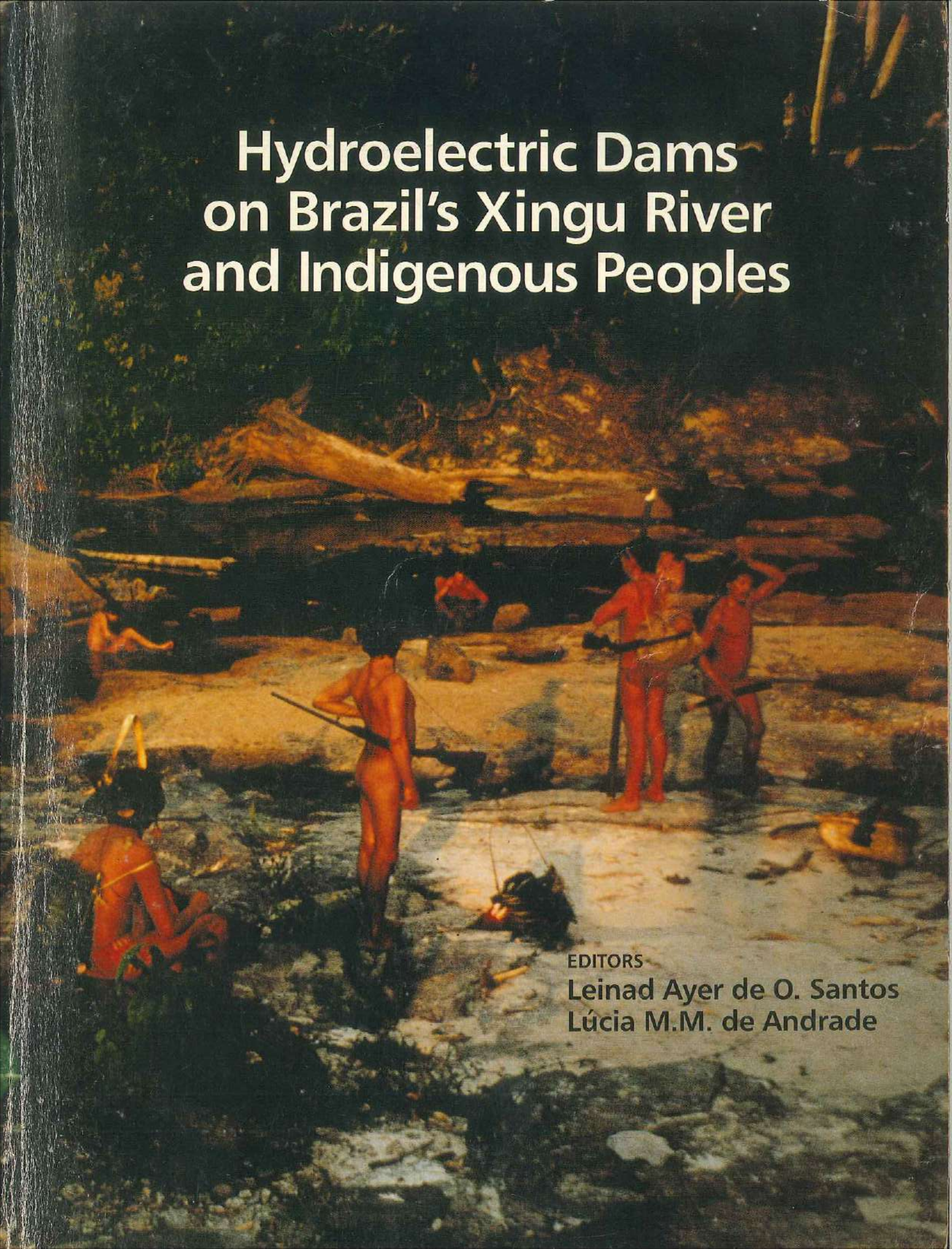
Hydroelectric Dams on Brazil's Xingu River and Indigenous Peoples



EDITORS
Leinad Ayer de O. Santos
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HYDROELECTRIC DAMS ON BRAZIL'S XINGU RIVER AND INDIGENOUS PEOPLES

Cultural Survival Report 30

Hydroelectric Dams on Brazil's Xingu River and Indigenous Peoples

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Preface

With this book the Pro-Indian Commission of São Paulo launches the campaign "Hydroelectrics of the Xingu and Indigenous Peoples." The objective of this campaign, which has the support of organizations such as the Union of Indian Nations, the Brazilian Anthropological Association, the Syndicate of Engineers of the State of São Paulo, the Prelacy of the Xingu, and the Ecumenical Center for Documentation and Information, is to reopen for discussion the entire project proposed for Brazil's Xingu River before any one of the seven planned hydroelectrics starts up. We refuse to accept the hydroelectrics of the Xingu as a consummated fact. The Cararão Dam, the initial phase of the project, is still in the viability phase; thus, we have the unique opportunity to discuss in advance the engineering project of the work and not merely denounce disasters in hindsight.

This book aims to examine the different aspects of the hydroelectrics of the Xingu. Thus, in terms of the consequences for the indigenous peoples, we seek to point out the grave social, political, economic, and ecological problems incurred by this project. We know, on the other hand, that the Xingu project is not an isolated case, but is part of a larger plan by the electric sector to build 297 new hydroelectrics (Eletrobrás, Plan 2010, 1987). The recent history of the Guarani, Parakanã, Asuriní, Gavião, Waimiri-Atroari, and Tuxá peoples, already affected by the hydroelectrics of Itaipu, Tucuruí, Balbina, and Itaparica, alerts us to the dangers that Plan 2010 presents to the indigenous communities.

It is for this reason that we consider the Xingu campaign to be an integral part of a reevaluation of Brazil's energy program and the search for alternatives. This debate has been going on for some time in Brazilian society. By inviting participants in this debate to contribute articles, we have sought to incorporate this discussion into this book. On the other hand, this book, with its examination of the indigenous question, makes a specific contribution to this national movement as well.

We hope that these articles serve to alert public opinion to the electric sector's control over environmentalist discourse. The principles that guide energy planning have not been redefined, but there is only an investment in palliative measures that fulfill objectives much more related to the public image of electric sector campaigns than to an effective ecological concern.

The consequences of the hydroelectrics cannot be reduced to "environmental impacts." Undertakings of this dimension create social, economic, and political problems as well. The "effects," as well as the planning, of the hydroelectrics encompass a political and economic project for the country as a whole, and it is in this perspective that they must be confronted.

This campaign needs to politicize the ecological question, as many environmentalist groups have been doing. The ecological concern is not just a matter of environmental preservation, but includes proposing political and economic alternatives for the country that could lead to a new relation of humans to nature, of humans amongst themselves. The electric sector with its "environmental measures" sidesteps one of the most important questions posed by the environmentalist movement (together with several other popular movements): the need to change the present structure of domination of Brazilian society and to rethink the country's development model.

This brings us to the crucial point of the alternatives. The search for new forms of electrical energy depends on political will, not only on existing technology. The technology at our disposal today in Brazil meets the needs of specific sectors of society and is designed to make megaprojects viable. It is a technology that leads to centralization of power and authoritarianism (José A. Padua [ed.]: *Ecologia e Política no Brasil.* Rio de Janeiro: Espaço e Tempo, IUPERJ, 1987). To build new models we must find new solutions. This search depends on a political decision that will only be made after pressure from civilian society and its effective participation in decision-making processes.

Until today, the electric sector has given little indication that it will consider the rights of the populations affected by its undertakings and of Brazilian citizens as a whole in its policy planning. Similarly, it has advanced very little in the democratization of its decision-making process. What we have seen instead is that the proposals for initiating "debates with representative organizations" and for promoting "broad access to information" (Eletrobrás, Plan 2010, 1987) have remained on the level of vague discourse, while, in practice, the sector invests massive amounts in materials of dubious quality that seek to sell a "concerned" image on social and environmental questions. The development of the Xingu case amply demonstrates how it is not possible to believe in the transparency and good will of the sector. As it affects access to information, the answers we were able to obtain from Eletronorte were all evasive, and no study was officially made public. This shows the disregard the sector has for organizations of civilian society.

The Pro-Indian Commission, through the Xingu campaign, thus is part of a wider movement of Brazilian society struggling for the construction of a participatory democratic state in which the ethnic minority rights of indigenous people are respected.

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Xingu Hydroelectrics: The State Versus Indigenous Societies

Eduardo Viveiros de Castro
Lucia M.M. de Andrade

"The presence of indigenous communities represents one of the most complex environmental problems in the planning and implementation of hydroelectric plants and transmission lines."
(Eletrobrás 1986)

THE IMPLANTATION OF THE Altamira Hydroelectric Complex, an already defined part of a gigantic hydroelectric development plan for the Xingu River Basin, immediately and directly threatens seven indigenous populations that inhabit this region. The Cararaô and Babaquara hydroelectric plants and their reservoirs represent a decisive step in the history of the veritable war mounted by the Brazilian state against indigenous peoples. The Juruna, Arara, Kararaô, Xikrin, Asuriní, Araweté, and Parakanã will be faced with a qualitative leap in the process of territorial confinement and expropriation, demographic reduction, political subjugation, and planned sociocultural destruction—fates that they have suffered since the end of the sixteenth century. Their territories will be partially or totally submerged. Several of their villages will be relocated. Their political and economic forms will be disrupted. In the end, the "benefits" that they will gain from "compensation" will, at the very least, constitute a new set of external factors that they will have to fight to control.

The immediate and greatest dangers today fall on these seven peoples, who belong to distinct linguistic and cultural groups and who find themselves in different historic situations, some having been "contacted" less than five years ago. But they are not the only ones who will have their existence threatened by "the largest national project at the end of this century and the beginning of the next," as the government characterizes the Xingu Hydroelectric Project (Eletrobrás 1986:6/91). With the construction of the Altamira Complex, effects will be felt among Kayapó groups more to the south. As a continuation of the Xingu River Basin project, three more dams are planned on the Xingu River and two in the Iriri. The latter two will directly affect the Xipaia-Curuaia and the still unknown indigenous peoples who inhabit the region of the upper Iriri. The hydroelectrics planned for the Xingu, on the other hand, will affect the four groups of the Kayapó Indian Reserve (Kokraimoro, Aukré, Kuben-kran-kren, and Kikretum), as well as the people of the Xingu Indian Park (XIP).

Eletronorte has tactically sought to dissociate the Altamira Complex from the word *Xingu*, which, to Brazilians, carries strong associations with indigenous peoples. Specifically, Eletronorte claims that the hydroelectrics and dams will "preserve the upper Xingu" and, thus, the people who live in the Xingu Indian Park (Nunes 1986:8). That claim, however, ignores serious implications and facts. In the first place, the indigenous peoples immediately affected by the Altamira Complex vanish from official discourse; the "Indians of the Xingu" are reduced to the peoples of the XIP, whose greater visibility in the media make them less susceptible to such rhetorical manipulation. Secondly, the fundamental "impact" that the hydroelectric system of the Xingu will have on the indigenous peoples is systematic, and cannot be reduced to the more brutal phenomena of forced transferral ("resettlement") by flooding villages and gardens. In the case of the seven tribes under consideration, besides having a large part of their territories among the "areas directly affected" (flooded), all of their lands will be included in the "areas of influence" of the Altamira Complex (Eletrobrás 1986). They will be subjected to immigrant pressures, land-grabbing by large mineral and agroindustrial projects, clandestine occupation, prospecting, lumber extracting, and, finally, to the disorderly, cosmetic, and "modernizing" effects of financial resources—the so-called indemnities—administered by FUNAI in its usual disastrous way. Above all, the entire Xingu River Basin will suffer with the final implementation of the complete system of dams and ecological, demographic, and economic modifications that are being underestimated, ignored, or hidden.

GIVEN THAT, through a typical perversion of discourse by government planners, the Indians are an "environmental problem" *for* large engineering firms, it is not surprising to find that none of the peoples mentioned were consulted about the decisions that affect their basic survival. "Consulted" would perhaps be asking too much, since no one was; the Xingu Hydroelectric Project, however, has been under study and in planning since 1975, and yet, until today, on the eve of the initiation of work on the Altamira Complex, these people have not

even been advised of their fate. Only now, in the last phase of the viability studies, when all the physical variables of the project have in fact been determined without any alternative, has Eletronorte—through a consulting firm, CNEC—turned its attention to undertaking lightning surveys and preparing "social impact" reports to comply with their legal obligations. Obligations that, in turn, have their ultimate justification in the conditions imposed by international lending institutions, which themselves are pressured by the growing world concern for the deleterious environmental effects of megaprojects in Amazonia. The "environmental consciousness" that seems to have suddenly illuminated the large concessionary firms and contractors of the energy sector is nothing less than a move in self-defense, or a counteroffensive that seeks to perfect a "managerial product"—the public image of the company (Eletrobrás 1986:5/8)—capable of guaranteeing defined objectives without any previous discussion with society as a whole or with the populations directly affected in particular. As we shall see, this "official environmentalism" cannot hide an essentially authoritarian concept of what is public policy, and is a perverse inversion of the hierarchy between technical and social reason. In a system that promotes the idea that society is at the service of the economy rather than vice-versa, indigenous peoples can only be seen as obstacles to economic development.

WE MUST REMEMBER that the Xingu Hydroelectric Project is only a part of the current strategy to exploit Amazonia, a strategy that gives priority to an "export model" (Nunes 1986:4) that excludes small property and peasant forms of occupation and favors large mining and agroindustrial complexes. The region of the middle Xingu Basin, in particular—included in the area of the Great Carajás Program—has been the object of a series of governmental measures that seek to close the frontier to peasant expansion, concentrating ownership instead in large estates and guaranteeing the operation of cattle ranching, lumbering, and mining development poles (Almeida 1986). The indigenous territories that remain are easy prey for such enemies, either as lands to be expropriated in the name of "national interest" or as a safety valve for the pressures that such a policy of "large projects" will create in the heart of the moving frontier population.

People and the Environment Or the State and Nature

In November 1986, Eletrobrás brought forth a "Master Plan for Protection and Improvement of the Environment in the Works and Services of the Electric Sector," which is the "environmental" side of the National Plan for Electrical Energy 1987/2010 concluded in May 1987, for which the Brazilian government has been negotiating voluminous foreign loans. This master plan follows directives established in the First National Development Plan of the "New Republic," and follows on a recent series of laws and resolutions that reveal the Brazilian population's heightened consciousness as to the negative effects of a myopic and authoritarian "developmentalist" policy and a greater sensibility on the part of foreign lending institutions, who have been pressured by public opinion in their countries of origin.

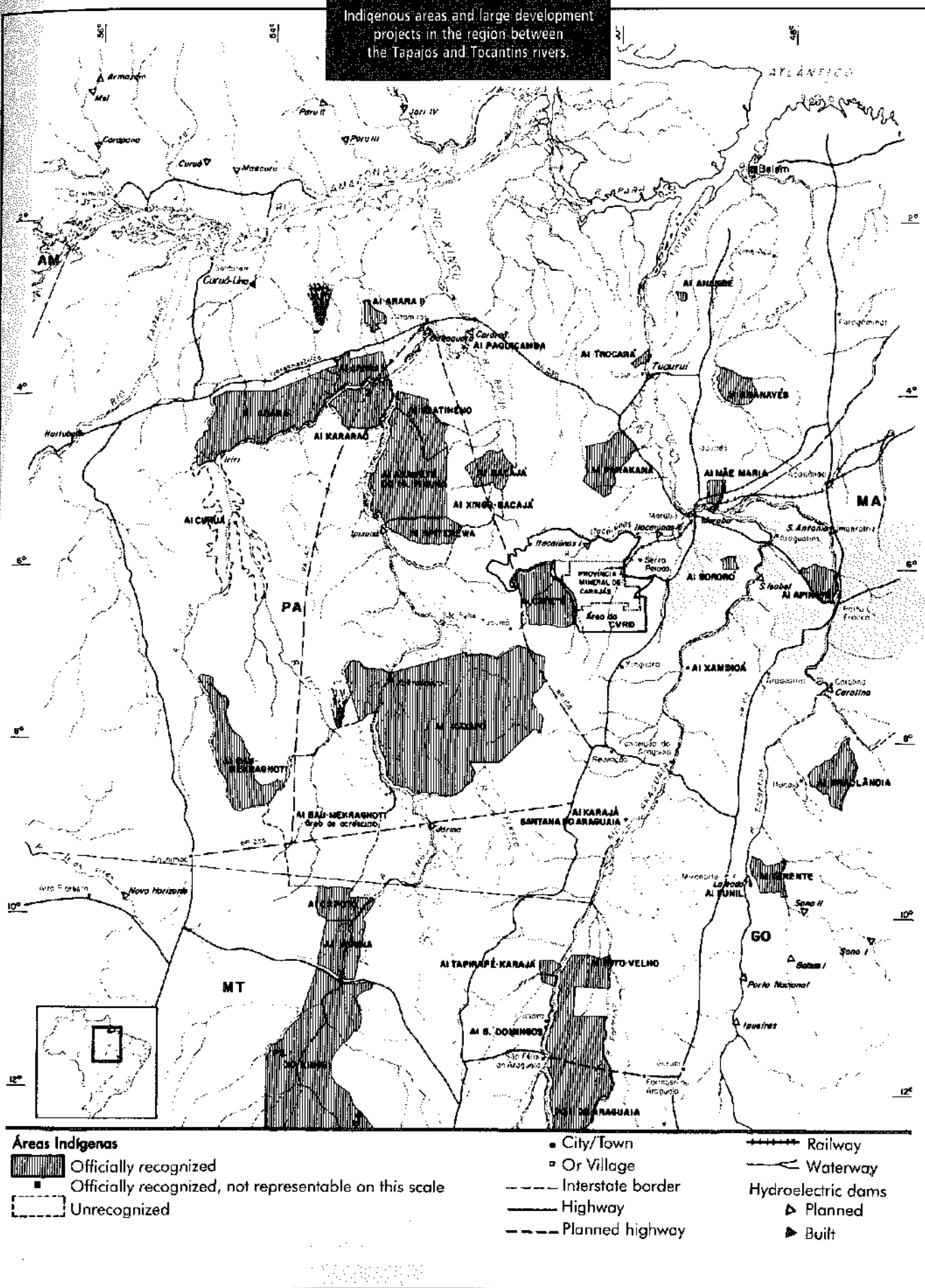
The Indians occupy a prominent position in this "environmental" document. It mentions the effects of works in operation on various indigenous territories and suggests measures for "minimizing [these] negative effects." Clearly, the "environmental" concern of the electric sector is due to an increase of the political costs of implementing its projects ("there is a process of rejection, by segments of the population, of large engineering works in general . . ." [Eletrobrás 1986:5/12]) and to the necessity for adopting an image of "environmental consciousness" in order to make the 2010 Plan politically viable (Eletrobrás 1986:5/13). The Eletrobrás document goes out of its way to stress the threats that its projects present for the indigenous societies as a way of featuring "humanist" discourses within a "managerial" mold.

Before examining Eletrobrás' diagnoses of the effects of its works on indigenous peoples and the host of measures it proposes for the future, it is useful to evaluate the conceptual framework of the Master Plan. What is Eletrobrás' concept of "environment"? What is the relationship among project, population, and environment?

THE ENGINEERING WORK PRODUCES an "environmental impact" that must be "evaluated." The expression "environmental impact," decidedly in vogue, is a translation from the original American English. It was consecrated in the rhetoric of the planners (governmental and related) by Law No. 6.938 of 31 August 1981, which established the "National Environmental Policy," and was instrumentalized through a Resolution of the National Environmental Council (Conama Res. 001/86) that requires the preparation of an "Environmental Impact Statement" (RIMA), the approval of which is the condition for the "Licensing of Environmental Modification Activities."

Although the definition of "environment" provided by Law No. 6.938 mentions a series of *natural* conditions that "cover and govern life in all its forms," Resolution 001 of Conama introduced a *new* component. Thus, the "environmental diagnosis" in a large project's area of influence should consider the physical, biological, and *socioeconomic* environments as subsets of the total environmental system.

Arq. Alicia Rolla



Source: "Brasil—Áreas Indígenas e Grandes Projetas," CIMI:, CEDI:, IBASE; GHK:, 1986.

Thus one notes a curious inversion: *the human populations (the "socioeconomic environment") affected by the engineering project have come to be a part of the environment.* It is then, for example, that the indigenous societies come to be considered an *"environmental problem."* And Eletrobrás, in a particularly clear way from the doctrinaire point of view, will establish *for whom* the environment exists and what is the place of the social sectors affected:

> The environmental system establishes the connections between the geographic unit and the electric system by means of three subsystems: the physical subsystem, the biotic subsystem, and the social, cultural, and economic subsystem. In the last mentioned, three environmental components have shown themselves to be particularly important for the planning of hydroelectric dams: the indigenous communities, the rural and urban populations, and the political leaders of the region affected by the formation of the reservoir. (Eletrobrás 1986:7/1)

The "environment," as ecologists and common sense teach us, is a notion void of significance unless *a point of view* has been previously established. An environment only exists for someone, for a determined form of life with an independently variable value—that is, every environment is an environment of a *subject.* Now, in the concept expressed in the Eletrobrás document, the "environment" is the *environment of the electric system.* The place of the environment's subject is displaced by the engineering work. The reservoir and dams are the "created environment"; the human populations affected are a component of this environment. Thus, rather than interfering in the environment *of* these populations, the work is conceived as affecting and being affected by an environment that *includes* these populations. It is not surprising, then, that we read that indigenous communities "frequently occur" in the areas of hydroelectric undertakings (Eletrobrás 1986:6/94), while the case seems to be that hydroelectric projects frequently "occur" in indigenous areas.

This is how the social sectors affected by engineering megaprojects are relegated to the *background*—the "environment"—over and against which is traced a *form*: the project. The human populations are assimilated to *nature*; the work gathers within itself the values of subject. It is thus not by chance that the planning decisions and execution of large hydroelectrics take place in the total absence of the sectors affected: one does not consult "objects."

Indeed, the very idea of "society" is reduced to environmental status—that is, naturalized—before a government that, being materialized in its engineering project, assumes the place of society. The confrontation becomes one between State and Nature, a subject that acts and an environment that reacts. People become the environment, and the project becomes the agent. Under this magic spell, societies and concrete social groups vanish; the political dimension evaporates and, in the end, only two Natures remain: the brute nature of the State, which falls on the "impacted" populations as if it were a *natural phenomenon*—the filling of a reservoir has to be experienced as inevitable, as a natural flood—and a brute state of Nature, in which "the indigenous communities, rural and urban populations, and political leaders of the region" are assimilated.

The notion of "environmental impact" thus hides, under its apparent transparency and good will, a set of ideological operations that can be summarized as follows:

(1) The project appears as absolute Cause, the conception of which is, on any inspection, removed, distant. It is transformed into a veritable transcendental instance, the unconditional condition, a given fact to which it is only possible to react, adapt, and accept as an unfathomable plan is accepted. The project is transformed into a *work of destiny.*

(2) The "impacted" human populations are conceived of as part of the environment *of the project,* which is the subject; they are subsumed as background to an extrinsic, superimposed form. They are naturalized, assimilated to natural species submitted to "negative impacts" and to palliative or "creative" measures; they are "improved" (Eletrobrás 1986:6/95, 6/98, 6/100). Thus, two ghostlike entities arise in confrontation: the State (agent and cause) and Nature (patient and reaction). The engineering of dams becomes social engineering.

(3) The political dimension intrinsic to conceiving, deciding on, and executing an engineering project is eliminated. The State, author of the work, is falsely identified with an abstract Brazilian "society," and concrete societies are put as *objects for the State.* The project, in short, is made out to be like a natural catastrophe (or, as the planners prefer to say, a miracle), an event that is nurtured and born outside the reach of the political will of society, and in particular out of reach of the "affected" social sectors.

WHAT WE SEE, THEN, is the complete perversion of a legitimate and politically fundamental discourse—the struggle for respect for the environment—through its incorporation into the ideological arsenal of the authoritarian State. The notion of "environmental impact" thus easily lends itself to the masking of political domination. The effects of works such as the Xingu Project are not simply or mainly "environmental" or "socioeconomic." They are essentially *political,* resulting from a will to dominate that denies the affected human populations their place as people with rights, as social groups endowed with a positive political existence. The political dimensions of these works only enter into consideration in government discourse once they are reduced to the conditions of products and effects that are to be implemented or avoided—once

A VALE DÁ UM PRÊMIO PARA QUEM CUIDA DA VIDA DOS OUTROS.



PRÊMIO NACIONAL DE ECOLOGIA.

O Prêmio Nacional de Ecologia, instituído pela Companhia Vale do Rio Doce (CVRD) e Fundação Roberto Marinho vai premiar aqueles que estejam da vida dos outros. Do animal, das plantas, do homem, do meio ambiente. De todos.

Em parceria com a Vale, o Prêmio Nacional de Ecologia deve atrair um bom número de inscritos. Afinal, a empresa é uma das maiores mineradoras do mundo e também uma das que mais investem em projetos ecológicos.

E quem ganha com isso é a natureza e a qualidade de vida de todos nós.

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E quem ganha com isso é a natureza e a qualidade de vida de todos nós.

E quem vai ganhar, você já deve estar imaginando. Pois ganha a primeira Polo Ecológico de Carajás, onde 97 alunos e 15 escolas indígenas são protegidos por um programa especial criado pela Vale. Lá, vivem os donos da floresta somam mais de 6 mil hectares de mata nativa.

E ganha em Linhares, no Espírito Santo, onde um Centro de Pesquisas Agrícolas, desenvolve projetos de florestamento para a floresta. Entre eles um de 20 mil hectares da Mata Atlântica são preservados.

E ganha em Tubarão

they are part of a managerial logic of the "public image" of the company or government. The political environment of the State, in short, is an apparatus for the *depoliticization of the environment*, part of an ideological offensive that seeks to facilitate politically the implantation of large projects in Amazonia. Such an offensive can be seen in the proliferation of propaganda distributed by Eletronorte, CVRD, and the like, in which the environmental and social concerns in projects such as Itaipú, Tucuruí, and the Carajás Iron Ore Project are lauded; in the institution of ecology prizes and the financing of "ecological" documentaries by these same agencies; and by efforts to spread the idea that the "small" environmental errors of the last few years will now be substituted by special consideration for the turtles, the trees, and—who knows?—even the Indians (cf. "O Brasil fica mais verde," *Veja*, 11 February 1987). If the importance of the appearance of environmental variables in government planning is undeniable—which is not due, evidently, to a sudden conversion of technocrats in the electric or mining sector, much less of large-scale businessmen, but to a series of national and international pressures—it is no less undeniable that there is a need for extreme vigilance regarding the ideological uses of this official environmentalist discourse, the cosmetic and mystifying power of which has been denounced for years by responsible scientists, watchful environmentalist agencies, and the social sectors that find themselves to be the victims of this new national miracle.

The Indians and the Environment

In the case of the indigenous societies threatened by large electrical projects, the distortions present in the State's environmentalist ideology are particularly grave. Inheritors of distinct political dynamics, submitted to an historical process of subjection and territorial confinement, possessors of complex and unique forms of articulating their relations with *their* nature (their "environment"), indigenous societies are extremely vulnerable to the process of naturalization alluded to in the previous section.

Components of the naturalized environment of the large engineering project, like most groups affected, the Indians are more generally thought of as *natural peoples*. This concept underlies two apparently opposed, even contradictory, attitudes which in the end prove themselves to be complementary and functionally connected: the naiveté of one serves the malicious ignorance of the other.

The "positive" naturalization of the Indians represents them as living in societies that show a perfect continuity with nature, "integrated" to the environment like an animal species (we leave aside here the bad biology underlying such an idea). The indigenous societies would thus be "ecological," needing to be protected and "preserved" as evidence of a socioenvironmental Golden Age (see Seeger 1982). Indigenous rights to the integrity of their territories and to social and political autonomy thus come to depend on *our* rights, our right to the contemplation of a *homo naturalis:* the Indians become part of our ideological environment, symbols stripped of a politically positive existence. They have to be "preserved" because they "preserve" nature. In this case, indigenous rights are conceived of as outside of any political dimension, despite the fact that such rights do not depend on the "ecological value" of these people but on their *condition as human groups socially and culturally differentiated within the nation.*

A sinister counterpart to this incapacity to think of indigenous societies in their quality of *social subject* is "negative" naturalization, which is the official ideology of the State. Following an evolutionist reasoning, this ideology considers Indians as backward representatives of the human species, as a people that is *still* not fully social.

By assuming that indigenous societies are imperfect samples—and statistically insignificant—of an abstract Human Race, such ideology refuses to consider the integrally social aspect of these people's condition, for it is incapable of accounting for cultural differences unless they are under an objectifying, asymmetric, and naturalizing form. This ideology imagines that these societies should go through an inevitable process of change (preserving, nevertheless, some "typical traits" for the national folkloric heritage). Thus, the consequences of building hydroelectrics, for example, are seen as only *one more factor* that these people confront within an inexorable process of "transition." It is the "transition" that now appears as *natural* (inexorable). And, because of that, the indigenous peoples can and should be supervised by the State: territorially dislocated, culturally managed, socially changed.

Doubly and alternately depoliticized (because they are desocialized) by these complementary naturalizations, indigenous societies are inevitably seen as *passive* variables, object-populations for external environmental decisions. Their "protection" or "integration"—measures that do not lack in consultancies for those interested, and so do not require confrontation of political wills—has as its object, in the final analysis, less these societies than the management of the ideological environment of the surrounding society. Environmental component or environmental problem, which must be protected (because it is rigidly "adapted") or that can be indefinitely "adaptable" (being malleable, removable, indemnifiable, and modernizable), indigenous societies are inevitably understood *outside* of the element that defines their relations with the State: the element of domination.

What does this discourse hide, or rather manifest in its ambiguity? On defining the relationship between the State and indigenous peoples as being one of "protection," this discourse does away with violence and ambivalence. If, on the one hand, the "Indian" has a substantial symbolic value in the ideology of nationality, on the other hand, the

Indian was always considered as an impediment to progress and development, the two main goals of the Brazilian nation (Durham 1983:14). This ambiguity marks the relation between the State and indigenous societies, one that, since the beginning, has been characterized by protective legislation and at the same time a systematic disrespect for such formal rights. On the other hand, the Brazilian government holds as an article of faith the theory of integration—upon which it establishes its Indian policy even to the present day—which sustains the *physical* preservation of the Indians but justifies their destruction inasmuch as they live in *specific societies*, in the name of progress (Durham 1983). The "protection" that is offered to indigenous peoples, indeed, presupposes their "cultural backwardness" and seeks only to halt their immediate physical disappearance, awaiting their integration (dissolution as differentiated ethnic groups) into "Brazilian society."

Thus the ideological background on which the electric sector's policy of "environmental protection" is built is nothing new; it is the same one that has been the basis for official Indian policy since the beginning of the century. This similarity is not surprising, since such policies share common objectives: both seek, in the last analysis, to liberate indigenous territories for the advance of capital.

This poorly disguised aim is frequently justified by state planners on the grounds that indigenous peoples are quantitatively unimportant vis-à-vis those "beneficiaries" of the megaprojects that have, over the last few years, characterized the occupation of Amazonia. Such an argument is an obtuse and biased fallacy. A version of the persistent "statistical mentality" so often found in confronting the indigenous question (Cardoso de Oliveira 1978:70–71), it finds support in the abstraction alluded to above: indigenous *societies* are reduced to their *demographic component*, and this is taken as a neutral (and not too brilliant) sample of a generic humanity. Similarly, indigenous territories are reduced to neutral, equivalent geometric spaces, *the only measure of which is the square measure.* Now the rights of the Indians derive, inter alia, from their *social* condition as an *ethnic minority*, and the violence against such rights cannot be quantified. Indigenous lands are not measured in terms of kilometers expropriated or flooded—even if many square kilometers of indigenous lands *are* flooded and expropriated—but in terms of their political and symbolic uses as supports for the sociocultural identity of indigenous minorities. The statistical argument is the numerical version of the Reason of State, which depoliticizes society, despotically assuming the value of universal Subject. Before the authoritarian State, *any number* of people is a minority: its regime is one of distributive injustice.

Let us now examine what Eletrobrás asserts it has "done" with the indigenous societies that "occur" in these projects, and what it says it will do, in particular with the peoples threatened by the Xingu Hydroelectric Project.

The Indigenous Peoples in Eletrobrás' Master Plan

Eletrobrás' master plan establishes the "capacity for adaptation of human cultures and respect for the cultural values of indigenous societies" as one of its "key conditions" (Eletrobrás 1986:2/5). It recalls "indigenous reserves" as particular cases within that general objective of "integrated regional development," the more "useful" name ("administratively") for the notion of "protection and improvement of the environment" (Eletrobrás 1986: 5/4, 5/5).

Populations Affected by PRS Hydroelectrics

Project	Location	Total energy (mW)	Human population		
			Urban	Rural	Indigenous
ELETRONORTE					
Tucuruí	Tocantins	3,960	–	–	–
Balbina	Uatumã	250	–	250	374
C. da Porteira	Trombetas	750	–	–	[1]
Samuel	Jamari	216	–	1,800[2]	[1]
Ávila	Ávila	28	–	100[2]	–
Jiparaná	Jiparaná	568	–	2,670	472
Paredão/Mucajaí	Mucajaí	27	–	–	[1]
Manso	Manso	210	–	[1]	–
CHESF					
Itaparica	S. Francisco	2,500	12,630	26,610	669
Xingó	S. Francisco	5,000	150[2]	–	–
Pedra do Cavalo	Paraguaçu	600	–	4,400[2]	–
FURNAS					
Serra da Mesa	Tocantins	1,200	4,239	2,500[2]	[1]
Cana Brava	Tocantins	460	–	500[2]	[1]
Corumbá I	Corumbá	350	[1]	[1]	–
CEMIG					
Nova Ponte	Araguari	510	2,941	[1]	–
Miranda	Araguari	390	[1]	[1]	–
Capim Branco	Araguari	600	–	[1]	–
Igarapava	Grande	200	–	[1]	–
CESP					
Rosana	Paranapanema	320	–	700[2]	–
Três Irmãos	Tietê	640	150[2]	1,450[2]	–
Taquaruçu	Paranapanema	500	–	200[2]	–
Porta Primavera	Paraná	1,800	–	7,000[2]	–
ELETROSUL					
Ita	Uruguai	1,620	1,450[2]	5,700[2]	–
Machadinho	Uruguai	1,200	500[2]	14,500[2]	[1]
COPEL					
Segredo	Iguaçu	1,260	–	1,200[2]	–
CEEE-RS					
Dona Francisca	Jacuí	124	–	1,065	–
BINATIONAL PROJECTS					
Itaipú	Paraná	12,600	–	–	–
Garabi	Uruguai	1,800	1,440[3]	5,360[3]	–

[1]Not Evaluated
[2]Approximate Number
[3]Only on Brazilian side

Source: Eletrobrás 1986

It is in the chapter on the "Program for Actions," where the document reviews the measures for environmental protection of the works in course (those included in the Energy Sector Rehabilitation Plan—PRS), that one can evaluate the nature and verisimilitude of the measures referring to the indigenous peoples who "occur" in the areas of the dams of the PRS.

PRS: The Cases of the Tucuruí and Balbina Hydroelectrics

The hydroelectrics of Tucuruí and Balbina, both the responsibility of Eletronorte, are well-known cases. Through these examples, we will seek to characterize, on the one hand, the real activities of Eletronorte—which is now developing the Xingu Hydroelectric Project—on the indigenous question, contrasting them with the version presented in the master plan; and, on the other, the actions of FUNAI, the agency which, by law, is supposed to defend the interests and rights of the indigenous peoples affected by such undertakings.

The Tucuruí dam unfortunately is known for its effect on peasant populations and several indigenous groups. Nevertheless, a look at the table presented in the master plan (and reproduced here) does not reveal any estimate of the populations affected. To the unschooled reader, the table gives the false impression that no "human populations" were affected. This is clarified further on (see pp. 6/9 and 6/11) when the plan evaluates the measures for environmental protection taken in this case.

The item "Description of the Principal Environmental Effects" makes no mention whatsoever of indigenous groups,[1] and the document only makes reference to them in the item "Measures for Protection of the Environment," which devotes the following to the question:

> The Parakanã Indians, who were relocated from their village, have already had their reserve demarcated and the invaders removed from it. Currently, a review process of the agreement made is being initiated to compensate them for the damages caused by the partial flooding of their reserve. The review of this agreement with ELETRONORTE is being done with the participation of the indigenous community under the guidance of FUNAI. (Eletrobrás 1986:6/11)

Observations about the effects of the Tucuruí dam on the indigenous peoples are summarized in this single paragraph. The master plan omits, however, the grave implications of this undertaking for the indigenous peoples of the region. It does not make such consequences explicit in its description of the environmental effects, nor does it mention the repercussions of this hydroelectric for the Gavião of the Montanha, whose territory was directly occupied by the dam. In the same way, the document makes no evaluation whatsoever of the "indirect" effects on the Asuriní Indians of the Tocantins, who live downriver from the dam on the Trocará Reserve, located only 24 km from the city of Tucuruí.

The territory of the Gavião of the Montanha, which was legally granted to them in 1945 through a state decree, was located on the right bank of the Tocantins River, in front of the city of Tucuruí. Between 60 and 70 percent of the indigenous territory was invaded by the hydroelectric. During its construction, trucks and tractors circulated daily through the reserve, where roads were opened by contracting firms. The area was deforested and sand was taken out from its interior for construction. Eletronorte built three large, high-tension transmission towers exactly in the place where, up to the beginning of 1977, the old Gavião village was located, and the construction made the region uninhabitable. The group saw itself forced to abandon its territory.

Over several years, Eletronorte refused to recognize the territory of the Montanha as an indigenous area, despite the documentation available. At the time of transferral, in 1977, the Gavião were indemnified only for the improvements they had done in the area.[2] Five years later, a Gavião family returned to the area in an attempt to reoccupy it and force Eletronorte to reimburse the indigenous community for the use of its lands. In the beginning of January 1984, after seven years of negotiation, the Gavião succeeded in getting an indemnification from Eletronorte of 50 million cruzeiros. They were nevertheless obliged to abandon their territory.

The Gavião of the Montanha were then transferred to the Mãe Maria Reserve, which was inhabited by another Gavião group. Located on the divide between the municipalities of Marabá and São João do Araguaia, this reserve suffered the "indirect" effects of the Tucuruí dam: the area was cut by a corridor 150 meters wide and 19 km long, where Eletronorte put a high-tension transmission line, auxiliary of Tucuruí (CEDI 1985b).

As in the other case, then, the Indians were not consulted or even officially informed of Eletronorte's plans. The Gavião of Mãe Maria became aware of the building of this line in September 1976, when they surprised surveyors working on defining the tracing of the transmission line within their territory. On that occasion the

[1] In the same way, there is no mention of the peasant population affected. The text merely says: "It is noted that there are several social questions resulting from the invasion of populations in the area of protection of the reservoir and the arrival of small farmers to the locale, after the filling up of the reservoir" (Eletrobrás 1986: 6/9–6/10). No mention is made of the populations that inhabited the region *before* building of the hydroelectric and had their lands flooded.

[2] This transaction occurred with the underwriting of FUNAI, which, as the purchase-and-sale signed between the Gavião representative, Paiaré, and Eletronorte, attests, "assisted" the Indians in the act of sale.

technicians alleged that they did not know of the existence of an indigenous territory in that locale—even though the Mãe Maria Reserve had been a legal entity since 1943.

On becoming aware of this project, the Indians immediately suggested changing the tracing. This corridor would cross right through the Gavião village, destroying their gardens and their principal castanha trees and frightening away game animals (Ferraz, in CEDI 1985b:71). This proposal, however, was not honored. What the Gavião succeeded in getting, after four years of hard negotiation, was an indemnification of 40 million cruzeiros paid by Eletronorte in 1980 (CEDI 1985b).[3]

But let us return now to the Parakanã—briefly mentioned in the master plan—and see how Eletronorte and FUNAI have dealt with questions regarding the transferral and legalization of a "new" territory for the Parakanã.

The different Parakanã groups contacted in the 1970s and 1980s today live in three village groupings: Paranatí, Marudjewara and Bom Jardim (CEDI 1985b). The first two groups had their territories partially flooded by the Tucuruí reservoir, and the Parakanã of Bom Jardim find themselves threatened by the Altamira Hydroelectric Complex.

The Tucuruí reservoir flooded 2,430 km², part of which (about 36 percent) belonged to the Parakanã people (Magalhães 1987). The flooding of this area meant the transferral of two of their villages. This was not the first relocation to which the Parakanã have been submitted: between 1971 and 1977, they were transferred *five times* by FUNAI officials (CEDI 1985b).

The first field works for the building of the Tucuruí dam were initiated in 1975. Three years later, the "Parakanã Project" was created to establish a new locale for settling the Indians and a plan for transferral. Instituted through an agreement between FUNAI and Eletronorte, this project was, however, deactivated in 1979—two years before the first relocation, done in August 1981. On this occasion, tired of FUNAI's lack of definition in undertaking the transferral, one of the Parakanã groups decided to do it on its own account. In the following year, the other Parakanã were taken by helicopter to a new locale, known as Marudjewara, where they have lived until today (Magalhães 1982). These transferrals were done without observing the minimum health care standards: the new villages were not sprayed with DDT, a basic sanitary measure since malaria is the main cause of mortality among the Parakanã (CEDI 1985b:41). Similarly, FUNAI did not exercise any control over the health conditions of those who carried out the construction work for the headquarters of the new assistance posts in the area (Magalhães 1982:41).

FUNAI's actions in regularizing Parakanã territory were equally "ineffective" and negligent. Even during the term of the FUNAI/Eletronorte contract, the anthropologist who coordinated the "Parakanã Project" presented a proposal for the new area, which established a reserve of 319,000 hectares for the two groups along with a "fisheries area" between the Tucuruí reservoir and the reserve itself (Magalhães 1982). In December 1980, FUNAI elaborated another proposal that diminished the area selected in 1978 to 163,000 hectares (CEDI 1985b:40).

In the following year, FUNAI made another attack on Parakanã territory: the delegate of FUNAI's 2nd Regional Delegacy authorized part of the unflooded lands of the Tucuruí Reserve to be opened for settlement by squatters. To justify such a measure, the FUNAI representative alleged that the Indians—already transferred to the new village—would not return to the locale. It is worth noting that this decision was made in the circuit of the 2nd Regional Delegacy, an administrative unit that had no legal authority whatsoever to make such a decision (CEDI 1985b:44).

With the lands now liberated, about 600 colonists settled in the area. The Parakanã, who were accustomed to returning regularly to the site of their old village—in contrast with what the FUNAI delegate had asserted—clashed with the colonists. The threat of a conflict of greater proportions pressured the government to approve, in March 1985, the creation of the Parakanã Indian Reserve, according to the proposal presented in 1978. The so-called "fisheries area," however, was excluded from the reserve. According to the presidential decree that created the Parakanã Indian Reserve, the Indians were supposed to be indemnified for the loss of this territory (CEDI 1985b: 44–45). In December 1985, a commission was created by the president of FUNAI to determine the value of this indemnification; it is to this reimbursement that the master plan refers in the paragraph that we transcribed. As of 1987, however—three years after the inauguration of the Tucuruí dam—the Parakanã had still not received this indemnification (Magalhães 1987).

[3]It is worth noting that the indigenous territory of Mãe Maria was also cut through by the Carajás railway (built by the CVRD for transporting iron ore—the initial phase of the Great Carajás Program), which passes about 10 km from the present Gavião village (CEDI 1985b:96). The reserve is also cut by Highway BR-322 and is invaded by squatters, a number of whom were settled within the indigenous area by GETAT. At the western limit of the territory is another invasion, by an old political boss of Marabá (Ferraz 1985a, 1985b). Thus, as observed in the introduction of the *Levantamento dos Povos Indígenas no Brasil* (CEDI 1985b:v), approximately 72,000 hectares of the Gavião's land of Mãe Maria have been occupied by GETAT, CVRD, and Eletronorte (as lots for colonists, railway, transmission lines, and roads)—this without calculating the complete loss of the territory of the Montanha. The prediction is that, in the region of Pará, alone about 480,000 hectares of indigenous lands will be occupied by the turn of the century by state infrastructural projects (CEDI 1985b:v).

The Waimiri-Atroari and the Balbina Dam

The Balbina dam is located in the state of Amazonas, approximately 146 km northeast of Manaus. The dam should go into operation in 1988, generating 250 mW of electricity for the city of Manaus. The work is in the phase of execution, and the beginning of the damming of the Uatumã River for the formation of the reservoir is scheduled for October 1987. The amount of flooding calculated for the first six months is about 46 meters; after that, it will reach 50 meters, creating a lake of 2,360 km², which will directly affect the Waimiri-Atroari territory.

The region of the Balbina and Morena rapids, where the hydroelectric is being installed, was occupied until the 1970s by the Waimiri-Atroari Indians. They had to abandon the area because of pressures from invaders occupying the area of the headwaters of the Santo Antonio and Abonari rivers, which also form part of the traditional territory of these people (Marewa 1983). The reservoir of the Balbina dam will flood about 311 km² of the indigenous area, affecting two villages (Taquari and Tapupunã) and three FUNAI assistance posts (Alcântara 1986; Carvalho 1986; Enge-Rio 1986).

In the item "Description of the Principal Environmental Effects," Eletrobrás evaluates these consequences thus:

> The area of the reservoir is covered by tropical forest with great faunal diversity and low human population density, being utilized as an area of indigenous perambulation and not having any urban centers. . . .
>
> The area of the Waimiri-Atroari Indian Reserve is 18,981 km². The total number of Indians on this reserve is 374, of whom 223 are Waimiri and 151 Atroari. With the reservoir on the 50 m elevation, and considering a fill with return time of 1,000 years, the stagnant water of the reservoir is raised to the 53 m elevation. In this extreme case, the reservoir should flood an area of 311 km² of the indigenous reserve. The area of the reserve that will be affected by the reservoir has already been demarcated and is currently being studied in terms of compensation measures. Initially, with the approval of FUNAI, contact will be promoted between the Waimiri and Atroari and the Parakanã of Tucuruí. The purpose of this contact is to have these Indians get a notion of what the construction of a hydroelectric represents and to absorb the experience of the Parakanã. The ultimate goal is for the indigenous communities of Balbina to seek the most appropriate solution ahead of time. (Eletrobrás 1986:6/12–6/13)

WHAT IS NOTABLE right from the beginning is that the same master plan that precisely quantifies the indigenous area to be flooded by the reservoir omits the fact that there are two villages within the 311 km² to be flooded. One-third of the present Waimiri-Atroari population will have to be relocated as a result of the lake formed by the Balbina dam (see "Report on the Possible Interference of the Damming of the Uatumã River–Balbina Hydroelectric in the Waimiri-Atroari Indian Area," a 1986 report by José Porfírio de Carvalho, indigenist consultant for Eletronorte). It is indeed odd that such important data—data that were known to the company—are left out of the master plan.

Through this same report,[4] Eletronorte was aware that the Waimiri-Atroari territory was not demarcated, as the master plan asserts. The land titling of the area only took place in July 1987 through Presidential Decree No. 94.606,[5] which created the Waimiri-Atroari Indian Reserve with an area of 2,440,000 hectares. According to this decree, however, "excluded from the area . . . are the flood surface from the Balbina dam, according to Decree No. 85.898 of 1981, and the area of domain of BR-174," which crosses Waimiri-Atroari territory (Article 1, No. 1, Presidential Decree No. 94.606/87).

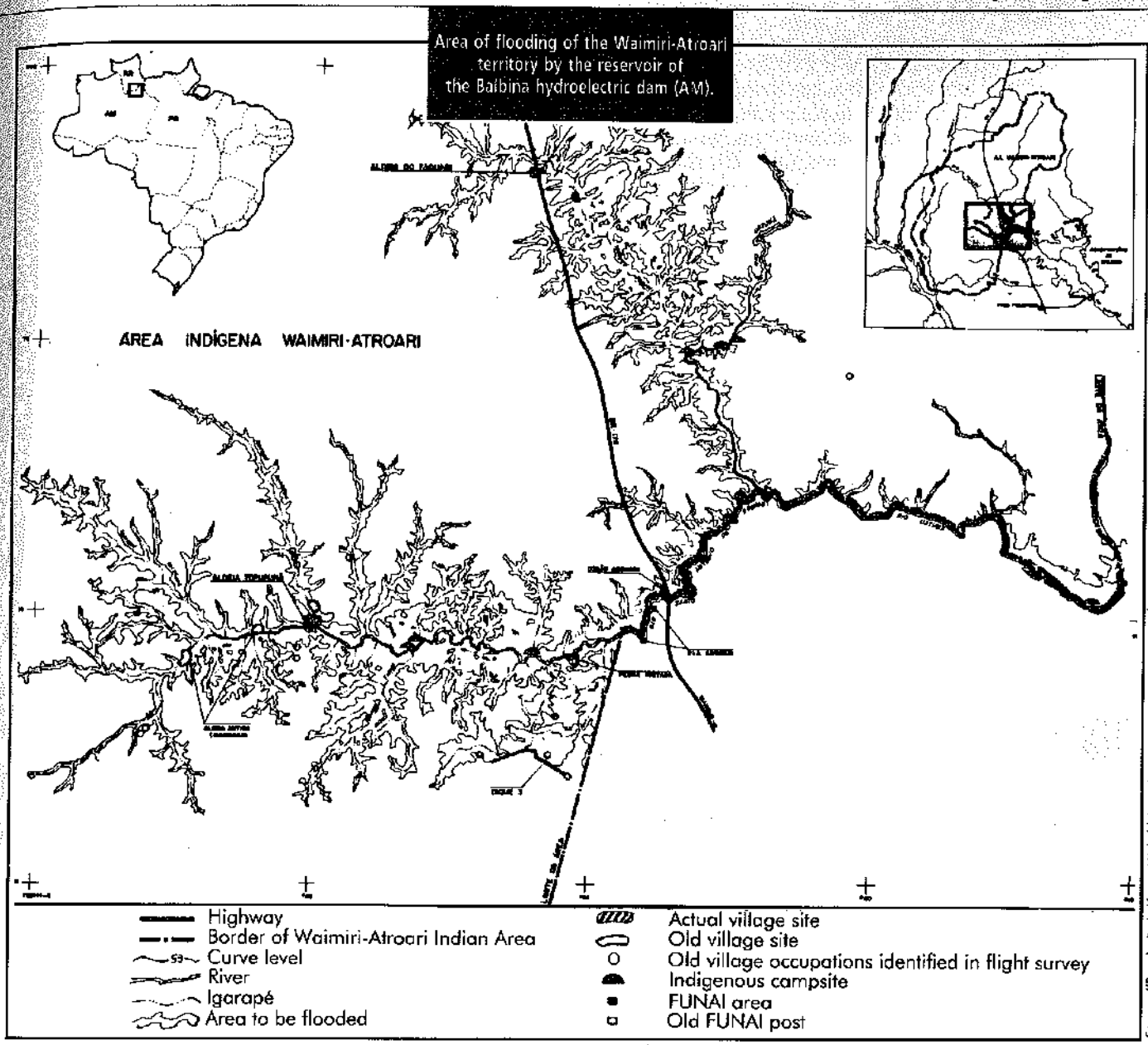
The loss of the area flooded by the Balbina dam will be "compensated" through the "Waimiri-Atroari Program." Created through an agreement between FUNAI and Eletronorte, this program includes a plan for assistance to the indigenous community, with resources allocated by Eletronorte. The compensatory character of this program that provides for assistance—to which the Indians would have a right *anyway*, by law—seems very dubious, since projects of this nature have, over the last few years, been the target of severe criticism as much in relation to their conception as to the tutelary agency's capacity to administer the necessary resources (see below: the evaluation of the Carajás and Polonoroeste support programs).

THE MASTER PLAN SAYS that a meeting will be promoted between the Waimiri-Atroari and Parakanã (this took place in 1987) so that the Waimiri-Atroari could "look for the most appropriate solution ahead

[4] And also one produced by Enge-Rio (1986), a consulting firm contracted by Eletronorte to do the impact evaluation studies for the Balbina dam.

[5] In November 1986, when the master plan was produced, the Waimiri-Atroari area was in the stage of being "interdicted." The process of regularizing this territory, however, has been very complicated. In 1971, the Waimiri-Atroari Indian Reserve was created, for the first time, with an area of 1,611,900 hectares—a reduction of 75 percent of the traditional territory of these people (MARWA 1983). Several villages remained outside the limits established on this occasion. These problems were partially settled by two presidential decrees, of 1974 and 1975, and by a FUNAI decree that interdicted three more areas of 704,900 hectares.

In 1981, however, a presidential decree canceled the reserve, altering its juridical status to an area "temporarily interdicted for the purpose of attraction and pacification." This same decree took out 526,000 hectares from the reserve, which came to be occupied by the Taboca Mining Company (CEDI 1984).



Area of flooding of the Waimiri-Atroari territory by the reservoir of the Balbina hydroelectric dam (AM).

Art: Alicia Rolla

Source: "População Indígena Waimiri-Atroari—Ocupação e Utilização do Área," Eletronorte, doc. no. BAL-50-4009, 19 November 1986

of time." This statement is a bit cynical: what kind of "antecedence" is it that gives the Indians a few months to look for "appropriate solutions"? On the other hand, it doesn't seem that many solutions will be found in this case, for the work is already practically finished—the meeting took place less than a year from the beginning of the damming of the river. Once again, the search for alternative solutions is being confused with palliative and tardy measures, cosmetic in nature, taken when all the decisions on the works have already been made. Thus, one creates a false idea of "participation."

The same kind of criticism could be made with regard to the "impact evaluations" done in the Waimiri-Atroari area a year before the flooding. Prepared on the basis of a field trip that took less than a month and was limited only to the area to be flooded (the so-called "directly affected" area), these evaluations (Alcântara 1986; Carvalho 1986; Enge-Rio 1986) presented extensive lists of improvements—houses, chicken coops, farinha houses; banana, papaya, and other crops; FUNAI installations—that will be lost with the flooding. These lists constitute a clear example of that "quantifying" tendency which pretends to evaluate the losses suffered by indigenous peoples by counting the square kilometers and "banana trees" flooded by the reservoir. None of the evaluations mentions the constitutional right (Article 198) of the indigenous peoples to the lands they inhabit, nor do any offer concrete proposals for the transferral of the villages. Until April 1987—six months before the damming of the river—*there was no plan for transferral* of the groups whose villages were to be flooded. What is known, informally, is that FUNAI intends simply to relocate the two groups to the interior of the reserve, ignoring the fact that the territory is occupied by about eight other villages and is thus not empty nor ready to receive new villages. These transferrals will have as many political consequences in the relationships among the different local groups as they will economic ones, since they

will imply a reduction of the territory utilized by each village for subsistence—a territory, moreover, that is already much smaller than that traditionally utilized by the group. In the two cases we have analyzed, hydroelectric projects crown the process of reducing indigenous lands, bringing with them significant territorial losses and thus threatening the sociopolitical autonomy of these indigenous people—damages that, we repeat, *are not* indemnifiable by money or support programs.

Plan 2010's Program for Protecting the Environment

In Plan 2010, which relegates the Xingu Hydroelectric Project to the status of a major project, Eletrobrás contemplates one of its objectives as the following:

> the integral development of large regions of Amazonia, utilizing hydroelectric projects as vectors, but always considered in terms of a multi-use perspective for water. Associated with this development, agrarian reform programs, territorial occupation, transport, and communications infrastructure, population settlement, *protection of the environment and of indigenous areas and reserves* [emphasis added] could be established. For its size, the use of the Xingu River will possibly constitute the major national project of the end of this century and the beginning of the next. (Eletrobrás 1986:6-90/6-91)

Among the recommended studies on specific "environmental" aspects for the plan, the main question is the "Regional Insertion of Electric Sector Enterprises, in View of the Presence of Indigenous Communities."

WHAT CAN BE SAID about the electric sector's directives as outlined in the master plan for the indigenous peoples of the Xingu Project? A superficial reading quickly leads us to admit that certain questions and necessities, raised by sectors of opinion concerned with the threats to the rights of the Indians, find an echo in government discourse—in the plan of the master plans, at least. But we soon see that this echo is distorted by that naturalization of the Indian alluded to repeatedly above. The document assumes a humanistic posture—preserving the "cultural values" of the Indians—but not before underscoring a comfortable "advantage of thousands of years" that we possess over them, without mentioning, among such values, and peculiarities such as a certain "fear of the power of nature" (which, if it didn't exist, will certainly arise as the reservoir rises). The painful coexistence of this humanistic discourse with a technocratic and ideological substrate, ethnocentric and arrogant, makes the Eletrobrás document an ambiguous piece, propelled by objectives that we suspect are more scenic (or cynic) than "operational." In particular, a comparison of the list of measures proposed and the actual practice of the consulting, building, and contracting firms that do or will operate in the Xingu (the version given by Eletrobrás of what is *already* happening in other areas attacked by hydroelectrics is a significant example) is not optimistic.

A cautionary approach to the "operational procedures" is due not only to discredit for what comes to be really "operationalized," but also to profound disagreement over the presuppositions on which these procedures are based. The authors of the master plan believe in the existence of a process of "sociocultural transition" through which indigenous peoples pass. At no time in the text, however, do they clearly define this transition. At times they confuse it with the evolution of humanity: "primitive" peoples are thus progressing in the direction of a developed society "which possesses technological and administrative knowledge with hundreds or thousands of years of advantage" (Eletrobrás 1986:6/96). At other times, such change figures in the confrontation with the "irreversible and accelerated process of regional occupation," or even in the moment of the building of a hydroelectric in indigenous territory and of an eventual transferral. The question of "transition" is presented in the item "Regional Insertion of Electric Sector Enterprises, in View of the Presence of Indigenous Communities" as a fundamental factor of the problem. The document alerts us to the "long-term need for sociocultural transition, when this is desired by the indigenous groups or *becomes inevitable*" [emphasis added] (Eletrobrás 1986:6/95). It even asserts that "although the societies may be dynamic, it is indispensable to count on the time factor, so that the transition may be promoted" (Eletrobrás 1986:6/96). Such concerns, however, do not mask the fact that the "sociocultural transition," lamented but nonetheless decreed by the plan's authors, is nothing more than the *disappearance of the indigenous groups as distinct peoples.* Thus, the electric sector's policy in relation to the indigenous societies is *based on the presupposition that in the future, they will no longer exist.*[6]

[6]The Eletrobrás document utilizes an equivocal and antiquated concept of culture, and consequently introduces bizarre ideas on the dynamics of human cultures. Mixing an eminently substantive, folkoric, and reifying concept of culture, the intellectuals of the master plan seem to believe that, notwithstanding the rhetorical reference to the "dynamicism" of "societies," indigenous cultures are objects (more or less "pure," etc.), substances whose contact with other, more powerful substances necessarily produces mixing or dissolution. It thus oscillates between a static and vaguely romantic notion of indigenous cultures and a *Realpolitik* of "inevitable sociocultural transition," which presupposes between the lines, or anticipates as a result, the disappearance of these sociocultural formations.

