A Brazilian boy about 10 or 11, João was fishing from his dugout canoe in the Rio Jari one April day in 1978 when it happened.

The Jari is a dark tributary that splashes down from the remote Guiana Highlands over many waterfalls, grows wide and deep, and merges into the north channel of the Amazon before that mightiest of rivers reaches the sea. This is a land of primeval forest, rife from root to canopy with fecund plants and rapacious creatures.

At daybreak the air trembles with bird-songs like cellos and chimes played deep in a well. After midday heat has silenced the birds, cicadas assail the eardrums with an unwavering high-pitched buzz. Toward evening awesome thunderstorms shred leaves and limbs and uproot aging trunks.

As he had canoed on and bathed in the river all his life, I suppose João had an almost fetal awareness of the currents of the Jari. He sensed that day a pulsing of air and water perhaps long before you or I—riding in his canoe—would have felt the low-frequency throb of a massive propeller driven by a 22,000-horsepower marine diesel.

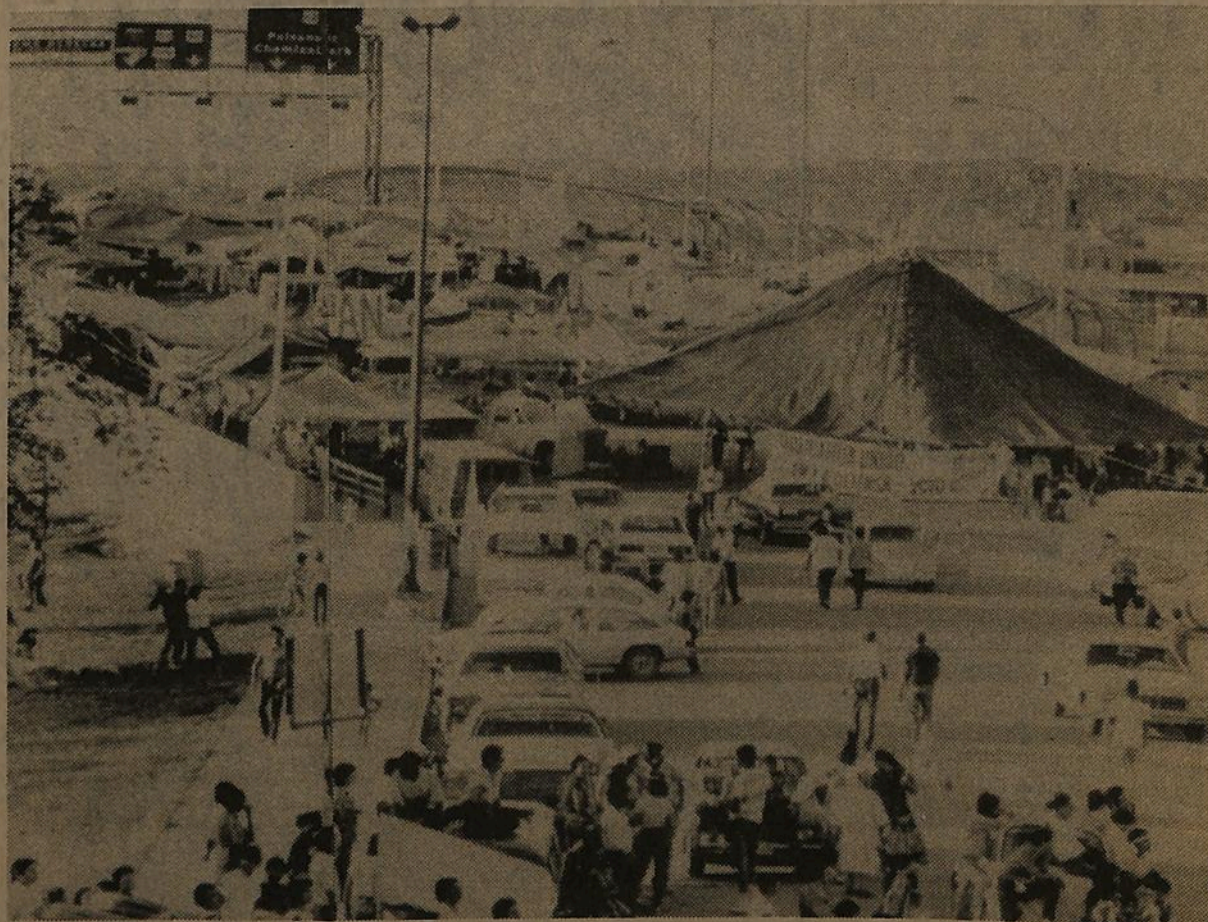
The boy looked up. Beyond an island in the river a silvery cluster of towers loomed above the forest crown and drew toward him. It was spooky, he later said to me.