A culture is a system of responses to questions that history proposes to a human society. If the questions change, the responses will change, without that necessarily implying that the society is disorganized. Necessarily, we say: for, some questions are so absurd that there is no possible response. It is questions like these that Eletronorte finds "natural and inexorable" that are being put to the indigenous groups of the Xingu—and

THE MASTER PLAN OUTLINES a list of "traditional values" that can be "ridiculed and destroyed" as a result of a "deficient humanistic culture," putting on the same list "typical music," religion, eating habits, "institutional family organization," collective land ownership, and the so-called fear of the power of nature (Eletrobrás 1986:6/96). Further on, it calls attention to the "strong tensions and disastrous social disorganization" to which indigenous communities in the process of "transition" are subjected:

> In fact, the decrease of rebel leaders is inevitably followed by the emergence of illegitimate chiefs, emotional disorders, the loss of a social identity of self-esteem, the generalization of depraved behavior, and alcoholism. Problems of public health decimate indigenous populations, with a worsening of the existing lack of immunization programs, before the contact with diseases which were foreign to them.
>
> In parallel fashion, since there is no written memory, a valuable stock of knowledge accumulated by indigenous tribes is lost. Mainly with respect to the thousands of native biological species, present in their ecosystem and with which they have been living for centuries. (Eletrobrás 1986:6/96, 6/97)

Strangely, the plan makes no mention whatsoever, in this dark panorama, of the very first and most direct damage: the loss of significant portions of indigenous territories which are essential for the survival of these people as much in physical as in sociocultural terms. *If anything demands being preserved, it is the integrity of these territories.* Now, in relation to this question, the plan suggests the need to offer to the Indians a *"geographical space"* during the *time necessary* for the "transition." But this is only a preface to the real point: the effective existence of the infamous Article 20 of Law 6001/1973 (the "Statute of the Indian"), which authorizes the relocation of indigenous populations "for the undertaking of public works that are of interest to national development." This is the door through which Eletrobrás enters—not without a previous ritual lamentation—into indigenous lands. Reassured by the legal authorization of the *forced transferral* of populations—and leaving aside the question of knowing *who* decides *which* public works are of interest to *what* types of national development—Eletrobrás then takes on the task of minimizing negative effects, ensuring a peaceful transition within a "geographical space" (and a "chronometric time"?) conceived as *transitory*: a restricted and abstract space-time that seeks to "shelter" the indigenous group until its inexorable sociocultural assimilation (*when it will then no longer need any space!*). The persistence of an integrationist ideology couldn't be more clear; it is an ideology that seeks the destruction of the indigenous population's conditions of existence—i.e., ethnocide.

Later on, the buck is passed to FUNAI. This agency, "authorized to tutor the Indians," should "guarantee their quality of life." No comment, naturally, is made on FUNAI's "credentials"—among which we could point out their proverbial capacity to dissipate the voluminous sums of money for "protection and indemnification" designated to the agency through the terms of agreements with BIRD (the World Bank) and like-minded institutions.

Then comes the problem of "regularizing indigenous territories," defined as a "managerial result of highest priority." This result should be prepared by an "expeditious field reconnaissance, to ascertain the real existence of the indigenous communities considered." Perhaps due to the transitory nature of the geographical space set aside for the Indians, this check can be "expeditious"—a word which, in the dictionary, means "rapid," "diligent," but in FUNAI's case should be translated as "superficial," "careless." Evaluating the indigenous peoples' *real conditions of existence* is, in turn, replaced by the ontological concern for the question of the *real existence* of these people—a recurrent concern for the Brazilian government, which continues to nurture the hope that the Indians are imaginary.

AS FAR AS THE DEMARCATION of lands,[7] Eletrobrás insists that it be done as quickly as possible, before the beginning of the construction of the hydroelectric plants, the borders being settled (with the participation of the Indians "duly assisted") before the viability studies have been finished.

It is appropriate to ask here whether *in the case of the Xingu Complex, which is in the final phase of its viability studies, such investigations have been made*; whether the Indians, *previously informed* of their fate, have already defined the territories that they want *demarcated*, the areas that

then, all that's left is the manner of "transition," which, transforming (the "time" factor being observed) the Indians into whites, preserves a folkloric base for cultural traditions of ornamental value.

In any living culture, the *tradition* is the support for *invention* and this is the inalienable mark of the creative autonomy of a society. The "transition" induced under the hypocritical mask of inexorability is, by the conditions contemplated in the Eletronorte document, the pseudosociological name for ethnocide.

Everything happens, then, as if the hydroelectric anthropology of the Brazilian State believed at the same time in the fossil objectivity of indigenous cultures and in the infinite malleability of the Indians as individuals, beings abstractly conceived as separate from the social conditions of existence. But this, after all, is the theory of integration and assimilation: cultures are folklorized, humans are civilized—societies are destroyed.

[7] The demarcation process is left to the Brazilian State, and seeks to promote the administrative recognition of the Indians' lands, reserving for them the permanent possession and usufruct of the wealth existing on them, as the law guarantees (Article 4, No. 4 and Article 198 of the Federal Constitution and Law 6001/73). The right of the Indians to their lands is independent of demarcation, but this administrative recognition constitutes one more guarantee in securing their permanent possession of their territories (Oliveira Filho 1987:iv–v).

should be *proposed* to them as compensation; and if they were *"duly* assisted." Or is all of this being done in haste in order to fulfill legal requirements, with the habitual interested complacency of FUNAI?

The "criteria for indemnification," finally, are also FUNAI's responsibility. In relation to the so-called indemnifications, two observations must be made. In the first place, it has to be left clear that such losses affect the physical survival of the indigenous peoples in an *irreparable* way, as well as their sociocultural autonomy, and that this cannot be quantified in terms of square kilometers expropriated. The value of indigenous lands for the peoples that inhabit them cannot be measured in financial terms. The concept of land as merchandise—an alienable object of individual transactions—has never existed among any known indigenous societies. The lands occupied by the Indians are not merely a means of production, a place for agricultural labor or soil where natural resources are located, but *territories* with wider socio-politico-cosmological dimensions (Seeger and Viveiros de Castro 1979:104). One thus sees how myopic or hypocritical the proposals for "agricultural facilities to compensate lands" or for "boats adequate for crossing the dam lakes" are as compensatory benefits (Eletrobrás 1986:6/105); they will hardly contribute to "improving living conditions" of indigenous peoples, as the master plan intends (Eletrobrás 1986:6/105).

It is necessary to maintain a critical position on this policy of monetarizing symbolic and political values, which is today taking shape in the government and, indeed, hardly hides the fact that the indigenous peoples do not have a voice in governmental decisions. *To discuss indemnifications is to yield to the policy of consummated facts.* In the item on "other cooperative programs," the master plan calls attention to the possibility of evaluating *alternatives* (that is, "semiconsummated" facts) for the location of hydroelectric plants and reservoirs in view of the presence of indigenous peoples in the region. Unfortunately, this suggestion does not seem to have been taken in the case of the Altamira Complex; in fact, *at no place in the master plan* is the existence of the seven threatened peoples mentioned (perhaps even their "real existence" is not known), whose virtuality is only now being contemplated by CNEC, the engineering firm doing the viability study.

It is worth noting that Eletrobrás, in its master plan, makes use of only *one* example of "initiative and sensibility of the electric sector": the relocation, for ecological reasons, of a *thermoelectric* plant in Santa Catarina, in *1974* (1986: 3/17–18); this is somewhat unimpressive. For the rest, as the master plan proposes, such studies of alternatives should be done during the phase of estimating potential and inventory. In the largest engineering work of the late twentieth century, this has absolutely not been the case.

The second question in relation to the indemnifications refers to FUNAI's capacity to plan and execute the "support programs." The first two major experiences in this area, the Carajás Iron Ore Project and the Polonoroeste Project,[8,9] clearly show the failure of such compensatory measures. In these two cases, as a result of the requirements of the World Bank (which partially financed the two projects), support programs were instituted that would guarantee respectable conditions of survival to the indigenous populations affected, with emphasis on the demarcation and protection of their territories. However, what occurred in both instances was FUNAI's utilization of enormous quantities of dollars to acquire equipment and complete works of questionable importance, without having the demarcation of indigenous areas guaranteed.

In the case of the Carajás Iron Ore Project, the CVRD, complying with World Bank demands, signed an agreement (No. 059/82) with FUNAI in 1982. This agreement anticipated "the providing of financial support by the CVRD to FUNAI for the implantation of socioeconomic projects benefiting the indigenous communities located in the area of influence of the 'Carajás Iron Ore Project,' in the states of Pará, Maranhão, and Goiás, guaranteeing resources in the amount of US $13,600,000" (FUNAI and CVRD 1982). In three years of operating this agreement (that is, until September 1985), $7,095,194.10—52.1 percent of the $13.6 million available—had been spent in the following manner:

Lands (demarcation)	11.7%
Health	5.5%
Education	0.5%
Works	31.5%
Equipment	20.0%
Maintenance	28.8%
Technical Reserve	2.0%

Source: CVRD-GTMAK/DEAV-143/85, 13 November 1985

About 80 percent of the resources destined for the Indians were spent on the FUNAI infrastructure, and only 11.7 percent went to regularizing the indigenous lands. Of the 23 reserves assisted by the CVRD-FUNAI agreement, only 40 percent had been demarcated by 1985, and 31 percent had been

[8]The Carajás Iron Ore Project—part of the Great Carajás Program, which anticipates setting up mineral-metallurgic programs, infrastructures, cattle ranching, and reforestation in an area of 900,000 km² in eastern Amazonia (Ferreira 1982)—is the responsibility of the Companhia Vale do Rio Doce (CVRD), a company of mixed national and foreign interests. This mineral exploitation project is formed by the complex: Carajás mine (in Pará), Itaqui Port (in São Luis do Maranhao), and the Carajás Iron railway. It is this railway, inaugurated in February 1985, that transports the iron ore destined for export.

[9]The Polonoroeste Project is a more than $1 billion program that has as its axis the paving of the Cuiabá–Porto Velho Highway (BR-364) and includes colonization and rural development projects (Mindlin 1985).

invaded. According to the opinion of the anthropologist consultants hired by the CVRD during the period of the agreement, "such a policy of application [of resources] has served to sustain the broken-down machine that FUNAI is today much more than providing any real assistance to the indigenous communities" (Magalhães et al. 1985).

In the document "Indigenous Peoples and the Carajás Iron Ore Project: Evaluation of the Companhia Vale do Rio Doce–FUNAI Contract," these anthropologists conclude that:

> The experience in these years of the CVRD-FUNAI agreement shows that the simple administration by FUNAI of abundant financial resources does not go hand in hand with more global political changes capable of promoting the strengthening of indigenous groups in a way that they can better confront the changes resulting from the implementation of these projects.... The elaboration and execution of agreements of this nature can be refined, but they do not constitute the ideal solution; they are only palliative solutions. The existence and the rights of indigenous peoples should be considered when *planning* the projects, seeking to study all other possibilities that do not infringe on the integrity of the people and their territories. (Magalhães et al. 1985).

This conclusion does not differ much from that which the anthropologists who since October 1982 have made up the evaluation staff for Polonoroeste (through the Foundation Institute for Economic Research at the University of São Paulo [FIPE/USP] have come to. The Polonoroeste Project anticipates a support program for the indigenous communities of $26 million, to be instituted by FUNAI (Mindlin 1984, 1985). Polonoroeste currently encompasses 64 indigenous areas, 19 of which belong to isolated groups or groups not residing in reserve villages. Half of these territories are still not demarcated, and three-quarters of them need to be homologated. On the other hand, at least half of these areas were found invaded in 1986 (Mindlin 1987:71).

In March 1986, Betty Mindlin, the anthropologist coordinating the FIPE/USP Evaluation Staff for the Polonoroeste Project, made the following evaluation:

> FUNAI's planning for the Polonoroeste for 1985 was very extensive, with considerable resources (30 billion cruzeiros). Operations for defense of the areas and removal of invaders were anticipated, along with vigilance posts, funds for demarcation and reactivation of borders, localization of isolated groups and definition of territories for those residing outside of reserve villages, construction of access roads to avoid costs or lack of planes, sanitation.... The successive crises in FUNAI and the delay in liberation of resources made the execution of the plan inviable. Almost nothing was done....
>
> At the same time that resources were lacking, it was common for FUNAI to misspend them on non-priority expenses, like construction, purchase of equipment, *per diems*, loans to programs other than the Polonoroeste.
>
> The invasions continued (especially on the Urueu-Wau-Wau, Rio Branco, and Zoró Posts), except when the Indians themselves have taken justice, expelling the invaders, as did the Cinta-Larga of Roosevelt, the Bakairi, the Pareci of Formoso, etc. No measures were taken on the imminent hydroelectrics, nor were the Indians informed, nor was FUNAI itself prepared to defend their interests.... Administration is the most delicate area of FUNAI, absolutely incapacitated to carry out a program of this size.... If there are no positive changes in the action of FUNAI, and the 30 areas to demarcate and/or identify are not immediately regularized, and others homologated, it would be better for the Indians to have the Polonoroeste funds interrupted, as a form of pressure, so that alternative forms of utilizing them could be studied, rather than the financial strengthening of an authoritarian and inert FUNAI, as it is at present, feeding an inoperative bureaucracy which, outside of rare exceptions, seems to work more against the Indians. (Mindlin 1987:72–73)

Past experience with FUNAI's support programs does not lead to any enthusiasm. Indeed, they crown the process of the indigenous groups' dependence on the official Indian agency, instead of promoting the strengthening of these people.

These "indemnifications" are a long way from compensating the indigenous groups affected by the "large projects." We have already alerted the reader to the fact that these large projects, in reality, manifest the policy of the consummated fact that characterizes governmental action and its incapacity to debate alternatives. Thus, *it is not fitting to discuss indemnifications*, for this means accepting such authoritarian policy and the paradigm of integrationist modernization that guides it.

The master plan refers to alternatives—as well as other essential questions and measures referring to a minimum program of understanding with the indigenous peoples threatened by hydroelectric projects, which should include the defense of indigenous territories and the resettlement of landless squatters—as part of the distant horizon of "cooperative programs," secondary to the FUNAI/Eletrobrás (and/or concessionaries) agreements. In the same manner, the ecologically and sociologically fundamental problem of defining what constitutes an "area of influence" of the dams on indigenous territories and societies is evoked in the quality of idea to be contemplated by a "cooperative program." What *is effectively prepared*, in the ambit of the agreements between the electric sector and FUNAI, is exclusively the

"expeditious" demarcation of the lands affected, the forced transferral of indigenous people, and the establishment of indemnifications that will be administered by FUNAI.

It is on that point that there is clarity, for it is that which is sought. Demarcation—the directives for which are found today in the obscure sphere of the National Security Council, and the instruments for which are in the inept and careless hands of FUNAI—essentially seeks to juridically "clean" the area and confine the Indians as much as possible. Its logic is to liberate the largest area possible for "integrated regional development" projects to be installed near the plant. And indemnification has been, in numerous analogous cases, the instrument for corrupting the "tutelary" agency and for creating a political and economic dependency of the people victimized by it.

In short, the general impression elicited by Eletrobrás' environmental concerns and directives, above all as they relate to the present—which includes the current development of the Xingu Complex—is that they are only intended to be cosmetic, palliative, and indemnificatory measures. In the case of the Xingu Complex, the document conceals the fact that alternatives for the dimensions and location of dams, discussions with the threatened indigenous populations, and careful evaluation of the territorial question—all of which *can no longer be done* if the present work schedule continues—supposing that that is what was effectively intended. The evaluation of Eletrobrás' policy and its concessionaries in the works of the PRS—see Balbina and Tucuruí—amply demonstrates the level of seriousness that can be expected from such directives.

Thus, what we propose here is the paralyzation of the studies and works, *for a rediscussion of the entire project of hydroelectric utilization of the Xingu River Basin*, in the circuit of the National Congress, with the participation of the Indians, of the regional population directly affected, and of all concerned sectors of civil society. It does not interest us to discuss indemnifications and compensatory benefits, but rather *alternatives for the utilization of the Xingu*, in a debate that considers the *prior* existence, in the region, of indigenous peoples and of a peasant population, whose fundamental rights cannot be dismissed for a work of dubious political and technical importance.

FINALLY, WE BELIEVE that it is essential to distinguish between the struggle for the defense of the environment and the struggle for respect of indigenous rights: in both, the Indians are the interested party, but as subjects who struggle to see their rights recognized, not as components of a physical or ideological environment of the surrounding society—that is, as objects of alien rights (even though these be collective and just rights). There is no doubt that the indigenous societies of Amazonia, for example, possess knowledge and techniques of environmental management infinitely more sophisticated and balanced than the "technological and managerial" tactics of bombarding the forests with Agent Orange, flooding the forests, polluting the rivers with mercury, and other capitalist feats. But their rights do not derive fundamentally from this; rather, they derive from their condition as ethnically and culturally differentiated minorities. The struggle for the protection of the environment threatened by energy pharaohs is also a struggle for the protection of the environment *of the* Indians—and all other threatened populations—and not one which situates indigenous societies on the same plane as the fish and turtles—that is, as objects of our environment. The rights of the Indians are our rights because they are, *first*, their rights.

It is thus necessary that we belabor the obvious, and that we struggle to make the arrogant paternalism of the engineer-State stop to recognize this condition in indigenous societies, a condition that we hold to be so precious for us that we negate it to others as soon as they show themselves to be minimally different from us: the condition of subject. Now, if to do that it is necessary for us to denounce the assimilation, gross or subtle, of these societies to a Nature taken as *object* for Man (an abstract value, in turn, appropriated by the State), one question still remains, a final horizon: *but with what right do we objectify this Nature?* Indigenous societies, we have said, cannot be seen as "naturally integrated" into Nature. But if they cannot, it is because their transactions with the environment—with fish and birds, plants and waters, time and space—tie them to it through a series of relations that are already *integrally social*—that is, relations *among subjects*. Nature only exists for those who think they are outside of it, who make it out to be a nonhuman residue at the service of humankind. For the Indians, everything is society; for this primitive version of the West incarnated in the Brazilian state, everything is Nature (including the Indians)—except, evidently, those who give the orders:

> It began by separating man from nature, and by creating for him a sovereign realm; it was thus believed to obliterate his most unquestionable characteristic, that is, that he is before all else a living being. The blindness to this common property opened the way to all sorts of abuses. Now more than ever before, at the end of the last four centuries of his history, could Western Man awaken to how, on arrogating to himself the right to radically separate humanity from animality, and in conferring to the first all that he denied to the second, he opened up a cycle of damnation, and that the same frontier, constantly repudiated, would serve to separate man from other men, and to claim, to the benefit of ever more restricted minorities, the privilege of a humanism already born corrupted for having extracted from self-love its principle and concept. (Lévi-Strauss 1973:53).

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Works on the Great Bend of the Xingu—A Historic Trauma?

Oswaldo Sevá

Xingu Bound, the Great Mine in the Rush for Megawatts[1]

FOR THE ELECTRICITY-PRODUCING companies, a mighty river with falls, rapids, and chutes represents a *great energy potential that one day could be utilized* by means of construction of dams and the assembly of mechanical and electrical equipment, and by means of connecting these producing centers, via power stations and transmission lines, to electricity users.

This energy potential is based on the quantity and velocity of water that flows over each point of the river and also on the differences of water level that already exist naturally on certain stretches, or on the differences created artificially by the building of dams that block the river and form artificial lakes.

Currently, even in the cases where the historical and geographical information on the behavior of rivers is scarce or does not exist, it is possible to estimate, through various technical and scientific methods, what the approximate or average dimensions of this potential are. To do this, various alternative forms are imagined for *damming the river at various points along its course;* by computing water discharge and fall heights obtained by dam construction, several estimated values of firm potency from the waters of the river at each point are obtained. Finally, one arrives at a sum that expresses the so-called "hydroelectric potential" of a river.

In the mid-1970s, the project offices, government agencies, and electrical companies had already calculated and recalculated the values for these potentials in the principal river basins of the southeastern and southern regions of Brazil, as well as in the valley of the São Francisco River and Parnaíba River, and they began to do the same on the Tocantins River. On the basis of these calculations, several large hydroelectric works were being completed or were initiated, and several others were proposed.

The Amazon Valley, little known until then in terms of its hydroelectric possibilities, was already being exploited and occupied along numerous stretches for its minerals, fisheries, and abundant forest resources. During this period the valley was entered *onto the agenda of probable (in the near future) investments of the electric sector.*

Sometime in 1974–1975, the recently created Eletronorte,[2] and other government agencies, commissioned engineering firms to survey the hydroelectric potential of the principal rivers of the Amazon Basin. For several years the consulting firm CNEC mobilized its technicians to study the Xingu River,[3] mapping almost the entire river and its main tributaries and conducting investigations of the most favorable points for damming.

So that we can get an idea of the importance of this alternative, let us remember that at the time when the inventory studies were published (CNEC 1980), the entire generating capacity then installed in Brazilian hydroelectrics was on the order of *25,000 mW,* and that the most realistic projections with regard to the hydroelectric potential for all rivers of the country were on the order of *150,000 mW.* The total formed by the two projects of the Great Bend, today called the "Altamira Complex," promised to provide a capacity equal to *half of what there would be in operation in the entire country;* moreover, the integral utilization of the Xingu, if undertaken according to this alternative, in itself would represent *10 percent of the entire potential of the country.*

In the decade of the 1970s, the internal production of the entire Brazilian economy grew exceptionally—an average of 8 percent a year—and electricity consumption was growing at rates of up to 12 percent annually. Thus, the technical experts and corporate directors of the sectors were really in favor of accelerating their studies and plans—

Version prepared especially for the dossier organized by the Pro-Indian Commission of São Paulo between October 1986 and June 1987. Several previous stages of this research were supported by the Federal University of Paraíba, and these are included in my program of research at the State University of Campinas. For this text, two old colleagues collaborated in a decisive way . . .

[1]Units of measure of electrical power: 1 megawatt (mW) = 1,000 kilowatts (kW), 1,000 mW = 1,000,000 kW.

[2]Eletronorte (Centrais Elétricas do Norte do Brasil SA) is a regional subsidiary of the state "holding" company Centrais Elétricas Brasileiras SA, with active presence in the states of Pará, Amazonas, Mato Grosso, Rondônia, Acre, parts of the states of Goiás and Maranhão, and the territories of Roraima and Amapá. Created on 2 May 1973, its goal is to coordinate the electrical energy program in the Amazon region and build and operate electrical centers and systems of transmission in this region. Its headquarters is in Brasília (DF).

[3]CNEC (Consórcio Nacional de Engenheiros Consultores SA), whose headquarters is in São Paulo (SP), is a member of the industrial-financial group Camargo Corrêa/Banco Geral do Comércio.

especially those concerning hydroelectric projects, which were considered to be low in terms of investment and electricity costs.

The figures presented, then, were extremely attractive, and they provided the necessary arguments for the programs to be publicized and for investment projects to be presented to national and foreign financial institutions. For example, the investment costs in these power stations of the Xingu were calculated on the basis of $400–600 per kilowatt installed; the "Altamira Complex" would cost a maximum of $8 billion; or, even, the cost of electricity production for these power stations was estimated at less than $10 per thousand kilowatt-hours, while in the majority of the other Brazilian stations, this index was already around $20.

Thus, the ground was prepared for the technical and economic arguments that would be used when this hydroelectric program was made a priority by the government and the interested firms:

- it was necessary to confront the "probable deficit of electricity, which would certainly occur" if new and large-scale investments were not made;
- once again, the widely known dogma of economic theory would enter into effect, according to which "there is always economy of scale" (i.e., the larger the undertaking, the smaller the unit costs of implantation and the cheaper the electricity generated);
- and, more than any other reason, it is presented even today as evident and inevitable that a stretch of river with such concentrated potential "must necessarily be utilized in its totality" for energy.

The Present Version of the Altamira Hydroelectric Complex: $10.6 Billion and 740,000 Hectares to Install 17,600 mW

The engineering work involved in projects of this type is considerable, especially in isolated, difficult-to-reach areas, as is the case of the Xingu River. In the inventory studies (CNEC 1980), nearly 100,000 km² of territories have already been photographed and mapped; 200 clearings have been opened in the riverine forests; several fluviometric posts have been installed to measure the discharge and water levels; and soil and rock samples have been taken at the points determined for the six dams and on various other stretches nearby.

More than half a million worker-hours have been utilized and nearly $10 million spent. The results, for the firms and for the government, have been highly promising, for these works are the largest undertaken thus far. Altamira would be "larger than Itaipú," as the official propaganda was to say several years later.

In fact, considering the physical and territorial arrangement initially proposed, the walls and dikes of the dams would be made along a total of nearly 70 km, with more than 200 million cubic meters in volume of earth embankments and rock walls (the largest walls made until then—such as Ilha Solteira or Itaipú—measured less than 30 million cubic meters). As an engineering work, the Altamira Complex would be comparable only to Tucuruí, which was, then, in the peak phase of its work schedule.

Judging by the published figures on the electrical generating capacity, the equipment used was the largest then existing in Brazil, larger than that of Paulo Afonso IV and slightly smaller than that of Itaipú; its total nominal potency would be higher than that of some of the largest hydroelectrics in the world, such as the Grand Coulee Dam (USA), the Caroni River Dam (Venezuela), and the Ienissei River Dam (Siberia, USSR).

In the next phase, Eletronorte and the contracted firms entered into the so-called "viability studies," which involved new field work, with topographical measurements, soundings to evaluate soils and rockbeds, and geographic and socioeconomic surveys (which have still not been completed). According to Eletronorte's president, in a lecture given

The "Integral" Utilization of the Xingu River Basin

According to the document "Hydroelectric Inventory Studies of the Hydrographic Basin of the Xingu River" (CNEC 1980), *the best alternative for integral utilization of this river* would have the following characteristics:

- between altitudes of 281 meters (northern Mato Grosso, Xingu National Park) and 6 meters (near Belo Monte, Pará), *six dams* would be made: Jarina, Kokraimoro, Ipixuna, Babaquara, and Cararaô on the Xingu River, and *one* on its main tributary, the Iriri River;
- this series of dams would form a *succession of "lakes,"* and the river would then be "developed" for electricity production, with its flow duly regulated;
- these lakes would cover a surface of more than *18,000 km²*, or 1,800,000 hectares, and the fixed energy potential offered by the river thus modified would come to 9,500,000 kW, or 9,500 mW;
- by the usual indices of the electric sector, this fixed energy potential could correspond to the installation of generators at a total of *19,000 mW*, which represents the *theoretical generating capacity* of all stations operating at full load and with all reservoirs filled;
- about 70 percent of this capacity would be installed in the stretch of the Xingu known as the Great Bend, not far from its confluence with the Amazon, where there is a long twist of nearly 100 km, the natural difference of level of 100 meters height that passes there could be raised through the hydroelectric works to 180 meters (70 meters in the Babaquara dam and 90 meters in Cararaô). □

in Belém (PA) on 30 September 1986, from 1980 until mid-1986 2.4 million worker-hours had already been spent for a total value of $33 million, and that amount was expected to reach $50 million by the end of 1987, when these studies would then confirm the viability of the works and the investments anticipated.

For local public opinion—of the state of Pará—and for Brazilian citizens in general, these proceedings and their consequences only surfaced in 1986; before that, arrangements had been made for publicity packages, in English, filled with pretty photos and suggestive designs and sketches of the dams and power stations. Eletronorte continues to insist that it has made no formal decision as to the project's execution; but, despite this official clarification, the fact is that a few months ago the press in the south of the country published the news that Eletronorte would build the Altamira Complex.

These, in short, are the known dimensions and characteristics of the Altamira Complex. Several crucial questions could be raised by knowledgeable persons, professional associations, militants or local agents, religious or lay persons, and, principally, the local population in the region of Altamira, as was seen in a recent public meeting in this city,[4] at which Eletronorte and other government agencies were unable to respond satisfactorily to questions raised.

For that reason, in various parts of this chapter, the same delicate and strategic points of this project will be mentioned and questioned. In so doing, we reaffirm the right of all Brazil's citizens and especially, of the local populations and electricity users *to obtain detailed and justified answers and explanations* for the choices made and the initiatives taken by the government and by the companies.

In view of the magnitude of the project, the first question that everyone raises is, obviously: *What is this electricity for?* And, secondly: *When and how is it intended to initiate and finalize these works?* And, bearing in mind the volume of economic resources that will have to be mobilized, it is also pertinent to ask: *How will it be financed and how will the project be paid for?*

Assuming that the answers to these questions can be clarified, it would therefore be necessary to know precisely *what the economic and political interests are* that have unleashed this offensive, are sustaining the continuity of the proposal and the studies, and, in the event the work is undertaken, will benefit from the construction activities and, later, from the operation of these centers.

The Schedules and Trajectories for Exporting Electricity

The very agencies and firms that until now have been involved with the hydroelectric program have not clarified their plans. The most important data of a project the size of the Altamira Complex have not been released to the general public, nor are the existing representative branches of government duly informed—municipal and state government, chambers, state assemblies, and the National Congress. Thus, anyone interested in the problem will have enormous difficulties in obtaining the necessary information—principally if this information could be used to criticize the project or to try to modify or put a halt to it.

[4]Meeting held in May 1987, in Altamira, with representatives of the directors of Eletronorte, CNEC technicians, and local representatives.

A Technical Checklist for the Altamira Complex

According to the documents consulted, the complex would have the following principal characteristics:

- an artificial lake of about *1,100 to 1,200 km²* formed by the *damming of Juruá*, at a point between the mouth of the Bacajá River and the city of Belo Monte, 250 km from the mouth of the Xingu, on the Amazon; on one of the branches of this lake, the *Cararaô power station* would be built, where the turbined waters would be washed by a channel to the Xingu, 50 km below the first damming;
- a second artificial lake, with a surface between *5,600 and 6,200 km²* formed by the *Babaquara dam*, at a point soon above the city of Altamira; in the current version of the project, the spillways for the runoff from fills and the power station would be located on the same site as the Babaquara dam;
- the first "lake" would have its water mirror at a *maximum altitude of 96 meters*, and the level of the waters downriver, at the exit of the Juruá and Central Cararaô spillways, would oscillate between the *altitudes of 4 to 10 meters* relative to sea level; on the branch of the lake that goes from Juruá to the Cararaô canal, more than 10 km of dikes will be necessary to contain the tendency of overflowing of the waters in the direction of the left bank of the Xingu itself;
- the second "lake" would have its water mirror at a *maximum altitude of 166 meters*, and at the base of the Babaquara wall would be the water mirror of the first lake (part 96); here also, to contain the spillover, 37 km of dikes would be necessary;
- the generating capacity to be installed would be nearly *17,600 mW*, about 11,000 of which in Cararaô (21 turbogenerators of 525 mW) and about 6,000 in Babaquara (18 turbogenerators of 366 mW); the investment costs are estimated, respectively, at $417 per kilowatt installed and $916 per kilowatt installed (calculated in 1978–1979), totalling *$10.6 billion*; included in the total is the interest paid during the construction, but not the subsequent interest nor the costs of electrical energy transmission lines and installations. □

This chapter, organized by several organizations and several independent and voluntary collaborators, does not intend to meet this urgent demand. However, it seems valid to use, from the scientific point of view—and extremely opportune, from the point of view of the popular interests threatened and probably damaged—to go ahead with our analyses and suggest our responses, based *not only on the little information available*, but also founded on *that which is already known with respect to the electric sector in Brazilian economy and policy.*

Currently, various activities of detailing and calculations referring to the projects of the Cararaô-Juruá and Babaquara power stations are in course:

- the CNEC consulting offices are preparing the calculations and specifications of the engineering works, as well as the estimates for labor mobilization and subsequent urban and regional studies, which seek to plot, with antecedence, ways of dealing with problems of housing, food supply, and the general living conditions of the workers and technicians at the work sites, as well as the changes foreseen in local and regional life;
- in addition to its major propaganda effort in several communication networks and many professional and scientific sectors, Eletronorte has, directly or through third parties, commissioned specific studies on the environment, the ecology of the zones affected by the works and by the lake, and the local population and the indigenous peoples of the region. Some of these items are being developed, for example, by the Museu Paraense Emilio Goeldi, in Belém (PA), others by the National Institute for Amazonian Research (INPA), in Manaus (AM), both connected to the National Council for Scientific and Technological Development (CNPq);
- the directors of the equipment companies or the representatives and local affiliates of foreign manufacturers must naturally be informed about the project and must evaluate their immense commercial and financial potential. In this case, there are probably, among others, the following companies: Brown-Boveri, Siemens, Voith, Alsthom, General Electric, Westinghouse, Zanini, Bardella, Villares, traditional suppliers of turbines, generators, and other heavy equipment;
- the Brazilian contracting firms, which currently participate in and have a strategy on the international circuit—as, for example, Camargo Corrêa, Mendes Junior, Andrade Gutierrez, C.R. Almeida, Odebrecht, and Constram—also are not unaware of the project and are probably making moves to obtain, once again, an arrangement of commitments that will guarantee several more years of commissions and large-scale earnings. (They could obtain these commitments through "consortiums," which, given their force and given the existing practice in past initiatives such as this, will inevitably come out as winners of a supposed "competition" for the execution of the works.)

The work schedules would already be traced out; as is typical of the heavy construction sector, their horizons are medium and long-range;

- the work areas of Cararaô-Juruá would be initiated in *1991 or 1992*, would have their most intense phase around *1994–1996*, and their first generating machine on line in *1997 or 1998*;
- the Babaquara work areas, expected to begin operations in *1994*, would have their peak phase around *1998–2000*; electricity generation would begin in *2002 or 2005*.

This calendar would have a more general logic when connected to the energy situation and economy of the country, for, according to Eletronorte's president, engineer Miguel Numes:

> Actions directed toward Amazonia are confounded with the very process of expansion of the Brazilian economy, and thus have a logic which extrapolates explanations and justifications based exclusively on the regional picture.
>
> Eletronorte considers that the development of large projects focused on the exploitation of the potentialities of Amazonia, within an export model, will continue to exist, due to the amount of Amazonian reserves.

Knowing that electricity consumption in the northern region is today on the order of 2 to 3 percent of the national total, even if this consumption were to grow at very high annual rates (10 percent, for example), the region would still have to wait 25 years to attain energy equivalent to the total that could be generated by simultaneously operating Tucuruí-I (3,600 mW maximum) and the Altamira Complex (around 17,000 mW maximum).

THE CONCLUSION THAT one comes to is that there will be *regional exportation of electricity*—as is already the case with Tucuruí, by means of the high-voltage line interconnecting the systems of Eletronorte and CHESF.[5] It is exactly what is anticipated in the several studies existing on new connections between the north and northeast, and on the future connections between the north and southeast regions, which have already been discussed among technicians since the mid-1970s.

In the early 1980s, the "Eletronorte 2000 Study" was prepared, followed by the "Study for Transmission from Amazonia," prepared along with CHESF. The current study is the "Xingu Collector Study 2015," the main directive of which is to reach a capacity of electricity exchange on the order of 12,000 mW between the north and southeast and 6,000 mW between the north and northeast by the year 2015. It is understood, in this case, that the exchange will be almost exclusively *unidirectional, from the north to the other regions.*

[5]CHESF (Companhia Hidrelétrica do São Francisco, SA), is a regional subsidiary of Eletrobrás with an active presence in the states of Bahia, Ceará, Piauí, and part of Maranhão. It was created on 3 October 1945 by Decree Law 8.031, signed by Getúlio Vargas. It was the first intervention of the Brazilian government in the construction of hydroelectric plants in the country (cf. Gomes 1986).

Connecting the Altamira Complex with the southeast's electrical network was conceived to run along a route of more than 2,000 km, a route that passes through Tucuruí and Marabá, in the state of Maranhão, on to the region of Brasília/Goiânia, in the state of Goiás. The transmission lines and towers would follow a tracing very close to, and perhaps coincident with, the tracing of the controversial Açailândia-Brasília railway, the so-called "North-South" railway, one of the priority projects of José Sarney's government.

The connection with the northeast would be achieved by multiplying the existing lines along a route that crosses the state of Maranhão, going from Imperatriz to President Dutra, from where it bifurcates to the capital city of São Luiz and to the hydroelectric station of Boa Esperança on the Parnaíba River, on the Maranhão-Piauí border and thence via Sobradinho and Paulo Afonso, in the state of Bahia, connecting to the main CHESF network.

This great north-northeast "line," built hurriedly in the beginning of the 1980s, was justified at that time by the two state companies as being an "urgent" priority due to the threat of rationing electricity furnished by the CHESF stations on the São Francisco River. This threat would be decreased as energy was exported from Tucuruí to the CHESF area. In reality, what one often saw was the contrary:

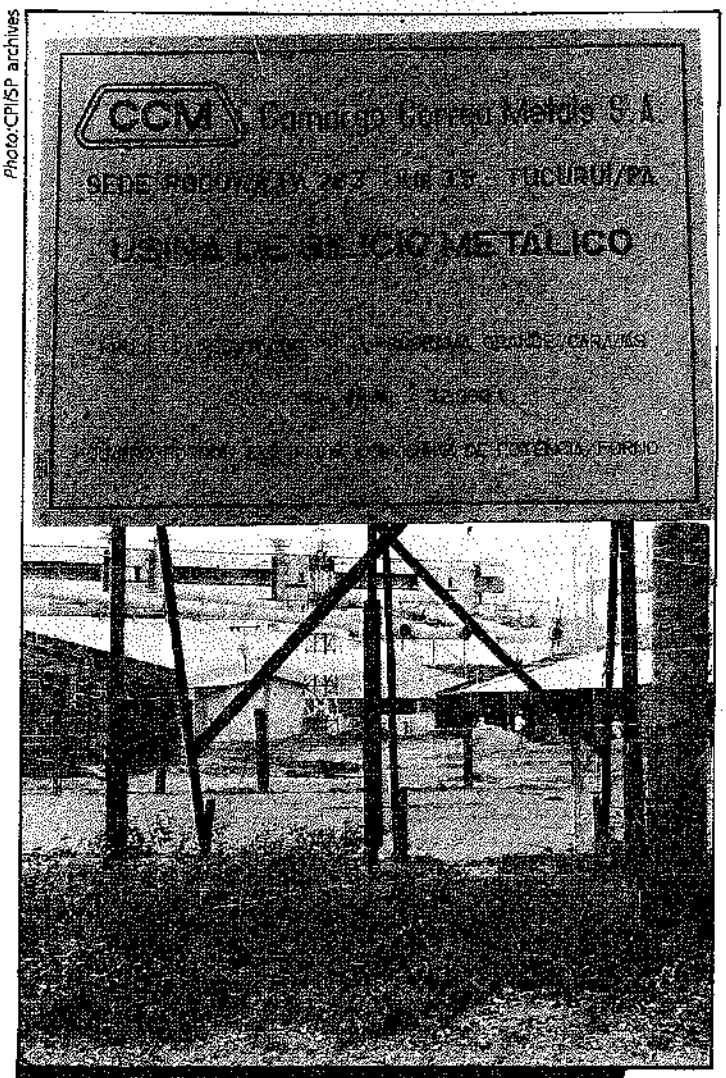
- to allow the aluminum smelter of the "Alumar Complex" in São Luis,[6] in the state of Maranhão, to begin its industrial operation, CHESF supplied the energy; even *before* the assembly of Tucuruí was complete;
- in early 1987, due to the abrupt decrease in the São Francisco River's discharge, the entire region covered by CHESF's presence faced a real rationing, *without* any significant importation of electricity coming from Tucuruí—for this electricity was completely committed to the operation of the same Alumar smelter and also new and similar installations of Albrás in Barcarena,[7] in the state of Pará, not to mention the growing use of electricity in the activities of mining and processing of iron ore from Carajás.

Thus, to be realistic, only two alternatives remained for all of this electricity that would be generated in Cararaô and Babaquara:

1. Another *$10 to $11 billion* will be spent to build and assemble a new "great-line" for exporting energy to the southeast. In this case, with the present technology, this would imply a big loss of income during the transmission, and a hike of the final cost of the energy delivered to up to *$25 per 1,000 kilowatt-hours (kWh)*, by the most optimistic estimates, or surpassing *$50 per 1,000 kWh* (if we take as a base the present costs of energy delivered by Tucuruí);

2. Or, as we have already seen on other occasions, in the case of the Altamira Complex, new investments would be *anticipated, but not publicized, in mining activities and the metallurgic or chemical industry, high-energy consumers,* to be installed in the regions near the Xingu or at other points along the Eletronorte network. For example, another aluminum smelter on the same scale as Alumar would utilize integrally the first two generating machines projected for the Cararaô station. Or an ironworks plant on the scale that is being anticipated for the Ironworks Plant of Maranhão (Usimar), in São Luis, depending on the type of technology utilized, would alone consume all of the energy of a machine from the Babaquara station.[8]

Photo: CPI/SP archives



The Metallic Silicon plant, recently inaugurated, is one of the "preferential clients" of the Tucuruí dam (PA)

[6]Alumar (Maranhão Aluminum, SA) is a metallurgic complex owned by a consortium formed by Billiton/Shell, Alcoa, and Camargo Corrêa. It has been operating since 1984, and has a current production capacity on the order of 500,000 tons of alumina and 200,000 tons of aluminum ingots per year.

[7]Albrás (Brazil Aluminum, SA) is an aluminum smelter owned by a Japanese consortium, Nippon Amazon Aluminum Company (NALCO), and the CVRD.

[8]The total consumption of electricity to smelter 100,000 tons of aluminum can be estimated to be on a scale equivalent to a generator of about 400–500 mW.

Here are the sources of probable harm, the mechanisms for which are built into these alternatives: *if electricity is to be exported to the south,* it would get there more expensively than the electricity produced there (which costs about $30–35 per 1,000 kWh); *if it goes to feeding such electricity intensive activities locally,* the problem is no doubt in the contracts with these powerful multinational industries, associated with the great state companies, which provide for subsidized tariffs, on the order of $20–25 per 1,000 kWh, and the *difference would inevitably be paid for by the electricity users* and by Brazilian tax-payers in proportions that are more and more debilitating to the popular economy.

Preparing for One More Notable Conflict

As we have seen thus far, the first questions—which are always the most crucial when investment projects of this size are announced and when decisions are made in these circumstances—already indicate that the topic is *polemical and of great interest* to the upper echelons of the public and private sectors, and that it has, or will have, an ever greater *expressive weight* in the social and political relations of this country—or in any other where such initiatives may be taken.

It is not only in Brazil where projects such as Itaipú, Sobradinho, Tucuruí, Itaparica, and others have become polemical questions on the national circuit and *critical junctures* in the economic and social life of the country. In other countries, too, power stations have been major players in the process of capital accumulation and, at the same time, have provoked considerable *social and environmental traumas.* (Recall the cases of the Cahora-Bassa station in Mozambique; the Volta River dam in Thana; the various works of the Caroni River in Venezuela; and the James Bay hydroelectric program in Canada [Sevá 1986].)

Thus it is not very fruitful, in terms of advancing public debate on such projects, that the debate rest only on the technocratic arguments of so-called viability; much less is it recommended that people let themselves be convinced by the "opportunity" or the "urgency" of such investments. It is better to treat the situation as problematic right away: *we are living an intrinsically conflictive social experience,* and the investments—as do all technical projects of great dimensions and complexity—*lay open the risks of deteriorating living conditions* in the territories affected by the works, and they have repercussions in much wider regions.

It is exactly because it is inherently conflictive that the investment program anticipated for Altamira and the entire region nearby could present several massive damages; however, its promoters and several beneficiaries are betting on lucrative activities or business. This future—which today is uncertain for all those affected by such initiatives—will depend on many technical and economic factors, but also on several identifiable factors of a more political and social nature:

- the *absolute dimensions* of the investment program or the "size" of the works determine, in part, the "size" of the problems that have arisen and the volume of possible business; but also, the *relative dimensions* of the investments weigh heavily when compared to the general effort of savings and social and productive investments of the entire country and when compared to other recent industrial and energy undertakings in the same country;
- if the iron logic of capital accumulation commandeered by the industrial and financial oligopolies continues to hold true, the advances in capital, loans and financing *will have to be paid off, or reimbursed, at determined times and at determined rates* formally planned by the government, the companies, and the banks. However, in reality, in more recent years, these works are built and paid for at times and at rates that are very different from those anticipated, and these increases of costs and certain delays are often not controlled by the promoters of the investments;
- during the development of the assembly phase and the preparation of the work area, the social groups and their interests are numerous and diversified; at times they are able to ally themselves to support the project or, later, to regroup in order to force its modification or embargo.

The so-called *local powers* are: the landowners and owners of productive units, of transport and points of commerce, and also the elected representatives and leaders in the municipality and state, and the local directors and managers of the divisions and agencies of the government and banks. Untold juridical and economic conflicts occur between the promoters of investments and the neighboring and riverine populations over the *use of the soil and waters,* the *destructuring of patrimony and productive units,* and their *alternatives for restructuring* the productive bases and patrimony destroyed or affected. There are also *fundamental conflicts of production*—among the superintendencies of contracting firms, of subcontractors, of the specialized firms and state firms, and the salaried workers themselves, the hired workers, the laborers, and the technical experts.

There will even be a complicating factor on the national circuit that affects, and ends up involving—directly or indirectly—all the rest of the electricity users and all taxpayers and salaried workers in the country:

- rather than an *ample and reliable electrical supply for the population,* through democratic criteria, with principles of regressive fixation of tariffs, subsidizing the needs and collective and urgent uses of this form of energy;
- what is expected is that the *needs of preferential clients will be met*—that is, a large part of the electricity is destined to supply productive installations that are high consumers of electrical energy, with tariff principles based on selective favoring and with a posture of subordination of international variations of commerce and finances.

Dimensions and Repercussions of the Altamira Complex in the Panorama of Brazilian Hydroelectricity

Several of the world's largest dams have been built on Brazilian soil, housing electric power stations with some of the greatest installed firm power (i.e., minimum power generated by a dam). In addition to those that are already functioning and those that are in their advanced stages, there are still several in the preliminary phase and others in the project phase—or in negotiations—that can be considered as probable projects. In order to gain a

Who Consumes Electricity in Brazil?

To judge from data referring to the last few years (which can be obtained from the *Matrizes Energéticas* or from the *Balanços Energéticos*, prepared by governmental agencies), more than 50 percent of electricity is consumed by industry, and close to 25 percent is consumed in homes. However, if we compute for industry all the forms of energy that are utilized, we would have the following proportion:

Energy Consumed by Industry

Type of energy	Percentage of total consumed in industry
• derivatives of petroleum and natural gas	30%
• firewood and vegetal carbon	25%
• electricity	20%

This means that, although in the makeup of industry electricity has less weight than the energies with fossil and vegetal base, its consumption even so is so high that it absorbs *more than half of the total electricity consumed in the country*. And it also means that, within industry itself, certain production processes will be intense electricity consumers, and that a small number of *installations consume much more electricity than the great majority* of most other industrial activities. Utilizing the concepts of coefficients of energy intensity, or of the content of certain merchandise (Vanin and Graça 1982), we can point to the following production sectors:

Major Energy Consumers

All forms (direct plus indirect)	Electrical energy
• ironworks (pig-iron, ingots, laminated & smeltered steel & iron	• chloro-sodium & basic chemical
• chloro-sodium and basic chemical	• ironworks
• cement	• nonferrous metals
• cellulose, paper & cardboard	• cellulose, paper & cardboard
• lime	
• copper, aluminum & other nonferrous metals	
• railway transport	

However, even the analyses based on the *Balanço Energético* should be made with care and restrictions. The researcher A. Carlos Boa Nova (1985) alerts us to the following points:

> Examination of data reveal that the segments of major consumption of final energy are the very centers of energy transformation: petroleum refineries, natural gas industrial plants, coke plants, electrical plants, etc.;
>
> • if the reader of an issue of the *Balanço* wishes to know who is served by all of that energy, he won't find an answer, or even a clue;
>
> • The consumption that is recorded in the *Balanço*, as well as the investments made in the name of future consumption, supposedly serve the entire Nation. However, in a society such as Brazil's, which is marked by inequalities, there is very little probability that energy consumption would be egalitarian.
>
> • History is there to show that it is not to employ labor, but to substitute it, that the capitalist enterprise tends to use more and more intensive techniques in energy.

And, finally, as the works advance, and later, when the station begins to operate, the *technical and territorial concepts that have prevailed are put in check*—concepts that are dominant in the Brazilian hydroelectric sector. One has to know, in each phase and throughout the useful life of the installations, whether *the project has worked*, whether the investment decision was adequate or opportune.

There will also be repercussions for most other hydroelectric programs in Amazonia, the more problematic Altamira becomes, the greater the difficulties facing Eletronorte's monumental program. Below, we present a report on the 79 dams existing and projected for the Amazon and the Araguaia-Tocantins valleys.

The 79 Dams Existing and Projected for the Amazon and Araguaia-Tocantins Valleys (of the Eletronorte System)

Rivers	Dams	No. of dams	Projected power (mW)
Rio Negro Valley		7	
Uaupés/Negro	1. São Gabriel		2,000
	2. Santa Isabel		2,000
Branco[1]	3. Caracaraí-Mucajaí		1,000
Uraricoera	4. Maracá		500
Cotingo	5. Surumu		100
	6. Bacarão		200
	7. Santo Antônio		200
	Sub-total		6,000
Rio Madeira Valley		13	
Ituxi	8. Endimari		200
Mamoré/Madeira	9. Madeira/Caripiana		3,800
Jamari	10. Samuel		200
Ji-Paraná[2]	11. Tabajara		400
	12. Jaru-JP 16		300
	13. Ji-Paraná-JP-28		100
Aripuanã and Roosevelt	14. Preto RV-6		300
	15. Muiraquitã RV-27		200
	16. Roosevelt RV-38		100
	17. Vila do Carmo AN-6		700
	18. Jacaretinga AN-18		200
	19. Aripuanã AN-26		300
Sucunduri	20. Umiris-SR-6		100
	Sub-total		6,900
Rio Tapajós Valley		7	
Tapajós	21. Itaituba		13,000
	22. Barra São Samuel		6,000
Juruena	23. Santo Augusto		2,000
	24. Barra do Madeira		1,000
Teles Pires	25. Barra do Apiacás		2,000
	26. Talama		1,000
Curuá-Una[3]	27. Curuá-Una		100
	Sub-total		25,100
Rio Xingu Valley		6	
Xingu	28. Cararaô/Juruá		8,400
	29. Babaquara		6,300
	30. Ipixuna		2,300
	31. Kokraimoro		1,900
	32. Jarina		600
Iriri	33. Iriri		900
	Sub-total		20,400
Sector I: Left Bank Lower Amazon		5	
Uatumã	34. Balbina		300
	35. Fumaça		100
Jatapu	36. Onça		300
	37. Katuema		300
Nhamundá	38. Nhamundá/Mapuera		200
	Sub-total		1,200
Sector II: Left Bank Lower Amazon		9	
Trometas and Erepecuru	39. Cachoeira Porteira		1,400
	40. Tajá		300
	41. Maria José		200
	42. Treze Quedas		200
	43. Carona		300
	44. Carapanã		600
	45. Mel		500
	46. Armazém		400
	47. Paciência		300
	Sub-total		4,200
Sector III: Left Bank Lower Amazon		9	
Curuá	48. Curuá		100
Maecuru	49. Maecuru		100
Paru	50. Paru III		200
	51. Paru II		200
	52. Paru I		100
Jari	53. Jari IV		300
	54. Jari III		500
	55. Jari II		200
	56. Jari I		100
	Sub-total		1,800
Left Bank Amazon Estuary		5	
Araguari	57. F. Gomes		100
	58. Paredão		200
	59. Caldeirão		200
	60. Arrependido		200
	61. Santo Antônio		100
	Sub-total		800
Tocantins and Araguaia River Valleys		18	
Tocantins[4]	62. Tucuruí		6,600
	63. Marabá		3,900
	64. Santo Antônio		1,400
	65. Carolina		1,200

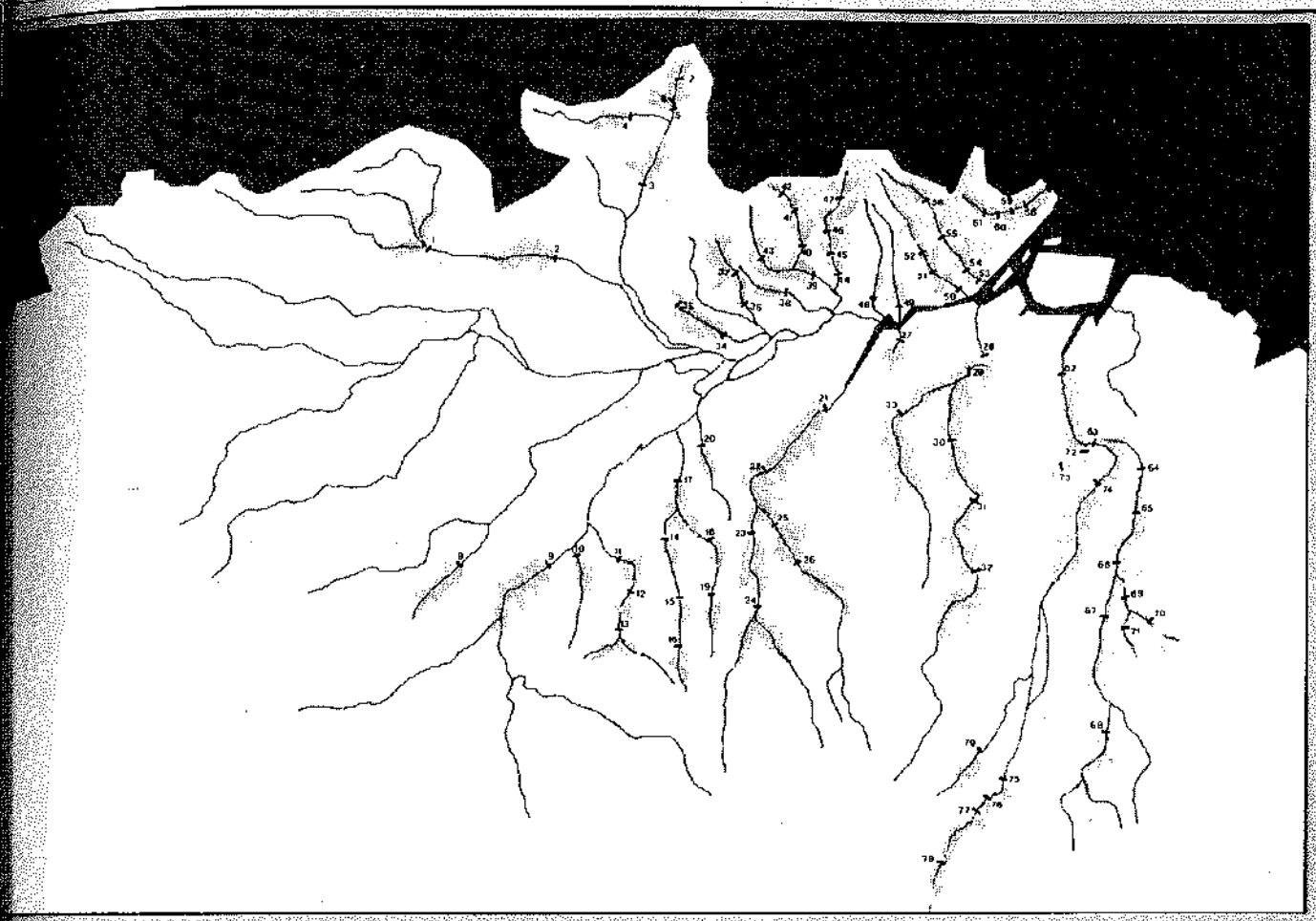
more precise idea of the absolute and relative dimensions of this truly large-scale "hydroelectric park," we have selected several of the indicator variables of the most crucial aspects of these undertakings:

- the surfaces of the artificial lakes;
- the lengths of the crests of the dams and other structures, and the volumes of the solid stonework constructed;
- the installed or expected capacities for electricity generation, and
- the economic and financial worth of the investments made or expected.

We will show these indicator variables with the help of lists and maps, and we will draw out some of the implications that this comparison can provide. In this way, we can establish the position occupied by the works of the Altamira Complex in relation to the other projects.

I. The Surfaces of the Artificial Lakes

The artificially created "lakes" were, until a few decades ago, much smaller than the natural lakes existing on the planet; dams and weirs that created lakes of 100 km² were seen as prodigious, but their



Art: Carlos Eduardo S. de Andrade

	66. Lajeado		800
	67. Ipueiras		500
	68. São Félix		1,200
Sono and Balsas	69. Sono II		200
	70. Sono I		100
	71. Balsas I		100
Itacaiúnas	72. Itacaiúnas II		200
	73. Itacaiúnas I		100
Araguaia	74. Santa Isabel		2,200
	75. Barra do Catapó		200
	76. Torixoréu		200
	77. Barra do Peixe		300
	78. Conto de Magalhães		200
Mortes	79. Noidori		100
		Sub-total	19,500
	Grand Total	79	85,900

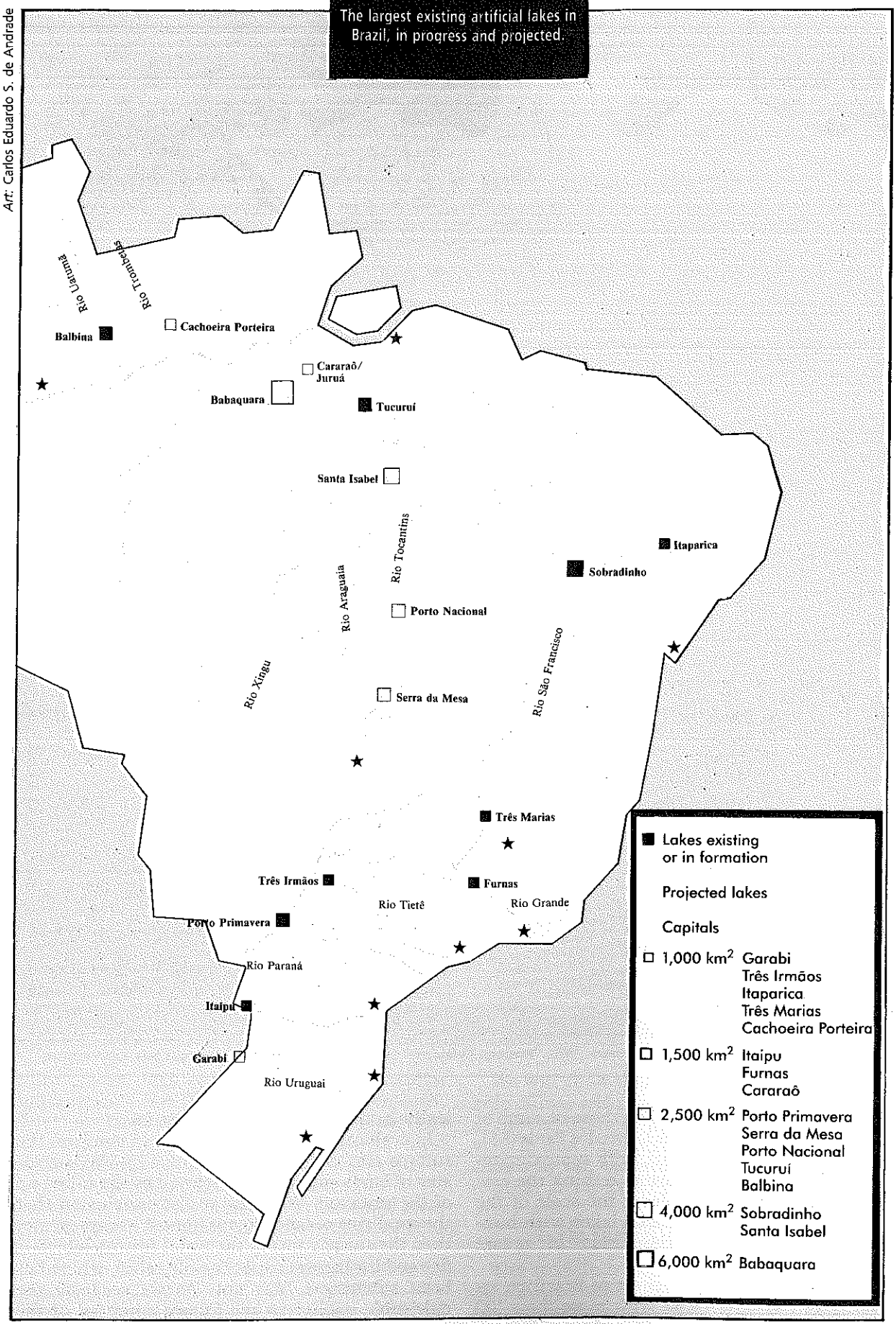
Notes:
[1]The Paredão dam, on the Mucajaí River, is under construction by Centrais Elétricas de Roraima.
[2]There is the Machadinho Project, on the Ji-Paraná River, by Centrais Elétricas de Rondônia.
[3]A station built and operated by Centrais Elétricas do Pará, SA (CELPA).
[4]On the Tocantins, in the same region as São Felix, are the projects of Serra da Mesa, Canabrava, and Porto Nacional, which are promoted by the Furnas company.

Source: **Plano de Recuperacao Setorial,** Eletrobras 1986; "Prospecto Eletronorte," Eletronorte; map: "Politicas e Estrategias para Implementacao de Vilas Residenciais," Eletronorte 1985.

surfaces were much smaller than those of some of the large natural lakes, such as Lagoa dos Patos (RS), or Lago Titicaca (Peru-Bolivia), with approximately 10,000 km². Today, we have to rethink the proportions and, above all, evaluate the scale of the alterations provoked by artificial lakes with hundreds, and even several thousands, of square kilometers.

If we consider—in the total set of Brazilian artificial lakes—as large those with more than 700 km² of water mirror, we can show them schematically in the illustration on page 28.

In evaluating these "lakes," we can compare the surface area of the water mirror with the surface area of lands and foliage destroyed by the filling up of the reservoir. We come to the conclusion that the total area of lands lost is almost always greater than the surface area of the water mirror, which is flat and horizontal while the old relief, which has been submerged, was not. As we compare the cultivable quality or the foliage potential of the lands lost on the banks and slopes of the old river


The largest existing artificial lakes in Brazil, in progress and projected.
Art: Carlos Eduardo S. de Andrade
Rio Uatumã
Rio Tocantins
Balbina
Cachoeira Porteira
Cararaô/ Juruá
Babaquara
Tucuruí
Santa Isabel
Itaparica
Sobradinho
Rio Tocantins
Rio Araguaia
Porto Nacional
Rio Xingu
Rio São Francisco
Serra da Mesa
Três Marias
Três Irmãos
Furnas
Rio Tietê
Rio Grande
Porto Primavera
Rio Paraná
Itaipu
Garabi
Rio Uruguai
Lakes existing or in formation
Projected lakes
Capitals
1,000 km² Garabi, Três Irmãos, Itaparica, Três Marias, Cachoeira Porteira
1,500 km² Itaipu, Furnas, Cararaô
2,500 km² Porto Primavera, Serra da Mesa, Porto Nacional, Tucuruí, Balbina
4,000 km² Sobradinho, Santa Isabel
6,000 km² Babaquara

Mirror surface	Denomination	River	Location	Status
between 700 and 1,000km²	Três Marias	São Francisco	MG	existing
	Itaparica	São Francisco	BA/PE	in progress
	Três Irmãos	Tietê	SP	in progress
	Garabi	Uruguai	RS/Argentina	projected
	Cachoeira Porteira	Trombetas	PA	projected
between 1,000 and 1,500km²	Itaipu	Paraná	PR/Paraguay	existing
	Furnas	Grande	MG	existing
	Cararaô/Juruá	Xingu	PA	projected
between 1,500 and 2,000km²	Porto Nacional	Tocantins	GO	projected
	Serra da Mesa	Tocantins	GO	projected
approximately 2,500km²	Tucuruí	Tocantins	PA	existing
	Balbina	Uatumã	AM	in progress
	Porta Primavera	Paraná	SP/MS	in progress
	Santa Isabel	Araguaia	PA/GO	projected
with more than 4,000km²	Sobradinho	São Francisco	BA	existing
	Babaquara	Xingu	PA	projected

to the quality and potential of the "new lands" formed around the artificial lake, we conclude that, *in general, the old lands lost today at the bottom of the lakes were better.*

II. The Lengths of the Crests and the Volumes of the Stoneworks

These two variables, taken together, can indicate, in approximate terms, the *total productive/constructive force* of the works of dam construction and other edifices and infrastructures. Let us visualize these works as finished products that required long and varied works of excavation and dismounting of rocky matter, of dragging, of earth embankments, and of laying concrete; the "product" has the geometric form of a truncated pyramid, in general longer than it is high. In Brazil today, the lengths of the longest structures are from 4 to 10 km, and the greatest heights are between 90 and 150 meters.

In addition to the main barring of the river, the construction of *auxiliary walls* and *containment dikes* on various parts of the new reservoir is becoming more and more common. This construction increases the length and the volume of the works, which can be estimated from the total volume of the "big walls" and the constructions of the dam and the power station: part earth, part concrete, and part rock and earth wall.

In the 1970s, the magnitude of the volumes of the masonry varied from 20 to 40 million cubic meters for the principal Brazilian works. Today, the upper level is different: Tucuruí has masonry of almost 70 million cubic meters. (For a comparison of the largest works of mobilization for the construction of dams in Brazil, see the illustrations on pages 30 and 31.)

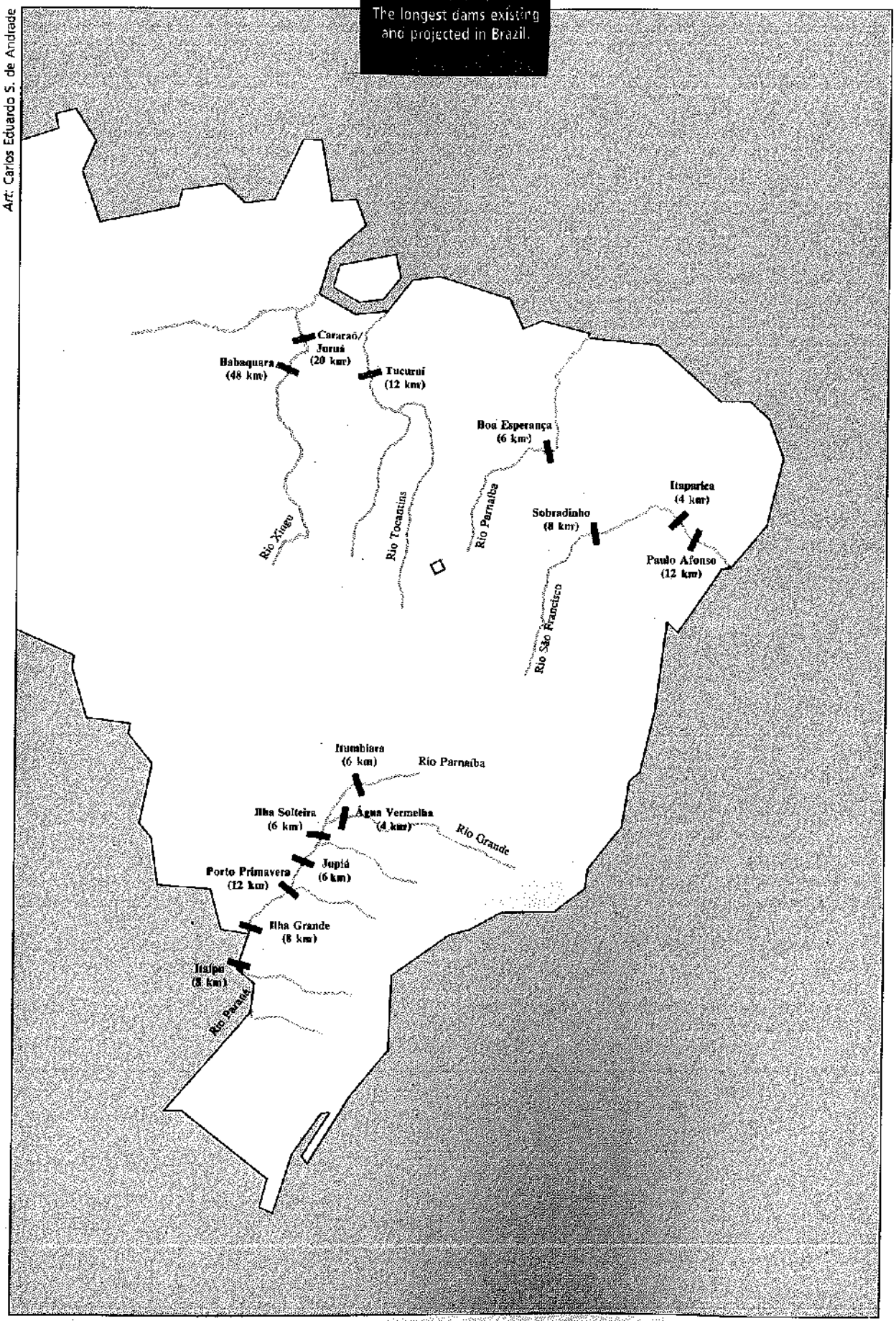
These evaluations, which only begin with the geometric dimensions of the products made, provide very interesting clues; for example:

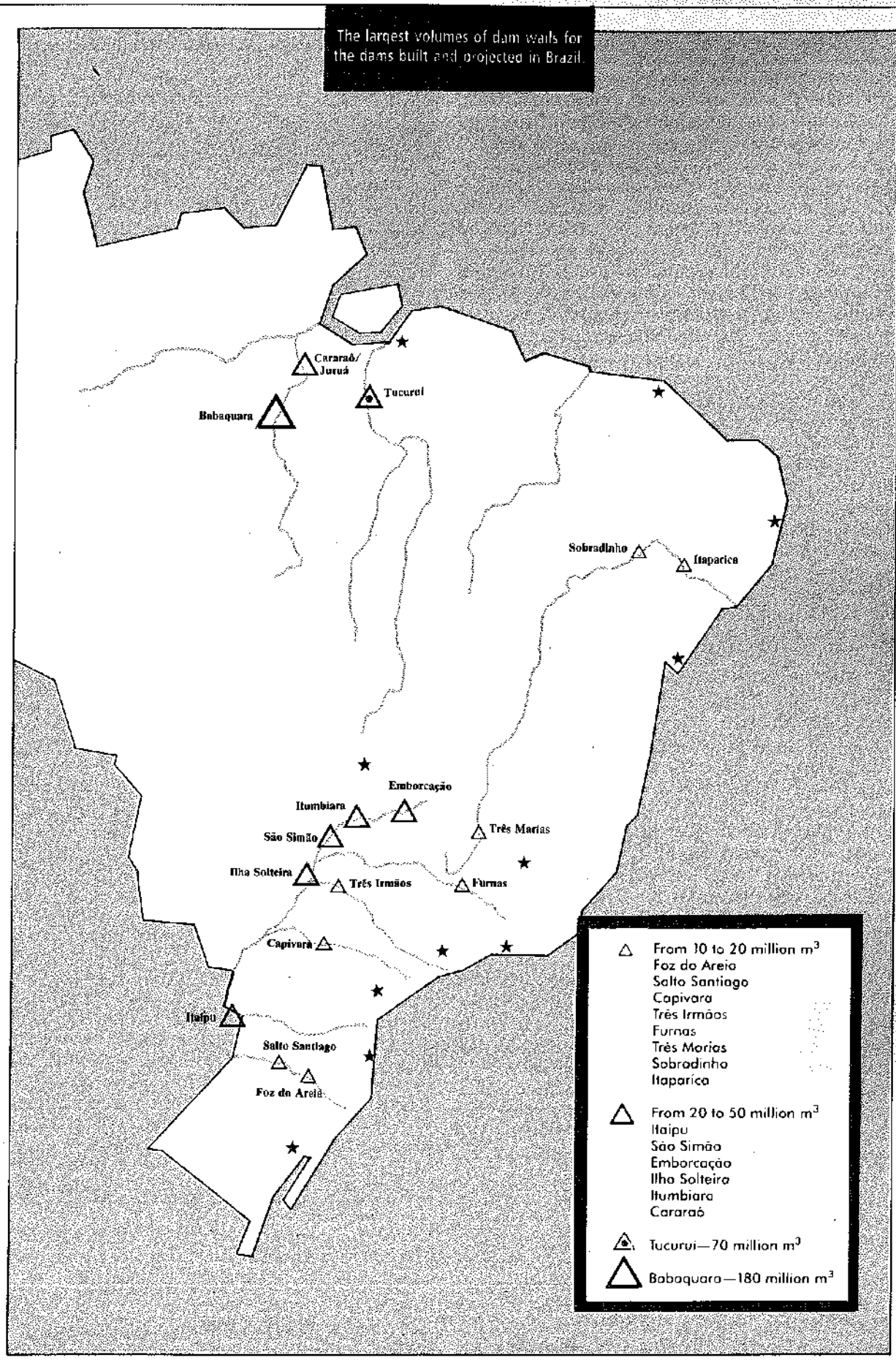
1) One can discuss the *greater or lesser adequacy of a project for hydroelectric utilization in relation to a determined part of the river and the river basin;* in accordance with the local "form" of nature itself, several dams really take advantage of some energy from the water cycle, already "channeled" by the relief, constricted in channels, or falling precipitously in rapids and waterfalls. Nevertheless, many other dams more and more often create this fall in a very artificial way.

This tendency is almost certain, for *the most appropriate hydrological and territorial sites,* especially those nearest to the consumer centers, have already been "utilized." Another important element is the width of the rivers in the parts that are being dammed. In this case, the tendency is that the parts with two, five, or more kilometers—and among these particularly those *most torrential parts, closest to the lower valley*—are being "utilized" or are slated for future investments.

2) One can also evaluate the *techno-economic impact of the construction works,* for in these dimensions of length and volume of masonry are included the *utilization of the labor force* in various phases of the construction of the work area and assembly, and two other key variables: the *consumption of* industrial *raw materials,* and the *mobilization* of *fleets of vehicles* and specific, large-scale equipment.

A study of the several work areas reveals that the mobilization affects hundreds of millions of worker-hours in the phases of construction and assembly, with local employment reaching 12,000, 15,000 or more than 20,000 salaried and hired workers over periods from six to more than ten years.


The longest dams existing and projected in Brazil.
Art: Carlos Eduardo S. de Andrade
Cararaó/ Jurua (20 km)
Babaquara (48 km)
Tucurui (12 km)
Boa Esperança (6 km)
Itaparica (4 km)
Sobradinho (8 km)
Paulo Afonso (12 km)
Rio Xingu
Rio Tocantins
Rio Parnaiba
Rio São Francisco
Itumbiara (6 km)
Rio Parnaiba
Ilha Solteira (6 km)
Água Vermelha (4 km)
Rio Grande
Porto Primavera (12 km)
Jupiá (6 km)
Ilha Grande (8 km)
Itaipu (8 km)
Rio Paraná


The largest volumes of dam walls for the dams built and projected in Brazil.
Art: Carlos Eduardo S. de Andrade
Cararaó/ Juruá
Tucuruí
Babaquara
Sobradinho
Itaparica
Emborcação
Itumbiara
São Simão
Três Marias
Ilha Solteira
Três Irmãos
Furnas
Capivara
Itaipu
Salto Santiago
Foz do Areia
From 10 to 20 million m³
Foz do Areia
Salto Santiago
Capivara
Três Irmãos
Furnas
Três Marias
Sobradinho
Itaparica
From 20 to 50 million m³
Itaipu
São Simão
Emborcação
Ilha Solteira
Itumbiara
Cararaó
Tucuruí—70 million m³
Babaquara—180 million m³

As far as the raw material required, we note the case of cement consumption, necessary in the phases of concrete-laying and local manufacture of articles; it is as if each work, such as Tucuruí, which alone consumed more than a million tons of cement, absorbed the equivalent of 10 percent of the entire annual Brazilian production in that time; or, if the works of laying concrete were done in only one year, four producers of cement would work exclusively to attend this project. In the preliminary version of the Altamira Complex, cement consumption was estimated at more than 9 million tons; in the best of hypotheses, this would be equivalent to more than 40 percent of national production or to what would demand 18 "exclusive" producers.

III. Capacities for Generating Electricity

This is the "measure" most commonly utilized by government publicists and by participating companies to exalt the contribution that this or that hydroelectric power station will make "toward one more phase in the resolution of the national energy question." And, in fact, the measure made by means of "installed power" has its logic, for in the end all of these investments have as *their goal* the generation of electricity. This being so, their buildings and machinery should have a "power range" in which they will function better, in which they can supply more electricity for longer time periods.

Up until the 1950s, the energy potential for each large hydroelectric station was nominally from half a million to a million kilowatts; today, there is generating equipment in which each turbogenerator "machine" is this size, and there are stations with 10 or more units of this scale. The scale today is measured by *millions of kilowatts* or, in the extreme cases, by 10 or more million kilowatts in a single hydroelectric station. The following table gives us an initial idea of the Brazilian stations and of several projects that have installed capacities greater than 1 million kW (or 1,000 mW).

Even so far as this indicator of the magnitude of the investment made, it is worth remembering that the indication is always of the so-called "plate energy" of the hydraulic turbines—that is, the theoretical maximum potency obtained by the perfect and continuous functioning of the turbine and all machines of each station. This never happens, in fact, for there are variations in the reservoir and variations in electricity demand (which cannot be stored as if it were a liquid or gas fuel).

Besides that, from the generator to the final point of the electric network, when each user will plug his utensil into an outlet, stove, or motor, the electricity is transmitted with a growing loss of return. The power of the generator is lower than that of the turbine, and the capacity of the transformers in general is lower than that of the generators. In all substations, and along all lines, there are *losses of several kinds.*

The Brazilian Hydroelectric Centers with Actual or Expected Capacity Above 1,000 mW

Hydroelectric centers existing or in construction (1987)	Nominal capacity installed/ expected (mW)	Projects for new centers
	13,600	Italuva, Tapajos River
Itaipu, Parana River	12,600	
	11,000	**Cararao/Jurua, Xingu River**
	6,000	**Babaquara, Xingu River**
Xingo, Sao Francisco River	5,000	
	3,800	Madeira/Caritiana, Madeira River Maraba, Tocantins River
Tucurui, Tocantins River	3,600	
Solteira Island, Parana River	3,200	
Itumbiara, Parnaiba River Sao Simao, Parnaiba River	3,000	
		Ipixuna, Xingu River
Porto Primavera, Parana River		Santa Isabel, Araguaia River
Foz do Areia, Iguacu River		Sao Gabriel, Rio Negro
Itaparica, Sao Francisco River Paulo Afonso IV, Sao Francisco River	1,800	Garabi, Uruguai River
Furnas, Rio Grande		Serra da Mesa, Tocantins River Canabrava, Tocantins River
Estreito, Rio Grande Agua Vermelha, Rio Grande Emborcacao, Parnaiba River Jupia, Parana River Salto Osorio, Iguacu River Salto Santiago, Iguacu River Segredo, Iguacu River Sobradinho, Sao Francisco River	1,000	Capanema, Iguacu River Ita, Uruguai River Machadinho, Uruguai River Cachoeira Porteira, Trombetas River Ilha Grande, Parana River

Source: PRS-Eletrobrás 1986; Gomes 1986

On the other hand, the "firm power" indicator is extremely useful in evaluating the *importance and cost of the electro-mechanical equipment* installed in the station: the greater the "plate energy," the greater the rolling bridges and winches neces-

sary to mount or fix them; or the greater the water discharge, the greater the floodgates and the motors necessary to regulate the inflow or outflow of water, and so on.

In economic terms, the work orders made to companies that manufacture machines and heavy equipment will be greater as will the income of the project and calculation "offices" that specify and favor the selection and acquisition of such equipment. In financial terms, bank movements are greater, and the commitment times between creditors and borrowers are much longer. This is what we will now show in more detail.

IV. The Economic-Financial Worth of the Investments Made and Anticipated

In the international reality of investments in heavy industry and the energy sector, large projects begin to be given consideration when they exceed $1 billion; several more complex or lengthy programs come to $20 or 30 billion. Despite the difficulty created by the extreme variation of the conditions of financing, with international interest rates being computed in different forms and on different occasions, it is usual in this sector of activities to estimate investment costs on the basis of parameters of known proportions observed in several similar cases.

Thus, we could construct the following diagram, where one emphasizes the values initially publicized for the Altamira Complex, in the range of *$10 billion*, and the value estimated by us for the same investment, in the range of *$25 billion* or more. That is, in comparative terms, the hydroelectric program planned for the Great Bend of the Xingu River could cost as much as three Angra dos Reis nuclear stations, or it could cost more than the world's largest gas pipeline.

But we also ought to think of other, different uses for this same "mass" of money, supposing that it may some day be "available" or—to be more realistic—that some day Brazilian society gets to decide, democratically and without harm to the population, *how to invest its annual savings capacity, which is on the order of $30 billion.*

For this, it would be enough to begin comparing the amount of investment that would be set aside for the Altamira Complex with several other

How Much Does It Cost to Invest? And to Invest Elsewhere, in Another Way?

US$ (billions)	Large-scale hydroelectric investments	Other energy, industrial, or transportation investments	Hypothetical social investments, equivalent in terms of cost, to productive investments
35	**Program for the Integral Utilization of the Valley of the Xingu** five plants on the Xingu and one on the Iriri, approximate total of 18,000 mW (e.p.v.)*		
30		Annual Formation of capital in the Brazilian economy as a whole: approximately 10% of the GNP (1985–1990)	ANNUAL TOTAL OF SALARY BENEFITS for all Brazilian salaried workers (including social security, vacations, ... 40–50% above payroll)—set aside for guarantees, indemnifications, welfare, assistance, credits, and savings
25	**Altamira Hydroelectric Complex** dams, plants, and dikes at Cararaô/Juruá and Babaquara—approx. total 13,000 mW (e.p.v.)*		SETTLEMENT of approximately 4 to 5 million rural workers or colonists
15	Itaipú Station and its system of transmission—current cost and increasing interest rates**	Construction of the largest gas pipeline, from Western Siberia to Europe, with 80% in USSR territory; cost publicized in 1978–1979: US$ 10 billion (e.p.v.)*	BUILDING/DELIVERY of approximately 2 million average urban residences—at a cost of US$ 80–100 per square meter, average area of 100m² per unit
10	**Altamira Hydroelectric Complex** value publicized by Eletronorte in Oct./Nov. 1986	Nuclear Plants of Angra dos Reis—including A-I, II, and III, approximate total 3,000 mW (e.p.v.)*	
7	Tucuruí Plant and its system of transmission—approximate current cost and increasing interest rates	High Velocity Railway Project—"bullet-train" between Araraguara–SP-RJ—value publicized by the government of São Paulo, April 1987	TRAINING of about 1 million upper-level professionals—at a cost of US$ 10,000–20,000 per trainee from 4 to 5 years
5		Carajás Iron Ore Project—including mine, railway and port—final approximate cost**	PRE-FABRICATION & CONSTRUCTION of about 5 million "popular houses"—at a cost of US$ 20–30 per square meter, unfinished, and average area of 40–50 m² per unit
2.5	Itaparica (CHESF) and Porto Primavera (CESP) Power Plants—final approximate cost**	Interstate Freight Railway Project—"North-South"—value publicized by the federal government, April 1987	
2		ALUMAR Metallurgic Complex—final approximate cost**	

(*) e.p.v.—*estimated probable value*, for the period in which the paying off of capital invested is begun; it is based on the average indices of investment cost; US$ 2,000 per installed and effective kilowatt for the hydroelectric power stations; and more than US$ 4,000 for the same kilowatt of the thermonuclear power stations; in the case of the gas pipeline, an annual increase of costs on the order of 4–6% was supposed.

(**) *the current* or *final approximate costs* were estimated by the author, based on information from the companies themselves published in journals, and from previous indices of the hydroelectric construction sector.

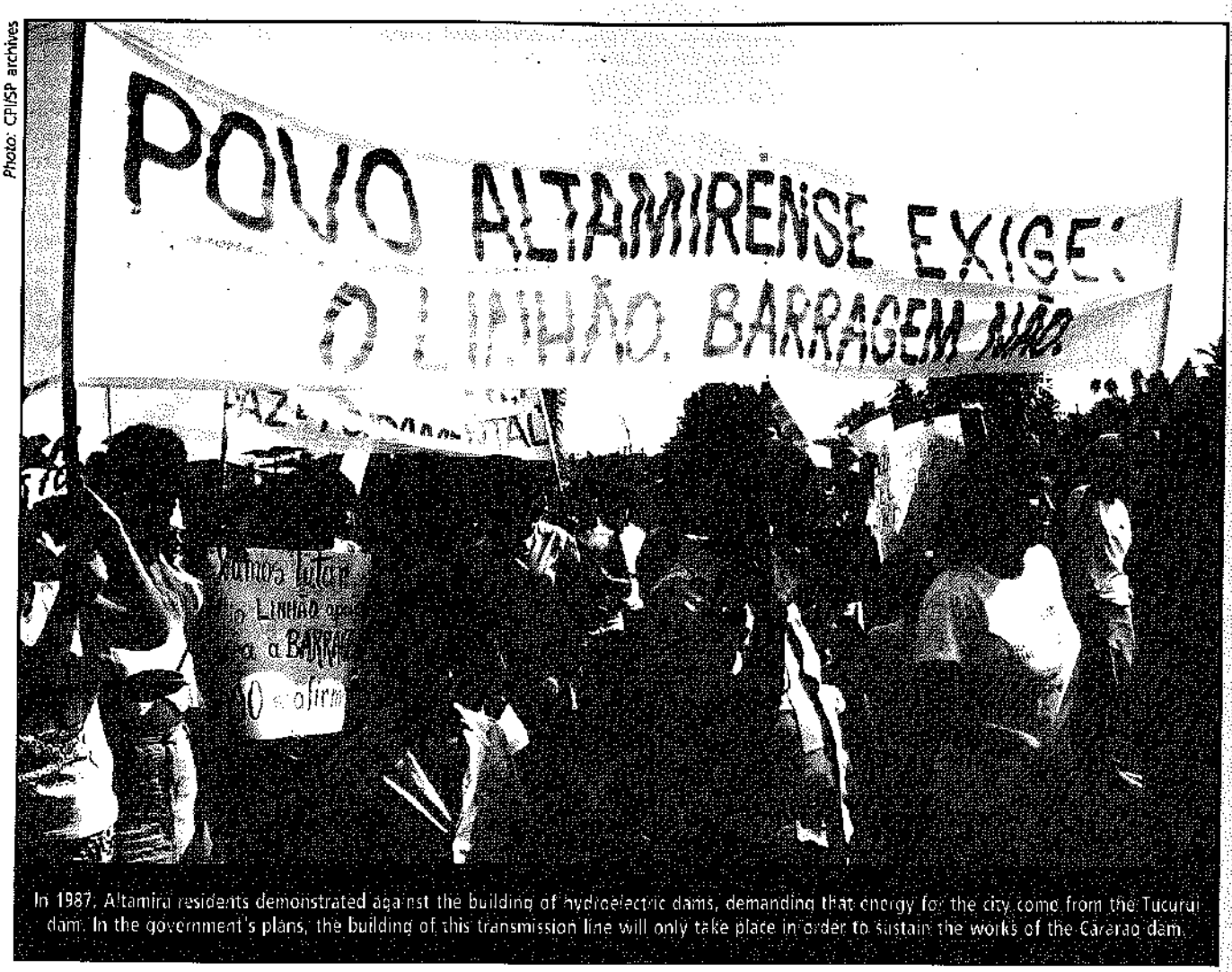


Photo: CPI/SP archives

In 1987, Altamira residents demonstrated against the building of hydroelectric dams, demanding that energy for the city come from the Tucuruí dam. In the government's plans, the building of this transmission line will only take place in order to sustain the works of the Carajás dam.

amounts that might be equivalent to it; for example: so many millions of houses built, or so many millions of rural workers settled by programs of agrarian reform or colonization. This would give us a first base for discussion, to clarify what in fact would be the social priorities of a country with an already very significant investment capacity.

The Question Already Came to Us Politicized

In completing the initial presentation of the Altamira Hydroelectric Complex, it is opportune to determine, with the help of several experts, the strategic position that the energy sector occupies in the political and economic life of this country and of all others. Over the last century, the history of Brazil and the histories of hydroelectricity, the development of industrial activities and exportation, and the political and cultural domination to which we have been submitted have been strongly interlinked.

The major boom of investments and transactions of international weight (in this sector of dams, power stations, and transmission lines) began in the government of Juscelino Kubitschek (1955–1960) and accelerated during the most repressive years of the military regime. This boom continued until even a short while after the recessive periods of salary compression that marked the government of General Figueíredo (1979–1985) and the Sarney government (1985–1989).

The director, staff, and executives of the electric sector, of the sectors of project construction and engineering, and of heavy industry have not turned over significantly in the last few years, especially in the Ministry of Mines and Energy, in Eletrobrás and in its associated companies, and in the state secretariats and state concessionary firms.

It is precisely in order to give continuity to this political makeup that investments such as the Carajás Project and the hydroelectrics of Itaipú, Tucuruí, and Xingu have been projected, prepared, forced, and finally put into operation. And the same thing is now intended with these techno-territorial excesses represented by the Altamira Complex and the Brasília (DF) to Açailândia (MA) and Vilhena (RO) to Goiânia (GO) railways. This could also be the logic of the mineral programs of the Calha

Norte Project (in the states of Pará and Amazonas and the territories of Amapá and Roraima).

This in part results from what has been called the "Energy Policy;" from time to time, this "Policy" is expanded into sectorial, regionalized, or company programs or plans. There is no neutrality, nor is there chance, a fact recognized by Dr. Rômulo de Almeida (1977):

> An energy policy is the fulcrum of the entire productive system and through it, the social system. The acceleration of economic growth, the degree of autonomy of national decisions depend on the command of energy sources; and the form in which the benefits of the national product are divided results in large part from the form in which this command is exercised.
>
> An energy policy is ultimately related to the knowledge of the natural resources and their control, as well as a policy for human resources .... One asks the disturbing question, *who controls or for whom* is energy produced? The one who produces dominates.

Perhaps the impression remains, for some interlocutors, that we ourselves would be "politicizing too much" the debate over a program of works. It happens that the question, when it "took hold" of us and of thousands of other Brazilians, was already politicized. It would be worth recording two popular understandings on this:

- for the populations to be destructured by the works and by the Lake of Itaparica (PE/BA), one of the recurring refrains is "We won't repeat Sobradinho";
- in the Altamira region, which is not too distant from the Tocantins, it is already well known that "the fights in Tucuruí and Carajás" were ugly and were against powerful forces.

THE QUESTIONING OF the Altamira Complex touches on one of the sustaining pillars of the current energy policy: large-scale hydroelectricity/high-energy-consuming industry/exportation of high energy contents—and this implemented through a succession of violent acts against nature and against the future of society. And there, almost all citizens—not only the riverine dwellers, but also the immigrants, the prospectors, the Indians, and more the users of electricity, and all voters and taxpayers—are involved in the problem.

In this regard, I point to the foresight of J. Ilich who stated the following in 1975 (and which apparently still applies today):

> The energy policies that will be applied in the next ten years will decide on the margin of liberty that a society in the year 2000 will enjoy. A policy of low energy consumption allows for a great variety of lifestyles and culture. A modern technique can be economical in terms of energy and still leave open the way for different political options. If, to the contrary, a society pronounces in favor of strong energy consumption, it will then see itself obligatorily dominated in its structure by technocracy; and, whether this takes place in a capitalist or socialist country, this will become intolerable.

If we are not sufficiently strong to question, and subsequently to paralyze, the projects, it is very probable that the works on the Great Bend of the Xingu may be experienced by our generation and by all succeeding generations as a heavy trauma of our history.

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The Decision-Making Process and Technological Aspects

The Altamira Hydroelectric Complex and the Present Context of the Brazilian Electric Sector

Fernando Augusto Cunha

THE DECISION TO BUILD the Altamira Hydroelectric Complex will affect the development of the entire Brazilian electric sector, if not the entire process of economic development of the country.

Such a decision occurs at a moment when the country is going through a process of political transition, reaffirming more democratic procedures in the decision-making process after two decades of a harsh centralization of power.

This political evolution is working its way through all segments of national life—rapidly in some, more slowly in others. The process of the country's electrical energy development must be seen in this light, for it is the electrical sector that bears significant marks of authoritarianism and centralization, and yet is also in the process of being democratized and is thus reexamining new criteria and methods.

The Syndicate of Engineers of the state of São Paulo is an active force working for Brazil's redemocratization. As the voice of an industry that is fundamental to economic life, the syndicate wishes to participate constructively in the debate over the construction of the Altamira Hydroelectric Complex, particularly with regard to the issue's technological dimensions.

Preliminary information reveals that 60 percent of the energy generated by Altamira will be consumed by markets in Brazil's southeast region (São Paulo, Rio de Janeiro, Minas Gerais, and Espirito Santo); consequently, São Paulo should be the state that participates the most in the project, which is confirmed by the state government's involvement in decisions on the project.

On the other hand, similar debates related to the nuclear program of the Brazilian electric sector have been led by environmentalist movements; however, scientific associations, such as the Brazilian Society for the Progress of Science (SBPC), have developed arguments that are more compatible with the current level of demands from Brazilian public opinion.

Thus, we believe that the inclusion of the technological link in the chain of disciplines contemplated by this chapter, which concentrates on the indigenous question, is valid.

We are faced with a project that divides people into two distinct camps of protagonists. One camp, made up of those who live in the area in which the project will be built, will suffer extensive and intensive negative impacts with reduced benefits; those in the second camp, located far from the project, will feel few negative impacts but will receive enormous benefits.

Another fundamental element to evaluate is the relevance of the final product in the context of the need for raw materials for the socioeconomic process; in this case, the raw material is indispensable.

Under these conditions, the *modus operandi* in Brazil has been that the decision to go ahead with these hydroelectric projects prevails, given the country's model of rapid and concentrated development.

It remains for us, therefore, to analyze the possibilities for initiating the Altamira project, its technical characteristics, and the conditions under which its implementation will take place, from the beginning of the decision-making process.

Returning to the parallels that the Brazilian electric sector has with the country's nuclear power program, we recall that the nuclear program failed in that it underestimated costs and overestimated the growth of demand and failed in adopting an equivocal technological line.

The electric sector's consumption projections are made by correlating the growth of the demand for electricity with the growth of the country's GNP through a factor of elasticity, which is always greater than unity. This methodology—which does not analyze the merits of electricity use and adopts indicators such as GNP growth, which has low credibility in Brazil—could lead to impracticable or unrealistic scenarios. On the other hand, we should recall that people are not the users of electricity, but rather of services.

The model of extrapolation from tendencies can lead to gross errors, for other countries became industrialized during times when energy was both inexpensive and plentiful; today, these countries can expand their GNP without expanding their supply of energy.

The export model itself, calculated in energy-intensive products, such as steel and aluminum, could, at any moment, be revised.

The possibility of incorporating nonhydraulic sources, such as natural gas and other thermic sources, for generating electricity could postpone the need for an expansion in supply.

Eletronorte, the company responsible for viability studies, assumes the enormous need for infor-

mation about the area of the project, foreseeing investments in construction on the order of US $10.6 billion.

The Itaipú hydroelectric, which was built in the most developed region of Brazil, cost a total of US $15 billion ($1,500/kW)—about triple the value estimated in its viability study.

These large hydroelectric projects reduce the flexibility of the electric sector—with disastrous results, as is attested by the current financial situation of the national electric sector.

The financial resources, in large part from foreign savings, also penalize the enormous investments with a long maturation term.

About 70 percent of the current Brazilian debt was incurred by previous government administrations and by large construction firms, with investments in useful works and useless or "inopportune" works.

The large construction firms have a cartel that claims the government as their principal—and almost only—client.

The electric sector, in turn, works with a system of rates in which services are recovered by cost. It is basically a state system that has borne the lack of control over project costs; all risks are assumed by the public coffers.

As far as the Amazon region, once again the export segment of the projects is considered indispensable.

Even upon examining the dozens of large hydroelectrics constructed in Brazil, we can see that their construction did not have significant impacts on regional development.

We have thus decided to try to systematize the proposed questioning and directing of alternative solutions. With this in mind, we present the contributions of two competent, very experienced engineers. The engineer Márcio Wohlers de Almeida has developed the political and sociological dimension of the question, and the engineer Reolando Silveira its technological dimension. This gives us a more comprehensive view of the problem.

We hope to have contributed in a constructive way to the development of national engineering, which is inextricably connected to the country's global development, and to have adequately fulfilled our responsibilities in this country of enormous social injustices.

Hydroelectric Utilization of the Xingu and the Electric Sector's Development Model

Marcio Wohlers de Almeida

The emergence of the hydroelectric energy sector in the country occurred on the basis of very intense processes in capital, incorporating technological development made viable in the central capitalist countries for the large-scale production of electrical energy.

The first hydroelectric projects were situated near the main consumer centers, particularly São Paulo. The intense post-World War II industrial and urban growth, which required increasing amounts of affordable electricity, forced the state to invest in large hydroelectric projects, the majority of which were situated in the Paraná, São Francisco, and Uruguai basins.

The installed electrical capacity in the country is currently about 45,000 mW, 90 percent of which is from hydraulic sources.

Over the last 30 years, the public firms that made possible the construction of large hydroelectric plants have turned into important nuclei for the real accumulation of capital, consolidated at an expansion pole of the base infrastructure for the supply of electrical energy. This success was connected to a complex arrangement among the principal agents of the process, in which, in addition to the regulating agency (DNAEE, of the Ministry of Mines and Energy), the following were prominent: Eletrobrás (coordinating agency), concessionary firms, large work contractors, large suppliers of electro-mechanical equipment, engineering and consulting firms, and financial agencies.

From the end of the 1950s on, these actors formed a powerful concession, sustained by a series of interconnected demands at the level of production. At the same time, they shaped, on the superstructural level, a very agile and efficient political institutional framework to legitimate the continuity of the process.

In the context of this model of sectoral development, constructing and going on-line with the hydroelectric plants of Itaipú (with its continuous current transmission system) and Tucuruí represented the crowning of the large works policy, by creating the conditions for making the transmission of large amounts of energy viable to the load center (Itaipú) and by initiating exploitation of the hydroelectric potential of Amazonia through large hydroelectric projects (Tucuruí).

Eletrobrás anticipates using the hydroelectric potential of the Xingu River in the near future—estimated at 22,000 mW, 75 percent of which is concentrated in the Babaquara (6,000 mW) and Cararaõ (11,000 mW) plants, situated near the city of Altamira.

To continue this development model, it will be up to Eletrobrás, Eletronorte, and the consulting firms involved to finalize and detail the basic project and the engineering project for these two plants, given that the projections of demand have already been made, based on the prospects for Brazil's GNP growth. Beginning construction will depend on the balancing of resource programming and Eletrobrás' timetable for the works.

From the mid-1970s, however, the energy policy



Photo: Helio Campos Mello/F-4

The first plant of the Brazilian nuclear power program, Angra-I, built in Angra dos Reis (RJ) with technology from the Westinghouse Corporation.

elaborated for the electric sector suffered several distortions as a result of the fluctuating price of petroleum on the international scene and the very inconsistencies in energy policy. The principal equivocations in relation to the electric sector were the following:

- Incoherency with the large-scale Brazilian nuclear program, based on a nuclear accord with Germany, begun in 1975 and paralyzed in 1982, which consumed billions of dollars—with Angra II still unfinished (Angra I is with Westinghouse).
- Exaggeration in the concentration of investments in works of great import without the necessary balancing of resources, and through equipment acquired without bidding, and on dates prior to the desirable times.
- Distortion in the investments program, which was concentrated on generation to the detriment of transmission, contributing to the recent lack of energy in the south.
- Reduction of investments due to the economic crisis suffered by the country in the early 1980s, which brought with it a substantial rise in indirect costs.
- Restraints on duties as a way of making the electric sector companies instrumental for short-term circumstantial policies to combat inflation and to attract foreign resources.
- Large-scale utilization of international financing in a way that was incompatible with the sector's rate of remuneration and the country's exchange reserve.

The proposal for physical and financial reordering of this chaotic picture of the electric sector is to be found in the Plan for Sectoral Rehabilitation (PSR), which is being assessed by the World Bank and the Inter-American Development Bank and which has as its objective to provide those in-

volved in electrical energy with a coherent set of programs for action that could sustain the model.

It is within this context that the opportunity and impact of the program for large hydroelectric works on the Xingu should be debated, as a function of reorienting the model through incorporating new social and environmental demands.

Brazilian society already has an instrumental alternative for energy planning that contains the possibility of putting the demand for electrical energy into other socioeconomic contexts, including new modes of income distribution and regional and environmental development, based on creating an effective, broad-based agrarian and urban reform program and redirecting public expenditures.

The Decision-Making Process Behind Hydroelectric Projects

Reolando Silveira

A Retrospective View

In Brazil, electrical services had their beginning in the 1880s, in the early days of electricity, when the first thermal and hydroelectric plant was under construction—mainly for the purpose of public lighting and, subsequently, to provide energy. Bulletin No. 1 (1935) of the Water Service of the Ministry of Agriculture noted that: "Having begun with a small thermic plant in 1883 (for 52 kW), by 1889, the first hydroelectric of Brazil was inaugurated in Juiz de Fora."

By 1910, the Water Department of the Ministry of Agriculture published a statistical table of the installed power in Brazil:

Brazil—Ilstalled Power

Year	Thermic (kW)	Hydraulic (kW)	Total (kW)
1883	52	–	52
1889	3,143	1,475	4,618
1900	6,585	5,500	12,085
1910	21,996	137,684	159,680

It needs to be emphasized that, prior to the establishment of the Republic, by which time several hydroelectrics had been built in Brazil, there was no specific legislation on water use rights or on rights to ownership of the riverbanks, public rights to navigation, and so on, except for the archaic Ordinance of the Crown, the Resolution of 17 August 1775, and the Permit of 1804. Electrical supplies were governed by municipal contracts that awarded concessions and related rights, and the laws that governed the use of rivers were state and federal. In 1904, in response to the need for regulation, the jurist Alfredo Valadão prepared the first project for a waters code—which, however, was not converted into law until 1930. In these first decades of the Republic, several legal mechanisms arose that sought to discipline the use of hydraulic power without altering the essence of the juridical precepts in force: municipal concessions and ownership of state and/or federal waterfalls.

It was during this period (from 1900 to 1930) that two large foreign groups working in the area of electrical services settled and developed in the country: the Light Group and the Bond and Share Group. The Light Group obtained concessions for Brazil's major centers—Rio de Janeiro and São Paulo—and began its electrical services in 1900. The Bond and Share Group began its activities in the interior of the state of São Paulo by purchasing the majority of small hydroelectric plants, which, although built by Brazilian owners, by then did not offer any rental income because of debts and the lack of capital for expansion. These two foreign groups exploited the sector on the basis of municipal concessions, in which were established the "gold clause" and "maximum tariffs."

The Revolution of 1930 created the political conditions for promulgating the Waters Code through Federal Decree No. 24.643 of 10 July 1934. This code regulated the use of waters, the system of concessions for utilizing and exploiting hydraulic power for electrical generation, and the accounting and tariff system to which the concession firms were subject. An important aspect of the Waters Code—which already by that time revealed the public authorities' preoccupation with environmental problems—is its reference to protecting general or public interests, as stipulated in Article 143:

> In all hydraulic energy uses, the following precautionary requirements for the general (public) interest will be satisfied: a) food supply and needs of the riverine populations; b) public health; c) navigation; d) irrigation; e) protection against floods; f) conservation and free circulation of fish; g) drainage and rejection of waters.

Despite the existence of the Waters Code, foreign companies, which retained more than 80 percent of the electrical energy production in Brazil in the 1930s, never obeyed it. They used every means possible to undermine its authority, including lobbying to have it declared unconstitutional. Eminent Brazilians, such as Antonio Alves de Souza, Anhaia Mello, Meireles Teixeira, Catullo Branco, Gabriel Passos, Plinio Branco, Odilon Braga, Barbosa Kima Sobrinho, and so many others, obstinately fought to defend the Waters Code and its application to foreign concessionaries., Despite everything, foreign companies obtained new concessions and built works for hydroelectric generation that not only adulterated the natural conditions of many of our water courses, but also created nearly irreversible pollution damage to important water sources.

The truth is that in this period the "precau-

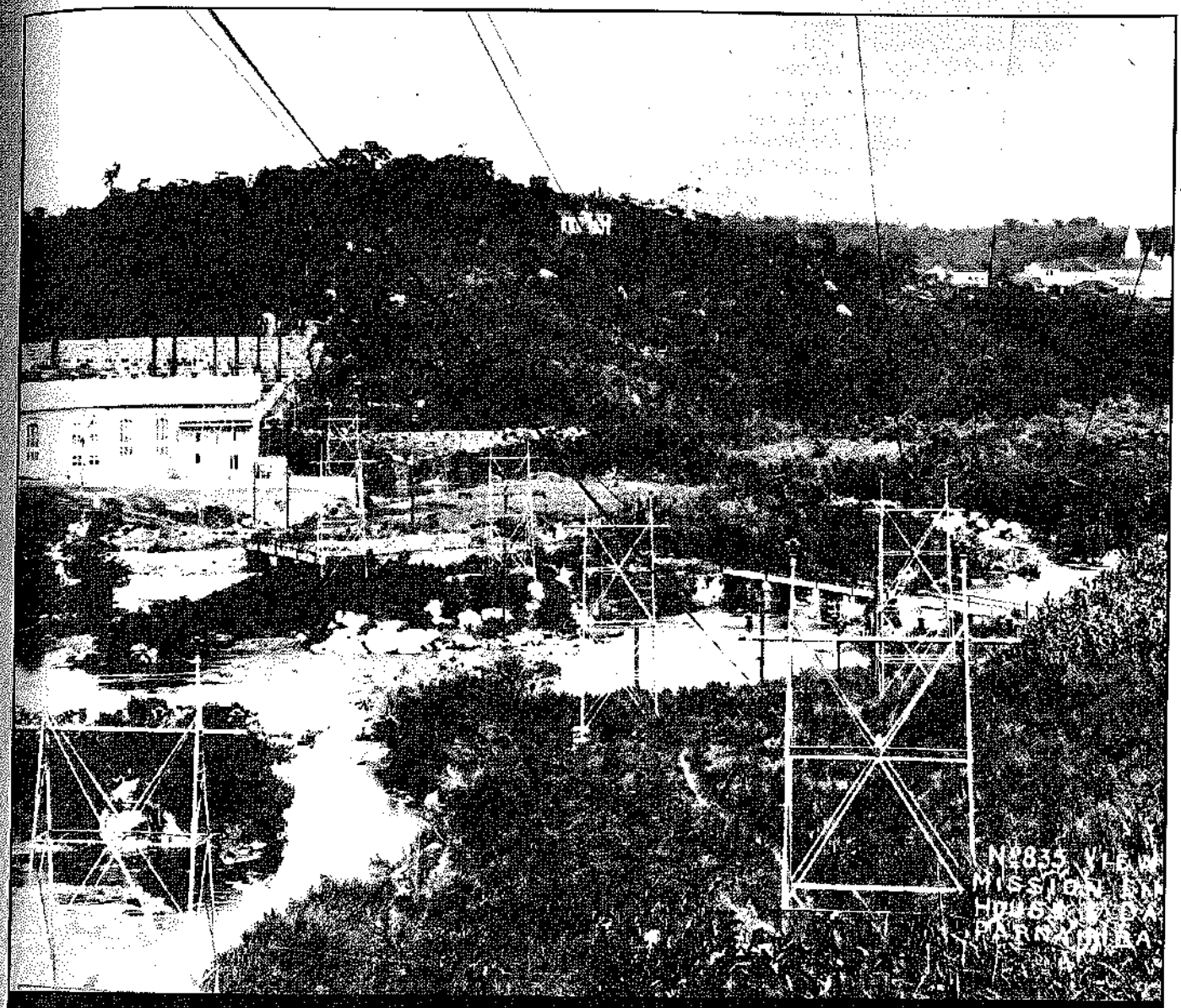


Photo: CDHEISP/Eletropaulo

Powerhouse and transmission lines of the Parnaiba hydroelectric plant, in the state of Sao Paulo, built between 1900 and 1904.

tionary requirements for the public interest" were never taken seriously when our rivers were used for generating electricity.

In the 1940s, the first state initiatives were taken for construction of hydroelectric plants: Salto Grande on the Paranapanema River in São Paulo, a plant projected and studied by the Sorocobana Railroad to serve its plan for railway electrification; and the Paulo Afonso plant, on the São Francisco River—with the creation of CHESF at the end of the decade—destined for the development of the northeast. Up until this time, the use of hydraulic energy for generating electricity was always associated with waterfalls; in this way, environmental interferences were less significant so long as the rivers maintained their general character of flowing water, according to criteria introduced mainly from European sources. The initial studies were authorized through a government decree from the Department of Waters and concessions granted by federal decrees, with few significant requirements as far as environmental interferences.

With the crisis in the electrical supply in São Paulo and Rio de Janeiro that began around 1946, and considering the large industrial expansion that was occurring as a result of the import substitutions policy, initial measures were taken for the state government to intervene in the electric sector. CEMIG was created in Minas Gerais and the State Commission for Electrical Energy in Rio Grande do Sul. The Department of Waters and Electrical Energy was created in São Paulo in 1951; it initiated the studies for hydroelectric utilization of the Paranapanema, Tietê, and Pardo rivers. On this occasion, Brazilian technicians deepened their understanding through experiences in North America, where large hydroelectric projects had been completed: Boulder Dam and Wilson Dam on

the Colorado River, the TVA's multiuse projects, and the Bureau of Reclamation dams.

In accordance with the requirements of the Waters Code, the process of decision-making behind the construction of hydroelectric projects can be summarized as follows:

First Phase (Preliminary Studies): Request to the Department of Waters of the Ministry of Agriculture to authorize studies for a determined part of a water course, after which that department issued an authorization decree. The requirements as far as environmental interferences were minimal.

Second Phase (Request for Concession): With the results of the preliminary studies, concession for hydroelectric utilization was requested from the Ministry of Agriculture; this request was made concrete through federal decree, which stipulated the time period for presenting the project plans.

Third Phase: After the projects were presented and approved by the Department of Waters, the period for construction was also fixed by government decree. In this phase, the requirements referring to environmental interferences were very limited, requiring only a succinct report on pisciculture with justification for the noninclusion of fish runs. Anything relating to alterations of the ecosystem, problems of eutrophication, and so on was totally neglected. When the reservoirs affected some settlement, only a superficial report was presented on the subject, and this always sought to minimize the economic and social repercussions of the artificial lake. It was, in short, the policy of *fait accompli*.

In this context, we would not say that it was out of the incompetence and negligence of public authorities, but rather due to their inexperience in the area of environmental interferences of hydroelectric projects that, in the period from 1950 to 1970, extensive programs of hydroelectric plants were developed and built that today serve the consumer markets of several Brazilian regions!

The early 1950s were characterized by an austere rationing of electricity, which in effect mobilized the productive sectors to demand from the government the construction of hydroelectrics in order to satisfy their energy demands. Wedded to these facts, the lobbies of large contracting firms and the nascent hydromechanic and heavy electric equipment industries were mobilized, which similarly pressured the governments toward the same ends. The response to these demands can be seen in the formation, at the end of 1962, of the Coordinating Committee for Energy Studies of the central-south region of Brazil, which planned the electrical supply in the region, surveyed the existing hydraulic potential in all hydrographic basins, and defined, in the face of the consumer market, which plants should have priority in construction. On 23 February 1967, Federal Decree No. 60.262 was passed, which approved the final report by the committee referred to above. In its Article 4, the decree stipulated that "the approval of the program of works contained in the report does not imply the approval of the respective projects, which should in all or most cases, be subject to the legal norms in force."

We wish to emphasize that the criteria for harnessing electrical energy utilized by the Canadian-Brazilian consortium Canambra, which was in charge of the studies for the committee, were exactly those derived from North American experience: to create a falls by damming the rivers at selected straits, with the generator plant situated, in general, at the base of the dam. These waterfall dams allow for near total utilization of the existing difference of level in the section of the river considered. In terms of river dynamics, this profoundly alters the system of water flow, which comes to be ballasted not in the equations of drainage to flowing water, but in the equation of lakes.

In this period, the "precautionary requirements for the public interest" in hydraulic energy use continued to be a dead letter.

Only in the late 1960s did the first concerns about the environment begin to emerge. In fact, it was at this time that the first works on eutrophication of the reservoirs created by dams began to appear. The fact that aquatic fauna were dying in great numbers had already been observed. The alteration in the system of river drainage as waterfalls passed into large lakes caused the many specimens of our rich aquatic fauna, so well characterized by the singular phenomenon of fish spawning (*piracemas*), to disappear: dolphins, piracanjuba, piapara, surubi, pintados, and so on. It is the sad syndrome of a rich natural life engineered by the insatiable predator!

Developing and Implanting a Hydroelectric Project

The growing popularity of groups concerned with environmental impacts caused by hydroelectrics – including the social problems incurred by resettling populations, as well as the flooding of productive lands – and demonstrations by scientific associations have led the authorities to look for solutions to these problems and to make their solutions compatible with the always growing needs to increase water power for communities. Thus, the National Department of Waters and Energy (DNAEE), the agency of the Ministry of Mines and Energy that coordinates national policy for the management of water resources and for the monitoring of electrical services in the country, has been developing efforts to endow the sector with institutional mechanisms that definitively regulate the questions arising from the environmental impacts of hydroelectrics. From the mid-1970s on, institutional norms were created for presenting technical viability studies and for presenting projects that sought to utilize water resources for whatever purpose. These norms have evolved and have been perfected, with always greater requirements to prevent environmental impacts.

For a better understanding of the problem, here is a summary of the phases of developing a hydroelectric project up to the time it is put on line:

First Phase—Pre-Inventory: In this phase, preliminary evaluations of the hydraulic potential of a section of river or of a hydrographic basin are made, based on maps, summary hydrologic studies, and local reconnaissance. The final report gives estimates for utilizable potential, fall division, and approximate costs. This phase *does not require* any authorization by competent authorities, given that it is fundamentally office work.

Second Phase—Inventory: In this phase, a more realistic evaluation is initiated, through grading the water course, installing pluvial and fluviometric posts, performing on-site geological and geotechnical investigations (including pilot seismic soundings), permitting the optimal use of the fall division, determining the firm power and respective potencies to install in each project, and developing an idea of environmental impacts of the reservoirs, as well as the costs of each alternative. In order to execute the *survey studies*, the respective *authorization of the DNAEE* is necessary, formalized through specific decree and obtained at the request of the interested party, to which are added, when they exist, pre-inventory studies. Once the studies are complete, the final report goes to the DNAEE for approval.

Third Phase—Viability/Concessions: As a result of the inventory studies, the scale of technico-economic priorities is defined for the project selected, for which *studies of technical and economic viability* will be developed. These consist of the most accurate analyses for each project, based on more thorough studies of topography, hydrology, and geology within the basic parameters of the fall division previously established in the inventory, including more thorough studies of ecology and environmental interferences, studies referring to the energy market and system of transmission, so that conclusions may be made as to how the hydroelectric project may be feasible from the technical and environmental points of view and how the benefits gained justify the respective costs.

The final report on the viability studies is sent to the Ministry of Mines and Energy, instructing

The dam of the Parnaíba hydroelectric plant (1904 photo)

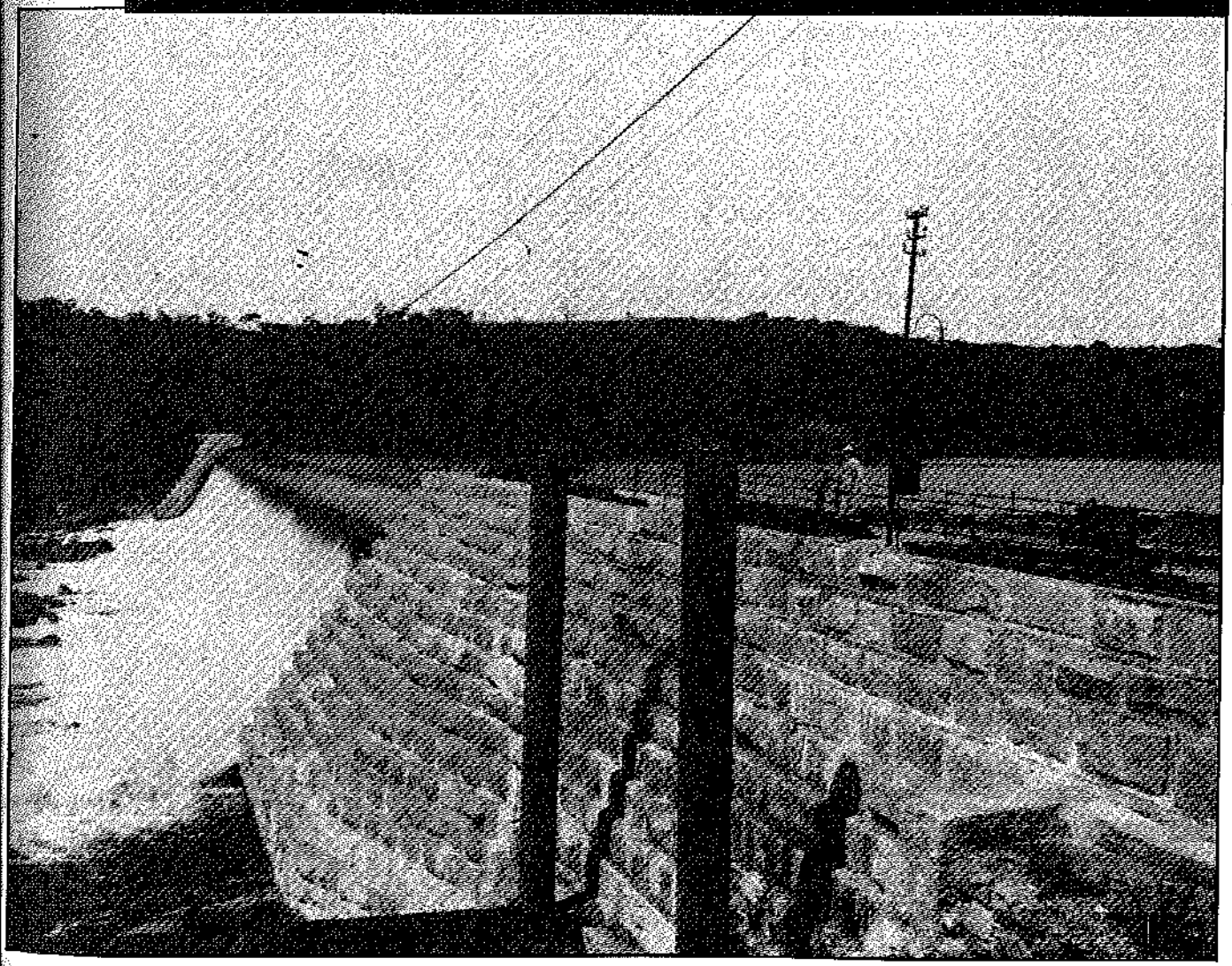


Photo: CDHEIS/Eletropaulo

on the requirements for the request for *concessions*. Once the studies have been approved, concession is granted through federal decree, which defines basic conditions: part of the river covered, names of the locations, purpose, system of rates, destination of the energy and period of concession, as well as time periods for presenting the *basic project* and for operation of the plant.