Trailing his fishline, João paddled furiously for home—a stilt-legged hut on the shore. Big eyed and breathless, he told his mother, "A city is coming up the river!"

In truth, nothing so immense had ever entered the mouth of the Amazon, realm of



To clear the way for new pulpwood-producing forest, Jari workers burn old native jungle (above), but only after culling usable trees. Later a pine seedling is tucked into its ash-enriched bed and nourished by the first seasonal rains (facing page).



**ELECTION PROTEST IN MEXICO:** Supporters of Mexico's National Action Party, known as PAN, blocking a bridge that crosses border at El Paso. The demon-

strators have blocked highways in the Mexican State of Chihuahua to protest what they claim was widespread corruption and fraud in recent state elections.

Agence France-Press



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**DEFORRESTATION:  
THE HUMAN COSTS**



# International Cooperation To Protect the Ozone Layer



United States Department of State  
*Bureau of Public Affairs*  
Washington, D.C.

*Following are an address by Richard E. Benedick, Deputy Assistant Secretary for Oceans and International Environmental and Scientific Affairs, before the U.S. Workshop on Protecting the Ozone Layer on March 6, 1986, and excerpts from a statement by Ambassador John D. Negroponte, Assistant Secretary for Oceans and International Environmental and Scientific Affairs, before the Senate Foreign Relations Committee on March 18, 1986, both in Washington, D.C.*

## MR. BENEDICK

I confess that, as a professional diplomat, it was with some diffidence that I accepted EPA's [Environmental Protection Agency] gracious invitation to address this impressive assembly of scientists. I have been told that the professional scientist, who is accustomed to dealing with great precision and clarity, finds it particularly difficult to listen with any patience at all to the professional diplomat, whose stock in trade is ambiguity. I think it was [former British Prime Minister] Harold Macmillan who once said that the conversation of a diplomat is disconcerting because it continually wobbles between the cliché and the indiscretion.

In any event, I will try today to avoid both dangers and to be both clear and brief in presenting a perspective on how your deliberations relate to a very innovative international process. I would like to share with you some thoughts

about that process: where we have been internationally and where we are going.

International attention to the question of stratospheric ozone depletion began shortly after Rowland and Molina<sup>1</sup> published their now-famous theoretical paper. A number of international meetings were held on this subject during the late 1970s, at the same time as several nations began to issue domestic CFC [chlorofluorocarbons] regulations. In 1980, the Governing Council of the UN Environment Program (UNEP) decided to convene a Working Group of Experts to discuss appropriate international action to address this potential problem.

The UNEP Working Group decided early on in their deliberations to develop a convention—that is, an international treaty—on the ozone layer. Four years and several long negotiating sessions later, they completed their work on such a treaty. In March 1985, at a plenipotentiary conference in Vienna, Austria, where I represented the United States, 21 nations signed the Convention for the Protection of the Ozone Layer. This was a landmark event: it was the first time that the international community acted in concert on an environmental issue before there was substantial damage to the environment and health—in effect, acting together in anticipation of potential problems.

<sup>1</sup> Molina, Mario J., and F.S. Rowland. "Stratospheric Sink for Chlorofluoromethanes; Chlorine Atom-catalysed Destruction of Ozone," *Nature*, Vol. 249 (1974), pp. 810-812.

The Vienna convention creates a framework for international cooperation on research, monitoring, and information exchange concerning the ozone layer. It also creates general obligations to protect the ozone layer and provides procedures for eventually adopting protocols to the convention, which could contain specific measures to control, limit, prevent, or reduce emissions of ozone-modifying substances—should such measures be deemed necessary.

The convention text is now before the U.S. Senate for ratification, and we expect hearings on it later this month [see Negroponte statement on p. 2]. After 20 nations have ratified it, the convention becomes international law. It is noteworthy that both industry and environmental groups endorse this convention because of its potential contribution to development of better data. Surely it is in everyone's interest that any possible regulatory measures be considered on the basis of sound scientific and economic information rather than emotion.

## Protocol To Control CFC Uses

As many of you may be aware, the question of a control protocol was the subject of considerable debate during the UNEP Working Group negotiations. In April 1983, Norway, Finland, and Sweden tabled a draft protocol for controlling all CFC uses. In October 1983, the United States voiced its support for that part of the Nordic proposal dealing with CFCs used as aerosol propellants.



**Stouffer's calls them Moonlight Miracles.**

Smithsonian · March 1987.

*By Joanne Omang*

# In the tropics, still rolling back the rain forest primeval



# SECRETS OF THE RAIN FOREST



# The New York Times Magazine

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## SECRETS OF THE RAIN FOREST

By Erik Eckholm