The analysis of the final report from the viability study is done by both the DNAEE and Eletrobrás, with the condition that the project should meet all of the necessary requirements: inclusion in the work program, level of costs, environmental aspects, and so on. Only after these demonstrations, and after everything has been duly clarified, is the *decree for concession* promulgated. Once this has been expedited, it is *implicitly admitted* that the plant *will enter into operation on a determined date*.

Fourth Phase—Basic Project: This is the phase of engineering conception: optimizing the overall arrangement and setting up the structures—the manner of diverting the river, the arrangement of the work areas, the residential nuclei for construction and for future operation, the auxiliary works (electrical energy, telecommunications, access roads, offices, etc.), the complementary works in the accumulation basin. In short, this phase serves to define technical specs for executing the civil works and acquisitions of electro-mechanical equipment and to detail the executive programming (physical and financial timetable). As far as the environmental aspects go, this phase determines what should be done in terms of clearing the area of flooding and relocating flora, fauna, and human populations, since these impacts and their shock "ought" to be evaluated, accurately, in the viability phase. The DNAEE's approval of the basic project signals the beginning of construction and defines the dates for initiating and completing the works, as well as the on-line dates for the generator groups.

Fifth Phase—Construction: In this phase, the executive projects are developed and all the work and measures necessary for realizing the project are made, within the technical conditions, time periods, and costs established in the basic project, up to delivery of the same to the commercial operation.

From what we have just described, one would presume that, at the beginning of a hydroelectric's construction, all environmental problems are duly balanced—at least after a certain date, when the authorities begin to take the initial measures to discipline the matter. In practice, however, the interests of one sector override another's: the electric sector, on the one hand, overestimates the importance of attending to electric demand and, on the other hand, underestimates the environmental implications of the project! In general, this sector relies on the lobby of large construction firms and the manufacturers of heavy electro-mechanical equipment. We believe, however, that in reality a distortion exists that can only be eliminated by a self-critical examination of the sector. One is not dealing, in essence, with combating this or that sector; one is dealing with aligning the directives for gaining the maximum benefits from the project from water resources for electrical generation, in perfect compatibility with policies and directives that emphasize full respect and preservation of nature.

In this way, the first emphasis should be on the *viability study* phase. It is in this phase that studies of environmental interferences must be the most accurate possible, for this is the *basic aspect* for making the decision, in definitive terms, of whether the undertaking is *feasible or not*, and, in being so, what measures and precautions have to be taken. Thus, even before getting to the basic project, all efforts must be exhausted in terms of studies, research, and investigations on the environmental implications in order to make a correct decision, free from secondary intentions!

The examples of procedures contrary to those described above are numerous: often, consideration passes directly from the viability phase, normally without going deeper into studies of environmental interferences, to construction, without even having concluded the basic project. These are political decisions that shorten the initial phases of the works without any other considerations. Striking examples of works that were initiated and concluded, based only on superficial consideration of environmental implications, are the majority, if not all, of the hydroelectric projects of the southeast and, more recently, the cases of Itaipú, Balbina, and Tucuruí. The destruction, as it was said, of the rich aquatic fauna that the Grande, Tietê, and Paranapanema rivers displayed is a sad example of a procedure that has to be revised and updated so that the same errors will not be committed in future hydroelectric projects!

Criteria for Dimensioning of Hydroelectric Projects

Current Criteria

The dimensioning of hydro projects is based on the following parameters:

a) fall height of the project;
b) available volume for regulation of discharge;
c) average discharge guaranteed throughout the hydrological period;
d) characteristics of the energy load to supply;
e) distances from the consumer center;
f) tariff/rate system.

In synthesis, it can be said that every hydroelectric plant should be projected or built to meet two

basic goals: first, to supply a certain guaranteed annual quantity of kilowatt-hours (energy), including during what is called conventionally the "critical period," normally designated as firm power; and second, to have the capacity of supplying a *certain immediate power* sufficient to cover the maximum demand for the consumer market, in whatever hydrological conditions, as well as allowing for periodic stoppage for maintaining the generator units, which parameters characterize the *installed power* of the plant.

If the first factor is directly associated with the operational income of the plant and connected to the quality of the energy generated, the second parameter determines cost, since this is mainly the result of the maximum discharge the turbines can handle, which in turn defines the maximum dimensions of the mechanisms for harnessing, adducting, and generating energy. It thus can be understood why technicians seek, whenever possible, to increase the fall height of hydroelectrics: it is that for a given unit of power, ("power" basically being represented by the product of the *outflow turbinated by the fall height*), the greater the fall height, the less the discharge and, consequently, the lower the final cost.

Now, the environmental implications increase in direct proportion to the increase of fall height for the types of hydroelectric predominant in Brazil—that is, the so-called "dam-base plants." In the United States, the Bureau of Reclamation, the agency responsible for planning and building multipurpose projects for hydrographic basins, fixed the limit of 100 feet (approximately 30.5 meters) as the maximum height of dams on rivers of low slope, considering three factors: one connected to the protection of aquatic fauna—that is, confirming that the salmon ascend fish runs up to this limit; another determined by the maximum height of navigational locks in a single operation; and the third by the maximum size of the diameter of the turbines.

Among us, these limitations were never considered, much less the limitations in height of fish runs for our rivers. With a few rare exceptions, our rivers were never studied for multiple uses of water resources. Those that were, such as the middle and lower Tietê basin, had their basic premises corrupted by the interests of electrical generation which, always in the essential part, prevailed to the detriment of other uses of water as important or much more important than generation.

A Change in Focus

Three factors show that it is necessary to revise the criteria for utilizing our rivers. First, the basic premise is that water is essential to life and that it is scarce and its quality progressively decreasing. Second, the demands for protection and care of natural resources because of the predatory actions of humans are growing. Third, the needs for electrical supply to the population, also considered essential, are always growing.

First, it is necessary to consider the hydrographic basin as the basic unit for planning the utilization of our water resources, independent of political and/or administrative boundaries.

Second, the utilization of our water resources ought to be analyzed with a multiple focus—that is, the water project should seek to bring together, in the same work, different use goals: flood control, navigability, energy generation, systematic management of floodplain and irrigation, pisciculture, water supply for populations, recreation, and leisure.

Third, in the joint planning for a hydrographic basin, the height of the dams should be limited to determined values, depending on the characteristics of each section considered: headwaters, plains, outlet, relief configuration, occupation of the soil, existing flora and fauna, and so on.

For example, in the case of electric energy generation on plains rivers—as in the case of the Tocantins and Araguaia rivers and the rivers of the Amazon Basin, the dams should be low fall, limiting reservoirs to the river bottoms, and always maintaining the flowing water character of the water course.

Another aspect that has to be revised is that referring to the dimension/size of the hydroelectric. The law of economy of scale has been observed up to a certain limit; when we extrapolated for gigantic works, such as Itaipú and Tucuruí, the economy of scale did not work. This more than proved that, although the indices of m^3 of concrete per kW, kilogram of turbine per kW, kilogram of copper per kW, kilogram of siliceous plate per kW, etc., may be much smaller for the large hydro plants, their specific costs, nevertheless, are much greater given the sophisticated technologies required for their production, which result in high final costs. And this without considering the costs that would have to be incurred for an adequate treatment of the environmental repercussions caused by these projects.

In Europe, large plains rivers have been integrally utilized in hydroelectric projects without sacrificing their flowing water characteristics. The uses of the Rodano, Rhine, and Danube rivers, among others, attest to this.

In Brazil, the regions of intensive energy consumption have had their hydroelectric potential practically exhausted, such as the northeast and southeast regions. The electrical supply to these regions will have to be sought in productive hydroelectric sources located far away (Amazonia), since thermoelectric sources based on petroleum or natural gas still do not have their viability confirmed.

Although the potential of the Amazon region is extraordinary, it presents two impediments:

- its great distance from consumer centers, and

• the irreparable consequences on its environment.

In fact, the studies that Eletrobrás and Eletronorte have been undertaking indicate a significant utilizable potential in Amazonia; in the Xingu Basin alone, there will be a total of 22,000 mW distributed in five plants on the Xingu River, and two on the Iriri River, its main tributary. However, the criteria utilized in evaluating this potential, as well as in establishing the dimensions of the plants, were practically the same as for the southeast, with the same possibility of annihilating the original aquatic fauna and causing irreparable damage to the indigenous populations that inhabit the rivers' banks. We firmly believe that a change in concept—from large projects to low-fall and medium-load projects for flowing water—could bring economically and technically viable results for electrical generation without the inconvenience from major environmental implications.

With all due respect for the Eletronorte and Eletrobrás technicians, we nevertheless have to be cautious in believing their levels of specific costs indicated for the projects studied. As we said, the costs of Itaipú and Tucuruí are there to attest to the illusion of economy of scale. Today, in the southeast and south, the specific cost for kilowatts installed ranges from US$ 1,200 to US$ 1,800; this is for the most developed regions of the country, without considering the immense difficulties of access and mobilization that characterize the Amazon region. If we add the immeasurable costs necessary to minimize the environmental impacts caused by large projects, we would conclude without discussion that these undertakings are not feasible.

We thus face a challenge: to mobilize our force and intelligence in order to develop adequate dimensional criteria for the great hydraulic potential of the Amazon region, so that the utilization of water power and its transmission to the southeast/northeast can be made technically and economically viable, while at the same time minimizing, if not eliminating, any environmental and ecological interferences.

In summary, we can make the following conclusions:

• the necessity and advisability of exhaustively developed studies on the environmental impacts of hydroelectric projects in the viability study phase, to permit correct decisions as to the feasibility of a project;

• the necessity and advisability of evaluating the remaining potential of Brazilian river basins, including the Amazon Basin, with the idea of multiple uses of water resources, limiting the fall height for each project in such a way as to minimize environmental impacts;

• the necessity and advisability of proceeding with studies that seek to make the smaller dimensions of the resulting hydroelectric projects compatible with the requirements for long-distance electrical transmission;

• the necessity and advisability of structuring the administration of water resources of the river basins, through organizations where the communities interested and users of these resources effectively participate in decisions.

In formulating these conclusions, we are certain that we will be contributing so that our natural resources may be technically, economically, and rationally utilized and that the legitimate interests of the local communities may be protected by eliminating the impacts, of whatever nature, that may befall the projects initiated.

Brazilian Energy Policy

Luiz Pinguelli Rosa
Roberto Schaeffer

Because of its capacity to affect all aspects of the economy, defining an energy policy is one of the most serious and complex decisions that a government can make.

Brazilian energy policy, for its part, has been supported by large energy-generating projects—a hydroelectric program and nuclear program[1] for the generation of electricity, a national program for alcohol production,[2] and domestic exploration for oil for the production of liquid fuels. Energy policy can thus be seen as the manifestation of a socioeconomic development model that seeks a rapid growth and diversification of the industrial base through a forcible concentration of resources in the modern sector.

Despite the fact that this policy has, over time, obtained an unquestionable success in promoting industrialization and in expanding Brazil's GNP, this process has created and exacerbated a large number of serious economic, social, environmental, and political problems. These problems can in no way be underestimated when evaluating the merits and defliciencies of this policy.

The fact that these large energy programs have tied up huge amounts of resources has led the Brazilian energy sector to resort repeatedly to international financing and all of its negative implications.

After the shocks caused by the sudden rise in international oil prices in 1973 and 1979, Brazilian energy policy for liquid fuels (alcohol, petroleum derivatives, and natural gas) was characterized by the creation of the Proálcool Program, in seeking a substitute for gasoline, and by the intensification of prospecting for oil on land and sea. Although this program undeniably contributed to alleviating the burden of oil imports in the Brazilian trade balance, it created several distortions, such as the substitution of food cultivation for the planting of sugar cane, environmental impacts from the dumping of large quantities of waste products in water sources, heavy subsidizing of alcohol producers by the federal government, and social problems.

The rapid expansion of hydroelectricity, for its part, predates the petroleum crisis, which only reinforced the importance of electrical energy in the national energy balance. The novelty was the option, in 1975, for a large-scale nuclear program, instituted in an authoritarian manner with no participation by the Brazilian people, through an agreement with Germany that was extremely expensive, highly debatable, and ultimately paralyzed by the economic crisis and by intrinsic factors.

The concentration of lavish investments in large-scale power stations (hydroelectric and nuclear), to the detriment of energy transmission, ended up creating distortions. Recently, the southern part of Brazil was subjected to a rationing of electrical energy, the southeastern region saw itself on the verge of doing the same, and the northeast at the moment is experiencing the serious social and economic consequences of the lack of electrical energy. At the same time, Brazil today still has large works that are uncompleted, lacks transmission lines, and has a hydroelectric potential capable of meeting the projected demand until the second decade of the coming century, if the present model of economic development is maintained, or very much beyond, if the current premises for development are considered.

This text is based on an article by Luiz Pinguelli Rosa, "Na gangorra do petróleo," published in *Ciência Hoje* 4(24) (May/June 1986), pp. 58–64.

[1]This program arose out of the nuclear accord with Germany, signed in 1975, which sought to install in Brazil a nuclear reactor industry with enriched uranium, and also the cycle of nuclear fuel, including enrichment (by centrifugal jet—still not practicable) and reprocessing. The initial program planned for the installation of eight reactors of 1,300 mW each by 1990.

[2]Also known as *Proálcool*, this program originated with the first oil shortage crisis in 1973 and with the sugar crisis on the international market. In this first phase, only distilleries annexed to the sugar-processing plants were used, and alcohol was used as a blend, in quantities of up to 20 percent, with gasoline, for use by automobiles in common Otto-cycle motors. After 1979, Proálcool took on a new dimension as it constructed independent distilleries, expanded sugar cane production, and manufactured automobiles with motors that used alcohol exclusively.

The inequalities in the distribution of wealth and labor product between developed and nondeveloped countries, among regions of these countries, between cities and rural areas, and among social classes, are clearly reflected in the distribution of energy consumption, especially in its commercial forms—as electrical energy and derivatives of oil and carbon. Table 1 gives a sample demonstration of the inequality existing among developed and nondeveloped countries. In North America, in 1981, energy consumption per person was more than

twice the proportion in Western Europe, more than five times the world average, nearly nine times the Latin American consumption, and nothing less than 70 times the African. With 1.2 ton-equivalents of oil per inhabitant (t.o.e./person), Brazil at that time was situated almost at the world average, which was 1.3 t.o.e./person. Although higher than the African and Chinese averages, Brazil would need to more than double its per capita consumption to equal the situation of Europe or Japan. This difference, in turn, is more pronounced if useful energy is considered—energy which, after being transformed into equipment, will in fact be used for doing work—not counting the losses, since national equipment has an average level of efficiency less than that of equipment utilized in developed countries. Besides which, Brazil's climate makes environmental heating unnecessary, a factor that accounts for a significant part of the domestic consumption of energy in colder countries. Added to this is the fact that national growth has been based on a productive system developed for an export model, heavily based on energy-intensive products (such as steel and aluminum). This is the same as saying that a large part of the energy consumed by the Brazilian industrial sector is being indirectly exported, built in as raw material in the consumption of these products, thereby reducing further the per capita energy actually consumed internally.

Table 1
Energy Consumption
(t.o.e./person)—1981

North America	7.0
Soviet Union	3.9
Eastern Europe	3.2
Western Europe	2.9
Japan	2.5
Latin America	0.8
Middle East	0.7
China	0.7
Africa	0.1
Average of nondeveloped countries	0.3
World average	1.3
Brazil	1.2

Source: Olsem 1984

Table 2 shows the relation between production and consumption of energy in several parts of the world in 1981. At that time, Japan produced only 10 percent of the energy that it consumed; Western Europe, 55 percent; Eastern Europe, 75 percent; and the United States, 90 percent. On the other hand, the Soviet Union produced 30 percent more than it consumed; South America, 40 percent more; and Africa, 140 percent more.

Table 2
Relationship Between Production and Consumption of Energy (%)—1981

Africa	240
South America	140
Soviet Union	130
Canada	110
United States	90
Eastern Europe	75
Western Europe	55
Japan	10

Source: Olsem 1984

Table 3
Primary Energy Consumption
in Brazil ($\times 10^3$ t.o.e.)

Source	1973	1979	1984
Oil	37.8	55.5	54.8
Firewood	23.9	27.2	32.3
Hydro	16.8	33.4	47.9
Sugar cane	7.0	11.2	20.3
Coal	2.4	4.8	8.0
Natural gas	0.3	0.9	2.6
Others	0.2	0.6	0.9
TOTAL	88.4	133.6	166.8

Observation: The Equivalence relation utilized was one megawatt-hour (mWh) to 0.29 tons equivalent of petroleum (t.o.e.) This corresponds to oil consumption, expressed in t.o.e's, necessary to generate one mWh of electrical energy in one thermoelectric plant, with approximately 30 percent output.

Source: Balanco Energetico Nacional

Table 4
Primary Energy Consumption
in Brazil (%)

Source	1973	1979	1984
Oil	42.8	41.6	32.9
Firewood	27.0	20.4	19.4
Hydro	19.0	25.0	28.8
Sugar cane	8.0	8.4	12.2
Coal	2.8	3.7	4.8
Natural gas	0.3	0.7	1.6
Others	0.1	0.2	0.3
TOTAL	100.0	100.0	100.0

Source: Balanco Energetico Nacional

The evolution of primary energy consumption in Brazil is represented in Tables 3 and 4, in which the years of the first and second oil shortages (1973 and 1979)—after which changes were promoted—are taken as reference points, along with the year 1984. The tables show that the role of petroleum remains dominant, although its significance fell from 42.8 percent in 1983 to 32.9 percent in 1984. Natural gas consumption increased greatly, in absolute terms, multiplying by nearly 10 times between 1973 and 1984, although it still remains at relatively low levels. The utilization of coal and sugar cane also increased. The significance of hydraulic energy increased from 19 percent to nearly 30 percent. The role of firewood, although it suffered a certain variation in this period, remained considerable.

Electrical energy in Brazil has two characteristics: it is national, and its source is almost exclusively hydric, which requires an effective planning of the power stations so that generation needs can be met. The first characteristic, which is connected to the continental dimensions of the country and to its geographical and economic aspects, has an important exception: a portion of the electrical energy to be generated in Itaipú, half of which belongs to Paraguay, will be imported by Brazil. Even in this case, however, the investment was Brazilian and made in accordance with the plan of the national electric sector.

NORMALLY, IT IS CUSTOMARY to establish a proportionality between the relative growths of electrical energy consumption and the GNP, based on a directly proportional, same sign coefficient of elasticity on the two quantities considered. This hypothesis, however, is extremely questionable. On several occasions in Brazil, this coefficient surpassed the value two and, in others, was negative, with a drop in the GNP and growth in electrical energy consumption. The high value of elasticity reflected, among other factors, the development of industrial sectors that use electrical energy intensively and the substitution in industry of petroleum-derived fuels for electricity. To the extent that the country attains a greater level of development, this coefficient is expected to become stable, close to unity, as occurs in developed countries. To give a better idea, last year electrical energy consumption in Brazil increased 8.8 percent and the GNP increased 7.7 percent, which is equivalent to an elasticity coefficient of 1.14.

The policy that guided Brazilian electric planning in the 1970s aimed to guarantee the supply of electrical energy with a more than sufficient margin for consumption, especially industrial consumption. In fact, between 1970 and 1980, the rate of annual increase in generation of electrical energy was always above 10 percent. The long-range extrapolation from that tendency led to enormous predictions for installed power, with estimates that it would reach 150,000 mW by the year 2000. Since, at the end of 1984, the national installed capacity for the electric system was 41,000 mW, in order to reach that amount by the beginning of the coming century 109,000 mW would have to be installed in 15 years. This would imply an average growth of 9 percent per year of the installed capacity of Brazil between the years 1985 and 2000.

In this perspective, in addition to the immense hydroelectric plants, such as Itaipú—with a capacity to generate 12,600 mW—a large program for constructing nuclear reactors was planned in 1975, in collaboration with West Germany, which would generate 10,400 mW in 1990 with eight reactors, and 75,000 mW in 2000 with fifty-eight reactors. The program for eight reactors, initially budgeted at a little over $10 billion, would in fact cost more than $30 billion. Itaipú, for its part, cost nearly $15 billion, also far surpassing initial predictions. Even so, its price per kilowatt installed was much less than that of Angra II, the second, still unfinished Brazilian reactor and the first constructed as part of the agreement with the Germans (Angra I, the first Brazilian reactor, already in operation, is by agreement with Westinghouse).

Among the arguments used during the military regime to justify massive investment in electric energy, with the almost simultaneous undertaking of several large works, was the energy crisis caused by the oil shortages. This, however, had a strong impact in Brazil only insofar as it affected liquid fuels—the country imports oil—but not as it affected electrical generation. Official sectors nevertheless foresaw the sudden appearance of an electric energy crisis by around 1990 in the southeast, where the major consumer centers are located. The crisis would result from the exhaustion of hydroelectric resources—underestimated at the time—and from the supposed inviability of long-distance transmission, which would prevent bringing potentially available energy in the northern and central-west regions to Brazil's more developed centers.

Whence, allied with other interests, came the expectation of nuclear energy as a source for thermoelectric generation. But the program ended up being frozen, after $4 billion was spent, $1 billion was owed, and with five years left to finish Angra II.

BRAZIL'S ECONOMIC CRISIS in the early 1980s, together with an overconcentration of investments in large projects, left the electric sector in a difficult situation.

At first, with the imbalance between supply and demand, there was an excess of electric energy. Then, contracts were signed to sell this energy to industry, to substitute fuel oil, as part of the thermoelectric program, at ridiculous prices. Even more serious is the case of the energy generated at Tucuruí, which, through deviations in national

economic policy, has supplied multinational aluminum corporations installed in the region in exchange for tariffs currently around 17 thousandths of a dollar per kilowatt-hour consumed, against a real cost of approximately 45 thousandths of a dollar for the same kilowatt-hour produced.

Then, the reduction of investments provoked by the crisis, together with the distortions of these investments—which were concentrated on generation to the detriment of transmission—recently led to the energy shortage in the southeast, affected by an exceptional drought. It is also currently leading the northeast to ration electrical energy, coupled with a very pronounced drought that has reduced the rivers to an extremely low level for this time of year, preventing normal local generation. The northeast could supply its demand by transferring part of the energy generated in the northern region—more specifically at Tucuruí—but, due to the existing system of production, which is based on exports and legitimated by large industrial projects, it now sees its serious social and economic problems aggravated by the compliance with contracts of energy supply to large multinational complexes for aluminum production.

Thus the situation has become a paradox: supplying energy to large consumer centers in the coming years could bring on an energy crisis, yet at the same time long-term projections guarantee the viability of meeting demand through hydroelectric generation, not nuclear power.

On the basis of market study, Electrobrás has made a projection that takes into account population, GNP, and electricity production. The relations among these variables, year by year (represented in Table 5), indicate that Brazil would reach the year 2005 with about 3,000 kilowatt-hours per inhabitant, which is a very reasonable goal (close to what Italy had in 1982).

Table 5
Evolution of Population, GNP, and Electrical Energy Production

	1970	1975	1980	1985	1990*	1995*	2000*	2005*
Population ($\times 10^6$)	93.8	106.3	119.7	135.5	152.2	169.7	187.9	206.2
GNP ($\times 10^9$ dollars for 1980)	108.6	178.3	248.7	264.7	334.2	447.3	598.6	767.6
Electrical energy production ($\times 10^9$ kWh)	46.2	79.4	139.6	191.2	282.8	383.5	501.5	638.7
Per capita income ($/person)	1,158	1,677	2,077	2,177	2,593	3,112	3,762	4,395
Per capita electrical energy (kWh/person)	492	747	1,166	1,410	1,860	2,259	2,669	3,097

*Projected

Source: Adapted from Gomes 1985

For that to occur, it would be necessary to generate 638.7 tWh (that is, 638.7 billion kWh) of electricity in 2005—which would imply an installed power of approximately 73,000 mW—an amount much inferior to the 930 hydroelectric tWh/year available, considering the hydroelectric potential of Brazil to be a firm 213,000 mW or 106,000 mW. Table 6 shows the results of different projections for electrical energy production; note that, for the year 2000, all values are greatly inferior to the hydroelectric potential available, which would only be used up by the year 2020.

Table 6
Different Projections for the Production of Electrical Energy (tWh)

	1990	2000	2005	2020
(1)	305	501	638	—
(2)	266	481	612	991
(3)	—	456	—	1,390

Observation: tWh = 1 billion kWh; hydroelectric potential = 930 tWh/year; production of electricity in 1985 = 191 tWh

Source: (1) Gomes 1985; (2) Carvalho 1985 (the constant values in this text were increased by 10% for they referred to consumption; and the table above refers to production which includes losses in transmission); (3) Brito 1986

To meet the demands of this market, the electric sector works with a view to resorting increasingly to the great hydroenergy power available in the northern and central-west regions, since it does not plan to expand the role of other existing energy sources—nor incorporate new alternatives—in meeting the projected demand for electrical energy.

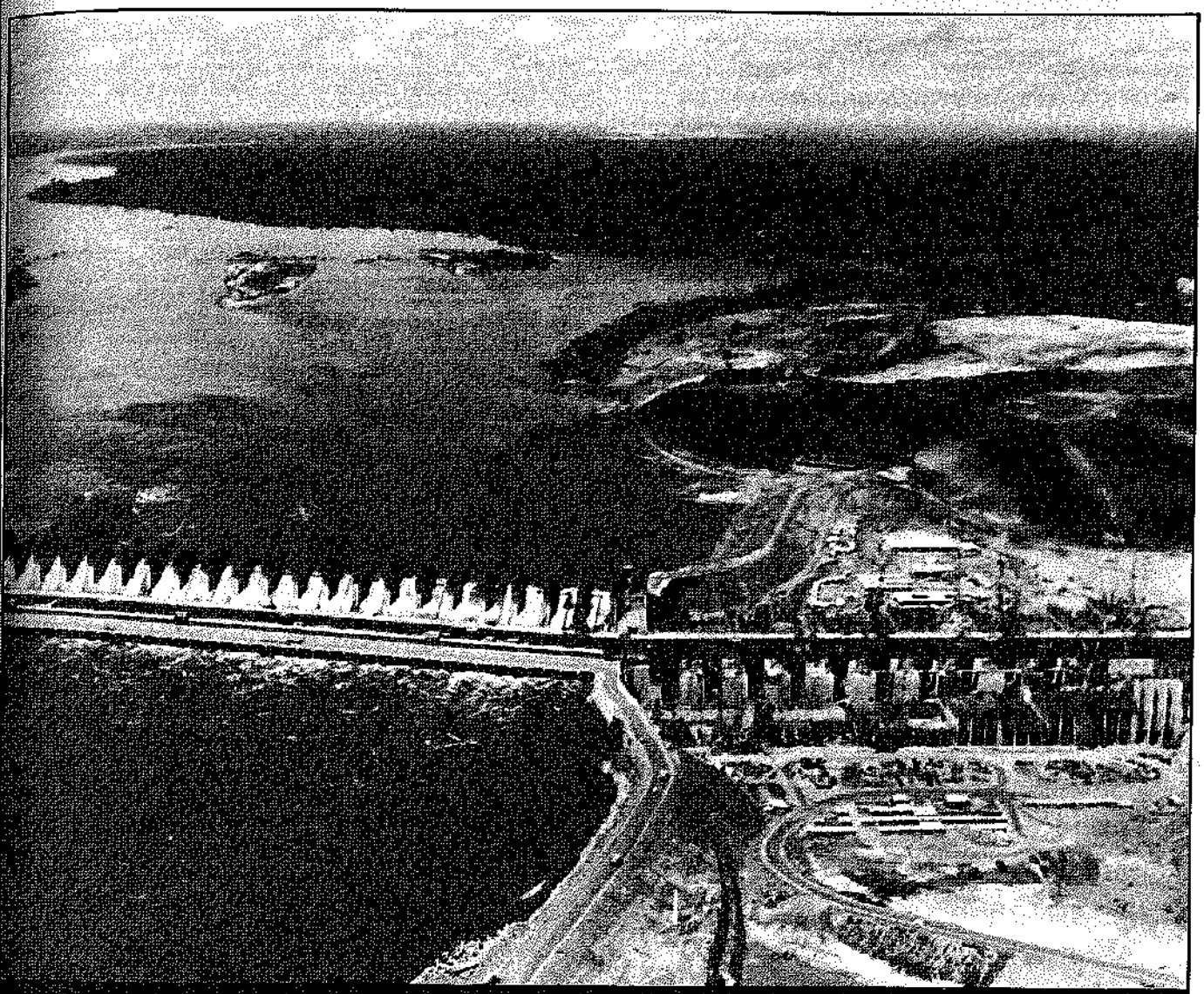
In this context of Brazilian energy policy and the logic of its development we can situate the Altamira Hydroelectric Complex, located on the Xingu River (state of Pará).

The survey studies of the Xingu, completed at the end of 1979, estimated its hydroelectric potential at about 22,000 mW, divided into five possible points on the Xingu River itself (Cararaô, Babaquara, Ipixuna, Kokraimoro, and Jarina) and two on the Iriri River, its main tributary. About 75 percent of this entire potential is concentrated in only two of these, Babaquara and Cararaô, which form the so-called Altamira Complex.

Babaquara, located upstream from Altamira, will flood an area of 6,500 km² (equivalent to more than five times the lake formed by Itaipú or three times the lake formed by Tucuruí), and will have an installed power of about 6,000 mW—18 turbines with 366 mW of unit power (equivalent to less than half of the installed power of Itaipú, or less than the final installed power of Tucuruí). The final estimated costs for Babaquara are, according to Eletronorte, around US$ 6 billion.

Cararaô, situated downstream from Altamira, will flood an area of 1,500 km² (comparable to that of Itaipú) and have an installed power of about 11,000 mW—21 turbines with 525 mW of unit power (equivalent to 90 percent of the installed power of Itaipú). The final estimated costs for Cararaô, are also according to Eletronorte, around $US 4.6 billion (Nunes 1986).

Given that the Cararaô and Babaquara plants, according to Eletrobrás' Plan 2010, are anticipated to go on-line in 1998 and 2001, respectively, it can be



Source: CPI/SP archives

The Tucuruí hydroelectric plant, initiated in the 1970s, on the Tocantins River (PA), is a landmark in Brazilian energy policy. Its construction enabled the development of large economic projects in the region, especially for exploring mineral resources (Albras, ALCOA, Alunorte, and the Great Carajás Program).

seen that the short- and medium-term policies to be followed by the electric sector tend to repeat the recent past—that is, of constructing large hydroelectric projects at high investment costs. Everything indicates that the inevitable environmental impacts will only be taken into consideration after the decision to go ahead with the work. Important social and ecological variables, however, have to be taken into account before the decision to build an electric plant is made, and alternatives that minimize the impacts must be sought that do not consider only electric power and cost.

Although it is an extreme example, it does not seem reasonable to think of building a nuclear reactor in the middle of a large metropolis, even though energy projections and economic criteria point to that possibility. Much less so, then, should a large hydroelectric plant be built out of necessity only because demand forecasts and cost-benefit analyses point in that direction. In fact, there seems to be a tenuous boundary between what is measurable and what is not in the process of deciding whether to construct a large hydroelectric project. There are many other aspects to be taken into account beyond energy and economic factors.

There are things which have no price and thus cannot be analyzed by economic criteria, such as the dislocation of an indigenous nation. This is a question that demands the application of political and social criteria along with the usual economic and technical criteria.

With the present focus, many works have been justified on economic and energy criteria. But what purpose should the energy generated serve other than as one more basis of support to guarantee the quality of life of humankind? A quality of life which, in large measure, depends on the quality of the environment put at the disposal of this purpose.

In effect, when the definition of an energy policy to fix a priori as an objective the attainment of a given per capita index of energy means abstracting the fact that there are several parameters that comprise the integrity of human beings (physical, biological, cultural, and social), the needs are differentiable. Developed countries have demonstrated that the correlation between increments in the quantity of energy consumed and quality of life ceases to exist after a certain level, and in some cases, starts to be inverted from then on. The value of this "level," in turn, is profoundly associated with the selection of the road that each country wishes to follow.

In the case of Brazil, any coherent policy for the electric sector cannot remain blind to the considerations presented here. Large power plants can no longer be justified through decisions revealed to society. The fact that promising sites have been identified in terms of water power on the Xingu does not mean that, of necessity, they have to be utilized. In a democracy, people must have access to all studies developed for the country and have the institutional means to veto, if they so desire, the implementation of any one of these projects. Despite the fact that this could affect the full utilization of Brazil's hydroelectric potential, the electric sector has to have the flexibility sufficient to find more adequate locations for dams.

At the same time, it is fundamental that mechanisms be created that permit ways of participating in the decisions on these works, including the participation of indigenous peoples.

Implementing solutions for these problems inherited from the authoritarian period of Brazil's government thus depends on a more complete and clearer understanding of the overall picture that lies ahead.

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Alternative Proposals for Brazilian Energy Policy

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THE BRAZILIAN SYSTEM of production, developed to meet the needs of an export model that has directed the country's growth, often requires the mobilization of financial and technological resources that are not available in the country at the levels required.

Brazilian energy policy, in turn, is a mirror of this system of production and the legacy of an authoritarian and centralizing government. Thus, attempts to change this policy must seek greater autonomy for states and municipalities. A more profound change in energy structure will depend on significant changes in the economy.

Brazil's growth has strengthened energy-intensive, industrial activities. This fact has implied the expansion of enormous urban conglomerates, characterized by vertical structures, by the need for large-scale, daily dislocation of personnel from home to work, and by intensive energy consumption. Thus, the need to meet large and precisely concentrated energy demands has led to the construction of large electrical energy generating plants, which have benefited large national and transnational economic groups—equipment suppliers, entrepreneurs, and financial conglomerates—for whom these large complexes are of great interest.

Thus, significant changes in Brazilian energy policy depend on structural changes in the political, economic, and social life of the country. The option exists and is viable—but, clearly, within a new logic of development.

In the case of oil, the recent relative lowering in the price of this imported product must not lead to the definition of shortsighted policies. Investments in off-shore exploration (maritime platforms) and in the development of deep-water technology cannot bear the solution of continuity, among other reasons because entering into a new field requires several years of work. Although it may be difficult to forecast the behavior of international oil prices over the medium range, the tendency over a longer time span is for higher prices. Thus, its principal use must continue to be, basically, in the sectors of transport and petrochemicals.

The use of oil in thermoelectric generation is totally impractical—due to its high cost, to the small internal availability of this energy resource for such an ignoble purpose as its burning, and to the environmental problems associated with its combustion, except under very specific conditions. Extreme situations, however, such as peak demand and generation reserves for very dry years and supplying isolated communities, can justify it.

The role of alcohol, in turn, needs to be redefined. The Proálcool program needs to be reformulated since the conditions under which it was created have changed completely. For example, there is already a possibility that in the near future the country will become self-sufficient in oil. In addition, the experience accumulated over the years in the development of the Proálcool Program is sufficient to allow for redirectioning.

Nuclear energy is, at the moment, totally inviable. Initially seen in Brazil as an alternative to large dams, or as a solution to the then-exhaustion of underestimated national hydroelectric potential, today it presents production costs many times greater than those from other sources, and, in its utilization, totally unnecessary risks.

COAL IS, AT THE MOMENT, a minor alternative, given that there are proven reserves only in the south, and these are of poor quality due to a high incidence of sulfur and ash. Its utilization in thermoelectricity could provide a good option only for the southern states and, together with other sources, could comprise a range of energy alternatives, as long as certain environmental protection measures are taken throughout its cycle of production, from mining to final burning. Despite the fact that coal could still fill a significant gap in the National Energy Balance, its ultimate inclusion will probably never be significant to the electric sector, in contrast to what occurs in many other countries.

Natural gas, which is abundant in specific regions of the country, seems to be one of the most promising resources for the future. In the southeast, where there is ample availability of resources at Bacia de Campos (Rio de Janeiro), right now natural gas has good potential to enter industry through its direct burning; this could mean a reasonable relief in industrial energy consumption for the region. In the north, in turn, the utilization of natural gas from the upper Juruá River as an alternative for generation in thermoelectric plants continues to depend on a more accurate evaluation of its potential and the definition of a policy for its utilization.

Biomass—essentially, firewood—as a source of

renewable energy to be generated and consumed in a decentralized way, appears to be an excellent alternative for a country with Brazil's dimensions. The potential energy autonomy this would allow at the regional level could make the occupation of certain remote areas of national territory viable. On the other hand, it is necessary to modernize and regulate methods for its utilization. Currently, the production of firewood and plant carbon involves an increasing amount of predatory deforestation, with the exception of domestic use of firewood in which gathering is nonpredatory. In addition to deforestation, the planting of energy forests, as in the planting of eucalyptus trees, radically alters environmental equilibrium.

The use of lands for reforestation should always be restricted to areas of low fertility to avoid competing with food production, in contrast to what is occurring with sugar cane for alcohol production. In regions with many water resources, however, the area necessary for biomass production for a thermoelectric plant often is greater than the area to be flooded by the construction of a small hydroelectric of equal potency. Also, it would be difficult for wood thermoelectrics to supply the energy necessary for large industrial complexes of big cities. Its great strength thus resides in the possibility of attending to the needs of isolated communities and in the development of these, through the use of a cheap, renewable source with accessible technology and which, in Brazil, presents an immense potential.

NONCONVENTIONAL ALTERNATIVE SOURCES of electrical generation, in turn, can be divided into two groups. The first is that of the so-called soft technologies: solar energy, wind energy, and energy from the oceans (tidal energy), from the waves, and from thermic gradient. The second is related to the so-called hard technologies: nuclear fusion and magneto-hydrodynamic generation.

Among the soft technologies, wind energy and tidal energy, because they are limited quantitatively to specific geographical settings, do not represent a global option. Most sources for soft technologies are more diffuse and add up to a very great theoretical potential but, with the exception of solar energy, present difficulties in terms of technical and economic viability. Solar energy could be converted indirectly into electrical energy, by way of thermic energy, in solar concentrators, or directly through photo-voltaic cells. Given the great dimensions of the concentrators, and the complexity of maintenance and control of the system of reflector mirrors, they will probably remain a less promising option than solar cells. These cells are used today in telecommunication stations, including satellites, or in distant, isolated bases, with a great deal of technical success. However, their cost is not competitive for massive generation of electrical energy because they require highly sophisticated materials. Despite that, perhaps it may be a more promising option, in terms of becoming viable, in a not-too-distant future, through technological advance. In this regard, the technology of solar cells is similar to the alternative technologies that we have here called hard technologies – nuclear fusion and magneto-hydrodynamics, both of which are also extremely sensitive to the hypothesis of technological progress. Although, with the elements available today, they are not viable on even an extended planning horizon, there is the possibility of breakthrough in the evolution of scientific and technical knowledge. [The case of super-conductors, so much in vogue today, is a recent example.] Even taking these hard technologies into account, solar energy remains the most promising option, depending on technical advance.

A MORE RATIONAL USE of energy, as currently dispensed, is a good possibility. Due to the low energy efficiency of domestic and national industrial equipment, increasing their efficiency would not be difficult, and this measure represents a good potential for energy conservation. Optimizing several industrial processes, too, presents a good possibility. The energy savings could be a significant factor and, although it will not resolve the Brazilian energy problem in the long run, it would constitute one more building block in the range of options that could ensure a greater latitude between the available energy potential and long- and medium-range demand.

The most important question concerns hydroelectricity, specifically the question of small versus large hydroelectrics, both of which have advantages and disadvantages, depending on the case.

The capital needed to construct small hydroelectrics is much less than that needed for large hydroelectrics. The time span between deciding to construct a dam and its actual entry into operation is greatly reduced, thus allowing the electric sector greater flexibility in the planning. The environmental impacts derived from its construction are less per plant, although this does not mean they are inferior per unit of installed power. The potential for these types of projects in Brazil is still very great, since small waterfalls are available in practically all regions. It is important to note, however, that these types of projects are of a certain scale and should not be confused with micro-plants, which can be important locally but the total potential of which, for Brazil, is relatively small.

The economic advantage of the large dam over the small one is frequently associated with the nonconsideration of the indirect costs, as much of the large projects as the small. On this point, the question also arises: to whom is the large project of interest? To international financial agencies?

work contractors? companies in the electric sector? Despite this, there are cases where the large hydroelectric could present advantages, as will be discussed later on.

Obviously, electric energy doesn't come from nothing. Small or large, works have to be undertaken to supply energy to the country. Clearly, also, countries such as China present a better situation in terms of certain social aspects of the population as a whole than the Brazilian situation does. But this was not the development model "chosen" by Brazil. With a predominantly urban population, one that wants access to a pattern of life highly dependent on electro-intensive goods, it becomes difficult to escape the large dam.

Far more distorted than energy policy is Brazil's model of development. With the limitation on the option of coal, and with nuclear energy being a remote solution, what remains is the large hydroelectric. The concept of the large hydroelectric, however, has to be well characterized. "Large" in this case refers to potency, not to flooded area. There are, in Brazil, hydroelectrics that flood immense areas of land but generate a relatively small amount of power (Sobradinho is one example; Balbina will be another). On the other hand, there are cases of hydroelectrics with a very favorable ratio of installed power to flooded area, which is to say that the number of kilowatts of available power per unit of area lost is very large. In that case, to generate the same amount of energy by means of a series of small hydroelectrics, the sum of the areas flooded by these is not necessarily less than that submerged by the lake formed by a large hydro plant. This is, then, one example where a large hydroelectric implies less impact on an area than a series of small projects.

Another fact to be remembered has to do with the immense water power still available in Brazil, in large part located in the northern and central-west regions. The south and southeast, in large measure, rely on this energy availability to meet their future demands. Due to the great distance between source and demand, the transmission of this energy will only become possible in the form of large blocks; without these, it will be technically and economically inviable. In this case, the large hydroelectric generator will here also have an important role to perform.

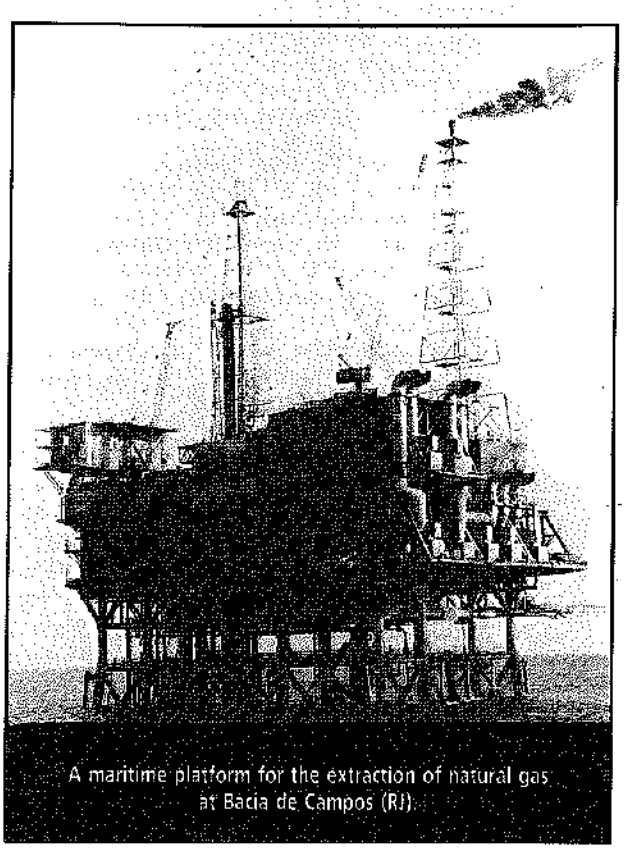


Photo: Fernando Cunha

A maritime platform for the extraction of natural gas at Bacia de Campos (RJ).

WHAT MUST BE STOPPED are the authoritarian decisions made without public participation. Studies can no longer be undertaken, nor can decisions be made, behind closed doors, without taking into consideration some form of participation by society. The moment in which we live today is different. Thus, in the case of Brazil, the best alternative to the large hydroelectric generating plant is still the large hydroelectric generating plant, but democratically discussed. And environmental impact evaluations have to be considered more and more in the decision to undertake a hydroelectric project.

The option of compressing national electrical generation into hydroelectricity was important to meet the needs of a market in growth and to promote the development of national engineering and base industry. Besides that, considering the enormous hydroelectric potential available in Brazil, the implementation of hydroelectric plants and the expansion of the interconnected system still continue to perform a notable role in policy for the electric sector in the coming decades. Nevertheless, there are strategic, economic, environmental, and technical justifications that point to other sources of energy as a complement to hydroelectricity. The electric network, associated with large hydroelectric complexes, tends to be oriented to meeting the needs of large industrial and residential complexes. Its expansion to small, more distant, dispersed loads tends to make it economically impractical. Thus, many of these derivations could be supplied, and with great advantages, by small hydroelectric or thermoelectric projects. These small projects, in addition to being economically viable, could even present important social advantages for the regions where they are installed. It must be emphasized, however, that the predominance of industrial energy consumption, the high rate of urbanization in the country, and the accelerated growth of large cities make these alternatives quantitatively less significant.

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MDBs and the Brazilian Electrical Energy Sector

Stephen Schwartzman
Michelle Malone

Introduction

The Brazilian government has not yet approached any multilateral financial institution for financing of the Xingu River dams as individual projects, nor is it likely to do so. The World Bank in particular has in recent years declined to finance large dams in the Amazon region on environmental and economic grounds (the Balbina and Tucuruí projects are two examples). Nonetheless, international financing, and World Bank financing in particular, are critical to these projects given the financial crisis of the energy sector and the sector's historical pattern of recourse to the multilateral banks for resources. Such support, in the case of the World Bank, would come in the form of loans to the energy sector as a whole, in so-called sector loans, such as the $500 million loan made by the World Bank in 1986. The Bank is committed to supporting Eletrobrás' Sectoral Rehabilitation Plan (PRS), as well as to the 2010 Plan. Perhaps in response to public criticism of the Xingu projects already raised, Eletrobrás had not included the Altamira-Xingu complex in new project lists for either the 2010 Plan or the PRS. The new 2010 Plan is presently being prepared and may include the Altamira-Xingu dams. Regardless of whether these projects are on the lists, they are under study, and if built, would benefit from Bank support for the sector as a whole. The Environmental Master Plan, required as a condition of the Bank's Electric Power Sector I loan in keeping with the general sectoral character of the Bank's support, is intended to address environmental and indigenous peoples' issues across the energy sector—that is, for all projects in all phases of planning and implementation.

In this chapter we discuss what the multilateral banks are and how they are organized, as well as how they can be influenced. We also discuss the World Bank's Electric Power Sector Loan and the conditions relating to environment and indigenous populations that it contains. We further describe the environmental and indigenous peoples' policies of the World Bank and the Inter-American Development Bank (IDB). While the IDB has not supported the PRS (its articles of agreement prevent it from making sector loans), it was approached by the government for such support; if a capital increase for the Bank is negotiated, it may move into this area.

What Are Multilateral Development Banks?

Multilateral development banks (MDBs) are international financial institutions established to lend funds from the developed to the developing world to promote economic growth. The banks are both development agencies and financial institutions. The MDBs are the largest public development lenders in the world; in 1985, the MDBs approved $22.2 billion in loans and credits (loans which are nearly interest-free). In 1987 the World Bank alone approved more than $17 billion in loans and credits. This year, the member governments of the World Bank will in all probability approve a capital increase of between $40 billion and $80 billion, and its total lending, tied by the Bank's articles of agreement in a one-to-one ratio to its capital, will eventually increase accordingly. Among the MDBs, the World Bank is by far the largest. The other MDBs have regional membership: the Inter-American Development Bank (IDB), the Asian Development Bank (ADB), and the African Development Bank (AFDB).

A president and internationally recruited staff manage each bank, but a board of governors makes policy decisions and approves loans for each bank. These governors represent individual member countries, where they are usually ministers of finance or heads of the central banks. However, the actual decision-making process is delegated to a board of executive directors. Executive directors are appointed by the largest donor countries—in the World Bank, one each for the five largest donors (the United States with 19.63 percent of the vote; the United Kingdom, 5.32 percent; France, 5.32 percent; Japan, 5.58 percent; and West Germany, 5.55 percent)—and elected by groups of the smaller member countries. Each country's voting shares reflect that country's financial contribution to the bank.

Each bank has a "hard loan" window—a lending program that charges close to commercial interest rates—and a "soft loan" window, which makes loans at reduced rates or no interest to the poorest countries. For example, in the World Bank, the hard loan window is the International Bank for Reconstruction and Development (IBRD) and the soft loan window is known as the International Development Association (IDA).

The loans disbursed by the MDBs have immense influence on both the financing of development and

on policy in the developing world. The MDBs not only provide capital for projects, but generate co-financing support from private banks, other public lending institutions, or bilateral development agencies. Every dollar that an MDB lends generates two to three more in additional capital. IDB loans for the energy sector, for example, cannot exceed 25 percent of the total cost of a given project.

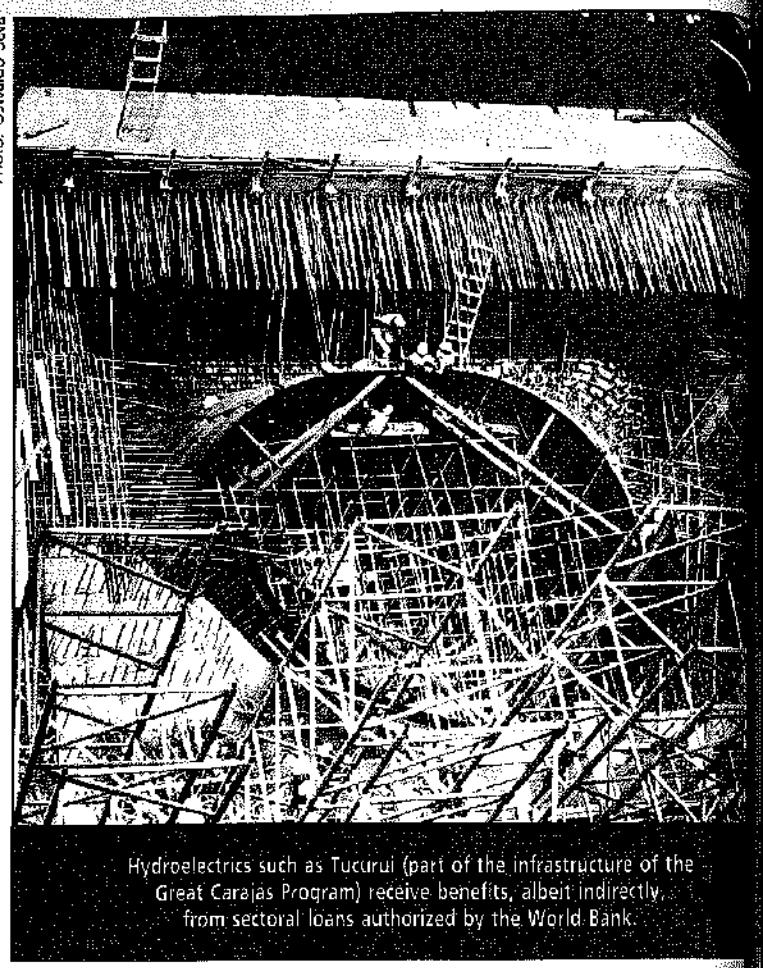


Photo: Oswaldo Sevá

Hydroelectrics such as Tucurui (part of the infrastructure of the Great Carajas Program) receive benefits, albeit indirectly, from sectoral loans authorized by the World Bank.

An example of co-financing agreements can be seen in the Carajás Iron Ore Project. The World Bank financed a loan on the conditions that 12 additional financing arrangements were to be made by the borrower. The co-financing was promised by international companies, international banks, supplier's credits, subordinated convertible debentures, and private banks in several different currencies. The World Bank loan totaled US$ 304 million. More than $3.8 billion more was required from a variety of government and private sources as co-financing as a condition of the Bank making its loan (International Bank for Reconstruction and Development 1982). The Bank in fact played a central role in organizing this co-financing.

Project loans are also only one part of the story. The World Bank funds research, training, and instruction in using new technologies. In some countries, the Bank persuades governments to establish entirely new government agencies. Such agencies range from development finance banks and agricultural credit institutions to energy and area development agencies. Further, the MDBs, along with the International Monetary Fund, are the linchpin of the international financial system. Good credit with the MDBs is crucial for access to private capital, so borrower nations are constrained to comply with MDB and IMF loan conditions to remain in good standing with private lenders. This role is becoming more significant in view of the growing importance in Brazil of private loans. Since 1967, the percentage of total private loans has increased from 26.9 percent to 81.5 percent of Brazil's public foreign debt. Conversely, the importance of multilateral loans has fallen from 14.2 percent in 1967 to 9.8 percent in 1983 (see Table 1).

Moreover, the Bank prepares a variety of research papers summarizing the economic situation of each borrower country. These documents and similar studies made by the regional banks are, in some developing countries, the most important planning documents the governments have.

The MDBs' greatest leverage is perhaps in "structural adjustment" and "sector" lending. Only the World Bank now makes these nonproject loans; they are typically large amounts of money that disburse quickly (e.g., $500 million disbursed over one or two years). The general justification for structural adjustment lending is to support programs and policies that change the structure of an economy to permit increased growth and favorable balance of payments. In practice, these loans come with conditions requiring reduction or elimination of import restrictions and price subsidies, and restriction of public expenditures. The board of the World Bank held, until a few years ago, that the Bank was limited by its articles of agreement to allocating no more than 10 percent of its total loans for nonproject purposes. In 1987, however, 23 percent of the Bank's total lending was for structural adjustment lending—and this does not count sector loans such as the Electrical Power Sector Loan, which in fact have the same kinds of goals: promoting "free-market" economic changes. This increase should be seen in the context of the US plan (the so-called Baker Plan) for the World Bank to address the debt crisis by making more such "policy" loans, to promote economic growth while imposing economic liberalization.

Increased emphasis on "policy" loans is consistent with the major goal of the MDBs since the 1950s: to integrate Third World nations into international markets. All MDB loans require that procurement contracts (contracts for goods and services necessary for a project, ranging from earth-moving equipment or turbines to consulting services) be subject to public bidding on the international market. This obviously favors the more industrialized countries. As of 1986, the United States had paid $13.5 billion to the World Bank, and US

Table 1
Structure of Brazil's Public Foreign Debt
by Lender Groups, 1967–1983 (as percentage of total)

Year	Concessional bilateral loans and official export credits (1)	Multilateral loans (2)	Suppliers' credits (3)	Financial institutions (4)	Bonds (5)	Other private sources (6)	Total private source loans (3+4+5+6) (7)
1967	58.9	14.2	1.8	12.6	–	12.6	26.9
1968	52.6	13.8	5.1	17.8	–	10.8	33.6
1969	44.4	14.2	7.4	25.4	–	8.7	41.4
1970	44.7	13.2	11.4	24.5	–	6.2	42.0
1971	38.4	13.6	11.4	31.7	–	4.8	47.9
1972	28.6	12.7	12.9	40.8	1.7	3.3	58.6
1973	23.5	12.3	11.9	47.9	1.9	2.4	64.1
1974	20.1	11.6	8.9	56.3	1.6	1.6	68.4
1975	18.1	11.4	6.6	61.6	1.2	1.2	70.6
1976	15.7	10.1	6.6	64.6	2.0	0.9	74.1
1977	13.8	9.4	7.1	63.3	5.5	1.0	76.9
1978	11.6	7.9	6.6	65.3	7.9	0.7	80.5
1979	9.8	7.8	4.9	68.6	8.3	0.5	82.4
1980	9.5	7.9	4.2	69.8	8.2	0.4	82.6
1981	9.4	7.7	2.8	73.1	6.5	0.4	82.8
1982	8.7	8.4	2.3	74.8	5.5	0.3	82.8
1983	8.7	9.8	2.5	73.5	5.3	0.3	81.5

Note: Debt outstanding and disbursed at the end of the year. Includes public and publicly guaranteed debt. Excludes short-term debt. Numbers may not add because of rounding.

Source: Batista, Paulo Nogueira, Jr. *World Bank Discussion Papers: International Financial Flows to Brazil Since the Late 1960's,* No. 7

companies had made $13.28 billion in procurements of goods and services for World Bank projects (Frank and Green 1987). The top 10 US suppliers to World Bank projects made $265.4 million from Bank projects in 1986 alone.

The Project Cycle

The process of identifying, approving, and implementing a development project is called the *project cycle.* Different types of intervention are possible at different phases of the project cycle.

The World Bank project cycle involves five basic steps: project identification, preparation, appraisal, negotiation and approval, and implementation and monitoring.

IN THE *IDENTIFICATION PHASE* of the cycle, a search is carried out for suitable projects for the Bank to finance. The Bank often maintains that it only finances projects brought to it by borrower governments, but in fact, country and sector economic studies carried out by the Bank provide the criteria for acceptable projects. Bank staff can suggest projects, as can government officials and borrower companies.

Preparation is the second phase. Here, the borrower assesses the financial, institutional, and technical resources required, as well as those available, for the project. Bank staff assist in this process.

The *appraisal stage* of the cycle covers four major aspects of each project: technical, institutional, economic, and financial. It is, in theory, an impartial process by which the Bank makes its case about whether a project is worth funding. In practice, however, once a project has the staff time invested in it to reach this stage, it almost always receives a positive Staff Appraisal Report and approval by the Board of Executive Directors. The Bank rewards approving projects—"moving money"—not disapproving them.

The fourth step in the project cycle is the *negotiation of the conditions of the loan.* Here, the Bank and the borrower set out any special conditions that

must be met for the project to succeed.

Once a project is appraised and negotiations are complete, it goes before the Bank's Board of Executive Directors for approval. In theory, the executive directors review each project and determine whether it merits financing. In practice, however, executive directors receive appraisal reports only two weeks before the board meets to vote. Moreover, most executive directors do not have the staff or resources necessary to examine the project files for criticisms, or data that are omitted from the Staff Appraisal Reports. No project presented to the board has ever been turned down.

The final phase of a project is its *actual implementation and monitoring.* Monitoring projects once they have begun or reached completion receives less attention from the Bank than any other part of the project cycle. Though the Bank can intervene while the project is being carried out and can work to see that loan conditions are met, any damage is often already done. Recently, the banks have, in response to pressure, monitored certain projects more closely and have actually intervened for gross violations of the terms of the loans by halting disbursements. In 1985, after two years of pressure, the World Bank halted disbursements on the Polonoroeste Project for failure to demarcate indigenous lands and environmental mismanagement. In 1987, the IDB formally commenced procedures to suspend disbursements in the Porto Velho–Rio Branco Road Project on the same grounds.

Environmental and indigenous rights organizations in the United States and Europe propose that environmental and health ministries be involved in the project cycle, and that nongovernmental organizations, particularly indigenous peoples', environmental, and community-based organizations affected by potential projects, have access to information and participate in project design and implementation. Projects are usually designed, and loans negotiated by finance and planning ministries, without consulting either environmental or public health professionals or the communities most directly affected by projects. The actual costs of the environmental, social, and public health effects of loans could be taken into account, and the process could be more participatory were these proposals implemented.

Nongovernmental organizations can intervene in the project cycle in several ways.

Bank Policy Guidelines for the Environment and Indigenous People

The World Bank

The MDBs have formal policies regarding the environment and indigenous peoples in their projects; environmental and indigenous land protection conditions, such as those in the Electrical Power Sector Plan, are based on these policies. Many of the specific criticisms that environmental and indigenous rights groups have made of Bank projects over the last several years are based on those policies, taking the position that unless the policies are actually put into practice they serve more as a public relations exercise than anything else.

Among the MDBs, the World Bank has the most explicit policies on environment and indigenous peoples. World Bank environmental and tribal peoples policies are found in the Operations Policy Manual (OPM), which details policy in all aspects of Bank work. The environmental guidelines state: "The Bank seeks to avoid unnecessary and, particularly, irreversible damage to the natural resource base on which development depends."

The Bank recognizes that sound economic development requires sound management of natural resources. The prevention of environmental damage is stressed, as well as the need to ensure that each project "affecting natural resources does not exceed the regenerative capacities of the environment." The guidelines assert further that the Bank will not finance projects that cause environmental deterioration without mitigatory measures acceptable to the Bank.

The guidelines for tribal people state:

> Experience has shown that, unless special measures are adopted, tribal people are more likely to be harmed than helped by development projects that are intended for beneficiaries other than themselves. Therefore, whenever tribal peoples may be affected, the design of projects should include measures or components necessary to safeguard their interests and, whenever feasible, to enhance their well-being.

The policy states that the Bank will not assist development projects that "knowingly involve encroachment on traditional territories being used or occupied by tribal people, *unless adequate safeguards are provided*" [emphasis added]. The sorts of safeguards required include the demarcation and protection of tribal areas containing the resources required to sustain tribal peoples' traditional means of livelihood; protection against diseases and the maintenance of health for indigenous tribes; and arrangements for the participation of tribal people in decisions affecting them and the provision of adjudication and redress of grievances.

The implementation of these policies, as projects such as Polonoroeste and Carajás indicate, is often sadly deficient. But the inclusion of loan conditions based in these policies offers institutional grounds for holding the banks publicly accountable for the effects of their projects.

The Inter-American Development Bank

The IDB is organized differently from the World Bank. The IDB does not have an environmental division; instead, an Environmental Management Committee, made up of department heads and other high officials, reviews projects for environmental impacts. The members of this com-

mittee usually have no background in environment or sociocultural impact assessment. At best, this committee can review in depth only eight to twelve projects a year out of more than eighty new projects and hundreds of ongoing ones. Projects considered to have environmental impacts must pass through this committee for review after a project analysis has been completed. The Environmental Management Committee must either approve the analysis or recommend improvements to the project committee. After this review, the loan is sent to the loan committee and then on to the board for final approval.

In addition to this committee, the IDB, in its programs, provides checklists to the borrowers to help identify, prevent, or mitigate the negative effects on the environment or on sociocultural aspects of projects. However, the IDB has no mechanisms to require borrowers to complete environmental checklists or to incorporate them into their project designs.

How the MDBs Can Be Influenced

Citizens in member nations can influence bank policy because the banks are responsible to their executive boards. Each executive director in the World Bank usually is accountable to the Ministry of Finance or Treasury Department of his or her country or to the group of countries he or she represents. In the United States, the Treasury Department is in charge of policy for the MDBs. Treasury is in turn responsible to several congressional committees that have legislative and funding (appropriations) authority for US participation in the MDBs.

US environmental groups interested in affecting the process have promoted 19 congressional hearings on the environmental and social impacts of MDB development projects in the last four years. Testimony presented at these hearings helped to convince the US Treasury and the congressional committees that there were systematic environmental and social problems in bank projects and that it was necessary to take action to correct these problems. In December 1985, then again in 1986, Congress passed legislation requiring the US executive directors to the MDBs to promote a series of reforms in project design and implementation. Within the Treasury, a staff member in the Office of Multilateral Development Banks is now designated to review environmental aspects of MDB-financed development.

The first point in the US legislative reform program is the need for staff that are more environmentally and sociologically trained. Until this year (1987), the World Bank had two staff ecologists to review more than 300 new projects a year for environmental impacts, and a similar number of anthropologists. This year, World Bank president Barber Conable announced an environmental reform in the Bank, in the context of a global reorganization of the institution. A new central environmental department, under the Senior Vice-President for Policy, Planning, and Research, was created, and each of the Bank's four regional divisions has environmental units to review projects. The Bank initially announced that the environmental departments would have 100 staff positions; now, the department and the regional unites are to have about 45 positions altogether. The regional units are responsible for reviewing new projects for environmental and social impacts and seeing that these considerations are taken into account in project planning. The Bank has yet to name a director to the new environmental department, even though the change was announced in April. The staffing reform is an important step, but unless much broader and more substantive changes occur, and result in different kinds of projects, it will have little meaning in the long term.

THE POLITICAL FORCE behind this initiative in the United States originates in the strength of the environmental movement and the existence of nongovernmental environmental agencies with the capacity to influence the legislative process. The national environmental organizations that work on the impacts of multilaterally financed development—the Environmental Defense Fund, National Wildlife Federation, the Sierra Club, and the Natural Resources Defense Council—have among them more than 5 million members. NWF and the Sierra Club have 49 and 57 local chapters, respectively. An informal coalition of these organizations has convinced key congressmen first that the effects of MDB projects merit attention, since the US contributes billions of dollars to these institutions, and second that the members of national environmental organizations—who are both Democrats and Republicans—want their representatives to act on international environmental issues. It is worth noting that the US and European environmental organizations that work on development issues have come to recognize the importance of indigenous peoples' land rights, as well as of social issues such as resettlement. Since "environmental protection" narrowly defined cannot be meaningfully discussed apart from the development process in the Third World, the land rights of indigenous peoples, and indeed the welfare of the rural poor in general, is inextricably linked to issues of natural resource management.

The Brazilian Energy Sector and MDB Lending

In the early 1960s, Brazil, faced with the increasing costs of foreign oil and the vast expenses of hydroelectric plants needed to generate energy, turned to the MDBs for energy sector financing.

Brazil has great hydroelectric potential. Some estimates suggest that as much as 213,000 mW of electricity could be generated through hydroelectric facilities throughout the country (Staff Appraisal Report, Electric Energy Sector Loan, World Bank, 1986). Associated transmission facilities are also important due to the distance from main centers at which most prospective projects are located. From 1949 up to the present, the World Bank alone has loaned roughly $3.5 billion to the Brazilian energy sector—nearly 26 percent of all World Bank investment in Brazil (see Table 3 for project loans). This also represents nearly 10 percent of all World Bank investment in the Latin American and Caribbean region. In its 1981 Annual Report, the World Bank stated that "helping its member countries to avoid [the heavy costs of energy development], has been an important objective of the World Bank Group in its power operations for more than two decades."

Table 2
Estimated Costs of Some Projects in the Energy Field

Projects	Time period	Investments (millions)
Nuclear program	1976–1985	$25,000
Alcohol program	1977–1985	$ 8,000
Coal program	1981–1985	$ 3,300
Itaipú hydroelectric plant	1972–1983	$10,500
Thermal electric coal plants	1982–1996	$ 3,400
Other hydroelectric plants	1980–1990	$30,000
Basin of Campos	1979–1985	$ 2,400
Gas pipeline from Bolivia	1982–1986	$ 900
Shale oil	1982–1987	$ 1,300
	TOTAL	$84,800

Source: Chaves de Mendonca 1982

The IDB has also heavily invested in the Brazilian power sector—nearly $2 billion since their first loan to the Companhia Energética de Minas Gerais in 1961 (see Table 4 for project loans). IDB loans are for individual projects; the IDB's articles of agreement do not yet allow sector loans. These energy project loans represent 30 percent of all IDB investments in Brazil. An IDB administrator at the Second Western Hemisphere Energy Symposium held in 1980 estimated that the annual production of the hydroelectric projects financed by the IDB and already in operation was equivalent to 9 million tons of petroleum (Pastor, McNamara, and Wagner 1980). It has been estimated by this same IDB administrator that one-third of the total money granted by all multilateral organizations and US agencies during the 1970s went to the energy sector (Pastor, McNamara, and Wagner 1980).

As the country's consumption and production capacity increased, Brazilian officials drew up an energy program for the country. This program projected in 1982 that $85 billion was to be invested in energy projects over a period of 20 years. Projections have since been revised upward.

The importance of the multilateral funding agencies for the energy sector is immense. According to IDB documents, most of the large dams in Latin America owe their existence to loans and technical support from the MDBs. The World Bank's series of sector loans, totaling $1,050 million, indicates that energy will continue to receive substantial MDB support.

World Bank Sector Loan

In January 1984, the Brazilian government asked the World Bank for assistance in preparing, implementing, and financing a sector rehabilitation program. The Bank approved a $500 million sector loan in support of the rehabilitation plan prepared by Eletrobrás. The power sector rehabilitation plan (PRS) intended to resolve the financial crisis of the sector through increased investment. The PRS was to ensure:

> (a) the minimum investments to be made on priority projects which are necessary to meet electricity demand with acceptable levels of reliability; (b) increasing substantially the sector's internal cash generation through tariff actions and other acceptable measures; (c) the commitment of the Government to provide equity contributions to the utilities with financial rehabilitation needs; (d) securing adequate financing sources for the sector to execute its investment program; and (e) promoting adequate energy conservation measures.

The PRS set targets for the financial rehabilitation of the sector and an integrated program to achieve them. The first World Bank sector loan was one step in this program.

This $500 million sector loan was negotiated to be disbursed in two tranches of $250 million each. The key conditions for release of tranches were related to the financial plans of the sector and to the rebuilding of equity capital. Specifically, the first tranche disbursement conditions stated that the government must have effectively allocated the agreed-upon $670 million to the sector in its 1986 budget; new borrowings must be available to the sector; rehabilitation plans for selected utilities had to be prepared and adopted; stockholders of Eletrobrás had to approve and subscribe two capital increases; and the government had to have paid-in equity contributions that it had agreed to.

The second tranche, too, had special conditions of disbursement. The first was that the Bank had reviewed and was satisfied with the sectoral performance and selected utilities rehabilitation up to that point. Others were that the Bank had received an acceptable 1986–1990 Sectoral Plan, and had received an acceptable action plan for achieving target rates of energy pricing. Price reforms for the

Table 3
World Bank Loans to Power Sector (through Jan. 1987, in millions of US$)

Project name and date*	Amount of loan	Amount owed	Total cost of project†	Undisbursed amounts
Brazilian Light & Power Co. Ltd., Power & Telephone 1/27/49	75	0		
Brascan Limited Power 1/16/51	15	0		
Companhia Hidrelétrica do São Francisco "Power" 5/26/50	15	0	56	
Centrais Elétricas de Minas Gerais–Itutinga Hydroelectric 7/16/53	7.3	0		
Centrais Elétricas São Paulo S.A.–Salto Grande Hydroelectric 12/17/53	10	0		
Brazilian Light & Power Co.–Piratininga Electric Power 2/18/54	18.79	0		
Centrais Elétricas São Paulo SA–Jurumirim Hydro 1/21/58	13.36	0	47.5	
Furnas-Centrais Elétricas Hydroelectric 10/3/58	73	0		
Brazilian Light & Power 6/16/59	11.6	0		
Furnas-Centrais Elétricas–Estreito Hydroelectric 2/25/65	57	28.51	90	
Companhia Energia de São Paulo–Xavantes Hydroelectric 2/25/65	19.8	10.55	69.5	
Centrais Elétrica de Minas Gerais–Jaginra First Power 3/8/66	49	32.92		
Furnas-Centrais Elétricas–Estreito Hydroelectric Power 12/13/66	19	13.69		
Furnas-Centrais Elétricas–Estreito Hydroelectric 12/13/66	20	12.24		
Companhia Brasileiro de Energia Elétrica–Power Distribution Program 12/13/66	6.2	0.6		
Companhia Paranaense de Energia Elétrica–Power Distribution Program 12/13/66	8.1	0.77		
Companhia Paulista de Forca E Luz–Power Distribution Program 12/13/66	40.87	4.34		
Centrais Elétrica de Minas Gerais–Power Distribution Program 12/13/66	6.3	0.62		
Furnas-Centrais Elétrica–Porto Colombia Hydroelectric 10/15/68	22.15	21.91		
Centrais Elétrica de Minas Gerais–Volta Grande Hydroelectric 10/15/63	26.18	24.13		
Furnas-Centrais Elétricas–Marimbondo Hydroelectric 5/19/70	80	87.19		
Eletrosul–Salto Osorio Hydroelectric 3/30/71	70	58.3	152.3	
Centrais Elétrica de Minas Gerais–São Simas Hydroelectric 5/16/72	60	58.35	396	
Light Services de Elétrica Power Distribution & Subtransmission 4/10/73	20	13.84	382.6	
Furnas-Centrais Elétricas–Humbiara Hydroelectric 7/5/73	125	133.51	593.2	
Companhia Hidrelétrica de São Francisco–Paulo Afonso IV Hydroelectric 6/4/74	79.77	63.96	693	
Companhia Paranaense de Energia Elétrica–Copel Power Distribution 5/11/76	46.25	37.68	188	
Centrais Elétricas do Brasil–Northeast Power Distribution 6/24/76	49.78	40.37	145.4	
Eletrosul–Transmisson 11/23/76	70.42	43.78	212.5	
Companhia Estadual de Energia Elétrica–CEEE Power Distribution 3/27/80	40.85	22.95	314	
Centrais Elétricas do Brasil–South-Southeast Power Distribution 3/28/78	127.38	89.53	2,346.8	2.33
Companhia Paranaense de Energia Elétrica 13–COPEL Second Power Distribution 6/7/79	86.67	71.28	361.66	
Eletrosul–Eletrobrás Second Power Transmission 7/22/80	85.45	50.24	265.31	16.34
Federal Republic of Brazil–Electric Power Sector Loan 6/19/86	500	534.94	500	
Companhia Paranaense de Energia Elétrica–COPEL Second Power Distribution 6/7/79	22.3	13.97	0**	9.2
Centrais Elétricas do Brasil–Electric Power System 12/23/80	54	13.46	140.3	31.54
Centrais Elétricas do Brasil–Eletrobrás I Power Distribution 5/11/82	182.7	41.45	739.3	128.46
Centrais Elétricas do Brasil–Eletrobrás II Power Distribution 12/8/83	250.6	50.67	785.6	212.17
Centrais Elétricas do Brasil–Rural Electrification 12/8/83	222.8	220.68	585	56.67
Centrais Elétricas do Brasil–Furnas Power Transmission 6/4/85	400	15.66	772.6	386.78
Centrais Elétricas do Brasil–Southeast Power Distribution 6/4/85	312	15.11	1,081	299.28
TOTALS	3,399.62	1,827.2	10,917.57	1,142.77

*Date refers to date loan approved.
**For loan total, refer to Companhia Paranaense de Energia Elétrica 6/7/79 (above). These two loans are part of the same total although they are treated separately in the loan statement.
†Total cost of all projects was not available.

energy sector, to phase out government subsidies and bring energy prices into line with the cost of production, were regarded by the Bank as the most important condition of the loan.

The last condition for the release of the second tranche was a condition intended to accommodate growing concerns about the environmental impacts of major power projects. It stated that the Bank was to receive and to judge satisfactory a master plan for strengthening the sector's environmental units.

Section 2.04 of the Project Agreement between Eletrobrás and the IBRD states:

> (a) Eletrobrás shall: prepare and furnish to the Bank a master plan satisfactory to the Bank containing (the Environmental Protection Master Plan): (i) specific measures to protect and enhance the adaptive capacity of the riverine ecosystem and human communities to be affected by hydroelectric

Table 4
IDB Loans to Energy Sector

Names and dates[1]	Amount of loan	Amount owed[2]	Total cost of project	Undisbursed loans
(Ordinary Capital Loans)				
Companhia Energética de Minas Gerais (CEMIG) 12/14/61	$4,995,972.13	$0.00	$8,473,000.00	
Companhia Hidrelétrica do São Francisco (CHESF) 8/9/62	$13,259,659.49	$0.00	$61,995,000.00	
Centrais Elétricas de São Paulo SA 11/14/63	$13,250,000.00	$0.00	$390,030,000.00	
Companhia de Eletricidade do Estado da Bahia (COELBA) 12/31/63	$2,440,021.24	$0.00	$7,171,000.00	
Companhia Paranaense de Energia Elétrica (COPEL) 11/19/64	$7,702,760.83	$0.00	$88,148,000.00	
Centrais Elétricas de Santa Catarina 4/8/65	$3,499,658.63	$0.00	$20,528,000.00	
Centrais Elétricas Brasileiras SA (Eletrobrás) 9/9/65	$17,215,633.87	$0.00	$80,715,000.00	
CHESF 8/25/66	$15,839,210.20	$0.00	$102,335,000.00	
Companhia Energética de São Paulo (CESP) 5/12/67	$33,030,288.72	$1,800,533.16	$1,059,300,000.00	
Eletrobrás 8/28/69	$24,726,539.55	$7,891,162.80	$84,417,000.00	
CESP 9/30/70	$87,864,529.68	$33,972,948.61	$220,422,000.00	
Eletrobrás 10/26/72	$19,414,024.21	$10,129,120.61	$162,138,000.00	
CESP 9/13/73	$50,787,392.16	$26,486,646.84	$130,892,000.00	
CHESF 12/20/73	$85,970,948.56	$56,070,680.29	$1,653,993,000.00	
Centrais Elétricas do Sul do Brasil SA (Eletrosul) 9/25/75	$39,989,216.30	$27,684,841.98	$664,500,000.00	
CHESF 11/25/75	$14,711,362.42	$5,293,383.03	$63,650,000.00	
COPEL 12/22/75	$59,491,680.81	$43,474,689.78	$664,369,000.00	
CEMIG 7/14/77	$33,104,562.21	$26,974,087.72	$732,220,000.00	
Federative Republic of Brazil (Regional)	$37,868,574.56	$34,318,395.70	$79,600,000.00	
CEMIG 3/31/81	$16,815,050.05	$15,764,109.42	$103,300,000.00	
CEMIG 12/28/83	$43,314,886.85	$14,851,234.82	$119,186,000.00	$28,463,652.03
COELBA 12/20/85	$115,897,643.98	$21,697,643.95	$315,100,000.00	$94,200,000.00
(Fund for Special Operations)				
CHESF 8/25/66	$9,011,853.25	$0.00	$48,875,000.00	
Eletrobrás 1/9/69	$24,819,365.83	$4,280,842.05	$75,100,000.00	
Federative Republic of Brazil 11/6/69	$28,723,176.37	$15,624,740.52	$60,000,000.00	
Eletrobrás 10/26/72	$34,133,720.12	$17,808,897.43	$363,073,000.00	
Federative Republic of Brazil 10/27/77	$36,173,469.75	$26,838,380.79	$91,330,000.00	
COELBA 12/18/80	$15,000,000.00	$14,500,000.00	$41,014,000.00	
CEMIG 12/28/83	$20,000,000.00	$14,258,231.92	$56,970,000.00	$5,741,768.08
COELBA 12/20/85	$25,000,000.00	$12,914,819.37	$68,632,000.00	$12,085,180.63
(Inter-Regional Capital Loan)				
CHESF 12/2/76	$117,393,298.25	$88,810,613.22	$1,126,880,000.00	
Federative Republic of Brazil 10/27/77	$19,537,434.52	$14,495,515.90	$35,870,000.00	
Eletrosul 4/11/78	$58,238,781.35	$51,518,921.99	$143,700,000.00	
CEMIG 11/30/78	$40,952,604.47	$37,919,078.21	$174,265,000.00	
CEMIG 11/30/78	$20,000,000.00	$15,000,000.00	$20,000,000.00	
CEMIG 11/15/79	$95,655,100.21	$94,940,494.34	$361,200,000.00	$714,605.87
CHESF 8/4/80	$11,266,796.38	$9,657,254.01	$224,630,000.00	
COELBA 12/18/80	$89,347,214.38	$85,654,559.12	$177,750,000.00	$3,692,655.26
CHESF 12/20/82	$116,226,702.67	$56,270,573.00	$340,209,000.00	$59,956,128.85
CEMIG 12/13/85	$56,398,066.48	$5,998,066.48	$186,800,000.00	$50,400,000.00
Eletrobrás 12/20/85	$73,595,241.66	$7,895,241.66	$243,300,000.00	$65,700,000.00
Eletrobrás 12/19/86	$122,000,000.00	$0.00	$406,700,000.00	$122,000,000.00
(Canadian Fund)				
Eletrobrás[3] 1/9/69	$9,261,125.43	$4,926,165.93	$22,344,842.52	
(U.K. Development Fund)				
Eletrobrás[4] 10/26/72	$533,412.48	$339,263.99	$20,667,766.82	
TOTALS	$1,764,556,390.05	$906,061,138.64	$11,101,792,609.34	$442,953,990.72

[1]Dates refer to date loan approved.
[2]Amount owed will increase as disbursements occur.
[3]Amount converted to US$ from Canadian $ using red line conversion rate for 1969 from American International Investment Corporation, World Currency Charts, 8th ed.
[4]Amount converted to US$ from Pounds Sterling using red line conversion rate for 1972 from American International Investment Corporation, World Currency Charts, 8th ed.

projects; (ii) programs to strengthen the electric power sector's environmental units through training, research, legal assistance, and adequate staffing and funding; and (iii) a timetable for its execution.

(b) staff its environmental unit with qualified staff in adequate numbers as required to carry out the Environmental Protection Master Plan in a timely manner; and

(c) carry out the Environmental Protection Master Plan with due diligence and efficiency and in accordance with appropriate practices and the timetable therein contained.

That is, the contents of the master plan as approved by the Bank have the force of loan conditions. Specific criteria for the preparation of the master plan were included in the Staff Appraisal Report on the Energy Sector Loan.

The appraisal report notes that Eletrobrás had created a new environmental manual to coordinate the action of the electric sector in dealing with social and environmental problems. This manual, "Study Manual of Environmental Effects of Electric Systems," published in 1985, lacks methodologies, procedures, and criteria for its implementation. The appraisal report also notes that the electric sector "pays only rhetorical attention at higher managerial levels to sociological and environmental variables as reflected in some of the projects presently under construction."

The Staff Appraisal Report also contains recommendations for strengthening the sector's social and environmental performance, including the allocation of funds for making guidelines operational in this area; the establishment of a public committee to review the progress of the sector in these areas; and the increased regional staffing, specifically including social scientists, biological scientists, and physical scientists or chemists. Training and research are two additional areas emphasized in the report recommendations.

The appraisal report further recommends that health concerns and indigenous land demarcations be included at the design stage of projects. All costs should be included in the project budget and assurances should be given that anthropologists contracted to study social impacts know the languages and cultures of Amerindian groups. Resettlement planning should be conceived at the design phase of projects; a formal process of public education, information dissemination, and dialogue in local communities should be developed; and potential public health problems should be investigated prior to construction. A last section on Bank supervision is included as well. It states that the Bank "will develop a systematic program for supervising compliance with the social and environmental measures outlined above on a sectoral basis and in terms of project-level spot check especially of critical cases."

The Project Agreement in Section 2.03 required as a loan condition the preparation of the Itaparica Resettlement Plan, containing measures to resettle the communities to be forcibly relocated by that project, and required that Eletrobrás have CHESF carry out this plan "with due diligence and in a manner satisfactory to the Bank." Bank staff later insisted on the Ministry of Mines and Energy signing an agreement with the Pólo Sindical of Itaparica before making disbursements on the second tranche of the loan, based on this condition.

In June 1986, the alternate US executive director, Hugh Foster, was instructed by the Treasury Department to vote against this loan on economic and environmental grounds. The director pointed out that "we believe that the loan as negotiated is fundamentally flawed," and he characterized as "pure folly" Bank support under the loan for the Ji-Panará dam, which would flood parts of an Indian reserve and a national forest that the Bank had previously helped establish. Foster noted that "major environmental questions, to all appearances, are being swept under the rug."

In March 1986, in response to an Environmental Defense Fund letter, the Latin America and the Caribbean Region Division of the Bank noted a number of positive developments on the "environmental front of the electric energy sector" in addition to the environmental master plan. The first development was that the Brazilian government had formed an independent "Blue Ribbon Panel" to define the methodology and operational steps for periodic evaluations of the implementation of the master plan. The government had also made assurances that in spite of a national hiring freeze, positions identified as necessary for the environmental plan would be filled. Assurances were also obtained that in order to take the initial step toward strengthening the government's environmental review and monitoring capacity, the power companies would fund certain positions in federal agencies responsible under the national legislation for reviewing the environmental and indigenous peoples aspects of proposed projects.

THE BRAZILIAN GOVERNMENT wanted to bring the second Electrical Power Sector Loan, for $350 million, to the Bank board for a vote in July 1987. This did not occur for several reasons. Negotiations between Eletrobrás and the government, and the Bank, were in effect suspended because the government could not demonstrate that the master plan was being implemented to the Bank's satisfaction. Demarcation of several indigenous areas, including that of the Waimiri-Atroari, and failure to increase environmental staffing levels in the regional power companies were said to be key issues. Negotiations were not suspended, but will be considered concluded when Eletrobrás furnishes evidence that the environmental master plan is being implemented.

The other—and more politically significant—point is that Brazil has not only suspended interest payments on its debt to private commercial banks, but to the Club of Paris nations as well. These governments include the major donors to the World

Bank, and while the World Bank has taken no formal action in relation to Brazil's interest payments, the European and US governments can use their influence to see that a loan does not come before the board. The Executive Board of the Bank operates by a kind of consensus process, at least insofar as loan approval is concerned, and in this light the US executive director's "no" vote on the first energy sector loan was perhaps as much a theatrical gesture as an attempt to stop the loan from being approved. An informal agreement that the second sector loan not come before the board before Brazil has reached an agreement with the Club of Paris, or presented a global economic policy acceptable to those governments, would be more effective in delaying approval of the loan. The second sector loan will not, in any case, come before the board until November 1987.

Information and Pressure Points Within the Banks

Citizens' organizations in the United States and Europe have begun to pressure the MDBs on their environmental and social performance; the World Bank's creation of an environmental department, among other signs, shows that these institutions are susceptible to change. World Bank pressure for the implementation of its policies has had positive, albeit limited, results in several projects, such as the Itaparica dam, Polonoroeste, and others. The collaboration of a variety of Third World organizations has been crucial to this campaign; most of the criticisms of projects, as well as of the decision-making process, originate with these organizations. US organizations in particular, however, have found it relatively easier to address criticisms of projects to the banks than have other groups, because they have had relatively greater access to information on the specifics of MDB involvement in particular projects, through the US government. In reality, the World Bank has no clear information policy. Most Bank documents are in theory internal documents, protected by the Bank's status as a treaty organization, but various types of documents marked "For Official Use Only" are given out by staff members if one makes personal contact, has some knowledge of the area, and so on. All Staff Appraisal Reports for approved projects, as well as operations summaries (which list projects under consideration), are available to corporations that bid on MDB contracts. The United Nations publication *Development Business* publishes the operations summaries of the MDBs as a supplement, as well as publishing procurement notices for MDB contracts (that is, notices that contracts for equipment, consulting services, or contracting are on the market for public bidding), and contract awards. (*Development Business* costs $250 per year and is available from Development Business, P.O. Box 5850, Grand Central Station, New York, NY 10163-5850, USA. *Development Business* is also available at UN libraries.)

In June 1987, EDF and several other US groups met with David Hopper, Senior Vice-President for Policy, Planning, and Research, and other World Bank staff, to discuss mechanisms for greater involvement of nongovernmental organizations (NGOs) in the Bank's planning process. The Bank's external relations department has conducted a series of such meetings over the last several years, typically confined to generalities, with US and European NGOs. In this meeting, the US groups took the position that the real issue was involvement of Third World organizations, particularly those that represent or work with populations affected by Bank projects, and that discussion of such involvement necessarily implied that those organizations have access to information on Bank projects. The Bank agreed, as a minimal condition, to provide copies of the monthly operations summary to a list of NGOs working in the Third World.

Access to information for Third World NGOs and participation of NGOs and local communities in the decision-making process are the most sensitive points raised by the international campaign on the MDBs. In theory, the MDBs could add environmentally and sociologically trained staff, or even change their lending priorities substantially, without altering their top-down technocratic decision-making process. Real accountability of these institutions to the communities affected by development, to groups that work with them, and to concerned citizens whose taxes guarantee the banks' capital, requires much more far-reaching change.

ORGANIZATIONS OR INDIVIDUALS interested in the Xingu dams or multilateral support for the energy sector can request information from several sources. The Ministries of Finance and Planning are involved in all negotiations and should be approached. The Brazilian executive director to the World Bank (who also represents Colombia, Ecuador, Haiti, the Dominican Republic, and the Philippines), Pedro Sampaio Malan, also has all of the relevant project information. The Bank maintains that the confidentiality of most Bank documents is at the discretion of the member governments, so the ultimate decision on whether documents are public or not is a national issue and can be discussed with the Brazilian government's representation in the Bank. The Brazilian ED can be reached at the address of the World Bank (see below).

Within the World Bank, letters can be addressed to the president of the Bank, Barber Conable. Copies can be sent or letters address to:

- *Armeane M. Choksi*, Director, Country Department 1, (Brazil)
- *W. David Hopper*, Senior Vice-President of the Policy, Planning, and Research Division
- *P.C. Mohan Munasinghe*, Division Chief of Infrastructure and Energy in Brazil

- *Robert Goodland,* Latin America and Caribbean Region
- *Maritta Koch-Weser,* Latin America and Caribbean Region

A letter to the president or the country department director for Brazil will be forwarded to other concerned individuals. Environmental and indigenous peoples' issues are dealt with most regularly by persons such as Maritta Koch-Weser or Robert Goodland, but it is worth drawing the attention of higher officials to these issues, particularly the country director or Mr. Hopper, who has made various public statements on the importance of improving the Bank's performance in these areas. Their address is:

World Bank
1818 H Street, N.W.
Washington, DC 20433
USA

Individuals to contact within the IDB include:

- *Sr. Antonio Ortiz Mena,* President
- *Jorge Ferraris,* Environmental Management Committee Chairman

Their address is:

Inter-American Development Bank
1300 New York Avenue, N.W.
Washington, DC 20577
USA

On issues concerning the IDB, the IDB Brazilian Field Office and representative may be contacted. They are:

- *William A. Ellis,* Praia do Flamengo No. 200, 21 andar (Caixa Postal 16209, Z0-01) 22210 Rio de Janeiro

A number of organizations in Europe and Canada are working to bring environmental and indigenous peoples' issues to the attention of their executive directors, through their own governments, as US groups have been doing for several years. Some of these groups have developed good access to their EDs. While information and concerns can be sent directly to EDs, it is most effective to attempt to have questions raised by the government agencies to which the EDs respond in their own countries. A West German group, Regenwalder Information, raised the question of environmental and social impacts of multilaterally financed development with the Committee on Economic Cooperation of the Bundestag. The committee took the issue up with the Ministry of Economic Cooperation, and the ministry has drafted directives to the executive director similar to the US legislation. Organizations that have expressed interest in Bank projects in Brazil and willingness to raise questions and concerns with their EDs include:

Energy Probe
Pat Adams
100 College Street
Toronto, ON M5G 1L5
Canada

IWGIA
Teresa Aparicio
Fiolstrade 10
Copenhagen DK-1171
Denmark

IUCN National Committee
Wouter J. Veening
Damrak 28-30
Amsterdam 1012 LJ
Netherlands

Friends of the Earth
Charles Secrett
377 City Road
London EC1 V1NA
United Kingdom

Regenwalder Information
Reinhart Berhend
Poesseldorfer Weg 17
2000 Hamburg 13
Federal Republic of Germany

Environmental Defense Fund
Steve Schwartzman
1616 P St., N.W., #150
Washington, DC 20036
USA

Friends of the Earth, Sweden
Ulf Rasmusson
Rain Forest Group
Nytorgsgatan 21B
116 22 Stockholm
Sweden

World Wildlife Fund
Tony Long
11-13 Oxford Road
Godalming
Surrey GU7 1QU
United Kingdom

National Wildlife Federation
Barbara Bramble
1412 16th St., N.W.
Washington, DC 20036
USA

Probably the most effective way to influence a project or program is to alert executive directors in the major donor countries to bad projects or specific problems before a loan comes to the board. The five major donors control nearly half the votes on the World Bank board, and could stop a project or cause it to be changed. Ongoing projects can be modified, and the banks can insist that loan conditions be honored.

Conclusion

Brazilian planners project a necessary growth of 150 percent in the next 15 years, at a cost of over $130 billion (Brown 1987). At this rate, by the year 2010 all of the available hydroelectric resources will have been tapped. If social and human disasters on an enormous scale are to be avoided, there must

be unprecedented international mobilization and cooperation of NGOs and concerned citizens, and all the responsible agencies—national and international—must be held accountable for the consequences of their decisions. The Xingu River dams may be the crucial test of the possibilities and potential for a more participatory development model for Brazil, and for the Multilateral Development Banks.

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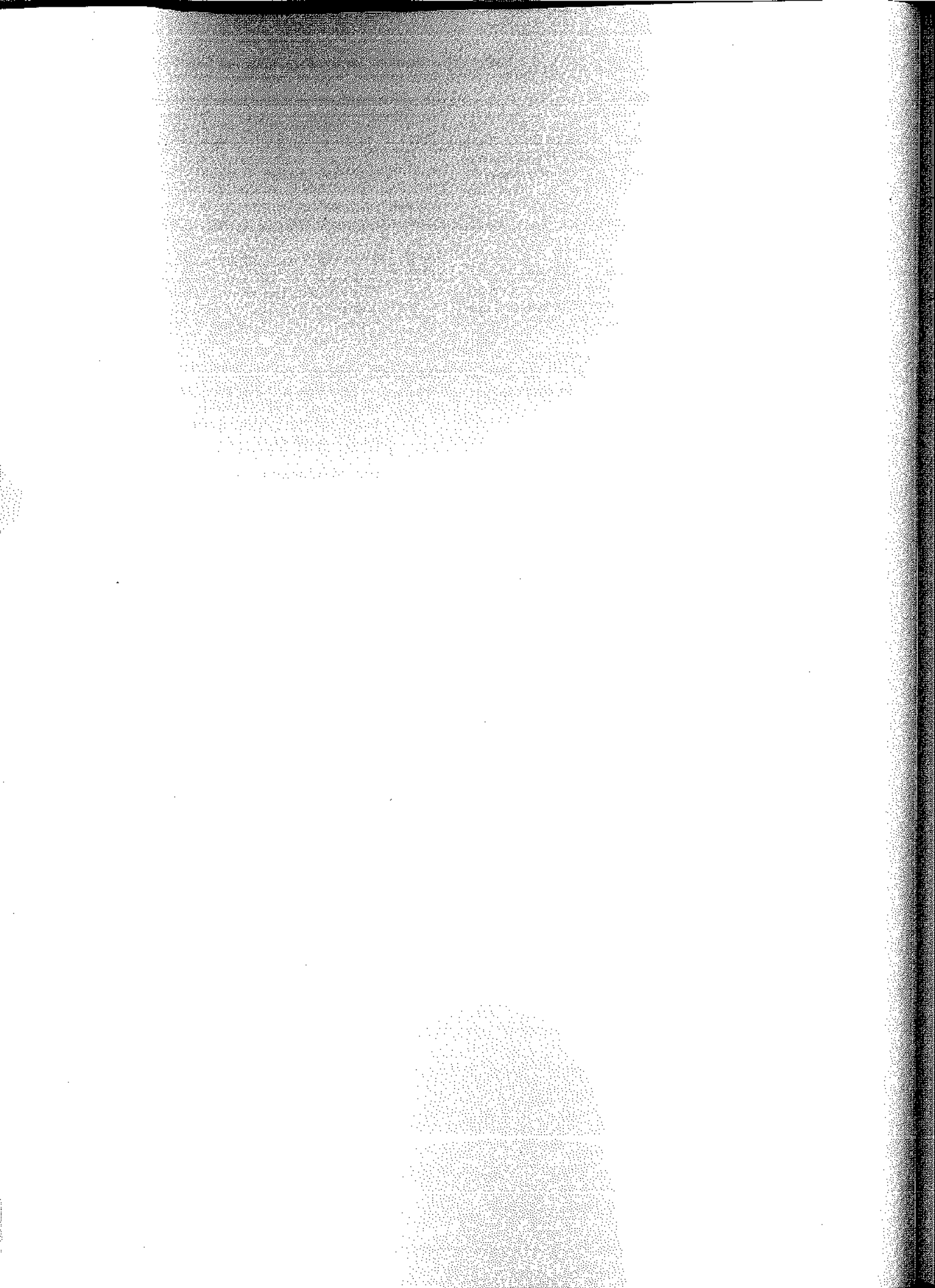
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Regulations for Environmental Impact Studies

Paulo Affonso Leme Machado

Introduction

The National Council for the Environment (Conama) has decided, based on Law No. 6.938/81 (Article 8, I and II), to make Environmental Impact Studies (EIS) obligatory for certain activities (Resolution No. 1/86—DOU of 2/17/86, p. 2548). The resolution also previews the content and elaboration procedure for this instrument of Brazilian environmental policy.

To evaluate environmental impact is a preventive measure included not only in the planning of activities directly related to development but also in the global planning for the nation, states, and municipalities. The EIS is an administrative procedure for preventing and monitoring environmental damages.

The EIS was introduced in Brazil through Law No. 6.803/80 (industrial zoning law in critical pollution areas). It resulted from an amendment presented to parliamentarians by the Brazilian Society for Environmental Law. In this law are two major guidelines: impact studies must offer alternatives, and they must point out the reasons for confidence in the solution to be adopted. This law came too late to affect the environmental deterioration in Cubatão, São Paulo, Santo André, São Bernardo do Campo, São Caetano, and Diadema, in the state of São Paulo. It did not fail, however, to make concrete demands as to the obligations to undertake EISs for the approval of strictly industrial use zones for petrochemical, chlorochemical, and carbochemical centers, as well as nuclear installations (Machado 1982).

Decree No. 88.351/83 left Conama with the job of fixing the basic criteria for the need for an EIS. The first project for a Resolution was offered by the Brazilian Society for Environmental Law, with regard to hydroelectrics. The representative for the state of Rio de Janeiro, Luis Alfredo Salomão, requested an inspection of the project and, with the collaboration of FEEMA (in particular, of Yara Verocai), presented a substitute. Amendments were made, including one by the Brazilian Society for Environmental Law, with regard to the autonomy of staff members in charge of preparing the study, and to the necessity of having industrial secrecy demonstrated and not merely called for. The material was voted and approved on 23 January 1986.

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Powers of the Union, State, and Municipalities

The EIS falls within the group of norms over which the supplementary powers for states and municipalities supervene, as well as about which the Union can only dictate "general norms."

In preparing Resolution No. 1/86, Conama did not exhaust the subject matter, nor did it go into details. The states and municipalities kept the power to require that, for activities not anticipated by the Resolution, the EIS may be done. Since the issue of the environment is not situated on the plane of residual powers, however, states and municipalities cannot fail to comply with the federal norm; similarly, they cannot innovate in such a way that what is introduced as new constitutes a veiled disobedience to Conama's general rule. This interpretation follows from the fact that, because there are no provisions for rules on the environment in the federal Constitution, the norm for defense and protection of health has been utilized in that which does not expressly conflict with the exclusive powers of the Union.

State and municipal administrations will be able to make suggestions as to choosing experts who will comprise the multidisciplinary teams; formulating questions to be answered by the teams; establishing time periods for the conclusion of the report; being informed beforehand of project-related area visits; and determining the presence of staff members for the holding of public hearings. To require all of these actions, it is not necessary for the states or municipalities to have passed specific legislation for environmental impact study. They are prerogatives of the administration that are included in the larger framework of the environmental police power and also have a basis in the general principles of Resolution No. 1/86 and in Laws No. 6.803 of 6/3/80 and 6.938 of 8/31/81.

Coverage of the Environmental Impact Study

The following activities are covered:

a) highways (two or more lanes), ports, terminals for chemical products, airports, oil ducts, gas ducts, and mineral ducts;

b) collector barrels for sanitary wastes and sanitary waste emitters (important for cleanliness of beaches);

c) hydraulic works for exploiting water resources,

including several situations: hydraulic works for hydraulic purposes, above 10mW, for sanitation or irrigation, rectification of water courses, opening of harbor entrances and passages, transposition of basins, dikes (works such as Tucuruí, Itaipú, and Balbina would have their environmental effects analyzed a priori, and the debate, moreover, would have taken place before location and construction);

d) extraction of fossil fuel (petroleum, schist, and coal), extraction of minerals;

e) location of sanitary embankments, final destination processing of toxic or dangerous wastes (deposits for nuclear wastes are included);

f) installation of alcohol distilleries (thought should be given to needs in the states of Mato Grosso and Mato Grosso do Sul so as not to damage the wildlife of the Pantanal), installation of metal-processing plants;

g) installation of industrial districts and industrial zones;

h) exploitation of lumber or of firewood in areas above 100 hectares, or less when it may affect significant areas in terms of percentage or importance from the environmental point of view (vital for the conservation of Amazonia);

i) urban projects above 100 hectares or in areas considered to be of relevant environmental interest, according to the criteria of SEMA and state and municipal agencies;

j) activities that utilize coal in quantities above 10 tons per day;

k) agricultural and stock-raising projects that cover areas greater than 1,000 hectares, or less when these may have some relation to important areas from the environmental point of view (addition to Resolution No. 1/86, voted on 3/18/86).

In the future, Conama will be able to establish other cases in which the study may be obligatory. Nevertheless, the provision made in Resolution No. 1/86 is important for there to be a determined environmental policy and so that the administration and society may intervene in an orderly and predictable way and not fortuitously.

Licensing and the Environmental Impact Study

The *licensing* of the activities referred to above depends on the completion of the EIS. Public administration will be able to make a decision against the EIS, but only if it is strongly based on arguments and facts that prove the EIS's conclusion to be wrong. To counter the EIS, once presented, the administration must gather information using similar procedures to those of the impact study; otherwise, its decision will be arbitrary.

The requirement of the EIS does not remain dependent only on the first licensing of activity, but also covers the licensing of expansion or alterations of the undertaking, and the manufacturing of new products. The resolution is not expressed in these terms but this interpretation is reasonable in view of the generally accepted usage of the term *licensing*.

Situations could occur in which projects of even the public authorities may not be clearly submitted to the licensing procedure. Would these projects be obliged to proceed with environmental impact studies? The force of the requirement for the EIS is based on the powers of Conama (Art. 8, Law No. 6.938/81). In this way, the EIS is not only required when there might be license, but in all cases that Conama sees as necessary. Thus, the undertaking of a public project (authorized or conceded) without the proper EIS makes the project illegal and subject to being paralyzed or embargoed through public suit (Machado 1986).

THE OBLIGATORY NATURE of the EIS should not turn the public decision-making procedure into a delayed process. Nevertheless, it widens the participation of the scientific sectors and of different social groups. Experience will have to dictate the time periods to be fixed in the federal, state, and municipal spheres for the *licensing*, after presentation of the EIS. The first article of the Resolution was fully debated so that the possibility of "licensing due to lapse of time" would not be created, in which the inaction of the administration would result in the project proponent's obtaining of license, without there having been any positive or negative decision as to the project's merit.

Content of the Environmental Impact Study

The Resolution established four technical activities to be addressed in the study:

I. Environmental diagnosis of the project's area of influence (physical, biological, and socioeconomic environment);

II. Analysis of the environmental impacts of the project, considering technological alternatives and location, confronting these with the hypothesis of the project's nonexecution;

III. Definition of measures to mitigate negative impacts, including the provision of equipment for control and removal and evaluating the efficiency of each of these;

IV. Elaboration of programs for accompanying and monitoring positive and negative impacts, including the parameters to be considered. (This last item is relevant, for the EIS is projected for the future, and is not restricted to the time prior to the execution of the study, so that continuous records of positive and negative data can be made. The monitoring will lead to perfecting and rectifying the very project analyzed, as well as contribute to the realization of similar EISs.)

The EIS is a procedure that requires gathering information for later analyses. It is not the occasion to be doing a thesis or the moment needed for

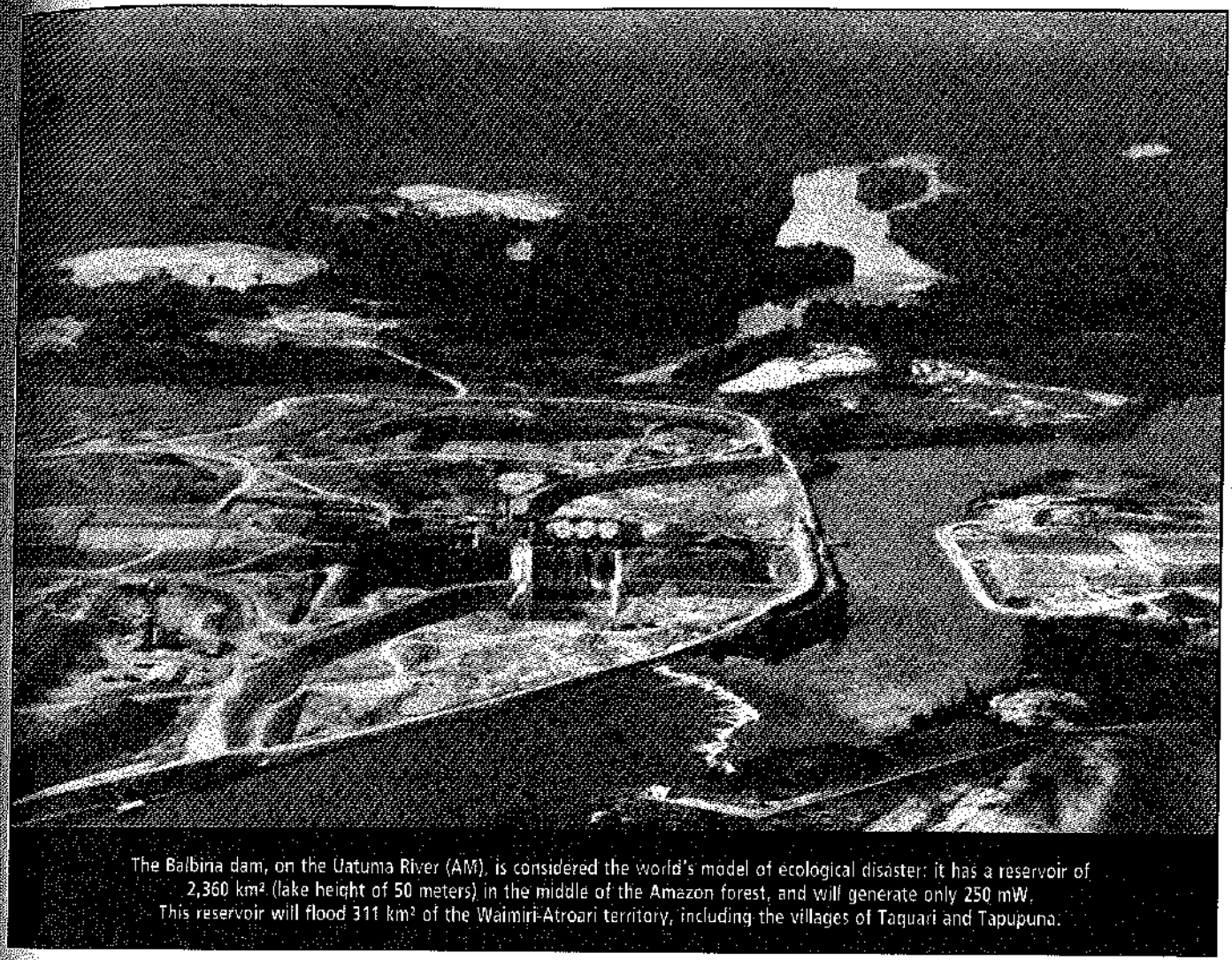


Photo: CPI/SP archives

The Balbina dam, on the Uatumã River (AM), is considered the world's model of ecological disaster: it has a reservoir of 2,360 km² (lake height of 50 meters) in the middle of the Amazon forest, and will generate only 250 mW. This reservoir will flood 311 km² of the Waimiri-Atroari territory, including the villages of Taquari and Tapupuna.

creating scientific theories (although it is evident that from the study, such opportunities may arise). Notwithstanding, it is necessary to maintain balance in the dimensioning of the study so that it doesn't remain only on the surface of the questions, as well as not expand to distant frontiers. The analysis to be done is that of "the area of influence of the project"; thus it is not of just the project itself but of the context in which it is being inserted. From comparative law, I cite the decision of the US Supreme Court, *Kleppe v. Sierra Club*, in which broad power was granted for the environmental administration to establish the units of the study (Rodgers 1977) in order to determine if the projects should have their effects analyzed separately or cumulatively (Shoenbaum 1982). As the Commissioner of the Salvadori government observed before the Administrative Tribunal of Toulouse, "impact studies should not be a generic and vague presentation of the operation, that occasionally address the question of damages and aggressions to the place. The study must evidence precise and verifiable facts. In short, it must be a true study and not the presentation of a project for publicity purposes" (Doumbe-Bille 1984).

Preparation of the EIS: Paying Expenses and Recruiting Personnel

The expenses for the preparation of the EIS will be paid by the proponent of the project; Decree No. 88.351/83 already pointed in this direction. Now, Resolution No. 1/86 specifies several expenses, foreseeing not only expenses of the phase prior to the project's execution, but also the later phase, during monitoring. It is reasonable to understand that, should there be environmental damage related to any of the activities foreseen in the Resolution, the monitoring of the affected area can be done through the very procedure of the EIS. In this monitoring, the evaluation of the damages is to be included as a condition of payment, in public suit seeking indemnification.

> The pilot experiences undertaken in the Low Countries indicate that the cost of preparation of the evaluation studies are around .25% of the total cost of the works; in France, a study of the Environmental Protection Agency indicates .19% and a look at 18 states affirms that the costs of impact studies represents, on the average, .5% of the total costs of the works. (Chambault 1985)

The EIS cannot remain tied to its source—this would engender suspicions of partiality. Were it prepared by persons hired by the proponent of the project, the study's conclusions would have their confidentiality compromised. The Resolution goes even further, by preventing persons or personnel indirectly dependent on the project's proponent from preparing the EIS. The Resolution speaks of the autonomy of personnel; moreover, it presupposes the autonomy of the individuals who comprise the staff. Thus, the individuals (or a component of the staff) cannot be connected to the project's proponent. The Resolution sought to avoid situations in which a team doing a technical project for the proponent might prepare the EIS for the entire project. The purpose of the prohibition is clear: it seeks to safeguard the broadest and least restricted freedom of the team. If it is already working on any part of the project (even if this part is not substantial or is not for execution), it will not be able to be part of the EIS team.

THE RESOLUTION WAS NOT EXPLICIT about the procedure to be followed in contracting the team—whether it would be the administration of the proponent of the project. In view of the Resolution's silence, both solutions are acceptable. There are those who favor hiring by the project's proponent, arguing that, in this way, the administration will have greater freedom to analyze the EIS. On the other hand, the other side sees it as disadvantageous for the proponent to be in charge of hiring, that contracting the team and agreeing on expenses and honoraria to be paid would take away part of the team's freedom. Practice will determine the necessity of additions to Resolution No. 1/86.

Recruitment of Experts and Staff, and Their Qualifications

Article 17 of Law No. 6.938/81 clearly establishes that:

> The Federal Technical Register of Activities and Instruments for Environmental Defense is instituted under the administration of SEMA, for the obligatory register of juridical or corporate entities that are specialized in technical consultancy on ecological or environmental problems.

The work to be performed by the team hired to prepare the EIS should be understood as technical consultancy, to which the law cited above refers. Thus, the preparation and candidacy for hiring juridical entities not inscribed in the SEMA Register should be contested. Furthermore, not only should the entity be inscribed, but its members should, as well; otherwise, the Resolution's requirements of a "qualified multidisciplinary staff" would be undermined. At the very least, the persons comprising the staff must be university graduates; although there is no need to regulate their profession, they must have a legalized university degree. In cases of greater complexity, the environmental agency can require that professionals with graduate degrees participate on the multidisciplinary team.

Availability of the Environmental Impact Study to the Public

The study was not intended solely to lay the foundation for the administrative decision in one sense or another. The Resolution sought, in the wake of what was already foreseen in Decree No. 88.351/83, to make the EIS accessible to the public—not only in the final stage, but also in the preparation stage, too. The multidisciplinary team will not work entirely separate from the local, regional, or national community. Article 11, §2 of the Resolution clearly specifies "the public agency and all other interested parties." The Resolution did not fix this period; however, it has to be compatible with the purpose of its existence—that is, if the period is small, the judicial power will be able to annul the EIS for deviating from its purpose. This phase of receiving comments from citizens, environmental agencies, or public agencies is not to be confused with the public hearing.

Law No. 6.938/81 has already foreseen the right of the public to be informed of *environmental licensing* before this was to be conceded by the administration. This is what Article 10, §1, of this law affirms, as well as that a summary of the request must be published in a widely circulated local or regional journal, and in the *Diário Oficial*. We are aware of the resistance of certain agencies in several states to comply with this requirement of the law (it is not a suggestion or a choice). Recall that Conama, in the same meeting at which it approved the EIS's general rule, also formulated norms as to publishing the authenticated copy for notice of licensing, and of Resolution No. 6/86. This notice should state whether there is a requirement for an impact study and, should it be desired, should state that it can be accompanied or a public hearing requested to be informed of the content of the RIMA and to debate it. Not publishing the notice can be corrected through public suit (Law No. 7.347/85).

The *public hearing* means the presence of staff specialists, the environmental administration, and the public. This phase became optional, in contrast to the phase of receiving comments, which is indispensable or obligatory.

It is not sufficient for the proponent of the project to invoke industrial secrecy in order to forbid public access to the EIS. The Resolution requires that the reason for the alleged secrecy be demonstrated, in this way, it will be the administration that affirms the reason for secrecy or not, and the grounds can be conferred by the judiciary power. Depending on the case, access to determined parts of the EIS or to its sources can be forbidden.

The preparation of the EIS is not a procedure that

is in itself exhaustive. In order to be valid, four parts have to be present in this procedure:

1) a multidisciplinary staff;
2) proponents of the project;
3) environmental administration; and
4) population of the area of influence of the project.

The procedure for public hearings is still unregulated. Schrecker's (1984) observation in this regard is valid when he says: "The legitimacy of political decisions on environmental matters is a function not only of their pertinence but equally of the process through which they were made. Those who are being asked to support the risks must have the opportunity to say whether they judge them acceptable."

The Environmental Impact Study and Judicial Control

Public suit and popular action, injunctions, and other manner of legal process, provide citizens and environmental associations, the Public Ministry, and the entities mentioned in Article 5 of Law No. 7.347/85 with access to the judiciary power to argue the illegality of an EIS.

The judge does not substitute the administration in deciding on licensing. However, as Waline (1973) affirms, "the administrative authority . . . has the obligation to put itself in the best conditions in order to have a sound appreciation of the opportunity for its decision." In the transformative decision Ville Nouvelle Est (1971), the commissioner of the Braibant government addressed the justices, saying: "your control will permit the censuring of arbitrary, unreasonable, or poorly studied decisions" of the administration.

Instituted in France in 1976, the EIS already offered the possibility for numerous court decisions. The Tribunal of Caen (1/12/82) annulled the decree of the Ministry of Industry that announced public utility works for the establishment of an electric line because the EIS omitted analysis of the natural and architectural patrimony affected, as well as leisure areas affected, and because the EIS was not precise in regard to the nature and dimensions of compensatory measures to be affected due to the implantation of the project (*Révue Juridique de l'Environnement* [3] 1982). The Administrative Tribunal of Grenoble (10/24/84) annulled the decree of the "Governor" (*Prefet*) of Issère, which had authorized an industry to produce lindane trichlorobenzene, because the EIS did not contain all elements of analysis of the installation's consequences (*RJE* [2] 1985). In the same way as the administrative tribunals, the French Council of State has demonstrated itself to be sensitive to the need for a well-prepared EIS: on 1 July 1983, it upheld the decision of the Tribunal of Marseilles, which annulled the decision of the Mayor of Roquevaire authorizing the construction of a school without an EIS; on 28 September 1984, it upheld the decision of the Tribunal of Toulouse that annulled the decree of the "Governor" (*Prefet*) of Haute-Garonne authorizing the exploitation of a quarry, because the EIS did not contain an analysis of the initial state of the site and the effects on the environment, notably sites, landscapes, fauna, flora, natural surroundings, and biological equilibria, as well as the fact that the study did not contain measures to compensate for the harmful environmental consequences of the project (*RJE* [4] 1984).

Hopefully, in Brazil the courts will take decisive action to ensure that the EIS fulfills its goals. Judicial control will have to be exercised in order to avoid deviations of purpose or the abuse of power, in such a way as to make this administrative instrument for the prevention of environmental damage effective and thus, protect the so-called intergenerational right—that is, so that not just the present generation enjoys the benefits of the environment, but also generations to come.

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Considerations on the Ecological Effects of Xingu Dams

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Jose Roberto de Miranda
Perseu Fernando dos Santos

Introduction

The construction of a system of dams on the Xingu River (Eletrobrás and CENEC 1980) will mean important alterations in the levels of the area's terrestrial and aquatic ecosystems—one of the most complex (Golley 1983), least known and studied (Halle et al. 1978), and most threatened on the planet (Caufield 1984; USA NASA 1985). The sum of the average discharges of the Danube, Po, Rhine, Nile, Loire, Seine, and Ebro rivers represents approximately the average discharge of the Xingu. In these circumstances, the building of a system of dams—as well as the resulting ecological impact in terms of area flooded, alterations in the hydrological behavior of the river downstream, and the development of economic activities inherent to construction—will have a crucial effect on the future functioning of these systems.

Ecological impacts are unavoidable in the construction of any dam, although its negative effects are frequently presented after the fact as *unforeseeable* when in reality they were merely *unforeseen*. In Brazil, the procedures currently utilized to measure the ecological impact of development projects are still little developed, and the pertinent legislation is insufficient. In view of this situation, legitimate concerns have been voiced not only from all segments of Brazilian society but also from around the world: that the ecological dimension in dam construction is belittled and insufficiently treated. This concern is justified; the situation brings together, on the one hand, a large-scale project in an ecologically complex and little-known region and, on the other, the tradition of state authoritarianism (Projeto 1987; Monosowski 1983) in the execution of such projects (Vieira 1984; Brasil s.d.). This chapter introduces some objective data on this question.

The problem is not new—neither in Brazil nor in the rest of the world. Since the 1950s, planning and political decisions in other countries have sought to establish the real ecological implications of dams. In the United States, the process has specific characteristics (Legore 1984); in Canada, others (Effer 1984), which in turn differ from the procedures of the European Economic Community (Lee and Wood 1984). But there are major points of convergence. Our concern is not to condemn or justify a system or proposed project, but rather to include an analysis of the dam's probable ecological impact relative to the project's decision and execution—the same as you would include analyses of economic, social, and financial impact. This process allows, through adequate scientific methods, a detailed and precise dimension to the conflict existing between utilizing and conserving natural resources. It is what is called the *evaluation of ecological impact* (Canter 1984), or *environmental impact*, as some authors term it.

The term *environmental* suggests several reflections on the ambiguity and use to which this term has been put. For ecologists, an environment doesn't exist in strict terms, unless one clearly defines one or several forms of adaptation. A single phenomenon of ecological disequilibrium—the eutrophication of a lake due to problems of pollution, for example—has distinct meanings depending on the environment considered. For the fish, the results are tragic since algae proliferate in an almost unlimited manner in the new context, to cite only one example.

Many authors say that when the effects of humans are added to the evaluation of ecological impact, the study becomes environmental. The main reason stems from the fact that the human population bears characteristics completely distinct from other animal populations, including its relationship to nature. A human-nature relationship does not exist; it is, rather, a relationship among humans through nature. In this sense, nature ought to be considered as the object of social relations, not as an end in itself. Every crisis in the use of nature is simply a reflex of a crisis in social relations.

In introducing "man" or "communities" into their studies, the supposed environmental impact assessments seek to have projects determined by restricted social groups accepted. These groups see in nature an object capable of affirming, extending, and perpetuating their own social position. Preferably, these problems should be treated by

specialists in the areas of anthropology, economics, and sociology. It is not up to the ecologists to venture into this field, or, worse still, to provide their services—consciously or not—to such dangerous propositions (Miranda 1984).

This process of assessment, whether it be in North America, Europe, or Japan, has little or nothing to do with what in Brazil is called the *Relatório de Impacto sobre o Meio Ambiente (RIMA)* ("Impact Report on the Environment"), extremely insufficient and limited in terms of clarifying the conflict in question, when it is duly presented. The experience with the RIMAs completed for other dams, above all in the north and northeast regions of Brazil (Eletrobrás 1986), would be even one more motive for concern in the case of the Xingu River (Monosowski 1983; Schaeffer 1986).

For the purposes of illustration, this chapter brings together some reflections on what would effectively represent a process of ecological impact assessment for a project such as that planned for the Xingu River, were it to be implanted in a developed country (Edwards 1984) or even in certain underdeveloped countries (Monosowski n.d.). We attempt to apply in this case the same methods used in Thailand (Manual of NEB 1979).

In Thailand, in 1975, the National Environmental Quality Act (NEQA) created the Office of the National Environmental Board (ONEB), more or less the equivalent of what in Brazil would be the National Council for the Environment (Conama) (Brasil 1984/86). Thai law, however, establishes a procedure for approval of environmental impact studies very different from the Brazilian case (Brasil 1986), and shows that the ONEB has broad powers of decision and regulation. In the case of environmental problems, the analysis is done before the projects are approved. The proponent initially prepares the Terms of Reference (TOR), which contain specific requirements for that project. The TOR is examined by the NEB (National Environmental Board), connected to the ONEB, and must be approved so that the proponent can receive direction and authorization to prepare the EIA, the environmental impact assessment. In general, some agency or institution with proper credentials prepares the EIA, which will be approved or rejected by the NEB in 90 days. If rejected, the proponent will revise the EIA on the points required and will resubmit it to the NEB, which reexamines it within 30 days. As long as the project does not fulfill any of the stages under the NEB's responsibility, it must return to the preceding stage. If approved, the result is sent to the government, through the Parliamentary Cabinet, whence it will proceed through the National Economic and Social Development Board and, from there, to the relevant ministries. Only after the project passes through all of these stages will the government decide on its execution.

In truth, it seems difficult to admit that a country such as Brazil, which makes a point of boasting its title of the eighth largest economy in the world, cannot emulate what is being done in this field in Southeast Asia—above all, because this concern has been turned into one of the requirements for project financing (World Bank 1983). A recent issue of *Science* magazine addressed the changes in World Bank policy in relation to the environmental question, using as an example the case of the Brazilian Amazon, where the impacts of development projects on ecology and indigenous populations (Walsh 1986) are specifically considered (Magalhães and Hummel 1987). It is clear that the ecological impact of the Xingu project (loan areas, construction works, containment dikes, roads, transmission lines, etc.) is somewhat greater and more complex than we address in this chapter. Here, through a small example, we seek first to illustrate the importance of the ecological question, now and in the future. In the second part of this chapter, we will analyze the direct ecological impact of the lake to be created on the several terrestrial and aquatic ecosystems in two locations of the region by applying part of an internationally utilized and recognized method: the Habitat Evaluation System (HES) (US Army Corps of Engineers 1980). This study presents a numerical and cartographic qualification and quantification of this impact on the locales referred to and the principal consequences for the fauna of these habitats.

In conclusion, we will discuss some minimum requirements that any Brazilian would certainly agree to—we live on one and the same planet, and this dam affects one of its most delicate parts. Would that those responsible for the project and the executors of the project also share them!

Methodological Aspects of Ecological Impact Assessment for Dam Construction Projects

The parameters utilized internationally in assessing dam projects' impact on the environment are well-established, perhaps better than for any other kind of project. The reason is simple: dams and their reservoirs profoundly alter the environment. Their impacts are differentiated in time, and they affect distant regions, both upstream and downstream from the site, in irreversible ways. To such a degree it is standard in other countries to require, for the environmental question, a detailing of the studies in stage A, which is only required at this level for other segments in a later stage, stage B. On the other hand, experience shows that in those countries which duly conducted impact studies, not only were the projects' main objectives achieved, but gains were made in energy production, agricultural production, flood control, water supply, navigation, the quality of life of the populations, and so on—with a minimum of environmental losses.

For humid tropical regions, even Thailand offers

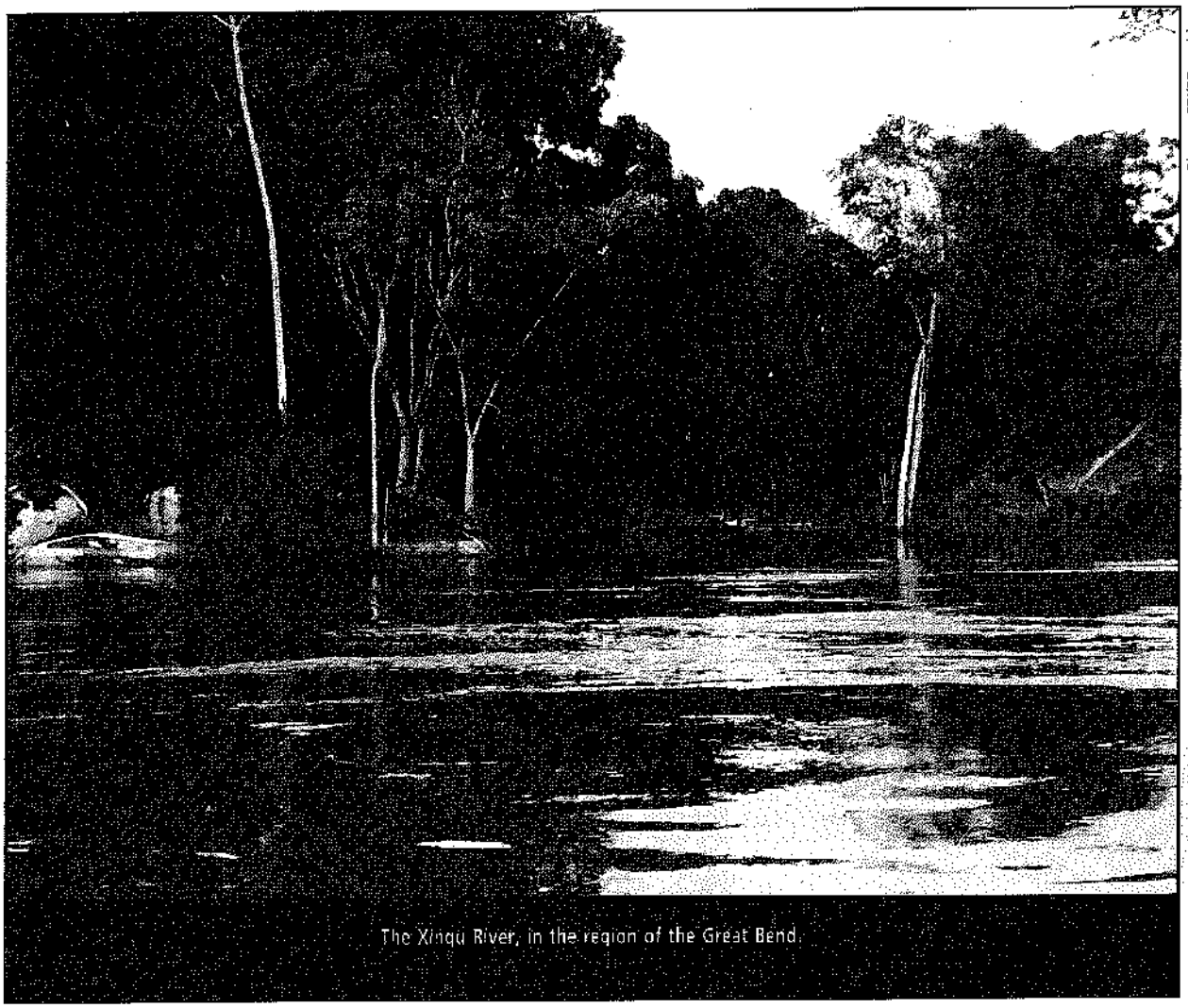


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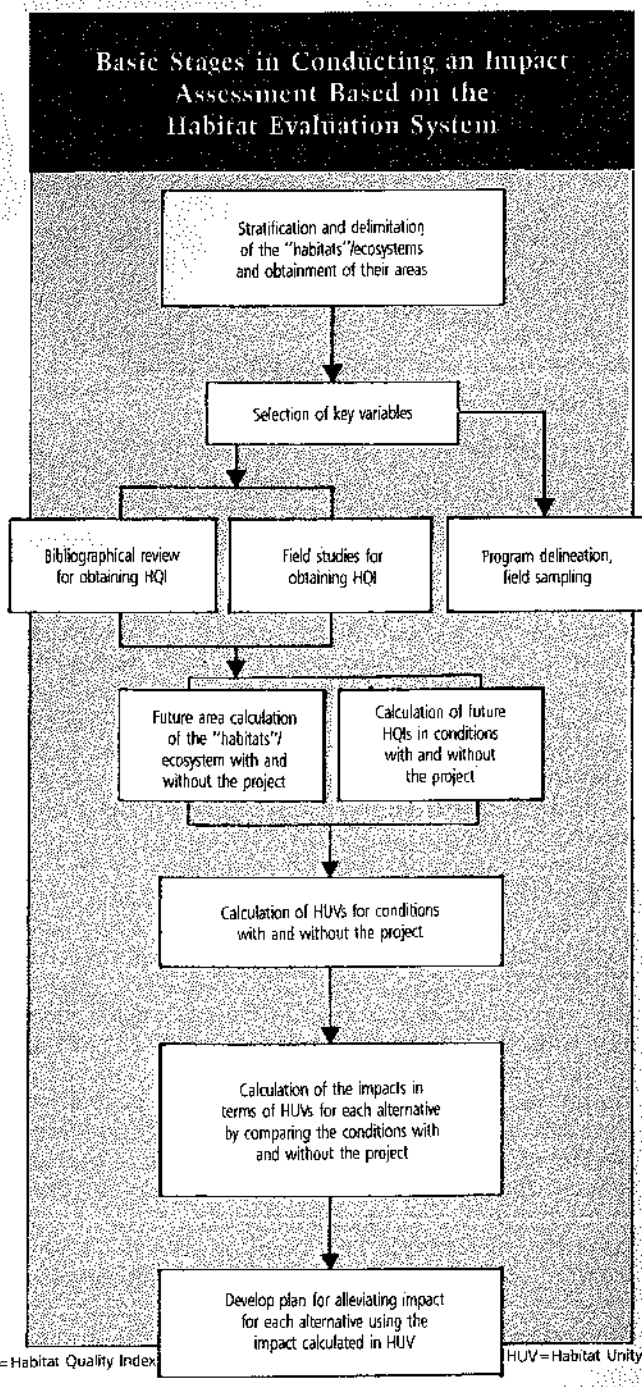
The Xingu River, in the region of the Great Bend.

valid examples as initial points of reference. The Pa Mong Optimization and Downstream Effects Study, prepared by the Committee of Mekong in 1976, and the Environmental Study of Nam Pong Dam and Reservoir Project of 1978, despite their having been done more than 10 years ago, still have great relevance to the Brazilian case. The fact is that the dam and its reservoir, electrical production and its transmission, and rural development inherent to the project ought to all be evaluated together. This impact assessment in countries such as Thailand involves the *physical resources* (hydrology of the surface waters, quality of the surface and subsurface waters, soils, geology, seismology, basin erosion, sedimentation in the reservoirs and tributaries, local climate, etc.), the *ecological resources* (terrestrial and aquatic flora and vegetation, terrestrial and aquatic faunal populations and population areas, fish, forests, aquatic biology, etc.), the *use values for the society* (navigation, electrical energy generation, water supply, irrigation, agroindustry, mining, tourism, flood control, aquaculture, agriculture, diversified use of lands, roads, and railroads, etc.), and the *elements of importance for the quality of life of the populations* (settlements, relocation of populations, archaeological sites, public health, endemic diseases, nutrition, historic and cultural aspects, etc.). It is in this perspective that various countries have developed ecological impact assessments for dams (Schorr 1984; Canter 1985; Canter et al. 1987). The methods utilized, although diversified, converge toward the same end. Given the limited scope of this chapter, we will consider only one of these methods.

One of the methods most utilized for assessing impacts at the level of ecosystems and habitats today is the Habitat Evaluation System (HES) developed by the US Army Corps of Engineers (1980). The basic phases for conducting these studies are outlined in the diagram on page 80. For utilizing this method, it is assumed fundamentally that the presence or absence, abundance and diversity of an animal population in a habitat or community are determined by basic biotic and abiotic factors that can be easily quantified. In other words, the carrying capacity of a habitat for a given species or group of species is correlated with basic chemical, physical, and biotic features of the habitat. Although more complex biological interactions, such as predation, competition, and sickness, also affect wildlife populations, the HES assumes

that if the necessary requirements for a species exist in a given habitat, then a viable population of this species will be—or potentially will be able to be—supported by this habitat. The HES considers groups of species and size of habitats, and the quality of these are combined to evaluate the project impacts at different levels.

As can be observed in the figure, the first step is to describe and obtain the types of habitat and land use for the areas. This makes the calculation of the "Habitat Quality Index" (HQI) viable, through the key variables for each habitat, as, for example, the index of sinuosity of rivers, the utilization of "Paired Weighting Systems" for terrestrial ecosystems, and so on. The third step is to calculate the possible "Habitat Unit Value" (HUV) to be quantified through a broad-based review of the literature (including reports, satellite photos, aerial photos, cartographic documents, etc.) (Miranda et al. 1986). In selected cases, the work includes only the data necessary so that the calculations of these indices can be made in a future field study. As another step, the projection of these HUVs is made both with and without the project conditions, and these same units are utilized to assess the impact of the different alternatives. In certain locales or alternatives for dams, the analysis of ecotones can be used to predict biotic productivity through the calculation of the "Edge Index" (EI). The "Edge Indices" are utilized for a basic description of the effects of the most destructive alternatives on terrestrial biota. In conclusion, the set of these assessments is synthesized and the basic requirements that could permit the correction or limitation of undesirable ecological effects are determined.



Preliminary Evaluation of the Impact of the Xingu Dams on Terrestrial and Aquatic Habitats

A Portion of the River and a Part of the Method

This chapter could not apply the methods for habitat evaluation to the totality of the area affected, directly or indirectly, by the system of dams on the Xingu River—we would not have the means to do this, nor is this the purpose of our chapter. It would be up to those responsible for the project to apply not only this method but also the entire set of analyses that characterize a process of ecological impact assessment. Also, the few documents available (topographical maps, satellite images, etc.)—without field surveys with the necessary resources—did not, in this case, permit the application of the totality of the habitat evaluation method (Brasil 1980).

Nevertheless, by way of illustration, and in a preliminary way, an initial evaluation of the habitats that exist and will exist after the construction of the dams was prepared for two distinct areas of the Xingu River. The perspective for ecological change has been minimized. Many habitats about which there were doubts were not mapped, despite the absolute certainty of their existence. It was preferable to stick to what appeared as indubitable in the few documents available, without considering the indirect ecological impacts of the dam construction. Certainly, in the areas studied, the habitats are more complex and possess features not detailed in this chapter. But, even so, this minimum of ecological qualification and quantification of the area allows for illustrating the magnitude of the direct ecological impact of this undertaking, even though only a portion of the river is being considered through a part of the method for assessment of habitats. For this, the following representative areas near Altamira (Pará) were analyzed:



Photo produced by LANDSAT-5, on 15 July 1986, shows the Great Bend, where the Xingu Hydroelectric Complex will be built. The large, light area of the photo shows the density of the forest broken by the tracing of the Trans-Amazon Highway and the indiscriminate deforestation accompanying the clearing for ranches.

area 1—Babaquara Reservoir
map 1: 340–370 & 9,625–9,645 UTM*
map 2: 340–370 & 9,600–9,620 UTM
area 2—Cararaô Reservoir
map 3: 410–440 & 9,625–9,645 UTM
map 4: 410–440 & 9,600–9,620 UTM
*UTM = Universal Transverse Mercator

Terrestrial and Aquatic Habitats on the Xingu

Occupying an area of 6.5 million km² (approximately 57 percent of the European continent), the Amazon River Basin constitutes the largest and most complex system of river drainage on the planet. Given the characteristics of the region, which contains a good part of the earth's pluvial precipitation and has a slow drainage as a result of the weak altitudinal gradients of the Amazon Plains, the rivers of this basin are permanently voluminous and responsible for maintaining extensive areas of seasonal inundation.

The local base level, the Amazon River, is the main sink for the runoff from important tributaries that drain part of the Guiana Highlands to the north, and from the southern Amazonian highlands. Due to the characteristics of their topographical profile, which include sections with sharp alternation of altitudes (contacts of the Amazon Plain with highland areas), these tributaries are interesting from the point of view of hydroelectric development, as is the case of the Xingu River.

With a length of 1,500 km from its sources in the Brazilian central highlands to its mouth on the Amazon (the equivalent of double the Rhine River and half the Volga River), the Xingu drains an area of 540,000 km², or twice the size of West Germany, with a flow of 7,100 cubic meters per second running through important indigenous areas in the state of Pará. This river belongs to the group of Amazonian rivers called "black-water rivers," that is, those with a low detritic load in suspension, even in the rainy seasons, and consequently a reduced rate of dissolved mineral salts.

When the reservoirs of the Xingu Hydroelectric Complex are formed, important natural areas will be flooded, diverse habitats that have been preserved from anthropic action, most of which are the result of fluvial action over the last 5 million years.

Based on the available documents, it was possible to detect, qualify, and quantify about 30 different habitats in the two areas studied. The cartographic results are shown on Maps 1, 2, 3, and 4 presented in the appendix. Despite their preliminary character, these results illustrate the magnitude of the ecological problem that the dams will cause. With more information, it would certainly be possible to go into greater detail; perhaps the number of habitats to consider would be closer to 50 (Bailey 1985). This is a figure which in itself illustrates the ecological diversity of a river the size of the Xingu. In temperate climates, rarely does one get 10 habitats, which are characterized by a much poorer display of fauna and flora. The main habitats detected and mapped will be the object of a succinct presentation, above all with reference to their status with and without the dams. Table 1 summarizes the essence of these results in the present situation. Table 2 presents the probable qualitative and quantitative evaluation of these habitats after the construction of the Babaquara and Cararaô dams.

Impacts on the Faunal Populations and Population Areas

As we have seen before, the area near the dams of the Xingu has a great diversity of habitats—approximately 50—some almost unequaled in the Amazonian world. Almost all of the habitats located at the level of the Xingu River channel will be submerged where the system of dams foreseen by the hydroelectric project is implemented. The number of faunal populations specific to these habitats is very important; it has the notable feature of belonging to one of the most complex ecological systems in terms of fauna/vegetation relations (Begon and Mortimer 1981).

In the habitats offered by the fluvial and riverine environment, principally in the Xingu River Channel, the faunal populations are very characteristic. The levels of the banks, secondary channels, islands, sandbanks, and so on abound in numerous aquatic and marsh birds, principally the *maguari* (*Ardea cocoi*), various herons, the cormorant (*Anhinga anhinga*), the jacana (*Jacana spinosa*), and so on. On the Xingu, gulls (*Phaetusa simplex*) hunt on and frequent the sandy beaches, as do large numbers of wild ducks, which feed and reproduce in the biotopes offered by the flood lakes, intra-island lakes, and marginal dikes, which will disappear totally.

Sandbanks and islands are habitats of reproduction, obviously vital for the subsistence of species. Each year in these habitats, large freshwater turtles lay thousands of eggs, such as the *Podocnemis expansa*, which reaches a weight of 70 kg and lays between 80 and 200 eggs at a time. It is enough to point out that even the populations that live in the tributaries of the Xingu are capable of migrating hundreds of kilometers to lay their eggs in the sandbanks of the river each year. Without adequate measures, the dams will present an insurmountable obstacle for these animals, as well as others that circulate through the river (fish in spawning). Populations that lived in interaction will be transformed into subpopulations at the level of each lake formed by the dams. There are even certain species of birds, such as the *batuiras* and *bacaraus*, that build their nests at the level of the islands due to the absence of predators in this kind of habitat. The chicks are raised in these locales until they reach adult age.

With the disappearance of these habitats, the

faunal populations will undergo very important qualitative and quantitative changes, as in the case of the giant turtles, the avifauna, and crocodiles (*Caiman crocodilus*—nearly 2 meters in length). They will suffer extreme changes in their population dynamics as they lose a large part of the habitats in which they reproduce and raise their young.

In the aquatic habitats, there are notable ichthyological fauna, such as the giant pirarucu (*Arapaima gigas*), the largest freshwater fish in the world, and the piraíba (*Brachyplastytoma*), as well as numerous species highly appreciated for their excellent taste, such as the tambaqui (*Colossoma*) and the tucunarés (*Cichla*). The banks of the Xingu, as well as its tributaries, bring together ecologically favorable conditions for large numbers of birds and mammals to feed and reproduce on, as well as invertebrates, fish, batrachians, and reptiles, among which are riverine anacondas, boa constrictors, and crocodiles (Pádua and Coimbra Filho 1979).

A significant number of mammals spend a great part of their lives in aquatic habitats (riverbanks, canals, streams, etc.), swimming, immersing, or looking for prey or for shelter: freshwater dolphins, or botos (*Sotalia* and *Inia*); otters (*Lutra*), and the largest of all known otters, the *Pteranura brasiliensis*; tapirs (*Tapirus terrestris*, large mammals that can weigh up to 180 kilos and spend the greater part of their time in water, feeding on algae and river-bottom vegetation; and the largest rodents in the world, the capyvara (*Hydrochaerus hydrochaerus*), which weigh about 60 kilos and live on the banks of the Xingu, its tributaries, and in the perennials and flood lagoons. The capyvara is exclusively herbivorous and represents, together with the tapir, an

Table 1
Preliminary Qualification and Quantification of the Terrestrial and Aquatic Habitats of the Xingu River, Altamira Region (PA)

	Area 1		Area 2	
Habitat	**Map 1**	**Map 2**	**Map 3**	**Map 4**
Main river (km)	32.5	36.5	16.0	34.5
Main river (ha)	5,925.0	2,300.0	1,100.0	6,200.0
Sinuosity index	2.1	2.3	2.0	2.4
Minor channels (furos) (km)	0.8	37.0	0.0	1.5
Sinuosity index	1.0	2.9	–	1.0
Paranás (km)	37.0	97.0	82.0	61.0
Sinuosity index	1.9	2.3	2.1	2.5
Igarapés (km)	210.0	293.0	328.0	332.0
Sinuosity index	2.5	2.1	2.4	4.0
Tributaries (km)	–	–	–	25.0
Sinuosity index	–	–	–	3.6
Rapids (no.)	1	1	1	3
Island lake (no.)	25	48	1	37
Várzea lake (no.)	2	2	43	18
Endorréico lake (no.)	1	2	3	5
Islands (no.)	62	178	139	320
Rivermouth island (no.)	–	–	–	1
Tributary island (no.)	–	–	–	18
Island bank (km)	86.2	325.0	7.5	85.0
Island ravine (km)	12.0	23.5	3.5	29.0
Island beach (km)	22.0	43.0	21.0	23.0
Fluvial beach (km)	4.5	21.0	9.5	29.5
Várzea bank (ha)	375.0	–	187.0	450.0
Abrupt margin (km)	90.0	161.0	137.0	213.0
Alluvial plain (ha)	4,525.0	4,950.0	4,870.0	4,000.0
Raised shorelines (ha)	5,550.0	2,300.0	4,510.0	2,050.0
Terra firma–glacial (ha)	74,822.0	64,782.0	71,870.0	78,965.0
Terra firma–hills (ha)	–	–	10,060.0	–
Plained toplands (ha)	–	5,847.0	1,312.0	1,275.0
Total areas (in hectares)	145,451		163,482	

important source of protein for the indigenous and riverine populations.

In the terra firma habitats occupied by broad-leafed foliage, even the habitats of the beaches and riverbanks abound in reptiles such as the gigantic crocodile (*Melanosochus niger*), which can reach lengths of 6 meters and which has an important role in controlling piranha populations. In the areas of less dense forest live land turtles (*Geochelone tabulata*), which represent an important food source for the indigenous populations.

Among the principal terra firma mammals are the jaguar (*Panthera onca*), the largest feline in the Americas, which weighs around 100 kilos. There are also anteaters, among which one finds the striped anteater (*Myrmercophaga tridactylus*), the largest of the family (weighing approximately 70 kilos), and the anteater (*Tamadua tetradactylus*), which is very numerous in these terra firma habitats. Among various species, the cervidae (*Mazama gouazabira*); the peccary (*Tayassu pecari*), equivalent to the wild boar in neotropical regions, and various armadillos, including the giant armadillo (*Prodontes giganteus*), which can weigh up to 70 kilos, are all exploited as protein sources and for commerce.

Table 2
Qualification and Quantification of the Probable Terrestrial and Aquatic Habitats After the Construction of the Babaquara and Cararao Dams on the Xingu River, Altamira Region (PA)

	Area 1		Area 2	
Habitat	**Map 1**	**Map 2**	**Map 3**	**Map 4**
Main river (km)	32.5	36.5	16.0	34.5
Main river (ha)*	16,709.0	11,843.0	9,390.0	16,172.0
Sinuosity index	1.5	1.0	1.0	1.5
Minor channels (furos) (km)	0.0	0.0	0.0	0.0
Sinuosity index	1.0	1.0	1.0	1.0
Paranás (km)	0.0	0.0	0.0	0.0
Sinuosity index	1.0	1.0	1.0	1.0
Igarapés (km)	88.0	90.0	93.0	107.0
Sinuosity index	1.5	1.5	1.5	2.0
Tributaries (km)	0.0	0.0	0.0	0.0
Sinuosity index	1.0	1.0	1.0	1.0
Rapids (no.)	0	0	0	0
Island lake (no.)	0	0	0	0
Várzea lake (no.)	0	0	0	0
Endorreico lake (no.)	0	0	0	0
Islands (no.)	0	0	0	0
Rivermouth island (no.)	0	0	0	0
Tributary island (no.)	0	0	0	0
Island bank (km)	0	0	0	0
Island ravine (km)	0	0	0	0
Island beach (km)	0	0	0	0
Fluvial beach (km)	0	0	0	0
Várzea bank (ha)	0	0	0	0
Abrupt margin (km)	36.0	49.0	58.0	83.0
Alluvial plain (ha)	0	0	0	0
Raised shorelines (ha)	0	0	0	0
Terra firma–glacial (ha)	72,972.0	60,457.0	68,345.0	78,190.0
Terra firma–hills (ha)	–	–	8,010.0	–
Plained toplands (ha)	–	5,200.0	1,312.0	1,275.0
"Future islands" (ha)	1,850.0	4,325.0	3,525.0	775.0
"Future islands" (km)	147	160	122	75
Total areas (in hectares)	138,629		157,032	

*Area corresponding to the lakes resulting from flooding, not presenting however the original features of the main river. This wasn't considered in the final totals.

Terrestrial and Aquatic Habitats: Predicted Alterations

The Main River

Given its altitudinal gradient, the Xingu River can be considered in its totality as a highlands river, since a large part of the sinuous line of its valley is located in the south Amazon highland. It can be considered to be the interface between the highland portion and the Amazon plain, the contact point between tertiary lands of the escarpment formation and paleozoic sediments of the Amazonian geosyncline. Rapids and waterfalls are common in this area, providing testimony of differential geological contact, forming truncations in the minor bed and the consequent appearance of distinctive deposits in the anterior portion and canyons of rapid runoff due to thresholds. This bar formation will be responsible for the appearance of a meandering bed, islands, cavities, and so on, as can be observed in Maps 1, 2, 3, and 4 in the appendix. In some areas of the Xingu, the clusters of diaclases are striking, providing testimony of a structural conditioning in the pattern of local drainage, giving rise to a system of specific islands (Map 3). Comparing Tables 1 and 2 shows that in the two areas there will be a complete change in this complex habitat that represents the sheet of water of the Xingu, corresponding to the loss of 69 km, or 8,225 hectares, in area 1, and 50.5 km, or 7,300 hectares, in area 2. This will be substituted by a sheet of water from the reservoir lakes covering 31,550 hectares in area 1 and 21,768 hectares in area 2. The spatial dimension of this habitat can be observed principally in Maps 1, 2, and 4, which show the diversity of fluvial forms subordinate to it.

The "Furos"

Minor channels which, in the várzeas, form a system of communications between the main river and its nearest tributaries, between várzea lakes, and so on, the "furos" constitute in some areas a true fluvial network. Such features are the result of interfluvial breaks of the high várzea that drains the floodplains. By contrasting Tables 1 and 2, we see that the furos will totally disappear, corresponding to 37.8 km in area 1 and 1.5 km in area 2. Although presenting difficulties in their identification on the scale used, their significant presence can be noted on Map 2, on the lower portion next to a substantial island sandbank.

The Paranás

Acting as complementary waterways to the main runoff, the paranás consist of extensive, wide, deep branches of large rivers which on the floodplain form a large island. They are called *paranás* in the region (*para* "sea", *nás* "similar to"). They are derived from the wandering of the minor bed over the alluvial plain, abandoned as marginal fluvial segments (see Map 3). It can also be observed from Tables 1 and 2 that these habitats will be completely compromised, given that a total of 134 km in area 1 and 143 km in area 2 will be covered by the dam's waters. The presence of this habitat is notable on all maps; however, it is worth noting its prominence in relation to the main river in the central portion of Map 2.

The Igarapés

These are short, narrow water courses with well-defined basins, found in both várzea and terra firma (from the Tupi: *igará* "canse", *pé* "trail"). They consist of elements more from the drainage of tertiary plateaus than from the várzea (see Map 2). They are responsible for the removal of sediments from tertiary drain surfaces, conditioning the evolutionary role of the footplain slopes. They contain very typical fauna and vegetation. The comparison of Tables 1 and 2 shows the disappearance of 324 km in area 1 and 460 km in area 2 after dam construction. This habitat is densely present in all areas analyzed, and is notable on the upper portion of Map 2, on both banks of the main river.

The Tributaries

These are canals of intermediate discharge for the large rivers and igarapés. Often, they are base level for considerable areas on the scale 1:50,000, presenting islands and sandbanks mainly near their mouths (see Map 4). Their downstream dynamic is governed by the debit of the main river. Tables 1 and 2 also show complete disappearance of the tributaries after the completion of the project, the loss of these habitats being on the order of 25 km in area 2. The sinuosity index will go from 3.6 (a value that indicates diversified biotopes) to the simplest possible value: 1. Map 2 shows an important tributary of the Xingu, the Bacajá River, occupying a considerable extent of space in relation to the area mapped, on the lower left portion of Map 4.

The Rapids and Cataracts

Differences in water levels produced by differentiated lithologic contacts give rise to rapids and cataracts (the latter present difficulties in their identification on the scale used), which, due to their particular hydric circulation, create zones of high oxygenation in the river bed. They are difficult to observe and map with the available documents, but their disappearance in the areas of flooding will be total. These habitats can be noted principally on Map 4, in its central position, and upriver and downriver of the Bacajá River.

(*more*)

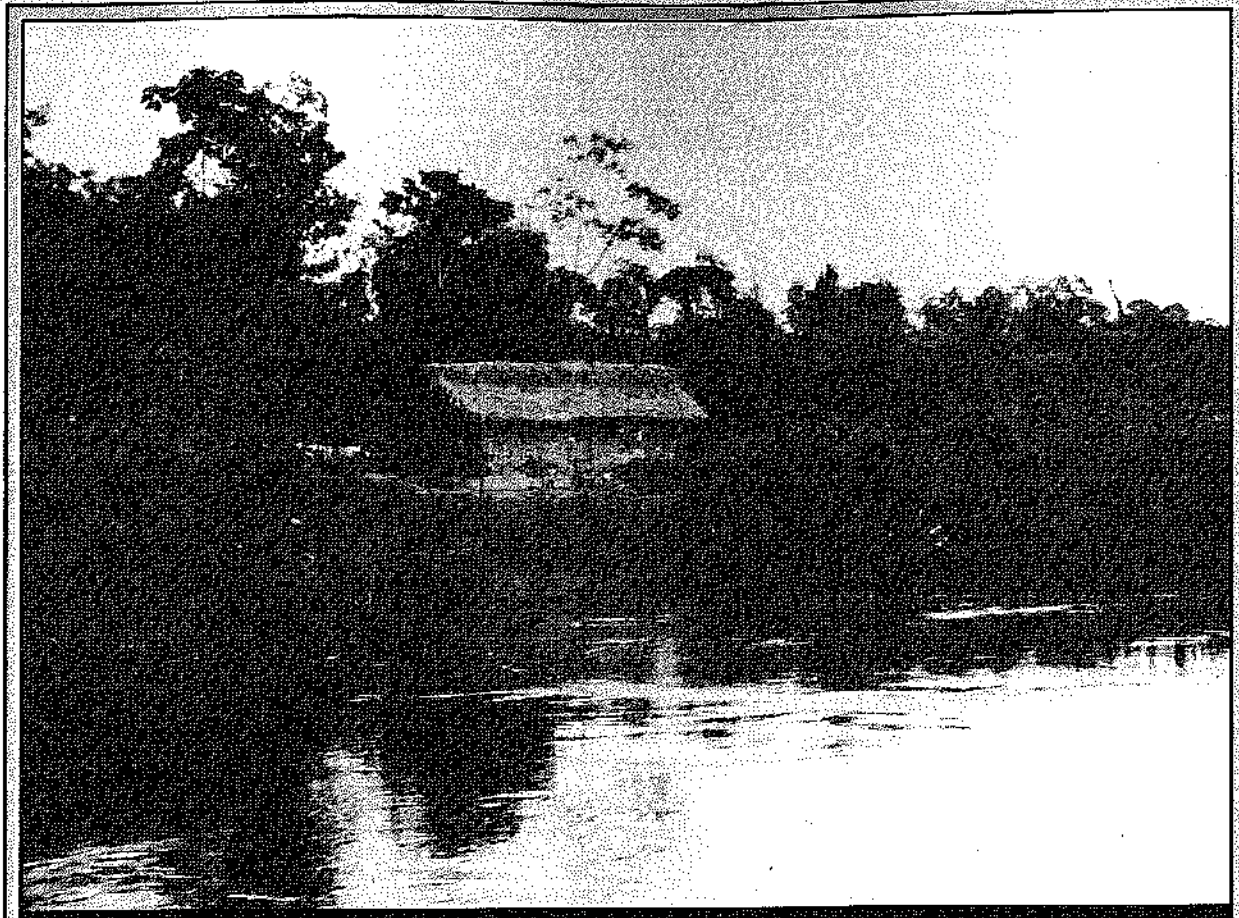


Photo: CEDI/SP archives

With the building of the hydroelectrics, the population that lives in the Xingu region today will be deprived of a whole tradition of knowledge that has been accumulated over generations—a loss that cannot be quantified or indemnified.

The Island Lakes

These appear on islands which have the same depositional dynamics as the várzeas, isolated by paranás, thus they result from the successive migrations of the minor bed (Map 3). The tables demonstrate that these habitats will completely disappear—73 in area 1 and 38 in area 2. With the exception of Map 3, these habitats are found on most maps; they can be especially noted in the upper portion of Map 4.

The Várzea Lakes

These are lacustrine depressions in the interior of the alluvial plains that contain large sheets of water in a progressive process of seasonal sedimentation. They are shallow-water bodies with a depth of 3 to 6 meters in high water, and 1 to 3 meters in low waters. They may have their formation associated with an abandoned meandering barred by sandbanks. They function as important reservoirs for part of the fluvial discharge during times of high water. A contrast of Tables 1 and 2 demonstrates that after the flooding, four várzea lakes will cease to exist in area 1, and sixty-one in area 2. Such habitats occur in all maps except Map 1, being most relevant in Maps 3 and 4.

The Endorréicos Lakes

These are characterized by lacustrine systems determined by successive deposits of várzea sandbanks, or by the deposit of sandy detritus load carried by streams from Amazonian tertiary tablelands. Many endorréicos lakes are found adapted to the network of regional faults, or built up by marine transgressions in the Pleistocene during the last interglacial phase. The irreparable loss of such habitats is shown by contrasting Tables 1 and 2: three lakes in area 1 will disappear and eight in area 2, the loss being total. Although they have a reduced presence in the areas analyzed, they can be noted in the upper portion of Map 4.

The Islands

a. Islands in diaclasis Elaborated on the basis of the differential action of erosion by the waters of the riverbed on fault zones of the lithological base, islands in diaclasis are delimited by these riverbed branches that isolate immersed portions of rocky material, exposed or recovered by fluvial detritus (sands, gravel, etc.). Generally, they are found in areas of rapid fluvial runoff due to distinct lithological contacts, for example, upstream from the future Cararaõ dam, but are

difficult to map on the basis of the documents available. They should increase after the dams are constructed, and will come to have a hydric dynamic very different from their present one. The islands in diaclasis are striking in the upper portion of Map 3, where structural control in the morphology of local drainage is visible.

b. Islands of detritic accumulation These are topographical forms situated in the bed of the canal, formed by the interaction between water flow and movement of sediments, resulting in irregularities produced in the bed of the alluvial canals. They are comprised mainly of sandy gravel particles interspersed with fine material (silt, clay). They can be related to phases of anastomosed morpho-genetic features on the lithological barring of the bed bottom (thresholds, etc.). They are environments of rapid mutability due to the inconsistency of the constituent material. Almost all the islands mapped fit into this case, which in determined portions of the river constitutes an impressive complex whole (Map 4).

The quantification of the disappearance of these islands in the two areas analyzed amounts to a total of 240 in area 1 and 459 in area 2, the loss being total. It is important to point out the dense presence of such habitats in the lower left portion of Map 4.

b1. River mouth islands Formed by unconsolidated detritic material, these have developed due to local difference in the velocity of flow between the main river and its tributary.

In periods of very high water, when the water level of the main river rises more quickly than that of the tributary, the process of "damming" the tributary waters occurs, restricting their velocity and provoking material deposits. These deposits are generally comprised of fine detritic material (clayey silt) in the immersed portion and gross material in the submerged base. This habitat, plainly visible in Map 4, will disappear after the concretization of the project. Map 4 represents a river mouth island of considerable spatial representativity, at the mouth of the Bacajá River.

b2. Tributary islands These islands correspond to type B, but are of smaller proportions, situated on tributary rivers of the Xingu. They are characteristic of the downstream portion of these tributaries, formed as much by the type of gradient (slow) as by the decrease of velocity of flow provoked by the local base level. Tables 1 and 2 show the complete loss of this habitat, amounting in area 2 to a total of 18 islands. In Map 4, along the bed of the Bacajá River, the importance of these islands can be noted.

c. Sand banks and island ravines These are fluvial depositional surfaces situated on levels topographically superior to the surface of the island, elaborated by the seasonal variation of the fluvial bed; in the period of high waters, there is a vertical rise and, in the period of low waters, lateral washout. The island ravine is created when the difference of level occurs abruptly at the island banks. These can be observed in the sections represented by Maps 1, 2, 3, and 4 in distinct locations and dimensions, of great importance for diverse faunal populations. Also, in Tables 1 and 2, the total loss of such habitats can be noted in the two areas analyzed, amounting to 411.2 hectares in area 1 and 92.5 hectares in area 2 for the sandbanks, and 35.5 km and 32.5 km, respectively, for abrupt ravines. Such habitats occur in all maps, and their marked presence can be seen in Map 2.

d. Island beaches Similar to the fluvial beaches in terms of genesis and evolution, the island beaches are features homologous to adjacent areas of island sandbanks and várzea sandbanks. The loss of this habitat corresponds in area 1 to 65 km, and in area 2 to 14 km of extension. Despite the difficulty in interpreting these habitats with the material available, their significant presence can be noted in Maps 1, 2, and 4.

The Fluvial Beaches

These are depositional features characterized by soft gradient, located on the banks of the large rivers, tributaries, and streams. They present a granulometric composition that can vary from fine sands to gross sands with gravel, resulting from recent sedimentation by nonsoluble detritic load in the water flow. This process is determined in most cases by the dynamics of local river circulation. An analysis of Tables 1 and 2 shows the total disappearance of this habitat. This habitat also presented difficulties in its identification; however, its presence can be verified in the lower portion of Map 3.

The Várzea Sandbanks

The successive inundations of the alluvial plains provoke periodic increments of sediments that may be similar to cordons or more extensive areas in topographically higher levels on the floodplain. These features are formed in the várzea sandbanks. During the process of dry weather, these may suffer erosion, thus creating forms in depression that can contain lakes or furos. When the várzea sand banks present semicircular forms, their genesis is associated with a development on the inner part of a meandering curve. In the specific case of the island sandbanks, fluvial degradation/aggradation action connected to seasonal behavior of the paranás can be observed. An analysis of Tables 1 and 2 shows the total disappearance of these habitats, representing 375 hectares in area 1, and 637 hectares in area 2. Except for Map 2, these habitats are notable on most maps, their occurrence being visible on Maps 1 and 4, on the left bank of the Xingu.

(*more*)

The Banks on Abrupt Slope

These are found in marginal areas where there is a direct drop in vertical slopes, with a strong declivity at the base, often funneling the runoff of fluvial canals when this unit of relief is repeated on both banks. In this case, frequently there are rapids or waterfalls when one is dealing with thresholds, resulting from the meeting of two interfluves in crest. It is a typical form of the headwaters of streams or in funneled portions of the main drainage, varying from thick colluvial deposit to exposed rocky bodies, depending on the decline. The results of Tables 1 and 2 show the partial disappearance of these habitats in the two areas, corresponding to 166 km in area 1, and 209 km in area 2. Present on all maps, their relevant occurrence can be noted on Maps 3 and 4 at the areas most distant from the main river.

The Alluvial Plain

This morpho-hydrological feature is formed by the successive deposits of sediments in suspension in fluvial channels when these are in the phase of seasonal overflow, corresponding to the periods of floods. It represents a drainage subsystem with difficult and disorganized runoff, even in the periods of low waters, conditioned by the dense and intricate grassy, arboreal, and shrubby vegetation that covers it. In the period of minimum inundation, a peculiar system of drainage occurs, characterized by the furos, lakes in process of filling up, and várzea lakes. Topographically, the alluvial plains present a minimum of rugosity with the exception of the occurrence of depositional features subordinate to them, such as várzea sandbanks or lacustrine depressions. This being the most significant habitat to be inundated, the comparison between Tables 1 and 2 shows considerable loss of these areas by flooding after the construction of the dams, the total loss being on the order of 9,475 hectares in area 1 and 8,870 hectares in area 2. The presence of this habitat is easily verified on all maps, with its main occurrence being visible on Maps 1 and 2 along the banks of the main river.

The Terraces

These features are found below the so-called "terra firma" and are also known as *tesos* (raised ground not reached by flood). They were formed during the Pleistocene era by deposits on paleo-alluvial plains that were reworked in the Holocene era, with colluvial-alluvial sediments contributing to their genesis. They are situated from 20 to 30 meters above the actual alluvial plains and do not suffer flooding. They are actually found carved by the dense network of streams that condition the appearance of small interfluves. Together with the alluvial plains, these habitats have a relevant spatial importance, but will completely disappear in the areas analyzed, corresponding to 7,850 hectares in area 1 and 6,560 hectares in area 2. Such habitats are present on all maps, and can be seen especially on Map 1, principally on the right bank of the main river.

Terra Firma

The complex of lands in which periodic flooding does not occur is known regionally as terra firma. This morphological unit presents local differentiations due to the lithology, responsible for the structuring of the relief in interaction with the climate. In this manner, terra firma of the convex hill type, maintained by Precambrian rocks of considerable resistance, are distinguishable from terra firma of the glacial type, characterized by broad surfaces of tertiary erosion, formed on solidified sedimentary rocks.

The hilly terra firma presents a relief dominated by abrupt slopes (where chemical intemperateness predominates), mass movements, and "V"-shaped valleys. The glacial terra firma, in turn, is characterized by gently inclining slopes, wide valleys covered by the streams and tributaries of the main river, and residual relief of pediplanation—that is, the planed toplands. An analysis of Tables 1 and 2 shows the partial disappearance of these two kinds of terra firma: for the glacial type the loss is 6,175 hectares in area 1 and 4,300 hectares in area 2; for the hilly terra firma, the area flooded corresponds to 2,050 hectares in area 2. This habitat is present principally in Maps 1 and 2.

The Planed Toplands

This is a form of residual relief formed by tertiary pediplanation, comprised of tabular surfaces, and corresponding on the top to ancient land surfaces. Planed toplands are maintained by the cementing of sandstones through the interspersing of iron oxides, forming lateritic carapaces responsible for maintaining altitudinal variation. Due to the topographical characteristics of such habitats, the areas corresponding to the flooded area are smaller, and in area 1 represent the loss of 647 hectares. Their generalized occurrence can be seen in Map 2.

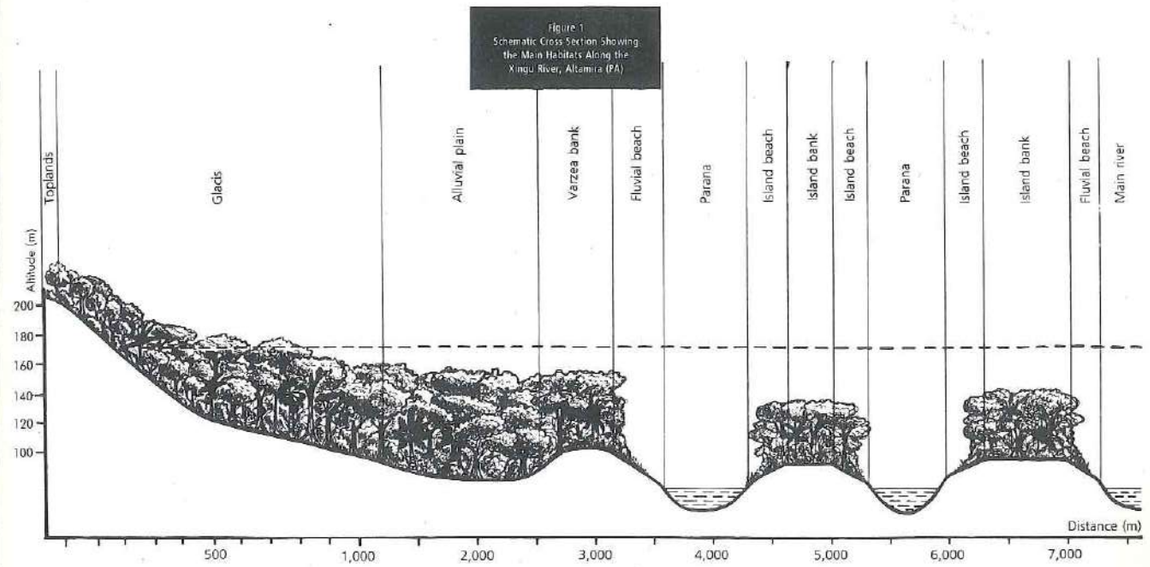
The Future Islands

These will be comprised of immersed portions that will present a morpho-genetic slope dynamic with a particular behavior. With the rise in the base level, a large part of the foothill deposits (colluvia, slopes of colluvia, talus) will disappear. The place for the deposit of the sediments removed by surface flow will be the canal itself, with the slope thus being characterized by an environment of removal and translocation of sediments. This could cause morpho-pedological alterations, given that the new dynamic of the slopes will compromise the density of horizon A, by constant removal of organic and clayey material, which could also give rise to processes of intense formation of ravines. Tables 1 and 2 demonstrate the magnitude of the portions of terra firma that will become isolated after flooding, affecting in area 1 6,175 hectares (with a perimeter of 307 km) and in area 2 4,300 hectares (with a perimeter of 197 km). The occurrence of this habitat can be verified on all maps, with an especially notable presence in Maps 2 and 3. □

Map 1
Preliminary Characterization of the Main Habitats Along the Xingu River, Altamira (PA)

Research: Evaristo Eduardo de Miranda, Jose Roberto de Miranda, and Perseu Fernando dos Santos
Art: Carlos Eduardo S. de Andrade

Figure 1
Schematic Cross Section Showing the Main Habitats Along the Xingu River, Altamira (PA)



Main river (Xingu)
Minor channels
Paranas
Igarapes
Tributaries
Rapids

Island lake
Varzea lake
Endorreico lake
Islands
Rivermouth islands
Tributary island

Island bank
Island ravine
Island beach
Fluvial beach
Varzea bank
Abrupt margin

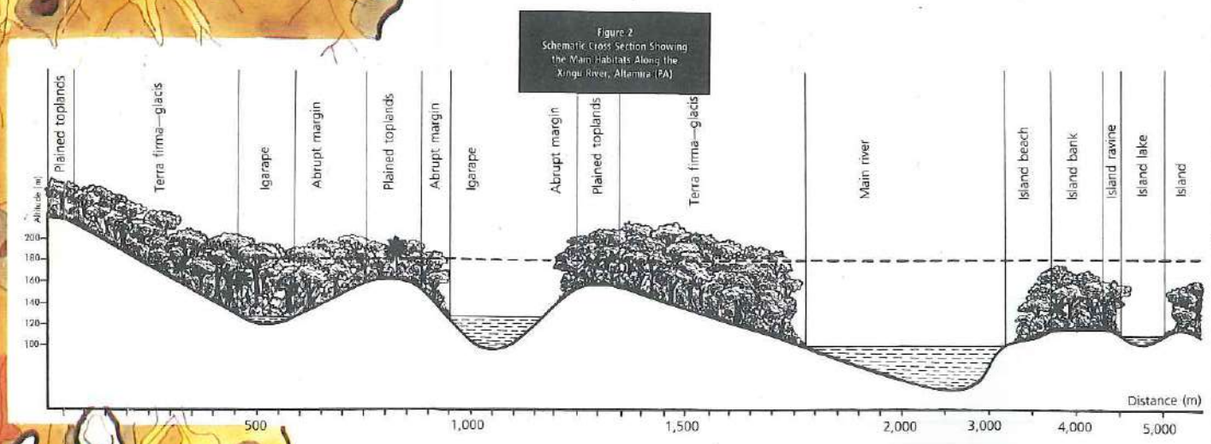
Alluvial plain
Raised shorelines
Terra firma—glacis
Terra firma—hills

Each contour line equals 10 meters
Location of cross section shown in figure

Source: Eletronorte, *Aproveitamento de Babaquara: reservatorio, area inundavel* (Brasilia, 1980).
Scale: 1:50,000. (Xingu Studies—Altamira Hydroelectric Complex, no. IHX-98V-2400)

Map 2
Preliminary Characterization of the Main Habitats Along the Xingu River, Altamira (PA)

Figure 2
Schematic Cross Section Showing the Main Habitats Along the Xingu River, Altamira (PA)



Main river (Xingu)
Minor channels
Paranas
Igarapes
Tributaries
Rapids

Island lake
Varzea lake
Endorreico lake
Islands
Rivermouth islands
Tributary island

Island bank
Island ravine
Island beach
Fluvial beach
Varzea bank
Abrupt margin

Alluvial plain
Raised shorelines
Terra firma—glacis
Terra firma—hills

Each contour line equals 10 meters

Location of cross section shown in figure

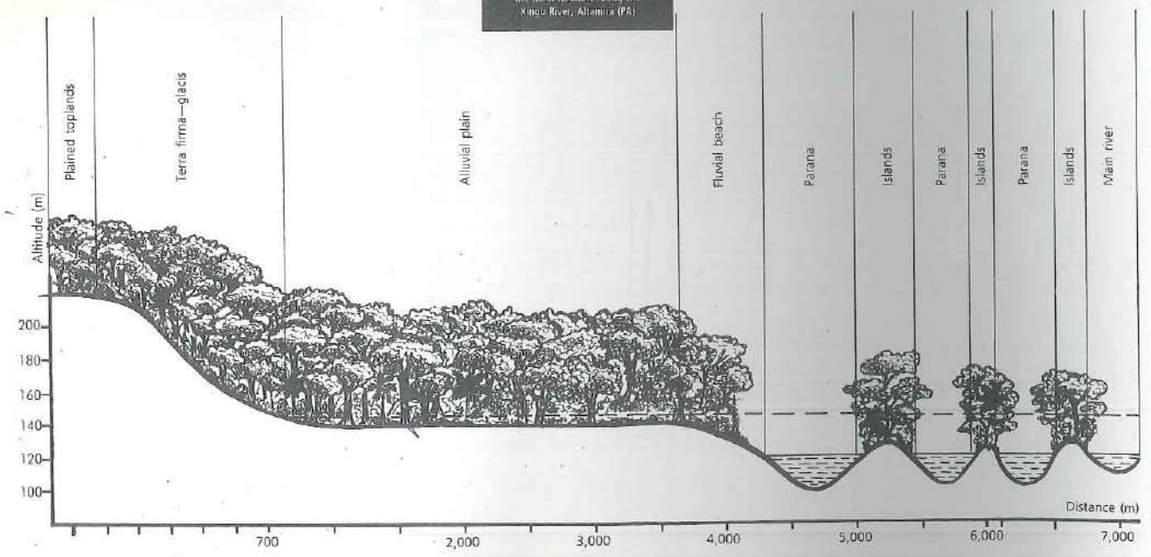
Source: Eletronorte, *Aproveitamento de Babaquara: reservatorio, area de inundacao* (Brasilia, 1980).
Scale: 1:50,000. (Xingu Studies—Altamira Hydroelectric Complex, no. IHX-98V-2402)

Research: Evanisto Eduardo de Miranda, Jose Roberto de Miranda, and Perseu Fernando dos Santos

Art: Carlos Eduardo S. de Andrade

Map 3
Preliminary Characterization of the Main Habitats Along the Xingu River, Altamira (PA)

Figure 3
Schematic Cross Section Showing the Main Habitats Along the Xingu River, Altamira (PA)



Main river (Xingu)
Minor channels
Paranas
Igarapes
Tributaries
Rapids

Island lake
Varzea lake
Endorreico lake
Islands
Rivermouth islands
Tributary island

Island bank
Island ravine
Island beach
Fluvial beach
Varzea bank
Abrupt margin

Alluvial plain
Raised shorelines
Terra firma—glacis
Terra firma—hills

Each contour line equals 10 meters
Location of cross section shown in figure

Source: Eletronorte, *Aproveitamento de Cararao: reservatorio, area inundavel* (Brasilia, n.d.).
Scale: 1:50,000. (Xingu Studies—Altamira Hydroelectric Complex, no. IHX-98V-2434)

Research: Evaristo Eduardo de Miranda, Jose Roberto de Miranda, and Perseu Fernando dos Santos
Art: Carlos Eduardo S. de Andrade

Map 4
Preliminary Characterization of the Main Habitats Along the Xingu River, Altamira (PA)

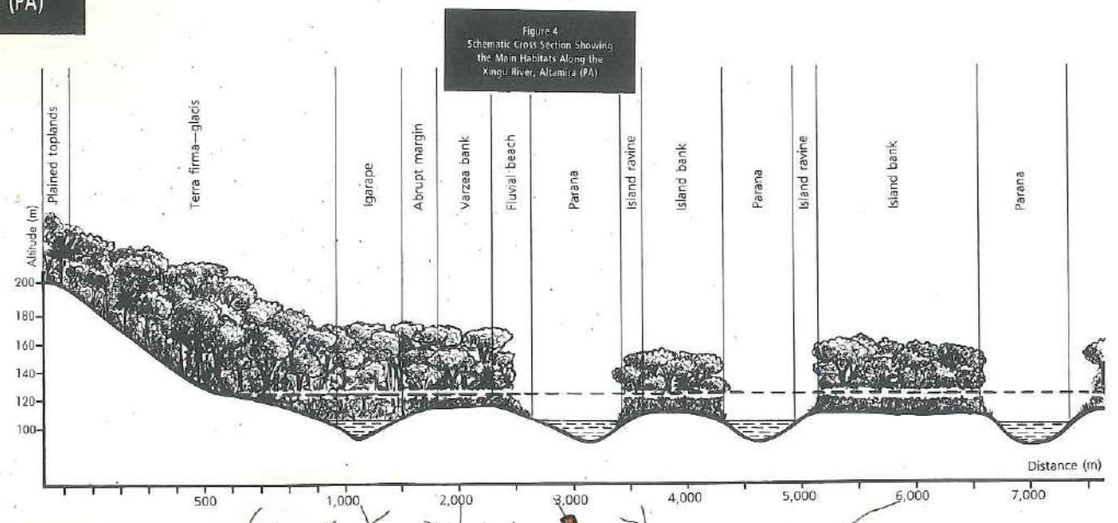


Figure 4
Schematic Cross Section Showing the Main Habitats Along the Xingu River, Altamira (PA)

Main river (Xingu)
Minor channels
Paranas
Igarapes
Tributaries
Rapids

Island lake
Varzea lake
Endorreico lake
Islands
Rivermouth islands
Tributary island

Island bank
Island ravine
Island beach
Fluvial beach
Varzea bank
Abrupt margin

Alluvial plain
Raised shorelines
Terra firma—glacis
Terra firma—hills

Each contour line equals 10 meters
Location of cross section shown in figure

Source: Eletronorte, *Aproveitamento de Cararao: reservatorio, area inundavel* (Brasilia, 1983).
Scale: 1:50,000. (Xingu Studies—Altamira Hydroelectric Complex, no. IHX-98V-2436)

Research: Evaristo Eduardo de Miranda, Jose Roberto de Miranda, and Perseu Fernando dos Santos

Art: Carlos Eduardo S. de Andrade

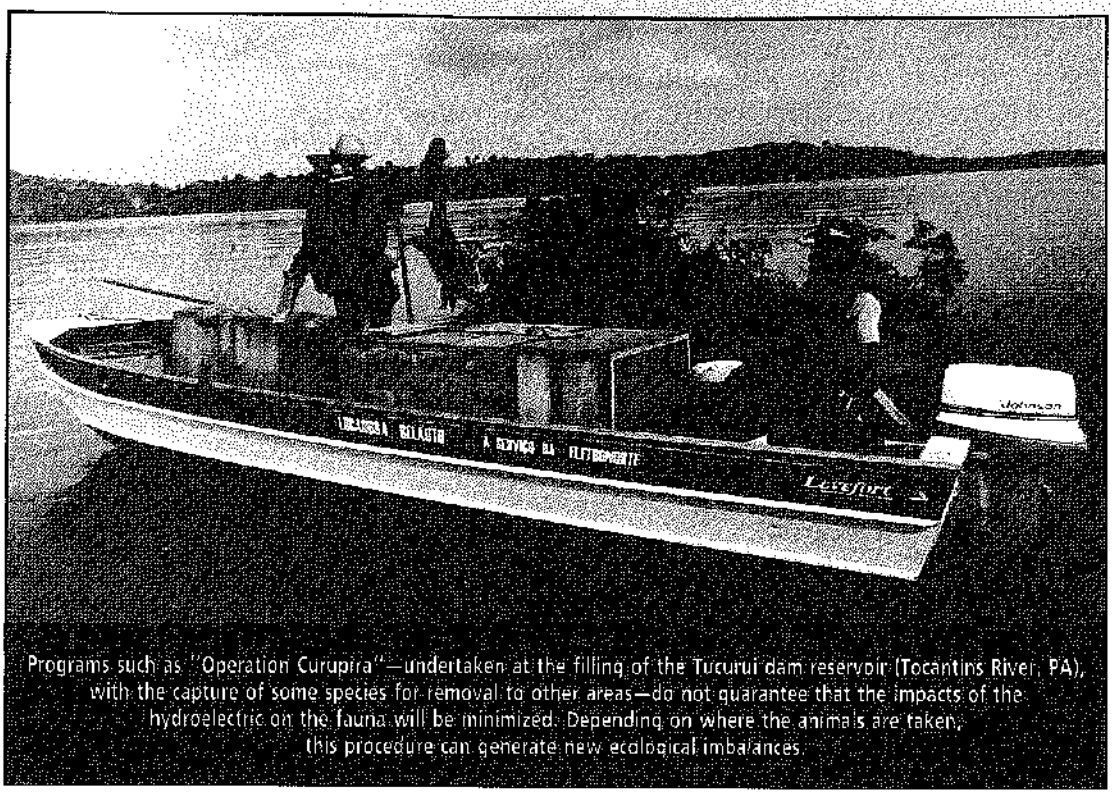


Photo: Leila Jinkings/AGIL

Programs such as "Operation Curupira"—undertaken at the filling of the Tucurui dam reservoir (Tocantins River, PA), with the capture of some species for removal to other areas—do not guarantee that the impacts of the hydroelectric on the fauna will be minimized. Depending on where the animals are taken, this procedure can generate new ecological imbalances.

At the treetop level in terra firma habitats live a large number of birds and mammals. Among these are the common sloth, the royal sloth (*Bradypodidae*), the howler monkeys, and especially the *macaco-pregoes* (*Cebidae*), with a long and prehensile tail, endemic to the Amazon.

While the artificial lakes are filled, when the dams close, the fauna will be more or less affected depending on the average depth of the lakes. In some places the filling will be slow, allowing some species to escape floods. This process necessarily brings about a greater density of faunal populations in the areas where these animals take refuge. Thus, ecological disequilibrium will occur around the reservoirs, widening the direct impact of flooding. At that time, the possibility arises of organizing rescue expeditions for species that are found marooned on treetops or in more elevated regions. The effect of this operation, significant in that it will partially assuage public opinion, will be almost nil with regard to minimizing the ecological impacts. On the contrary, depending on the destination of the animals captured, this strategy could provide a source for new disequilibrium, as in the example of "Operation Curupira."

These brief remarks regarding the areas that will be inundated do not exhaust the question of the ecological impact on the fauna. On the contrary, habitats will be eradicated not only on the level at which they will be submerged by water, but also in the loan areas, used for the construction of dams and numerous containment dikes for lakes; in the removal of wood for the various phases of construction; and in the occupation of areas by worker towns, technicians, and so on. The development of new economic activities will bring more deforestation. Illegal hunting, still limited to the areas near Altamira and along the several water courses today, will increase dramatically.

THE QUALITATIVE AND QUANTITATIVE LOSS of terrestrial habitat units on the Xingu River will be significant, and will promote profound changes in the structure of the populations and population areas. These changes must be monitored for early detection of anomalies, indication of areas to be protected, preserved, conserved, and so on (Godron 1979), in the sense of minimizing the ecological impact on the fauna.

To monitor changes in the dynamics of the faunal populations and population areas implies the definition of programs of follow-up research, with allocation of financial, logistical, and human resources to identify the new possible types of equilibria, interactive or not, that will be established among population areas, vertebrate populations, and the habitat (Barbault 1981). For example, it is necessary to detect on the banks of the future reservoirs which places could serve as new egg-laying sites for the aquatic turtle populations (*Podocnemis expansa*). It is necessary to determine the reproductive success of the turtles in these new "reproduction habitats," for they would be insignificant if there were significant predatory pressure on the eggs, the newborns, or the adults. This kind of verification can only come through follow-up studies of these processes. The understanding

achieved will provide elements for making conservationist monitoring methods adequate, which will make the maintenance of giant turtle populations viable in this system of dams.

Considerations That Should Be Presented on the Ecological Effects of the Proposed Dams

Preliminary Analysis

A preliminary analysis of the documents available on the section of the Xingu permits an initial definition of the nature of the studies necessary to evaluate and compare the ecological repercussions of the system of dams as currently proposed, within the methodological framework previously used.

The drainage area of approximately 510,000 km^2 covers a great variety of ecological situations defined at the macro-regional level by the existing north-south climatic gradient. Interacting with this larger conditioning factor is the diversity of the physical environment crossed by the Xingu, where several geological, geomorphological, lithological, and pedological structures form the locus of a extremely variable human occupation and use pattern. This diversity ranges from urban centers such as Altamira to indigenous villages. Thus, the actual structure of the flora and vegetation, the faunal populations, and the population areas should be studied at the ecological system level. The characterization of the ecological systems that will be flooded or altered by the dams should be executed in the most specific manner possible.

In this sense, the work to be done should present three levels of results:
(a) the probable effects of the dams on the principal ecosystems or habitats of the region;
(b) the probable effects of the dams on the actual floral and faunal resources of the region;
(c) a synthesis, by dam, subsystem of dams, and for the proposed system as a whole, of the probable effects of the process of implantation, installation, and management of the reservoirs.

These three complementary studies would, for example, make viable an evaluation and comparison of ecological recovery for the different alternatives for fall division, energy development, hydrological management of the dams, tracing of the transmission line, localization of the work areas, worker residential units, loan areas, and so on.

Finally, this study should also contain a chapter indicating proposals for the ecological monitoring of the area. A zoning of the Xingu Basin must be presented, indicating the areas destined for utilization, preservation, conservation, and protection for the ecological systems considered. Each one of these four concepts requires specific planning and monitoring strategies. Only with these elements will Brazilian society, with the participation of the scientific community, be able to comprehend and judge the positive and negative dimensions of this project.

The rest of this chapter will present the minimum content that can be expected of the final report with regard to:
(a) ecological systems;
(b) flora and vegetation;
(c) faunal populations and population areas;
(d) synthesis at different levels of the system of dams;
(e) action proposals for monitoring future ecological administration of the system of dams in the Xingu Basin.

The Study of the Xingu Basin's Ecological Systems

There are currently a series of internationally developed methods and techniques that permit short-term detection, identification, qualification, and quantification of the region's ecological systems. This initial inventory and evaluation should be undertaken in a semi-detailed way in the areas flooded and areas adjacent to the dams, and in an exploratory way in the area of the basin between parallels 5 and 12 as a whole. In the first level of study, the work should be executed in relatively large scales (1:50,000 to 1:100,000), and on the second level on medium scales (1:250,000 to 1:500,000).

The preliminary work done thus far shows the existence of about 40 distinct environments or habitats that will be directly altered by the construction of the dams, just in the immediate areas of the two locales studied on the Xingu and its tributaries. A hierarchized legend of these habitats and of their future ecological perspective with the construction of the dams has already been prepared and could serve as the basis for a future photo-interpretation. A preliminary cartographic outline for a later one-site field reconnaissance, which also has already been done (on the scale of 1:50,000), could be generalized with more details for the entire area by those responsible for the project.

When preparing the final report—with objective data that might permit the definition of options for those responsible in terms of the implementation of the dams—various internationally utilized ecological indices should be calculated to quantify the effects of the two levels of flooding actually proposed. The results should be represented numerically, graphically, and cartographically, distributed to multi-disciplinary teams, and made comprehensible to anyone interested in this project.

The Study of the Xingu Basin's Flora and Vegetation

In Amazonia, it has been common to present floral inventories as a basis for evaluating the ecological effects of dam construction. These studies are frequently prepared on the basis of general bibliographical compilations, and do not offer a mapped representation of their results. It is

not uncommon to see a confusion of concepts and definitions in the description of the flora and vegetation, and yet from this information an evaluation of ecological effects is expected to emerge. With the data currently available on the region, it could be affirmed, with great probability of accuracy, that there will be practically no significant alterations in the region's flora. However, the probable changes at the vegetation level will be of great magnitude. Thus, it is sufficient to point out that, even running the risk of a tautology, the flora represent the list of plants that grow in a given place. All those of the same species are designated by the same specific name, and all species are treated on the same plane (the common and the rare, the small and the large). The flora result from ancient actions and translate a whole botanical history. This is particularly important in regions such as the Xingu Basin—above all in its southern part—given the climatic fluctuations that occurred during the Quaternary era.

Vegetation, on the other hand, is the organized spatial emergence of the flora in interaction with a region's physical conditions. In this sense, the vegetation is comprised of the complex set of plants (frequently considered vasculars) that grow in a given place. The vegetation always represents a current datum, sensitive to variations as a function of the human presence in the area and of other factors. When compared with the flora, it is a very dynamic dimension. The different floral species fill diverse roles depending on their importance in terms of effective size and functions. The preliminary study of the vegetation of the Xingu River Basin, and principally of the areas that will be flooded, shows that this is comprised of complex wholes or very variable, and varied, vegetal communities from one place to another. These communities represent diversified uses for the fauna and for humans, above all the indigenous populations.

To evaluate the ecological effect of the dams on the flora and vegetation, it seems pertinent, at the level of inventory, to consider vegetal formations, forms of vegetation, the dominant species and their diverse functions (production, protection of soils, hunting, etc.). This study implies a more detailed preliminary cartographic analysis (1:100,000), based on aerial photography (1:40,000) and field surveys. The maps should simultaneously contain the habitat and vegetation units on the scale of 1:100,000, as well as their respective planimetry.

The actual use of lands should be mapped and translated into indices and rates of occupation; the degree of artificialization, measured by the greater or lesser influence of humans on the vegetation and physical surroundings, analyzed for the whole of the basin; the variables which interfere in the actual phytodynamics identified and described in a succinct manner. Indications on unconsidered aspects in terms of phytodynamics, which will occur between the upstream and downstream areas of determined dams in the proposed system, should be presented. The first study already provides good indications for critical areas in terms of utilization and preservation. This complementary study of the area's vegetation will provide specific indications as to the portions of territory that should be protected and conserved. The nature of these actions and the strategy adequate for their planning, implantation, and future monitoring should also be indicated in their main lines in the report, as a basis for future decision and a guarantee of their clarity for the public and national and international scientific community.

The Study of the Xingu Basin's Faunal Populations and Population Areas

Frequently, considerations of the ecological effects that dams have on animal communities aim to give a repertoire of the principal species present. This being the case, they undertake a faunal inventory of the principal populations found in a given area. This kind of purely qualitative survey does not take into account the principal relations existing between the faunal populations and different ecological situations. Since the structure of the habitat and food resources available in each type of "surrounding" conditions the presence of distinct faunal populations, it is fundamental to give an ecological direction to the analysis of fauna, as much in terms of populations as population areas.

The faunal population areas can be considered as an assemblage of species sensitive to the same biotic and abiotic factors of the physical surrounding. It is these factors that impose a distinctive character on each one of the population areas of a biocenosis. Ecologists today utilize statistical-mathematical methods for detecting, qualifying, and hierarchizing these ecological factors. Faunal population areas correspond to the level of perception of the biotopes. They present a greater or lesser number of species (specific richness), depending on the natural resources offered by the biotopes and on the level of specialization of the species that comprise them. In this sense, they should be considered as a point of departure in the evaluation of the ecological effects of the dams, above all in the case in question. In fact, the Xingu Basin corresponds to an important area of transition between the very distinct faunal and ecological domains of central Brazil and Amazonia.

Not all species perform equal roles at the level of faunal population areas. Some areas have species of ubiquitous tendency, very frequent and of great ecological tolerance, for they are present in almost all types of "surroundings." Other faunal population areas are comprised of specialized species, characteristic of determined "surroundings" where certain ecological conditions hold. These interactions among the principal kinds of "surroundings" and the large faunal population areas must be considered, even if in a preliminary way, in the eco-

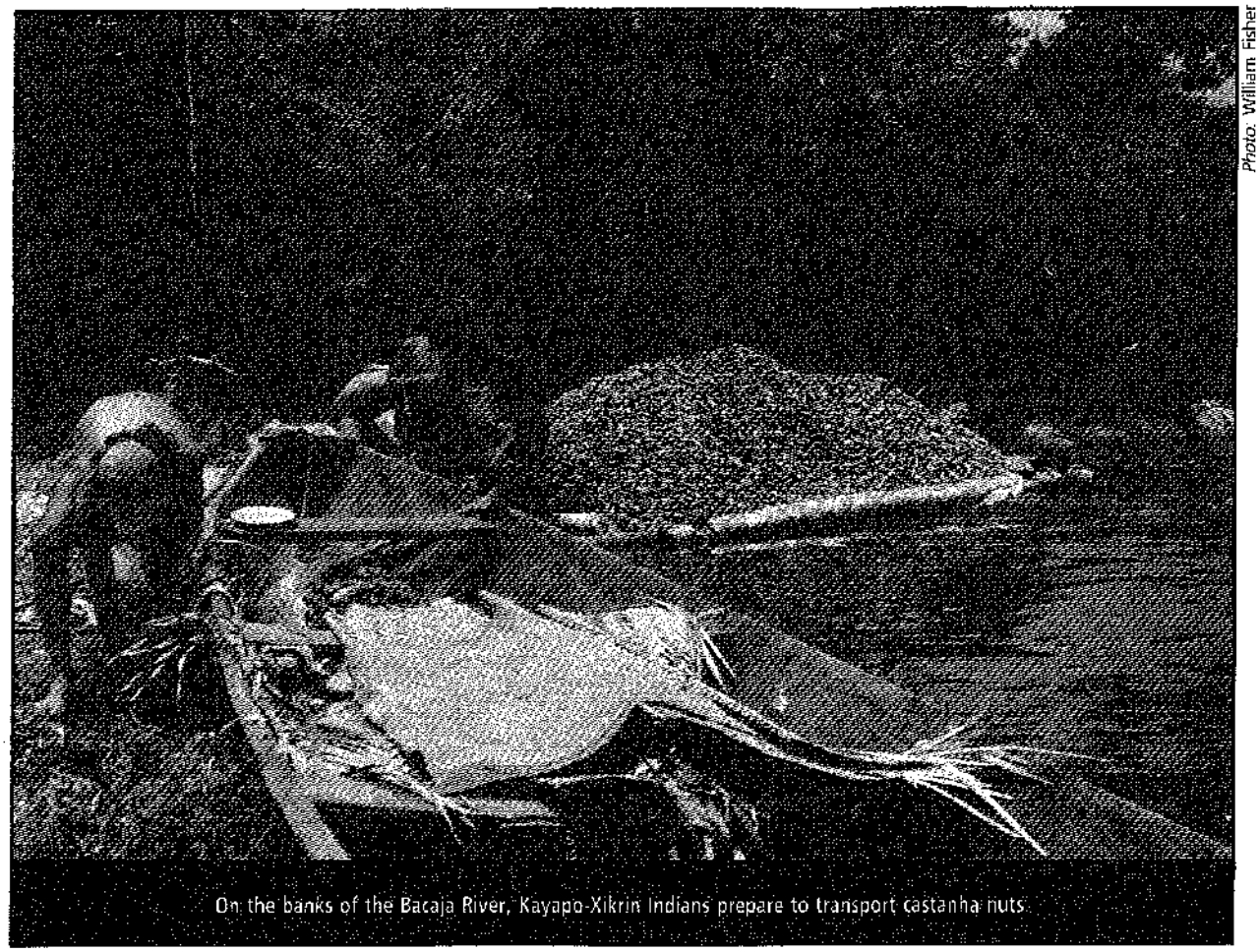


Photo: William Fisher

On the banks of the Bacaja River, Kayapo-Xikrin Indians prepare to transport castanha nuts

logical inventory of the Xingu Basin fauna. Several rigorous scientific methods permit an initial evaluation of this dimension, providing elements to evaluate the probable ecological effects of the system of proposed dams on the region's fauna.

The ecological effects on the faunal population areas of the project in question have to be evaluated in the complex whole of the Xingu sub-basins. It is important to determine the ecological microfactors that condition the spatial distribution of the main population areas and faunal biotopes. Field work should offer a more precise characterization of these biotopes. It is important to present a list of the populations existing in the area, with a succinct commentary on the ecology of the principal species and their future evolutionary tendency following the implementation of the program of dams on the middle Xingu. In a complementary fashion, a preliminary evaluation of the most characteristic faunal population areas for the main biotopes and the functional nature of their relations (locations of reproduction, food, ecotopes that perform a role as refuge areas for particular population areas, etc.) should be offered.

In an initial analysis of these major types of biotopes and population areas, it is sufficient to quantify them as to their specific richness (total and average) and their respective ecological complexities. These can be measured through the different internationally utilized indices of diversity (H'alfa = intra-biotope diversity; H'gamma = diversity of the number of ecological niches realized; H'beta = index of inter-biotope similarity). These algorithms are practical and objective instruments for characterizing and evaluating the ecological complexity of different types of biotopes and faunal population areas. Thus, for certain rare biotopes with complex faunal population areas that will be reduced by dam construction, these indices of diversity can provide indications and precise directions on places that should be protected and conserved. In an analogous way, various biotopes should increase significantly with the construction of the dams, and these consequences need to be measured.

Finally, it is necessary to indicate the indices of ecological diversity that should be utilized in monitoring the populations, the faunal population areas, and their respective biotopes with the aim to protect, preserve, and conserve them in the future.

Preliminary Synthesis of the Proposed Ecological Effects by Dam, Dam Subsystem, and Total System in the Xingu Basin

Despite the scenarios that exist for implanting

the system of dams, it is important to present a synthesis according to the most probable main alternative. Thus, the synthesis should consider each dam. For each case, a synthetic dossier must summarize the essential aspects of the ecological, floral-vegetational, and zooecological studies, presenting in the form of tables the essential numerical and cartographic information obtained in the afferent studies. The synthesis by dam subsystems should be organized according to the ecological significance of the data obtained in the preceding stages. It is not possible to define a pirori what these subsystems would be, but they will represent homogeneous wholes in terms of problems of ecological effects and planning strategy. At the level of the system to be implanted as a whole, it is important to consolidate the preceding stages; this will permit a global vision of the problems related to the process of implantation of the reservoirs and their probable effects on the environment and the anticipated projects.

It should be taken into consideration that the projects for construction of hydroelectrics, through the formation of reservoirs, generally result in new access routes to the areas upriver in the hydrographic basin; this also has impacts on the forest, wildlife, exploitation of mineral deposits, and agricultural practices in this same basin.

Proposals for Planning the Monitoring and Future Ecological Administration of the Xingu Basin

Given the developmentalist character of the Xingu dams, principally benefiting mining projects in their immediate surroundings, the assessment of the ecological impacts of this undertaking should present a balance between the quantity of units of value for habitats lost and gained, as much with the area flooded as with the drastic changes that may occur in the pattern of flow and quality of water, in the reservoir area and in the river system downriver. It should also present a detailed mapping of the units that will have to be monitored and improved with the new situation following the implantation of the project.

It is urgent that elements be proposed for a future monitoring and a possible global evaluation of the impacts of the Xingu dams on the ecological resources. An indication of the possible topics to be considered is provided here, considering the ecological effects of the dams in preliminary terms.

Fisheries Productivity

1. Loss of production should be evaluated, before the project is begun, on the fish existing in the riverine system. These losses can be caused by the reduction of areas flooded downstream, by the decrease in the production of fish in the zone of the rivers below the dam where the change in hydrology will be greater. Also, the reduction of nutrients downriver result when the dam interferes with fishing activity, as well as with migratory species.

2. The new situation of fishing in the reservoir should be outlined, including plans for managing the fish populations and also the expected effects on the fishing situation of the rivers that will be altered, especially in the lacunary zones downriver. The evolution of the submerged vegetal mass and its ecological consequences also must be considered and evaluated.

3. A comparison of the new situation to the old and a description of the plans for managing the replacement of lost fishery biomass is a minimum requirement on this topic.

Aquatic Ecosystems

1. First, the expected situation in the reservoir should be described, anticipating changes in the physical, chemical, and biological properties, including the water column and bentonic region.

2. The effects on the affected lacunary and waterlogged zones must be evaluated, including changes in salinity, probable effects of primary productivity of the food chains, considering as much the biological life of the water column and the bentonic region. Monitoring programs to evaluate conditions must be outlined before and after the dams in order to establish basic data. These will be utilized, if necessary, in planning corrective measures, including sampling details, and physical, chemical, and biological analyses of the aquatic zones affected; the frequency of sampling needed to give statistically valid information for all seasons of the year; as well as describing a priori the analytical methods for interpreting the significance of the data and the access that civil society will have to these works and results.

3. The monitoring of the management program for aquatic ecosystems should be part of the project's operationalization. It must be delineated for a continuous evaluation that can be done over the years, measuring the effect of the project on the modification of aquatic ecosystems. To describe viable corrective measures when required is also an important component (fish runs, artificial beaches for reptilian egg-laying, etc.)

Terrestrial Fauna

1. The impact of the project on the wildlife in the hydrographic basin above the reservoir and also in the downriver zones affected by the change in the hydrological regimes, and by changes in the access routes to the basin, must be described, including as much the region of the reservoir as the roads and infrastructures that will be constructed.

2. The impact on the fauna that will be inundated and plans for the rehabilitation and rescue of the same should be presented with indication of who will execute them and how they will be executed.

3. The new natural resource (wildlife) that will be formed by the reservoir and plans for its manage-

ment should be detailed. Specifically, for some regions, schemes should be presented to guarantee the conservation and protection of the population and population areas most affected.

4. The plan and resources necessary for the establishment of wildlife reserves in the hydrographic basin must be presented in detail as an integral part of the planning of the project (as a way of compensating for the losses of wildlife created by the same) and details should be supplied on how resources will be allocated and administered (Godron 1979).

Terrestrial Ecosystems

The impact of the projects on the flooded ecosystems should be foreseen, including:

1. the estimated loss of primary productivity of the forests and other terrestrial ecosystems;
2. the accelerated depreciation of these ecosystems increased by the new access routes as much by the new lake so created as by the new roads and infrastructures that will be built;
3. the present and future status of the forests in the hydrographic basin and their role in the conservation of water and of the soil; and
4. the measures proposed for preserving the role of these ecosystems in the hydrographic basin and the future rehabilitation of the loan areas, work areas, and so on.

Formation of the Reservoir

The environment of the new reservoir should be described ahead of time, including:

1. the new potential for fishing to be created and the plans for its administration, including the management of fish communities and regulations for the exploitation, commercialization, and storage of fish and fish products;
2. the use of the reservoir for the propagation of wildlife and for scientific research;
3. the physical, chemical, and biological properties of the new body of water, including the column of water and the bentonic region—for example, phenomena of thermic stratification and others that could occur;
4. the problem of stability of embankments and dikes, including protection against erosion created by wave action and preventive measures against possible breaks (above all in the numerous containment dikes found in the project);
5. sanitary control on the periphery of the new reservoir;
6. the systematic, systemic, and effective regulation of the use of upstream and downstream areas for agriculture and other purposes (Spedding 1979);
7. the ecological problems created by fluctuating levels of surface waters should be researched;
8. whether the trees that will be flooded will be removed or maintained and how their genetic preservation will be accomplished;
9. the problems for monitoring and controlling the growth of aquatic plants in the reservoirs; and
10. other problems related to the reservoir and that are not normally discussed in the Environmental Impact Report.

Conclusions

The relations between ecology and development are tragically difficult in Brazil. Economic and social imperatives have led those responsible to see in ecologists perennial censors of their actions. Ecologists in turn look on development projects with extreme distrust, for, in these cases, there exists a tradition of crimes against the environment, reinforced by impunity. It is urgent that a dialogue of trust be reestablished; this does not mean agreement between ecology and development at the level of the projects, above all when they reach the magnitude of the system of dams proposed for the Xingu.

The direct ecological impact of the proposed system of dams will be enormous, certainly the largest that the country has known. It is not limited to the artificial lake that will be created, the consequences of which in terms of the disappearing habitats have been preliminarily considered here. Despite its limited character, this small study of habitats in this chapter illustrates the diversity of ecological situations and the need for an assessment of the dams' impacts within internationally recognized, qualitative, numerical, and cartographic parameters. The considerable number of containment dikes, the dams themselves, the areas that supply earth and material for construction, the roads, the installation of work areas, residential units for technicians and workers, the building of transmission lines—all are among the main direct ecological impacts of this undertaking. In this sense, this ecological impact analysis is but a pale reflection of what the direct alterations promoted by the project are, should it come to be realized. These losses in natural resources are losses not only for the present but also for the future; it is an irremediably lost potential with no future perspective. But there also exist indirect and differentiated ecological impacts in time. These will be more serious. They are connected to the predatory and speculative economic development familiar to the region of legal Amazonia: extension of nonproductive pastures; indiscriminate deforestation; opening of roads, mines, and mining areas; disorderly growth of cities and towns; increases in illegal hunting and illegal exploitation of lumber and forest species; invasion of forest reserves and indigenous territories, and so on.

THE COUNTRY NO LONGER ACCEPTS development at any price; it wants to know what impacts the project will have, who its beneficiaries will be, who it will hurt, and who it is paying. Moreover, the coun-

try wants to decide and to be heard. In the case of hydroelectrics, this question has demanded an increasing effort on the part of companies that generate and distribute energy to "manage the interferences connected to the environment." The case of the Xingu River will perhaps represent the occasion for overcoming determined conflicts and historic distrust, to the extent that these questions are duly considered. There are excellent examples, at the international level, even in underdeveloped countries, for Brazil to consider. In this sense, it is not enough to comply with the law. It is not enough to present the RIMA. The dimension of the work, the ecological characteristics of the region, and the direct and indirect impacts of the proposed project demand a wider evaluation on the part of the government and proponent agencies. In the framework of current legislation, the RIMA, even if it is prepared, would be insufficient to deal satisfactorily with all the factors involved in this question. It is up to the public authorities and to the proponents to take the initiative to overcome the narrowness of current legislation and the studies presented up until now. It is not by hiring some consultants, however competent they may be, that all ecological questions inherent to the dams and reservoirs to be created on the Xingu will be answered.

The new Constitution will create pertinent mechanisms to assess and decide on the need for this and other large works. If confirmed, the measures necessary to evaluate their ecological impacts will have to consider the reflections of the scientific community and those portions of society concerned with preserving nature. These sectors are mobilized and vigilant. Certainly they will intervene in an unprecedented way in this case. Several elements about the report that should be presented, dealing with the direct and indirect ecological effects of the Xingu dams, were considered in this chapter by way of collaboration. In its present form, a simple RIMA is not enough.

The problem of the Xingu dams will surpass the ecological question, creating a crisis of much more serious dimensions. In the face of the current legislation, whoever wants to defend the legitimacy of such an undertaking will have to opt for the way of illegality.

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Social Implications of the Electric Sector Policy

Lygia Sigaud

Introduction

THE PROJECT FOR UTILIZATION of the hydroelectric potential of the Xingu River Basin, through the construction of the Cararaô and Babaquara dams, is still in the phase of "viability" studies—its realization depending certainly on a political decision. Everything leads us to believe, however, that the government is inclined to go through with it; despite its projected cost of $10.6 billion, its postponement in light of recent cuts in public investments has not even been contemplated, and the beginning of construction of Cararaô is projected for 1992 (Eletrobrás 1987).

Except for several indigenous nations about whom studies have been done, little is known with regard to the social life in that region of the Xingu, situated to the south of Altamira; not even census data are reliable.

Consequently, only through a massive investment in research would it be possible to produce more substantive statements on the possible effects of the construction of this project. For the time being, we can only say that, if completed, the Xingu project will inevitably flood thousands of square kilometers of Amazonian forests and destroy the way of life of Brazilian citizens living in the area, as well as seven indigenous tribes.

The lack of knowledge specifically with regard to the region where the Altamira Complex (the official term for the dams of the Xingu) will be installed does not, however, prevent a debate over the social implications of such projects, which are part of the picture of a national policy for hydroelectric energy generation that was launched in the 1960s and consolidated in the 1970s. Nurtured throughout this period in the Ministry of Mines and Energy by Eletrobrás, whose concessionary firm, Eletronorte, is responsible for the utilization of the Xingu, this policy has the curious feature of generating not only hydroelectricity, but also perverse social effects that seem to reflect *principles* and *procedures* common to all state companies of the electric sector which, if spelled out, will certainly contribute to illuminating the Xingu case.

The text that follows was prepared with this perspective in mind, and consists of an attempt to analyze some of the more recurrent dimensions of energy generating policy, specifically as it refers to social implications.[1] The special case of Tucuruí, the first large work completed by Eletronorte, is analyzed in the chapter "Tucuruí: A Relocation Policy in Context" (see p. 105), providing additional data for the identification of effective continuities in the policy espoused by different state companies of the electric sector.

The "Social" in the Decisions of the Electric Sector

The decisions with regard to energy generation through hydroelectricity, which normally implies the flooding of thousands of square kilometers and the dislocation of thousands of people, seem to always have been made on the basis of estimates of demand, which in turn have been calculated through not very transparent criteria.

If such strictly technical criteria and the possibilities of resources have been key elements in the decision to go ahead with hydroelectric projects, one must not underestimate the role of business groups: they exert strong pressure on the government to undertake projects. This lobby consists of consulting firms in charge of sector planning, several of the country's largest civil construction firms, companies that produce electrical equipment, and companies that need a great deal of energy to set up—as is the case, for example, with the aluminum industry of the north. It is worth recalling that each hydroelectric dam costs billions of dollars and, in addition, represents fabulous contracts that guarantee relative financial security to these companies, particularly the civil construction companies, for a good period of time. Thus, in contrast to what might be thought, the high national interests of energy production for development are not the only factor at play in the construction of a hydroelectric, but also the particular interests of groups of firms that would benefit enormously from investments in the electric sector,[2] as well as the interests of international financial capital, which supplies an important part of the resources.

In electric sector planning and in decision making on the building of hydroelectrics, we can see

[1] These reflections are the product of a research effort that I have been developing in the National Museum, in the context of the graduate program in social anthropology, on the "Social Effects of Large Hydroelectric Projects." This research includes case studies of the Sobradinho (São Francisco River), Itá, and Machadinho (Uruguai River Basin) dams.

[2] The data presented by Klein (1987) on the relation between business groups connected to the production of electrical equipment and government agencies are revealing in terms of the interests and pressures exercised by these groups. Similar indications are contained in the work of Diniz and Lima Júnior (1986), particularly on pages 69–70.

the lack of consideration for the social implications of the flooding of thousands of square kilometers and of the numerous infrastructural projects that run parallel to this type of investment. We can even state that the tradition of Eletrobrás and its concessionaries is to ignore the social implications of their initiatives at the time of decision making. Once it has been defined that this basin or that river will be utilized, and once the million-dollar contracts have been signed and the heavy and expensive equipment bought,[3] only then are the so-called "social impact assessment" studies performed. Thus, one is dealing with evaluations to "minimize," to "mitigate" or "neutralize" "impacts" for a decision that has already been made and is in progress, and never an evaluation of "impacts" to be taken into account in the decision to build a hydroelectric.

This was, for example, what happened with the Sobradinho dam (1,050 mW), located on the lower middle São Francisco, about 50 km from the city of Juazeiro, in the state of Bahia. In order to make this dam—which cost $2 billion (Banco Mundial 1984)—viable, the Hydroelectric Company of the São Francisco (CHESF) flooded four municipal centers and dozens of towns, relocated 70,000 people, and created profound alterations in the living conditions of the populations living downstream from the dam and upstream from the lake of 4,214 km².[4]

The decision to build Sobradinho was made in 1972, in the government of General Garrastazu Médici, one of the most authoritarian rulers Brazil has ever known. The civil works were initiated in 1973, but only in March 1975 did CHESF conclude a plan containing indications on what to do with the population; this plan projected the resettlement of nearly 4,000 families in a colonization project 700 km away from the region. This plan went directly against the express wishes of the population—they wanted to stay in the area—which was one of the principal reasons for its failures. Because the people refused to be removed, CHESF had to improvise a solution at the last minute on the edge of the lake and promote the resettlement almost simultaneously with the rising of the waters.[5]

Still in CHESF's concession area, the Itaparica dam (2,500 mW), which is being built on the São Francisco River, on the divide between the states of Bahia and Pernambuco, is another good example of how the "social" is an absolutely secondary question in energy planning. Construction was initiated in the 1970s, but only in December 1986 did CHESF define what to do with the population through the signing of an agreement (see CHESF/Sindicatos 1986)—and then only in response to the strong pressure exerted by peasants through their syndicates (Pandolfi 1986). Consequently, the building of homes and irrigation canals, indispensable for the resumption of productive activities after the change, is being done simultaneously with the damming of the lake and the transference of 26,610 rural inhabitants.

One could also cite the case of the Itá dam (1,620 mW), the construction of which should already have been initiated in 1987—according to the projection of Eletrobras' Plan 2010—on the Uva River in the Uruguai River Basin, on the divide between Rio Grande do Sul and Santa Catarina. The new city of Itá is practically ready, the work area has already been expropriated, and, until now, Eletrosul does not have a plan for resettling the 5,700 peasants who will have to leave their lands. Only in 1987 did Eletrosul recognize the peasant representation, the Regional Commission of Persons Affected by Dams (CRAB) (Sigaud 1986; Grzybowski 1986), as a legitimate interlocutor. Eletrosul signed an agreement with them in which it was obligated not to initiate the works before the relocation of those "affected."[6]

These examples, and the case of the Tucuruí dam, to be discussed in greater detail below, illustrate the manner of establishing priorities for energy in the decision-making process and the contempt for social implications exhibited in this kind of investment. The delay in defining the fate of the population to be removed, which should be the state's priority, reveals on the one hand the lack of foresight of companies in the electric sector, and on the other hand constitutes evidence that the "social," embodied in the populations affected, remains extraneous to priorities made when it was decided to build the dams, when contracts were signed, and when the works were begun.

As long as the "social" does not play a significant role in decision making, it comes to be considered a "problem" for which any solution must be sought and at any price, within the tight timetable of the civil works. And it is exactly because the "social"

[3]The already classic example of this haste by the electric sector is the case of Xingó (São Francisco River). Years before beginning the work, the turbines had already been acquired.

[4]For an analysis of the process of intervention of the state in the area of the Sobradinho dam, see Sigaud 1986. For a description of the living conditions of the population before the construction of Sobradinho, see the classic work by Pierson (1972) on the São Francisco valley, and more recently the works by Duqué (1980) and Barros (1984).

[5]The "lack of foresight" by CHESF is analyzed in the work referred to above (Sigaud 1986). Other indications are found in Duqué (1980), in the testimony included in the Annals of the Parliamentary Investigatory Commission on the São Francisco floods (Congresso Nacional 1982), and even in the World Bank Report on Sobradinho (Banco Mundial 1984).

[6]Signed on 29 October 1987 by representatives from CRAB and Eletrosul, the agreement offers alternatives for those affected, in terms of manners of indemnification, and establishes a timetable to be followed for the Itá and Machadinho (also on the upper Uruguai) hydroelectrics. From the political point of view, the agreement represents a victory for those "affected" and for CRAB, and reveals a greater flexibility of Eletrosul, which in turn could be interpreted as a product as much of the pressure of the movement, as the pressure of the World Bank which has conditioned the concession of resources on the elaboration of a plan for relocation, and even the interests of the company to project itself in the competitive field of the concessionaries of Eletrobrás through its "social side."



Photo: Lygia Sigaud

Demonstration protests the building of the Ita and Machadinho dams, organized by the Comissao Regional de Atingidos por Barragens in July 1987, in Erexim (RS).

occupies this subordinate position that the solutions found are always unfavorable to the population. For this reason, the companies in the electric sector have been responsible for the compulsory and disorderly dislocation of thousands of Brazilian citizens—for their Diaspora, their impoverishment, and the profound disorganization in their living conditions.

In the absence of a real evaluation of the social implications of these large works, not only are the populations severely affected, but other irreversible effects are produced that engender significant damages to the country. Thus, for example, the debatable decision to flood thousands of hectares of the most fertile lands of the northeast, a potential granary in the middle of a *caatinga*, was built into the decision to construct Sobradinho. Thus, for example, when it is thought that the problem of Itá will be "solved" by stimulating the purchase of lands in Rio Grande do Sul and at the same time putting several thousand cruzados in the hands of the peasants (Eletrosul 1986:6–7), one inevitably will be producing an incredible disorganization in the Rio Grande do Sul land market, inflating the price of rural property and creating favorable conditions for exacerbating land conflicts in that state, where the number of landless peasants increases daily.

If the electric sector planners had taken the "social" seriously, they would have been able to foresee, even in the case of Sobradinho, that the lands of the region would be overvalued by the investments made, and that people would tend to concentrate their land holdings. It is not fitting here to raise hypotheses on what happened in that region of Bahia, but only to indicate that, as INCRA and IBGE data clearly demonstrate, exactly in the period when CHESF intervened in the region an enormous amount of land was held in the hands of a very few, through pure and simple land-grabbing. In the municipality of Sento Sé (right bank) alone, the area of properties between 500 and 1,000 hectares increased 800 percent compared to 1972 (a year before the construction began). In this same municipality, where in 1972 there were only 98 "estate owners by exploitation," according to INCRA classification, in 1984 there were 985 (Sigaud, Martins Costa, and Daou 1987).

The cases presented here are the result of the policy that is being implemented by Eletrobrás and its concessionaries and unilaterally imposed on the nation. Neither the dislocated population, nor the populations in the area covered by the reservoir, nor Brazilian society through its representative branches of government, were consulted on any of these decisions. And yet, such decisions not only have

serious social implications, they also have a significant bearing on investments that constitute an important part of the country's foreign debt, the onus of which falls on the Brazilian people as fiscal burdens grow and social programs are reduced.

It could be countered-argued that, in the last analysis, energy generation is a basic infrastructure for economic development, and even that this is a "noble" alternative to nuclear energy, since it does not involve risks and it generates employment. However, this is not the issue, for no one in principle opposes hydroelectricity. The issue, rather, is this: for a society that intends to be governed by democratic principles, it becomes imperative that decisions of this type—which require massive amounts of capital and which create serious social problems—consider the interests of the thousands of Brazilian citizens affected by these works and the Brazilian nation itself to be variables just as important as energy demands, cheap energy, and million-dollar commissions. What is unacceptable is that, under the pretext of producing "clean" energy, an authoritarian and socially and economically irresponsible policy continues.

The Current Impasses

The democratic opening and the advent of the New Republic, insofar as they represented a broadening of democratic freedom, created favorable conditions for the populations affected by large projects to protest the excesses of the electric sector. In this context, one can understand the relative success of the Movement of Those Dispossessed by the Tucuruí Dam in obtaining a reversal of a settlement plan by creating an Interministerial Commission; the relative success of the Syndicates of Rural Laborers from the Area of the Itaparica Dam in getting a resettlement agreement; and even the success of the Regional Dams Commission of the Upper Uruguai in forcing Eletrosul to review its procedures and accept the commission as interlocutor.

This change in the picture, however much it favors civilian society, leading the state to open up some breaks, does not imply a real change in the decision-making process. The formal substitution of military power with civilian power has not been sufficient to change priorities, nor even to rescue the "social" in large engineering works.

As a result of political changes in Brazil, the country today has a new legal framework that in some ways considers the "social" aspects of large works. We refer to the laws for protection of the environment (Law No. 6938/81 and Decree No. 8835/83) which, in the New Republic, have led to the creation of the National Environmental Council (Conama), under the Ministry of Urban Development and the Environment, whose responsibility has been to establish directives regulating those works that could pollute the environment (Conama 1986).

Although the importance of protective legislation—and above all the transference of the power to license works from within the Ministry of Mines and Energy to environmental protection agencies—is undeniable, such changes will only contribute with difficulty to solving the real problems.

A close examination of the two decrees and the resolution itself verifies that, although Conama establishes parameters for the licensing of works (Article 6 of Res. 001/86, Conama), the prime material about which the licensing agencies should make pronouncements—the Environmental Impact Statement (RIMA)—will be prepared with the seal of approval of those supporting the projects. Now, even if the research teams are independent from the project proponents (cf. Article 7 of Res. 001/86, Conama), the very fact that these teams will be financed by the project proponents themselves (cf. ¶2 of Article 18 of Decree No. 8835/83) negates the very conditions of autonomy. Only with difficulty will a large consulting firm produce a RIMA suggesting that a project not be undertaken (as stipulated in item I of Article 5 of the resolution). An opinion of this type would spell suicide for a firm because it would make other RIMAs commissioned by the electric sector suspect. The risk of being excluded from the million-dollar consulting market (the transactions generally involve millions of dollars) is a risk that individuals could occasionally assume, but never companies, especially those which, in addition to their interests in the consulting market, are intimately connected to companies interested in large engineering works. Such would be the case with large consulting firms such as the National Consortium of Engineering Consultants (CNEC), responsible for the Xingu viability study. CNEC is the consulting branch of a large civil construction firm, Camargo Correa, which, it is worth recalling, is one of the beneficiaries of the subsidized energy generated by Tucuruí that feeds the aluminum industries of the Alumar group.[7]

EVEN IF THIS KIND OF CONSTRAINT did not exist, it would be hard to believe that the official environmental agencies would actually turn down licensing for the large hydroelectric projects. The law only requires a RIMA, and the understanding of the electric sector (DNAE/DCAE no. 342/86) is that the RIMA should be submitted to the licensing agencies after the viability studies in order to obtain an installation license. The viability studies constitute a third stage of a sequence that begins

[7]On the interrelations between consulting firms and civil construction firms, see Pinguelli and Mielnik 1987. As for Camargo Correa's interests in aluminum production, see information provided by the Secretary General of the Ministry of Mines and Energy in an interview with the *Correio Brasiliense* on 1/4/87. On the interests of the same group, see information in the magazine *Veja* 9/30/87.



Photo: Nataniel Guedes/Agencia JB

In February 1988, before the Itaparica dam lake was formed, CHESF organized the compulsory removal of families and the demolition of houses in various cities, even before the affected population had been resettled.

with the estimate of hydroelectric potential, a "first evaluation (made in the office) of the potential, the number of places where dams could be built, the cost of utilization of this potential, definition of priorities, time periods, and costs" (Manual of Environmental Effects of Electric Systems—Eletrobrás/Eletronorte 1986: 3). These are followed by inventories to "determine the energy potential of the basin, establishing the best fall divide and cost estimate for each utilization" (idem: 3). In these first two stages, the hydrographic basin is analyzed as a whole, based fundamentally on available data; field data are dispensed with, although the existence of cumulated knowledge is presupposed—something that is debatable insofar as it applies to social and economic aspects. Only in the final phases of the inventory studies, according to the Eletrobrás manual, are field studies mentioned. In this stage, however, one is evaluating the effects of the different possible uses for a basin in order to establish a hierarchy (one then sees that the *choice* of an alternative is at play, and not the *possibility* of doing it: clearly, the tendency of someone looking for an alternative is to minimize the impacts). What follows is the technical-political option for a form of utilization, excluding other possible forms; then, it goes on to the viability phase. At this point, one is defining the "global conception of a given utilization." Then, the studies have to be detailed and completed; among their objectives is the "proposal of measures designed to neutralize or attenuate negative impacts" (idem: 24) through a plan for environmental control. Only then should the company interested in the project submit the RIMA to the licensing agencies. Insofar as these three stages are lengthy and represent a large investment, we can expect that strong pressure will be exercised on the environmental agency to grant the installation license. The Xingu example is significant here. Its viability studies were initiated in 1980, and should have been concluded in December 1987. Just for this stage, the cost estimate is $50 million; up to June 1986, $30 million had already been spent (cf. speech of the president of Eletronorte in São Paulo, August 1986, on the occasion of Brasilcon '86). Data referring to the costs in relation to the estimate of potential for the Xingu Basin and to the inventory are not available. Even supposing that they may have been less, it is evident that the investments

already made constitute an extremely strong argument for receiving a go-ahead on the Xingu project.

FINALLY, IT IS PERTINENT to point out a weakness in the new legal framework: both the legislation and the decree creating Conama are extremely vague in relation to detailing "impacts," which creates space for the electric sector itself to impose its own interpretations. Thus, who defines the concept of "impacts" and the manner of dealing with them are the interested parties or proponents themselves, who define the terms of the competition, select the winners, and judge their work. This gives them enormous power: not only do they control the RIMAs through direct payment, but also through imposing the very manner of treating the question.

Although directives for the treatment of the environmental question may be recent in the Brazilian panorama, there are strong reasons to suspect that the electric sector will know how to bypass apparent difficulties created by the RIMAs. It is hard to believe that a group of state enterprises so powerful as those that comprise the Eletrobrás system, fortified in the strongest and wealthiest Ministry of the Republic and with significant support from business sectors, will let itself be embarrassed by determined legal constraints imposed from the outside—by the World Bank—or from within—by pressure from ecologists.

Certainly, those responsible for the electric sector are declaring themselves to be sensitive to the environmental question—in which the "social" aspect is included—and they seek to demonstrate this to society and to the World Bank through the *Manual for Studies of Environmental Effects* and the *Master Plan for Protection and Improvement of the Environment in the Works and Services of the Electric Sector* (the two main documents of the sector on the matter, dated 1986), and, more recently, through the *Plan 2010* (Eletrobrás 1987). Nevertheless, there are no real indications that the new posture represents a change in the manner of conceptualizing the question.

Not only is there no change in priorities in relation to the "social" aspect, but also it is confirmed that now, as before, one is dealing with *minimizing the evaluation of the effects, before even thinking of minimizing the effects themselves.*[8] In essence, the sector's two main documents do not specify how to evaluate impacts, or what methodology is to be used. How does the sector, for example, intend to evaluate the cultural repercussions of its initiatives? The understanding of the social aspect implies a certain kind of knowledge which, in turn, requires an intellectual investment as well as a time investment. Social life consists of social relations with their own dynamic, which cannot be simplified, like a laundry list, as the sum of juxtaposed activities, as the sector manual suggests. Insofar as one does not advance in the knowledge of social systems that will suffer interferences, it will hardly be possible—if in fact it is possible at all—to minimize any impacts. How, for example, will the sector compensate the losses to a social group that is split in half by dammed-up waters, as tends to happen on the upper Uruguai? In what way will the failure of forms of economic cooperation among small producers scattered by resettlement be minimized, if such forms are hardly perceived in the pretentious and megalomaniac studies commissioned by technocrats of the sector who surely think that the "social" can be photographed and done away with by a stroke of the pen?

WITHOUT DISQUALIFYING the professionals who collaborate in the elaboration of these works and who, as salaried workers of large consulting firms, are obliged to submit to the norms imposed by these firms, who find themselves deprived of independence in their work, partially depersonalized and reoriented in accordance with the interests of clients, the fact is that the majority of the studies commissioned by the electric sector are poor, repetitive, and reveal little about real social life. And it is on the basis of an impoverished vision of the "social" that "impacts" are evaluated, conceived almost as a "fright" that the populations—the poor Brazilian citizens in the areas of the electric sector's

[8]A good example of this posture can be found in the volume dedicated to the "Environmental Studies for the Basic Project" of the Itá dam (CNEC n.d.), elaborated by the same company in charge of viability studies for the Xingu project. A close reading of the text allows one to perceive the built-in tendency to disqualify the region and, by extension, those who occupy it. Thus, with the evident intention of minimizing the merit of the agriculturists of the region who, despite the unfavorable topography, manage to far surpass the average national corn production (2,400 kg/ha. vs. 1,730 kg/ha.), the company counterposes the productivity of the area to that of Argentina and the United States, through a totally extemporaneous comparison that nevertheless induces the reader to perceive the agriculture of the region as "backward," which thus makes the flooding of lands—after all, "poorly utilized" by such international standards—less problematic. In the seven pages of the text written on the "socioeconomic effects" of a work that will, according to *Plan 2010* (Eletrobrás 1987: 5.19), dislocate 5,700 people in the rural area alone, the so-called effects are presented under the fetishized form of "effects on the product" and reduced to the euphemism of "renounced production." In terms of employment, the "Itá Basic," after recording that (p. 19) 87 percent of the jobs are in the cattle-ranching sector, where one finds the majority of the population affected, in a proportion 24 percent for the urban population and 76 percent for the rural, that in rural areas 90 percent of the working personnel belong to the family of the occupant, and that the number of salaried workers is of little significance, points out, in the chapter on effects, as a benefit of the work, the generation of jobs (where there is no unemployment) and suggests the utilization of "local laborers" in the construction of the hydroelectric. Hence, one concludes that the "benefit" of Itá in this particular will be to flood lands, expropriate productive agriculturists, and transform them into sellers of labor. And it is this distorted vision of the social and economic facts—just to give one example—that Eletrobrás submits to the environmental agencies.



Photo: Natanael Guedes/Agencia JB

By ignoring the rights of the affected population, the electric sector creates situations that have no democratic solutions, as in this forced relocation of those affected by the Itaparica dam.

intervention—must suffer, but that one day they will give thanks for the "neutralizing" measures consolidated by what the sector calls "regional development programs."

Alternatives to this picture necessarily depend on political will. If the electric sector is willing to take the "social" seriously, it will have to try to understand it as a whole endowed with meaning, before creating situations of fact for which there are no democratic solutions but rather, solutions of force which, in order to be imposed, necessarily mean repressive forces—such as the Federal Police, which "rescued" the sector in Sobradinho, Itaparica, and Tucuruí. It is not enough, however, to have adequate knowledge. It is necessary to recognize that the "population affected" consists of Brazilian citizens or of indigenous populations who have the right to be respected. The recognition of the rights of Brazilian citizens and of indigenous people must be incorporated into planning and decision making, even if this option means reducing the programs for hydroelectric generation and searching for other energy alternatives, such as energy conservation and an industrial policy geared to the interests of the majority.

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Tucuruí: A Relocation Policy in Context

Sonia Barbosa Magalhaes

SEVERAL DIFFERENT CONSIDERATIONS have been made on the social implications of Brazilian energy sector policy as directed by Eletrobrás. In the specific case of Amazonia, where there are plans to build the Altamira Hydroelectric Complex, we have a closer and more concrete reference point: the active presence of Eletronorte (Centrais Elétricas do Norte do Brasil SA) and its implantation of the Tucuruí dam. This chapter proposes to examine in depth Eletronorte's policy in relation to the peasant population that has been dispossessed as a result of the hydroelectric's construction.

Eletronorte is the newest of Eletrobrás' regional subsidiaries. Its area of activities covers the states of Goiás (to the north of parallel 12 South), Maranhão, Pará, Amazonas, Acre, Mato Grosso, Rondônia, and the federal territories of Roraima and Amapá—58 percent of Brazilian territory (Eletronorte 1986:n/p). This area's hydroelectric potential has been estimated on the order of 48.1 GW/year (Eletrobrás 1987:2.8); by the year 2010, at least 57 percent of this potential is expected to be utilized (Eletronorte 1986:2.4).

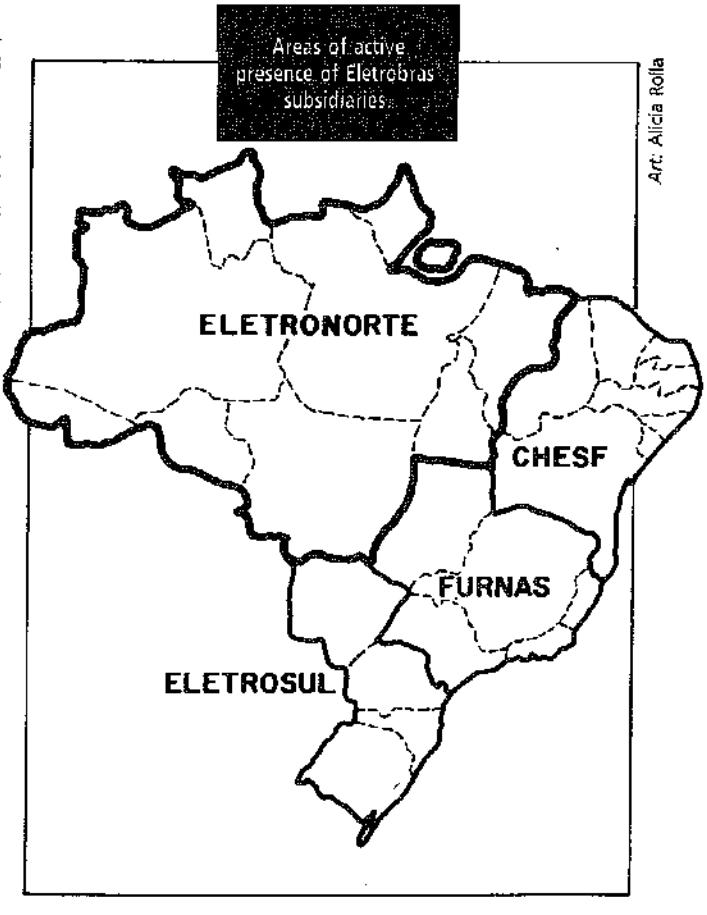
The creation of Eletronorte in June 1973—at the end of President Emílio Médici's government, one of the most authoritarian in Brazil's recent history—was justified by a combination of three factors: the maintenance of Eletrobrás as a holding company for energy planning and policy, which would perpetuate the model for activities already defined for the action of other subsidiaries (CHESF, Eletrosul, and Furnas); the utilization of the "enormous potential" of the Tocantins River; and the confirmation of mineral reserves of bauxite and iron, the exploitation of which would demand high energy consumption (cf. statement of the Minister of Mines and Energy, Eletronorte 1983a:6).

Since Eletronorte's first major undertaking was to build the Tucuruí dam, people tend to confuse the history of the company with the history of the dam. But, even according to Minister Dias Leite (Eletronorte 1983a), while there was a preestablished objective for energy production to facilitate international agreements for installing the alumina-aluminum complex, there was no definition as to the hydroelectric to be built. They spoke of the "hydroelectric of the Tocantins," projecting merely the construction of the Salto Santo Antônio dam (above the confluence of the Araguaia/Tocantins), with an on-line potential of around 800,000 kW.

> The idea of building the hydroelectric of the Tocantins was associated with international financing. The Japanese groups that were going to produce aluminum and alumina in the north would also be responsible for the financing of the dam. This I negotiated with the Japanese in Tokyo, at the end of 1973. I repeated several times to them, in that meeting, that the price of energy for the production of aluminum would be the result of the cost of their financing the building of the Tocantins River dam. If the financing of the kilowatt on the Tocantins were cheap, energy would be less costly. If not, then it wouldn't be. The next government decided to build Tucuruí and negotiate with the French. (Minister Dias Leite, Eletrobrás 1983a)

The decision to build Tucuruí was made in 1974, maintaining the initial objective but deciding that energy generation for the large projects of mineral exploitation would be the responsibility of the federal government. According to the statement of the Minister of Mines and Energy in the government of General Ernesto Geisel:

> I came to the conclusion that it would be very difficult, nearly impossible, to make the investors



> finance the building of the hydroelectric. The reasons were simple: the associates had almost conflicting interests and the time period for each one of the undertakings was different.... We then decided ... [that] each project should seek its own economy while energy generation would come to be the responsibility of the federal government.... When we went into the government, there was a subsidy for petroleum on the order of US$ 500 million, and few people knew of that. On March 31, 1974, we eliminated the subsidy and Petrobrás came to receive that subsidy, for we increased the price of gasoline 32 percent. With part of these resources, we initiated the work at Tucuruí. (Eletronorte 1984a:18)

At the end of 1975, the works of the Tucuruí Hydroelectric Dam (Eletronorte 1976:n/p), located in the region of the state of Pará, in the microregion of Marabá, 13 km from the city of Tucuruí, were begun. The Tucuruí dam blocks the Tocantins River on its lower stretch, 300 km from the mouth and/or in a straight line from the city of Belém (capital of the state of Pará), soon after the confluence of the Tocantins with the Araguaia, its main tributary. The dam was to be built in two stages to generate a total of 7,300 mW, of which 4,000 would be in the first stage and the rest in the second, depending on other hydroelectric utilizations on the upper course of the Tocantins and the lower Araguaia (Eletronorte 1986:n/p).[1] After a year of delay in its initial timetable, the first group of turbines went into operation in November 1984, when they were inaugurated by President João Figueiredo. One year later, in November 1985, the fifth generating unit came into operation, and its first phase was concluded (Eletronorte 1986). Among the large consumers were the Carajás Iron Ore Project; Albrás, for the production of metallic aluminum in Vila do Conde, in Pará; and ALCOA, in Maranhão, for the production of alumina (see *Estimativa do Mercado de Energia Elétrica* 1985). In addition to supplying electrical energy, the building of locks was projected in the layout of the dam blueprint (*O Liberal* 29 May 1984), which would make the Araguaia-Tocantins a viable waterway, with an estimated transportation capacity of 130 million metric tons per year (Eletronorte 1986:n/p). The elaboration of the project was to be done through a contract with Portobrás in 1976 (Eletronorte 1976:n/p), and the basic project would be undertaken from 1979 on (*Portos e Navios* 1981:59), but the works were interrupted in 1984.[2] The construction cost of the Tucuruí dam, initially projected at $1.2 billion (Eletronorte 1983a:18), was estimated in 1983 at $4.6 billion, which corresponds to $1.15 per installed kW (Eletronorte 1983a:9), not including interest.

THE HYDRAULIC ACCUMULATION RESERVOIR for the Tucuruí dam extends beyond the municipality of Tucuruí to Jacundá and Itupiranga, both also in the state of Pará (see map, p. 111). With a longitudinal extension of 170 km in the north-south direction, it has an accumulated area of 2,430 km² at its maximum normal level, representing 45.9 billion m³ of water. Its maximum width is 40 km and its average width is 14.3 km, with a perimeter of 3,700 km (1,300 km on the right bank and 2,400 km on the left bank), beyond the approximately 1,700 km corresponding to the perimeter of the artificially formed islands (Eletronorte b:04; c:n/p). The damming of the waters was begun on 18 May 1984, and concluded on 6 September 1984 (Eletronorte 1986:n/p). According to Eletronorte (c:n/p), the formation of the reservoir partially flooded lands in the municipalities of Tucuruí, Itupiranga, and Jacundá, and submerged 14 villages, two indigenous reserves, and 160 km of federal roads (the Trans-Amazon Highway and Highway BR-422). As a result, 32,871 people were dislocated, as well as the Parakanã tribe, inhabitants of the Parakanã and Tucuruí reserves (Eletronorte 1984c:4).[3] The Syndicates of Rural Laborers of the municipalities affected accept the data produced by an Interministerial Commission which, in a July 1985 survey, indicated approximately 4,300 *dispossessed* families (Comissão Interministerial 1985:4).[4]

[1]Among these utilizations is the Santa Isabel dam on the Araguaia River, which, allowing for the normalization of water flow on the Tocantins River, would make the implantation of the second stage of Tucuruí viable (Eletronorte 1984d:2). Eletronorte expects that with the building of the Santa Isabel dam (Eletronorte 1984d:26), twelve municipalities will be affected, seven in the state of Goiás (Ananás, Xambioá, Araguaína, Arapoena, Colméia, Couto de Magalhães, and Araguacema) and five in the state of Pará (São João do Araguaia, Xinguara, Rio Maria, Conceição do Araguaia, and Santana do Araguaia). These municipalities together form the region of the Bico do Papagaio, nationally known for the highest rate of agrarian conflicts in the country. In addition, there are indigenous areas in three of these municipalities: Santana do Araguaia (Karajá) in the municipality of the same name, Xambioá (Guarani/Karajá) in Araguaina—both recognized officially—and Barreira do Campo (Karajá) in Conceição do Araguaia (CEDI/Museu Nacional 1987), as yet lacking measures for its official recognition. The area to be expropriated for the Santa Isabel dam is 4,000 km² and will have an estimated population of 56,900 people by 1993 (Eletronorte 1984e:27). At a minimum, the municipality of Xambioá, including the municipal seat, will be totally submerged.

[2]In January 1988, the minister of transport authorized the renewal of works on the locks, this being associated with the building of the North-South railway; it is anticipated that this railway will be interconnected to the Tocantins River (*Folha de São Paulo* 13 January 1988).

[3]On the process of "transferral" of the Parakanã people, see Magalhães 1981, 1982, 1984. In addition to the Parakanã, the Gavião of the Montanha also had their territory occupied by the works of the Tucuruí dam (cf. pp. 1–18 in this volume).

[4]The reference to 4,300 *dispossessed* families indicates the number of families effectively registered by Eletronorte for the purposes of indemnification until 1985. According to the Syndicate of Rural Laborers of Tucuruí, this does not necessarily equal the number of families that had to be removed from the area occupied by the hydroelectric plant. This syndicate estimated a population of more than 5,000 families, considering the strong immigration that took place in the area after 1978–1979, when it became known that the indemnifications would not cover either the lands under title of possession, nor the permanent cultivated crops after that date.

The dislocated population consisted above all of small producers whose subsistence activities were intimately connected to riverine life and came essentially from a family-based agriculture that was complemented by hunting, fishing, extracting forest products, and related activities of a commercial nature, all of which were connected to the area's rigorous period of rains. Thus, during the Amazon summer, they practiced drainage cultivation on the banks and islands of the Tocantins River, planting especially corn, beans, watermelon, pumpkin, and melons. During the Amazon winter, mainly in the months of December to March, they concentrated their activities on gathering castanha and on the system of river transport, intensified by the precarious state of roads in the rainy season. The population centers, considered by Eletronorte as "urban areas," served especially as a base for the commercialization of products derived from these activities.

With regard to the process of dispossession and relocation to which this population was submitted, in August 1985, a year after the reservoir was filled, approximately 1,500 families were still homeless (Comissão Interministerial 1985:4). This was the result both of the "lack of a policy for relocation" (Comissão Interministerial 1985:2) and of the topographical nondelimitation of the operational surface level of the reservoir (Comissão Interministerial 1985:4), which meant the partial or total flooding of 630 rural lots that provided shelter for 3,700 people already relocated by Eletronorte (Sindicato dos Trabalhadores Rurais 1985:n/p).

If these data are due to the absence both of a relocation policy and of any verification of technical problems in the implantation of the dam (Comissão Interministerial 1985:2,3), they seem to be also related to a lack of knowledge about the region, which preceded and accompanied the building of the Tucuruí dam, and, consequently, to the preconceptions that informed the procedures adopted in relation to the peasant population, notably the presupposition of a social and historical vacuum associated with the "virgin forest" which was to be "dominated" (Eletronorte 1983a:17). Such a presupposition was not new; it had already been incorporated into other state interventions prior to Tucuruí, and in the same area. Yet, in this case, it surpasses all others in its lack of knowledge or its absolute lack of consideration for the widely known process of occupation of the region. The area is prominent for its production of castanha nuts, and it constitutes one of the Amazon's most important frontier areas (Velho 1972; Dias 1958, 1959, 1969; Lagenest 1958) as a result of more recent state interventions such as the Highway Program, included in the National Integration Program, or the Integrated Colonization Program, included in the Program for Distribution of Lands—both of which were put into effect in the late 1960s.[5] Several facts, cited in chronological order below, confirm that presupposition.

According to information produced by Eletronorte (1985a:1; 1983a:4; 1986:n/p), the building of the Tucuruí dam was an *ad hoc* confirmation that it would be necessary "to study, in a difficult and unknown region, what had never been the object of previous evaluation—the generation of hydroelectric energy," and that this "initiative clashed with the Amazon factor, until then unknown by man." This discourse, moreover, continued to be used in relation to the Xingu, according to a speech by Eletronorte's president (Nunes 1986:17–18).

Eletronorte (1985a:1) cited as an initial step in dealing with the *environmental problems* resulting from the building of dams in Amazonia "extensive research of data and information gathering, in Brazil and in other countries"—especially, a "visit" (made in 1976) to the Brokopondo Dam in Suriname[6] (Eletronorte d:1)—about similar situations and problems verified in the filling of reservoirs in other dams around the world, as well as the creation of an ecological division, later transformed into the Environmental Assessment Unit connected to the presidency (Eletronorte 1985a:1). And, in 1977, two years after construction began on Tucuruí, Eletronorte hired the ecologist Robert Goodland to prepare a diagnostic statement on the environmental problems associated with the dam, as well as archaeological studies and salvage research of the area to be flooded (Eletronorte 1985a:27,28).

Evidently, since the diagnosis was commissioned after the fact, no discussion was foreseen on the social and environmental effects of the project's engineering aspects, this being excluded by Eletronorte (Goodland 1977:7). One was dealing only with the proposal of measures for environmental protection for an already consummated fact (Goodland 1977:7).[7] But, despite the recommendations, and despite the concept of environmental impact that permeates the report (which, not by chance, begins with the item "human ecology"), Eletronorte made *its* definition of environment—equivalent to natural or naturalized environment—prevail in the development of later studies and activities. That is, although they requested a diagnosis that might consider the total environment (Goodland 1977:7), the population living in

[5]On the overall goals of public policies for the Araguaia-Tocantins region in the pre- and post-1966 periods, see Magalhães 1986 and 1987a.

[6]The preoccupation with Brokopondo was strictly associated with the consequences of the submersion of the forest for the turbines. In the Brokopondo dam (Monosowski 1983:12), the emission of sulphuric gas, originating from the decomposition of the forest, required the use of masks by the workers over two years. And, six years after the beginning of the dam's operation, repairs and/or replacement of equipment were necessary.

[7]Until 1986, the "environmental viability" studies for the Brazilian electric sector's works met only the requirements set forth by international financing institutions (Magalhães 1987b).

the area of the reservoir was to be excluded from the "environmental studies," and was to be studied later in more depth (Eletronorte 1985a:3). It could even be inferred that the sub-project "Control of Consequences Downriver from the Dam" (Eletronorte 1985a:30–31), one of the rare moments when some reference to the human population appears, although restricted to the period of filling of the lake, was principally associated with the polemic on its effects, which mobilized regional public opinion in that period (Eletronorte 1985a:36; b, appendices).

On the other hand, although the "environmental studies" were connected to the Environmental Assessment Unit mentioned above, the actions and surveys referring to the populations living upstream from the dam were coordinated by the Supplies Administration, Sector of Land Patrimony (Eletronorte 1983b, 1984a), despite the recommendations for establishing a competent staff of sociologists (Goodland 1977:61)—a procedure, moreover, that was in accord with the preconceptions surrounding the relationship that Eletronorte had developed with the peasant population in the area. In the first place, it ignored social practices regarding land use and, for the purposes of relocation, it anticipated moving only a fraction of those who held land ownership titles (Goodland 1977:58). In the second place, it refused to consider that population through adequate sociological knowledge.

In effect, inasmuch as "social ecology" was concerned, Goodland reported in 1977 Eletronorte's lack of any prior knowledge except for aerophotogrammetic surveys (Eletronorte c:n/p). Consequently, also in 1977, the real effects of the dam construction on the human population to be dispossessed were not known. Goodland (1977:55) warned that the dimensions of the impact on the human population could only be gauged after a census survey was undertaken, which at the time was projected by the company. However, even without any prior sociological knowledge, there was a predefined policy that in principle was not subject to changes. And any sociological knowledge was considered secondary: the very census survey, the only advance in this direction, appears to be included in the role of the "Works Complementary to the Topographical Quantification of the Areas of Reservoir Formation for the Tucuruí Dam and their Maximum Limits of Flooding," developed in the period from 1978 to 1983 (Eletronorte c:n/p). This seems to confirm, first, that the *aerophotogrammetic surveys* constituted fundamental support for the relocation policy and, second, the perception of the peasant population as merely an obstacle to the filling of the reservoir.

Thus, the "Commissions for Discrimination of the Lands" in the area of reservoir formation date only from 1978, whereas the area was declared to be of public utility in November 1976 by Federal Decree 78.659—about three years after the works had begun. And the "detailed initial survey of the local inhabitants" for the purposes of indemnification was recorded only in 1979 (Eletronorte d:25), which corresponds to the census survey. The local population refers to this census as equivalent to the registration for purposes of dispossession ("Documento de Denúncia e Reivindicações da População de Repartimento e Adjacências, Atingidas pelo Projeto do Reservatório da UHE Tucuruí" 1981:n/p). Moreover, it becomes clear that, until 1979, four years after the beginning of the works, Eletronorte did not know exactly who the population was to be relocated. This was not the company's concern; it concentrated only on quantifying and making passable the areas to be flooded. On the other hand, it was decided that the topographical delimitation of the perimeter of the reservoir would not be done (Eletronorte c:n/p; 1982) and, as was pointed out, "the dispossession of rural occupancies under title of possession, would only include the financial indemnification of agricultural works implanted, as well as the non-reproductive estates constructed" (Eletronorte c:n/p), for there was no prior policy for relocating those members of the population who held no property titles (Goodland 1977:58)—approximately two-thirds of the total number of families living in the area, or 3,431 occupancies (Mougeot 1986:407, n.r.2), of which 55.6 percent were small-holders.

Looking more specifically at the execution of the processes of indemnification and relocation, the works of dispossession initiated in 1979 consisted simply of paying the indemnification according to the registration done in the field. If for the non-title holders there was no provision for relocation, for the rest, due to the lack of a relocation policy simultaneous with the expropriation, "pecuniary aid" was instituted "for the desistance from any relocative benefit, where the dispossessed would be committed to abdicating their re-establishment in another place, reinstating themselves on their own account, in a new area" (Comissão Interministerial 1985:2). The policy for relocating the peasant population thus was transformed into a policy of relocative desistance, meaning that Eletronorte would only be committed to liberating the area of the reservoir, the filling of which, until that time, was expected for 1983 (Eletronorte 1982:n/p). The peasant population was advised of the expropriation only at the very moment when this act was being initiated, and they did not even know the values by which dispossession would be indemnified (Mougeot 1986:408).

It is not known exactly how many families in 1980 supposedly agreed to the relocative desistance, although it is believed that this number is signi-

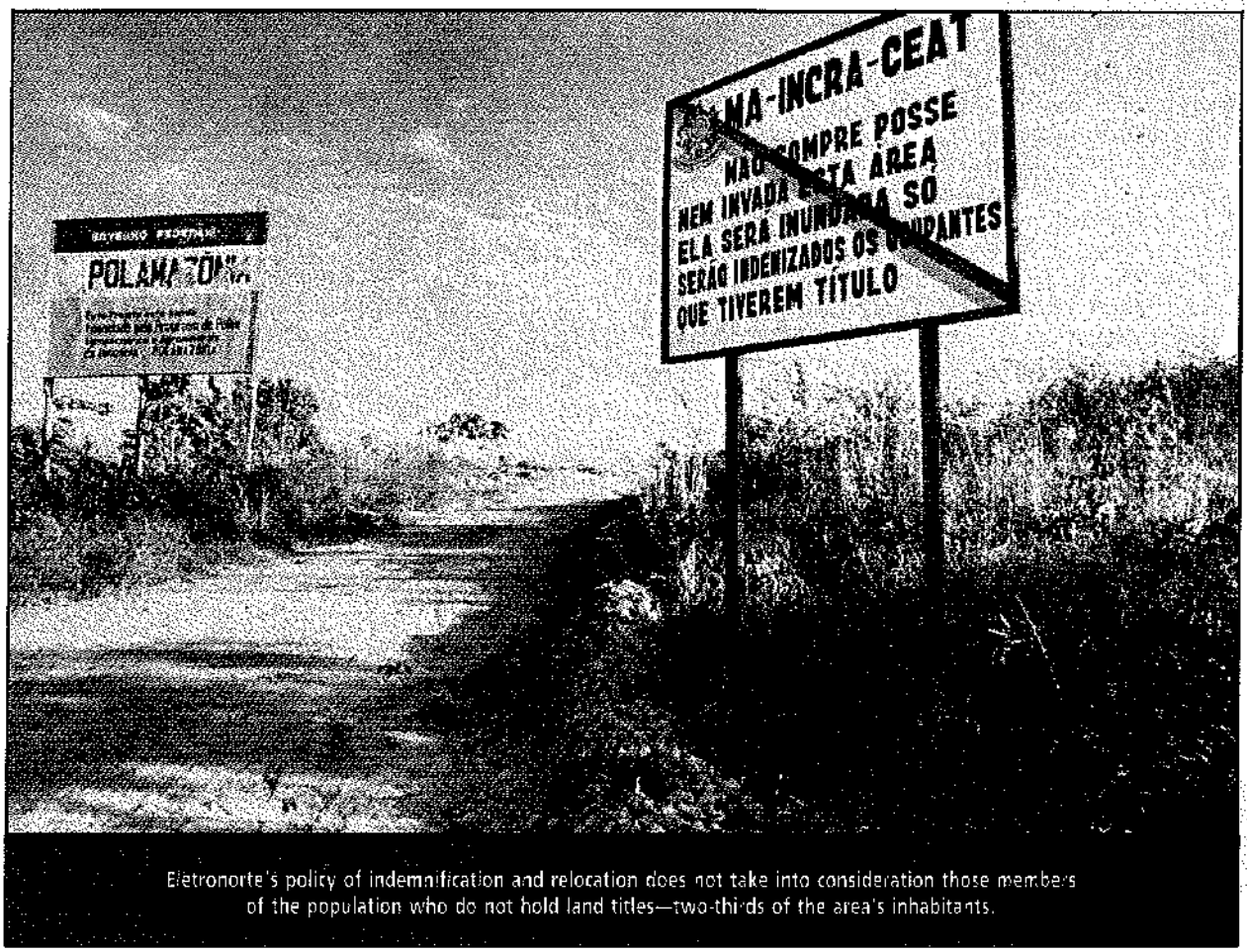


Photo: Salomon Cytrynowicz/Abril Press

Eletronorte's policy of indemnification and relocation does not take into consideration those members of the population who do not hold land titles—two-thirds of the area's inhabitants.

ficant. It is known, however, that the refusal of this "desistance" (Comissão Interministerial 1985:2) was the motive for an *"experimental* program and emergency housing," for which a total of 140 houses were built (Presidência da Eletronorte 1981a:2). Nevertheless, the secondary place attributed to the peasant population once again prevailed, and a portion of these houses ended up going to either "the company personnel contracted for implantation of the transmission line" or to "state and municipal public agencies, as well to the administration personnel of these agencies" (Presidência da Eletronorte 1981a:2). In fact, only 60 houses located on Highway PA-263 were set aside for the relocated population; today, these form part of the nucleus for resettlement known as the Rio Moju Rural Allotment, which contains 486 lots of 50 hectares each. This allotment, by the very fact that it was merely the result of taking advantage of the opportunity of the opening a state highway (Comissão Interministerial 1985:2), ended up being included in the *Associated Transmission System for the Tucuruí Dam*, with a 300-meter-wide right-of-way (Eletronorte c:n/p) passing over the lots set aside for relocation (Eletronorte 1981a:1). This was the first pole of rural relocation, and "these first population recompositions were concretized after about 1 year of indemnity payments had passed . . . [when] the dispossessed had already spent the indemnities received and thus no longer had the means which would allow them to invest in the new lot" (Comissão Interministerial 1985:3). Furthermore, the completion of registration inhibited agricultural production, mainly because the indemnification was to be restricted to improvements existing at the time of the survey (Barrow and Mougeot n.d.:26; Mougeot 1986:408), while later reevaluations were discarded.

But if the "emergency program" did succeed in accompanying these initial expropriations, the "late recommendation for utilization of the lumber potential existing on the perimeter of the reservoir" (Comissão Interministerial 1985:3), evaluated at 13.4 million m³ (Pinto 1982:22),[8] resulted in the continuation of expropriations without any parallel program for relocation; up to five years elapsed between these expropriations and the partial and precariously executed relocations (Mougeot 1986:408). Even the relocated peasants were penalized in 1980 by having their lots reduced in size from 100 to 50 hectares each when the state agency and land-holding policy changed in the region, when INCRA was replaced by the Executive Group on Lands of the Araguaia/Tocantins

[8]On the process of deforestation of the area of the Tucuruí dam reservoir, see Assis 1984.

(GETAT), under the National Security Council (Alameida 1980).

In fact, until 1982, two years before the plan was inaugurated, the Rio Moju Rural Allotment constituted the only relocation pole (see map, p. 111)—and it was not sufficient to attend to more than 10 percent of the dispossessed population.

The state company, for its part, did not consider itself responsible for the consequences of its policy; it understood the relocation process as an "additional benefit to the indemnification paid" or "an act of generosity by the company and GETAT itself" (Eletronorte 1982:3,4). In this sense, the Rio Moju Rural Allotment functioned much more as propaganda for the dues supposedly paid by the company than as a sign of the fulfilled expropriation process. But if Eletronorte says it adopted this procedure on the basis of existing legislation in the country (Eletronorte 1982:5), it shows, at a minimum, little concern for the fate of the population, which can once again be confirmed as much by the slowness and paralyzation of the indemnity payments (Eletronorte 1985b:n/p) as by the expropriation of an area at least twice the size of that which was to be effectively occupied by the reservoir (Mougeot 1986:405). Until 1982, the process of expropriation covered an area of 8,184 km² (Decree No. 78.659, Article 1, 1 November 1976), as a result of an initial overestimation of the maximum levels of the lake (Mougeot 1986:405)—the extent of which is 2,430 km² as mentioned—or, it could be inferred, as a result of the topographical nondelimitation of the operational surface of the reservoir, considered to be "impracticable" due to its size and to the "irregular twisting of the polygons necessary for its materialization" (Eletronorte 1982:3). Thus, given the overestimate, the lands that would no longer be utilized could once again be reclaimed by their original inhabitants. This solution—besides being late (six years after the publication of the expropriation decree) and when a strong immigration that followed indemnification had already been observed (Mougeot 1986:405)—was not sufficiently publicized (Mougeot 1986:406).


ARCA

Número 01 Setembro 82 a Janeiro 83

dos moradores
da área do reservatório
BARRAGEM DE TUCURUÍ

TERRA POR TERRA – Que a ELETRONORTE distribua outros lotes de 21 alqueires, titulados nos locais escolhidos por cada comunidade.

CASA POR CASA, VILA POR VILA – Que a ELETRONORTE construa novas vilas com casas melhores ou iguais as anteriores, luz, esgoto, água, ruas e prédios públicos.

INDENIZAÇÃO JUSTA – Que os processos de indenização sejam revistos e reavaliados de acordo com a tabela de valores feita pelos trabalhadores.

RECUPERAÇÃO DOS PREJUIZOS – Que sejam indenizados os prejuizos dos anos parados de plantar.

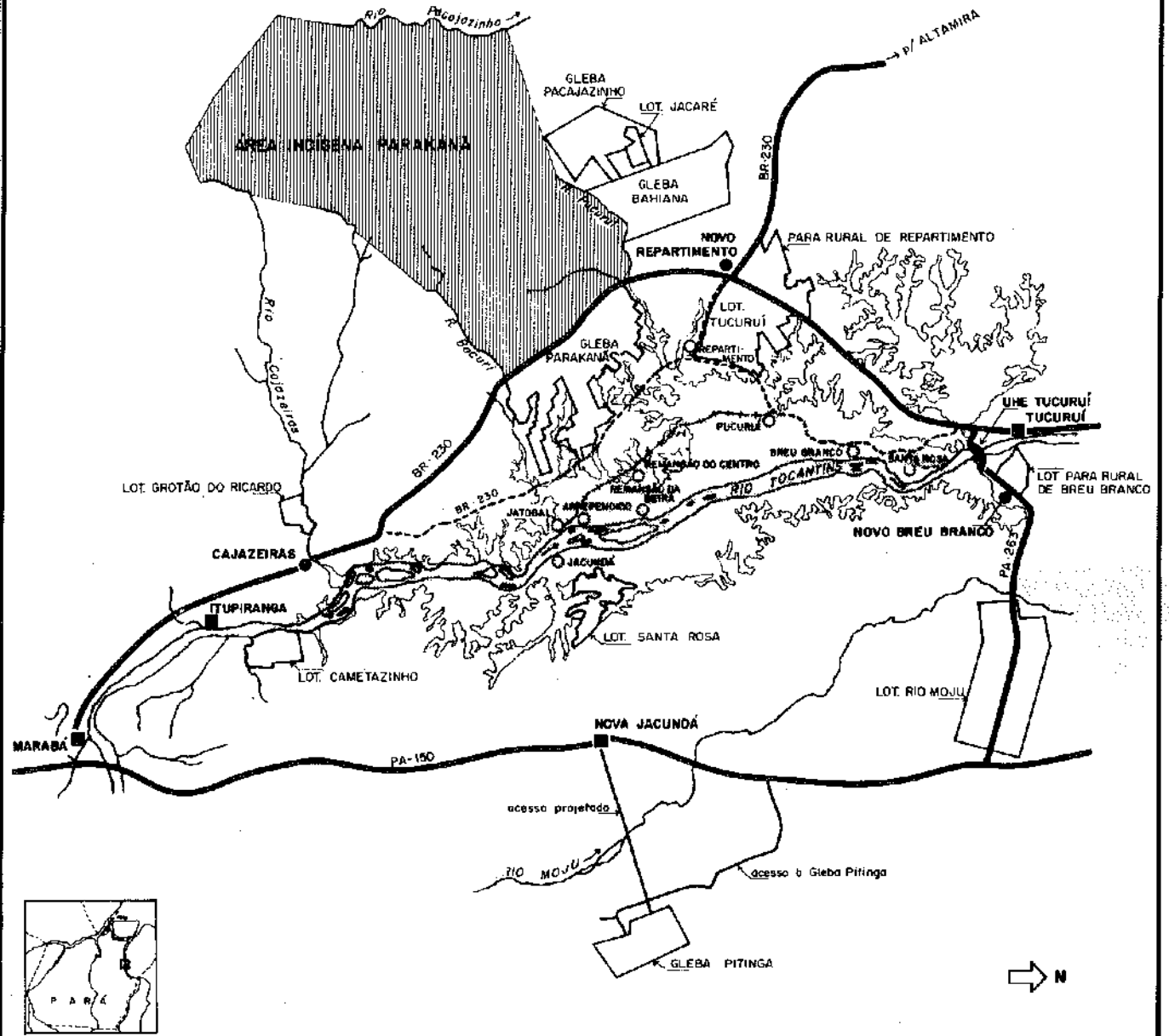
The first issue of the information bulletin published by the Movement of Those Dispossessed by the Tucuruí Dam.

This was the policy of expropriation and relocation until 1982, the fruit of an authoritarian decision and, mainly, the fruit of the company's persistence in remaining insulated by its own preconceptions, unconditionally refusing to recognize adequately the existence of a social and historical context in the region. The peasant population at various times took it upon themselves to point out the unsuitability of the situation imposed on them. From 1980 on, after the census survey was completed, the main questions raised by the peasants testified above all to the underlying unilaterality of the expropriation policy: When will we be indemnified? How much will we get? Where are the other lots? Who will and who will not be indemnified? (Documento dos Vazanteiros de Itupiranga à Eletronorte 1981). Thus, as from 1981 on, with the process of indemnification wide open, several documents produced by the peasant population pointed out the lack of technical preparation and the political arrogance of the procedures adopted until then. In a document sent to Eletronorte in November 1981, the same holm farmers mentioned above declared that:

> Many unjust and low indemnifications have been made . . . in Itupiranga [see p. 111], where there are hundreds of holm farmers who work six months a year [the dry season] to get their food for the whole year. . . . A minimum number of holm farmers were indemnified and these received a small portion which has made all of us indignant . . ., in exchange for a piece of land that sustains an entire family. Besides that, ELETRONORTE failed to indemnify hundreds of us, because we do not have houses and permanent gardens in the holms. . . . It is most regrettable that ELETRONORTE ignores our situation as holm

Land allotments created by Eletronorte and the Tucuruí dam reservoir.

Art: Alicia Rolla



- ○ Towns or villages removed as a result of the floodings
- ● Towns or villages
- ■ Municipal seat
- Allotments and resettlement glebes
- Area flooded by the Tucuruí dam
- Highway
- (Old tracing)
- Railway (old tracing)

Plan 1: This plan shows an example of Eletronorte's disregard for the population affected. As can be seen, past resettlement lots, created by Eletronorte itself, were flooded by the Tucuruí reservoir, dislocating 3,700 people previously relocated by the company.

Prepared on the basis of documents from Eletronorte Tucuruí Hydroelectric dam:
Plan of description of the reservation—fl. TUC-10-26819—1984
Area of influence—plan of situation—fl. s/n—1985

> farmers and requires permanent gardens and houses, when all of us know that in the holms, this can't be done, for, every six months, the floods come, fertilize the land, and eat up everything that had been planted and built. Is it possible that the experts and researchers don't know this natural law that works here in the North and on the great Tocantins? ... We demand a definition from ELETRONORTE, an adequate survey, and not a camouflaged policy..., to find another place to work.... We wish to state that we plant beans, corn, watermelon, tomatoes, yams, and all kinds of vegetables. It is what we need to live and to have a stock of beans and corn for the rest of the year.

The peasants resettled at the Rio Moju Rural Allotment (see page 111) pointed out in 1982 the serious difficulties they faced after the relocation: lack of nearby roads; lack of transport ("the truck promised and granted by the company was used for only three days and then was cancelled"); lack of houses to stay on the lot ("only 60 houses were built ... while the rest of the people relocated were left with miserable building aid"); no water ("Eletronorte ordered us to build wells in ... about 10 percent of the lots and, even in these, several did not find water"); and lack of electrical energy. They emphasized, moreover, that the dimensions of the lots (50 hectares) "did not present conditions favorable for the colonists to work and sustain their families for a greater living period. Besides that, several lots had their cultivatable area reduced because they were under the transmission lines, which prevents cultivating about 60,500 m² per lot."

Neither dates nor official reasons can be found to indicate on what basis and from what time the state company began modifying its relocation policy. It can be verified, nevertheless, that there does not seem to have been a planned determination but rather, mainly a response, through decisions made over time, to the intense claims movement (Eletronorte 1985d) organized by the dispossessed peasant population, which held significant public demonstrations, from 1982 on.

Thus, only in September 1982, during an important preelectoral period in the country—the election of state governors, after 20 years of dictatorial rule—did Eletronorte "agree to talk" with the population to be relocated. Such an "agreement" was the result of the first large public demonstration, with about 400 peasants invading and occupying the offices of Eletronorte's Service of Property Patrimony in Tucuruí for four days. The peasants demanded building of houses, 100-hectare lots in accordance with the land-holding policy developed up until 1980 by the regional government, and the construction of schools and access roads near the allotments. Effective measures, however, were only taken after April 1983, when about 2,000 peasants once again camped out in front of Eletronorte's Service of Property Patrimony at Tucuruí for five days. The relocation program, however, was begun in June 1983, with the occupation of the Parakanã Glebe—the unflooded area left over of the Parakanã Indian Reserve, with 36,458 hectares (see map, p. 111), with priority given only to the dispossessed peasants of the Marabá Integrated Colonization Program. This relocation provoked a strong climate of tension between Indians and non-Indians (Eletronorte 1984c:n/p).[9] In 1984, Eletronorte announced its acquisition of the areas known as Grotão do Ricardo and Cametauzinho (Eletronorte 1984b:2), as well as the Santa Rosa Glebe (see map, p. 111).

Even though these elements indicate a change in the relocation policy, the concern for the dispossessed population did not seem to have formed a priority at any moment of the process. In July 1984, two months after the filling of the reservoir had begun, approximately 170 families still remained in the area to be flooded (Eletronorte b:12,17).

In October 1984, faced by the filling of the reservoir before the relocation process had been concluded and faced by the slowness that characterized the relocation program up until that time, a third public demonstration took place. Bringing together approximately 1,500 peasants, this demonstration, held in the city of Tucuruí, went on for about 40 days and had the single objective of accelerating the relocation process and seeking government measures that would allow for the renewal of agricultural activities after five years of increased impoverishment. At the plant's inauguration in November 1984, General João Figueiredo, then president of Brazil and nearing the end of his term, promised to meet the basic demands.

But in July 1985, despite conditions made worse by the flooding of lots that provided homes for a fraction of the recently relocated population, resulting from the topographical nondelimitation of the surface of the reservoir as mentioned above,[10] all measures both referring to indemnification and to relocation were suspended "due to absolute lack

[9] In October 1984, the Parakanã Indians threatened to set fire to the Parakanã Glebe, the largest rural resettlement pole, with 737 lots of 50 hectares each. This glebe was formed on lands belonging to the Parakanã Indians and its flooding was planned by Eletronorte itself. The Indians demanded, principally, the demarcation of the indigenous reserve chosen since 1978 and the reintegration of that part of their territory utilized by Eletronorte for relocation purposes.

[10] In March 1985, 630 families, or approximately 3,700 people, "had their lots and/or houses totally submerged or surrounded by water" (Syndicate of Rural Laborers of Tucuruí and Jacundá 1985). That is, approximately 35 percent of the families relocated up to that time had to go through a new process of transferral. See, for example, on map, p. 111: Santa Rosa allotment, part of the Parakanã Glebe, part of the Tucuruí and Pucuruí allotments affected by the waters of the reservoir.

of resources" (Eletronorte 198b:1; and 1985c), which exacerbated the already grave social tensions in the area (Eletronorte 1985b, 1985d). Approximately 1,500 families remained homeless (Comissão Interministerial 1985:04), about 900 of whom had been waiting for resettlement since 1979–1980. These suspended measures, which ranged from ongoing payment of indemnities, obtainment of new lots, building of nearby roads on the glebe, and demarcation of lots, to food, transport, and medical assistance (Eletronorte 1985b:1), were only to be renewed after the intervention of an Interministerial Commission (Portaria 447/A of 19 July 1985), authorized by Brazil's president during his first visit to Tucuruí. The political circumstances at the beginning of the first civilian government, after 20 years of military dictatorship, together with the pressure that continued to be exercised by the dispossessed, favored the formation of that commission. With the participation of the ministries of mines and energy, of justice, and of agrarian reform and development, as well as Eletronorte itself, GETAT, and a representative of the government of the state of Pará, this commission was given the responsibility of proposing a program for action and solution to these problems, especially those raised by the popular movement.

The commission's report, compiled in August 1985, called the solution to these problems "basically indispensable to the very subsistence of these populations . . . for they consist, unpretentiously, in merely securing for the homeless families a new area so that they can reestablish themselves and thus recommence the activities from which they obtain their very sustenance and where they have at least a roof to give them shelter" (Eletronorte 1985b:7).

In November 1986, two years after the dam was inaugurated, there were still some "social questions" to be resolved, this time attributed to the "invasion of populations" in the protection area of the reservoir and from the influx of agriculturalists after the lake was filled, as a "revision of the resettlement plan" was being made (Eletrobrás 1986:6-11). However, the plan for utilization of the reservoir has still not been elaborated (Eletrobrás 1986:6-10). The Tucuruí plant has been included in the Program for Protection of the Environment "complementary" to the Electric Sector's Rehabilitation Plan (1986–1989), the objective of which is no more than to "meet the demands of environmental protection" defined by Eletrobrás itself in the Manual for Studies of Environmental Effects of the Electric Sector (Eletrobrás 1986:6-2, 6-3), in the terms previously commented upon (cf. Sigaud, p. 97 in this volume). According to unofficial information, the plan for utilization of the reservoir should be ready during the first semester of 1988 and will give priority to the population downriver from the dam.

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Workers in the Amazon Region of Pará and Large Dams

Angela Tude de Souza

The slumber of eighth-notes
sol-fa on mattresses of silent arcs.
Drums performers
sonorous bone flutes
carimbós in the background.
And tractors break out against the myths.
Uirapurus, Indians, colonists
Are de-legendized in the confusion of the world.
Canoemen are deflected from their ways . . .

"Deslenda Rural II," J.J. Paes Loureiro

Introduction

One of the principal questions that has come to mobilize wide sectors of Brazilian society and the state has to do with the implications and possible repercussions of building large electrical energy generating installations.

This question, however, has taken diverse forms in the different regions of the country where these installations have been built and put into operation. In some cases, the experiences go back a long time, with results and evidence left by the dam construction that can be evaluated today. In addition, the construction of dams is part of a veritable frontier for the hydroelectric utilization of entire river valleys. We could cite the cases of the São Francisco Valley in the northeast, and the Paraná and Rio Grande rivers in the frontier areas of the state of São Paulo with the states of Minas Gerais and Mato Grosso do Sul.

There are other cases that suffer not only from a lack of research and accumulated knowledge by the electric sector (building and operation included), but above all from an absence, precariousness, and fragility of the productive base and regional infrastructure from which, normally, the large hydroelectric projects get their support.

The best and most reliable illustrations of such situations are found in the areas of frontier expansion through processes of recent occupation, as is the case of Brazilian Legal Amazonia. Before examining this, however, let us look at the principal elements that can be extracted from the electric sector's past experiences in Brazil.

The Destructuration and Restructuration Promoted by the Works

A first glance at the recent dam-building experiences of the electric sector help to determine some of its principal internal characteristics: geographic mobility; territorial itinerancy of the public and corporate activity responsible for the construction; and assembly and operation of the hydroenergy site as a whole, not merely of the generating unit and its reservoir.

Such itinerancy has obvious consequences. It makes each work a unique and differentiable event from those preceding it, principally in the cases that involve distinct regions and cultures. From the physical conditions of the construction site to the economic and social context in which it is placed, the work tends to be differentiated from all previous ones. This includes cases where the energy concessionary is the same for different works and in which history has shown the inevitability of reviewing principles, calendars, and procedures customarily adopted by the enterprises. Recent cases include those of CHESF with the Itaparica dam (PE), and Eletrosul with the Itá-Machadinho dam (SC/RS), where the same concessionary was led to "modulate" part of its technical and political decisions in order to "safeguard regional interests."

Thus perceived, geographical mobility allows us to specify some of the central connections of the dam-building practice: itinerancy introduces the uniqueness and variability of the product built which, in turn, not only implies a wide margin of unpredictability of the investment, but also requires the concessionaries to transform their political and institutional formats in relation to the regional populations. From this point of view, the itinerancy of the profession displaces the permanent challenge and invitation to the internal transformation of the institutional practices that guarantee the implantation of these large energy plants.

Moreover, the mobility of the profession, combined with the temporary nature of these investments in general, implies a series of consequences as much for those who undertake them as for those who "suffer the effects of the work." It is worth pointing out that the large periodic mobilizations of labor needed for constructing works have as their principal corrolary the difficulty faced by the sector in forming, retaining, and reproducing a work force sufficiently adapted to and qualified in the technical and economic requisites of hydroelectric investment.

Thus, the economics of the work is a determining factor in the very high levels of annual demographic growth, with a high rate above all in the years that coincide with the "peak" of the works, from the diversion of the river to the end

of concrete-laying. This is followed by a period during which personnel are gradually demobilized; a significant part of them, being subcontracted, ultimately become "dead weight" and need government support, whether to survive in the area or to return to their homes.

This situation is made even worse by the fact that the nonadaptation of the workers to the kind of employment offered often results in high turnover and absenteeism, abruptly raising the cost of each direct job. As a counterpart to this, the work contractors and concessionaries are left to deal with subcontracting and with the precarious employment of a significant part of the workers in the work-site area.

Adding to these unstable and irregular work conditions, the companies associate the possibility of reducing the social cost of employment through transferring these responsibilities to labor contractors who, for their part, do not have the least possibility of sustaining the costs related to holidays, social security, and bonuses, as the country's laws require.

The importance of this point lies in the fact that dismissing these social costs of directly productive work promoted by the work contractors and concessionaries leads to a growing deterioration of the patterns of reproduction of the sector's labor population, as well as the patterns of sociability and consumption already very precarious in those urban centers and districts closest to the dam-building investments.

Even though "indirectly" connected to the works, the subcontracted contingents associated with the populations attracted by the abundant offer of employment, as well as by the remote possibility of obtaining a piece of land, end up "weighing" inexorably on the municipal and state economies, and are seen then as those responsible for offering basic conditions to enable them to stay in the area. This means that these populations directly or indirectly mobilized by the economics of the work not only participate decisively in the profile and dimensions of urban demand, but above all represent one more onus for the local and supralocal public authorities responsible for supplying equipment and services to the regional populations; the result is, ultimately, the dilution of the demand defined by the presence of subcontracted and service populations attracted by the work, within the regional demand for public services.

The reduction of the social costs of employment is associated in this way with a deterioration of the quality of life and reproduction of the local society; there is always an ever-increasing number of people who do not benefit from the services put at the disposal of the popular classes at the locale and in the region.

As a result of the points mentioned above (itinerancy and temporariness), the administrators of the large dam projects adopt certain labor policies that end up interfering directly in the gender, age, and civilian composition of the regional populations.

Insofar as the work force employed in the projects is mostly male (approximately 90 to 95 percent), and only a small part of them arrive with families, one can expect that there have been several perverse consequences in the sense of alterations in the local and regional demographic patterns and social life. A population predominantly male and unaccompanied by family has obviously contributed to the diffusion of a whole "industry" of prostitution, which is the product of the economy of the works as a whole.

Perhaps today one can already begin to say "it could result," "it is resulting," for unquestionably certain labor management forms are emerging in the worksite area which seek to reduce the conflicts generated within the investment itself; in addition, one notes a certain tendency for concessionaries and work contractors to pass review on a series of political and institutional procedures adopted in relation to the region and to the "host" society of the undertaking.

THE MOTIVES FOR the sector's unprecedented efforts at review and self-criticism are no doubt worthy of consideration, mainly because they are the product of the contradictory and conflicting character of the large hydroelectric development projects themselves. However, this contradictory character assumed by the development of productive forces—here, a significant portion of the industrial infrastructure—is not specific, nor exclusive, to the sector in question; it is present, as we shall see, throughout the modernizing of the economic base that the north and central-west regions of Brazil have been experiencing from the 1960s to the present day.

Several of these motives can be traced back to the same source: the dialectical destructuration-restructuration that are the basis for the contradictory character of the large official projects of regional development. It is the very characteristics of these investments—territorial dimension, "site" type productive unit, and self-contained life—that engender the need for promoting a social and economic destructuration and dis-occupation of the territory in order for material and social bases to be introduced and structured, and upon which regional development will find its support.

Thus, in the specific case of dam-building projects, it has already been demonstrated elsewhere (Tude de Souza 1986) that the undertaking is not something strictly localized that one can analyze as any other kind of industry. The electrical dam-building enterprise is something that extends for thousands of square kilometers and includes—in addition to the power-generating stations, dams, dikes, and reservoirs—lumber, soil, sand, and stone loan areas; dozens and even hundreds of kilometers of heavy-use service roads, ports, airports and

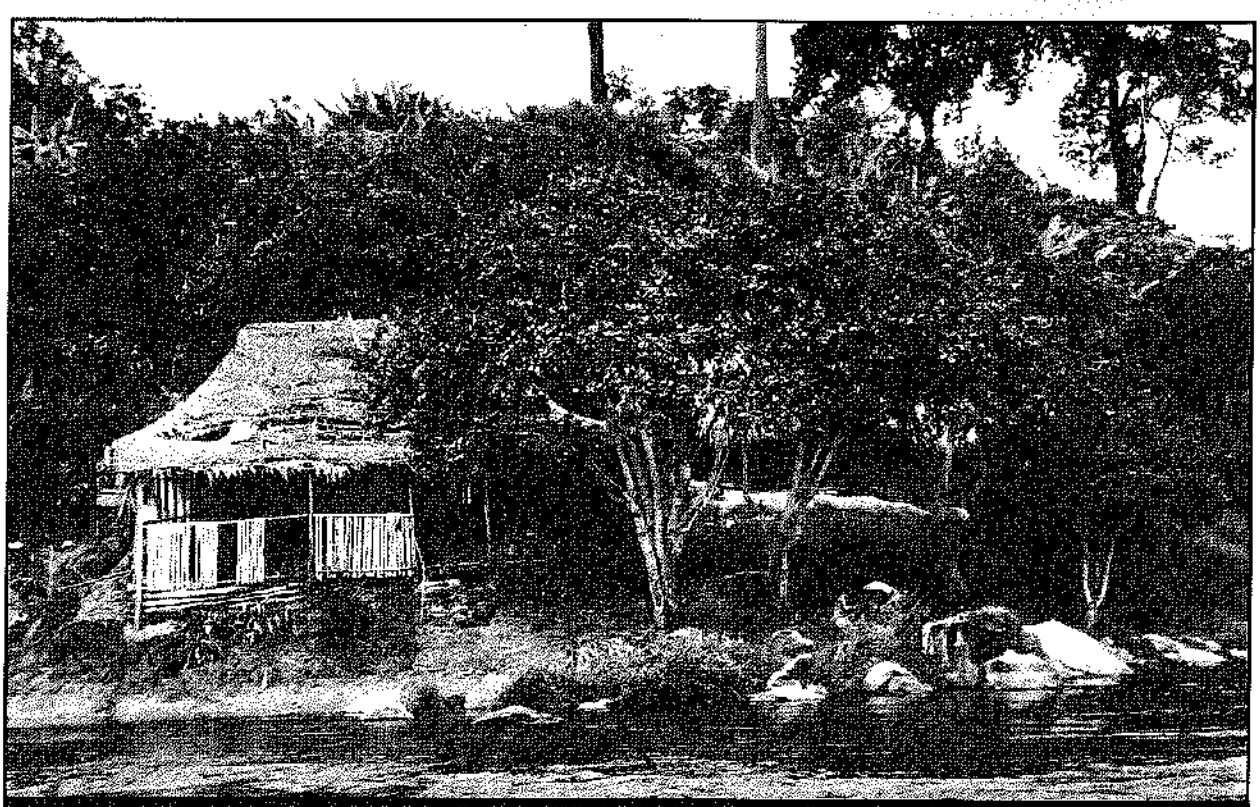
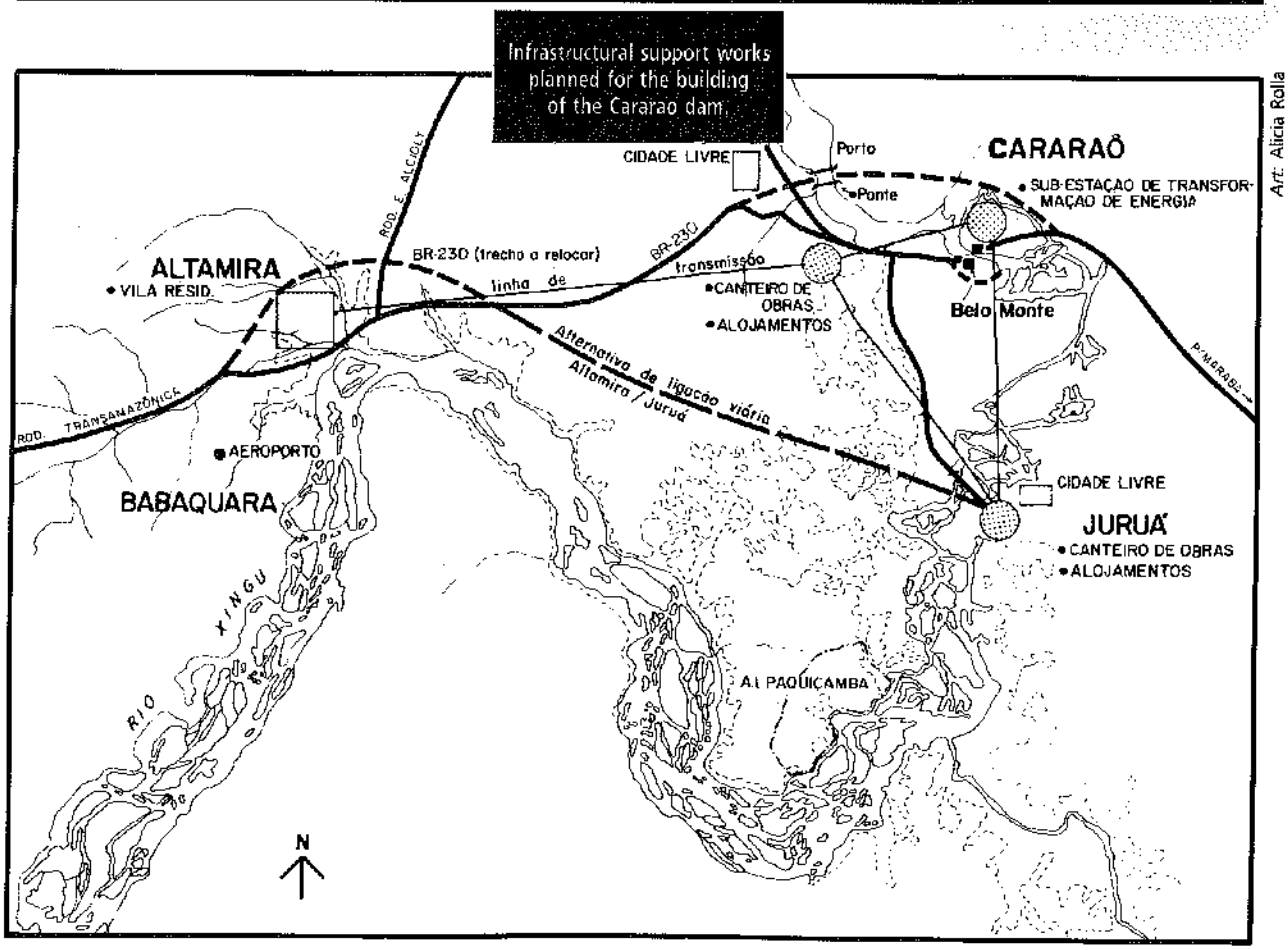


Photo: CPI/SP archives

The people who inhabit the banks of the Xingu River will suffer the consequences of the building of the Cararao dam—even before the reservoir is filled. The region will be drastically transformed when the infrastructural dam works are implemented.



Art: Alicia Rolla

heliports; administrative and industrial areas and installations; and assembly areas.

The list would not be complete if, however, it were to omit the several areas destined for the administration, lodging, and consumer needs of the thousands of direct and indirect employees. One may also add that simply to build the work site and its productive infrastructure, it already becomes necessary to disoccupy several areas and evict riverine dwellers and those near the sites that will suffer some type of intervention, whether from the future (and final) organization of the hydroenergy site or from the temporary needs of the work-area agencies.

Thus, the process of economically appropriating the water and environmental resources needed to produce hydroelectricity always implies a previous process of dispossessing and reconverting the material and social base of the region. Many of those who suffer dispossession, resettlement, or simply relocation end up not leading successful lives; they cannot reestablish themselves economically and socially in the productive way they once had. Others, although more fortunate, can never regain securely their old lives.

Competing for this are the abundant offers of male employment and the dynamics of the third-hand retailer and personal service lender, which end up creating an illusive scenario in which one can go from being a peasant to being a small-scale urban merchant or independent laborer. The process of dispossession is thus burdened with a certain popular consent in relation to its future proletariat.

Moreover, it is worth considering even that, for many of those "affected" by relocation, resettlement, and dam-building initiatives, what is at work is not merely of a material or juridical order; a whole historical and cultural dimension is being seriously threatened—when it is not destroyed—that does not translate necessarily into land, housing, improvements, or eating habits. It is worth recording here the totality of previously acquired, developed, and accumulated knowledge on the use of the land, forests, water sources, and waterways.

Consider the fishermen, whether they be regular or part time, small, medium, or large scale. One of the immediate consequences of the damming of the waterways has been to alter the fluvial routes and reproductive areas of the fish, which kills and even makes extinct entire species. The fisherman who otherwise knew intimately such species and their behavior now—with the damming, containment, diversion, and powerful discharges of water—sees himself deprived and violently dispossessed of an entire subjective universe (if not material in itself) that was the center of his immediate survival or, in most cases, of the universe of his social reproduction as a fisher, merchant, or simple, independent worker.

In the same way, the cases of populations downriver from the dam-building could also be included here. They will be victims of a process of diffuse expropriation brought about by the different alterations in the hydrofluvial system now put under the centralized administration of the hydroelectric plant. Fishermen, boat hands, merchants, washerwomen, and agriculturists of the várzea and lowlands will certainly be affected at different times by dwellers and users of the river upstream and downstream from the reservoir and its damming, and this list could even include the "estuary dwellers" and "coastal dwellers."

It is clearly not sufficient to deal only with indemnifying goods, property, and cultures or to seek definitive solutions with the plans for resettlement and relocation. It is important that all the impacts, implications, and diffuse consequences be foreseen; a productive apprenticeship and a social law of reproduction cannot be seeded like plant species and are not moved around the land like a house, a fence, a stable, or even an industry. They are, indeed, historical products germinated and fertilized by a whole economic and cultural environment that makes them suitable for reproduction and preservation; otherwise, they are worn out and thus suitable for overcoming and transformation. It is mainly through human action and not, as it is now intended, through administrative and environmental management.

The regional conflict thus reappears reworked and redefined by the very process of economic modernization of the region. Its new themes are dispossession, proletarianization, and violence in the field. Work and salary, daily and weekly wages are also objects of conflict in various areas and also in Amazonia; among the workers' themes, food, health, and education come to comprise the political agenda of regional conflicts (ABRA 1984).

It is not by chance, then, that the large investment projects implemented by public and private authorities in Amazonia are marked by their conflicting and contradictory nature. In being based on *a dynamic of destructuration and restructuration* of the regional economy—be it a dam-building work or an export corridor—the positive value of the single investment in itself does not come to have visibility; rather, it remains buried under the rubble of the regional society that it tried to transform.

The "Regions of Intervention" in Amazonia

The recent process of incorporating the Brazilian Amazon into the national and world capitalist economy has engendered (a series of) profound transformations in all areas and sectors of regional life.

Its marks are, no doubt, economic modernization and the spreading of social conflict. This process first developed in the 1960s, through the advance of settlement, the extension of the private property system and the market economy, and the introduction of large-scale agricultural and industrial production.

As such, this process forms part of the movement to extend the economic and social space of capitalist domination in the country and, since it is a region where expansion has taken place recently, a process of extensive development; at the same time the intensive mobilization of production and the creation of new labor forces have become combined and articulated. Salaried labor is presented as the only alternative for the economic integration of those laborers who have become alienated and dispossessed from their means of production and survival.

This process, however, was not merely the work of some isolated capital; in effect, numerous programs were conducted and measures taken simultaneously by the governments and private capital interests, sustained by the new alliances that definitively tied the Brazilian state to the interests of industrial and international financial capital. Thus emerges a new picture with significant changes:

- the introduction of a commodities market in the regional society;
- the emergence of new social relations caused by a view of land and labor as objects of mercantile trade; it is worth noting the aggravating circumstances represented by the fact that the regional society was organized around an extractive economy;
- the productive mobilization of the labor force is definitively disconnected from agricultural markets; industrial labor forms are set up in the principal cities of the "agricultural frontier," becoming articulated into the regional economy on the basis of the interests of mineral-metallurgic and energy production;
- occupation of the territory disorganizes the old network of riverine communities and disrupts the "isolation" of the forest dweller in order to promote a process of disoccupation of long-time inhabitants from their possessions and use areas; roads replace rivers and streams; towns replace the villages and huts of the caboclos;
- from the forest to the edge of the road—this has been the trajectory of the worker, the inhabitant, the caboclo squatter, the Indian, or the Black who may have been there.

Indeed, it was with the advance of forms of legal land ownership that one can substantiate this entire process of productive appropriation of the Brazilian Amazon. In order for a new perception of the Amazon economy to be imposed on its old extractive base, it was necessary to connect private property to commodity consumption, mediated by monetary trade. The roads fulfilled this role of diffusion agent for the general form of commodities, money, and social labor.

Money, merchandise, and laborers were supposed to come over the highways of "integration." And that was what came, and still comes, in both directions along the Belém-Brasília, Cuiabá-Santarém, and Trans-Amazon highways.

Accompanying them came the federal government's colonization programs, then under the military regime. The inequality is obvious: the lands of the highways were confiscated by decree, considered public lands belonging to the Union while, on the other hand, the long-time inhabitants, property owners, squatters, Indians, and colonists faced a slow process of legal regularization.

The agrarian reform anticipated by the Goulart government thus came to be splintered into a thousand "institutional efforts" that increased its bureaucratization and delayed its solution. It was this institutional action that gave visibility to the new political subjects who today maintain an intense presence in Amazonia as a whole, particularly in the eastern part.

With the opening of roads, especially the Trans-Amazon Highway, a new arrangement of territorial occupation began, occurring "spontaneously" through settling and dislocating the demographic frontier in the direction of the states of the Brazilian mid-north, north, and central-west.

THIS NEW PATTERN of territorial and economic occupation intercepted as much the north-south agricultural fronts as those that had come from the northeastern drought zone, arid interior, and forests to the humid valleys of the pre-Amazon region of Maranhão.

There was thus a "meeting," a shock of two expansion fronts of Brazilian society in the direction of their areas of recent occupation: one comprised of migrants pushed out by social pressures from the field (mechanization vs. small landholder, and large landholder vs. expropriation), and the other of a mercantile character, medium- and large-scale businesspeople backed up by the approval and financial stimulus of the military governments.

It was into the heart of this latter front that the cattle-ranching and lumbering projects, the large industrial infrastructural projects, and mining enterprises advanced, which not only permitted the advance of a new economic frontier for capitalist accumulation in Brazil, but also its consolidation.

It is within this front that salaried labor began to spread as a "lesser evil"—at least when compared to hunger and the deaths of families of agricultural laborers, rubber tappers, and nut gatherers who were gradually displaced and pushed off their territory by ranchers, lumber companies, and mining companies served by the "national integration" roads.

The policy of territorial occupation put into effect by the government combined in this way the advance of highway fronts with the colonization programs, in certain cases including them in the context of regional development programs, such as Polamazonia, the Great Carajás Program, and the Calha Norte Project.

Their foundations, however, rested on a hard-line

policy of federalization of lands and a controlled and selective land redistribution, combined with a veritable geopolitical strategy for controlling the priority areas for capitalist development. Diverse regions for state intervention were then created for the purposes of reconstituting the local power bases and securing ordered relations between landholders and squatters, as well as permitting the Brazilian state to concentrate and direct its financial and productive investments.

Around 1973, the government declared itself to be in favor of land concessions along the Amazon highway for the purpose of creating new development poles in the region. This meant coordinating government action and the interests of private capital through several programs of intersectoral development, the priorities of which were ranching and mineral development integrated by export corridors, along with improvement and transformation units. The Polamazonia was thus inaugurated and with it, a new vision of Amazonia: no longer merely a problem region but above all a new frontier for domestic and international financial resources.

In 1974, the economic and occupation policy for Amazonia changed its direction, resulting in the partial abandonment of the official colonization policy and in total priority being given to "integrated" investments, in which the private sector experience would come to serve as the basis for structuring the new regional society (Ianni 1979a, 1979b; Martins 1982).

Within the 15 parameters of investment chosen to "polarize the development" of ranching and mining activities, nearly all of the program areas were superimposed or juxtaposed on the zones of the most acute social tension in all of Brazil's north and west (Rodrigues and Silva 1977).

To give an idea: nine poles had ranching activities as their priority, three had exclusively mining development, and the remaining three were supposed to receive and support the development of agromineral activities. Seven poles were located in the state of Pará, where all emphasis was to be given to the five ranching poles (Xingu-Araguaia, Araguaia-Tocantins, Altamira, Tapajós, and Marajó) and the two mining poles (Carajás and Trombetas).

It is interesting to note first of all the superimposition of a single area in different poles, as is the case in the Araguaia valley, the Xingu valley, and the Tocantins in relation to the Araguaia-Tocantins, Xingu-Araguaia, Altamira, and Carajás poles. Secondly, it is worth emphasizing the strong concentration of these areas near natural access routes and corridors of the south of Pará.

In 1976 the federal government decided to concentrate its investments on eight of these fifteen poles, of which four were situated in Pará: Trombetas, Xingu-Araguaia, Araguaia-Tocantins, and Carajás.

By 1978, the tendency toward spatial and sectoral concentration introduced by the program in question was very clear: the applications made in four of these eight poles related to urban structuring and to transport were about 62 percent of the total investment in these poles under the jurisdiction of the Superintendency for the Development of Amazonia (SUDAM), while all expenses and investments in agriculture diminished by around 10 percent in the two preceding years. In a parallel fashion, a tendency developed toward the concentration of approximately 41 percent of the total resources invested in only two poles of eastern Amazonia: Carajás and the pre-Amazon of Maranhão (Tude de Souza 1983).

In fact what was taking place was more than the simple financing of capitalist implantation in agriculture: it was also the strengthening of urban support structures for productive activities in such a way that the cities, centers of regional development, would provide the necessary conditions for the dispossessed populations, forced out of their lands, to remain in the area, guaranteeing a labor supply for the productive investments implanted there (Tude de Souza 1983).

The strengthening and consolidation of certain cities in the 1970s in Pará, such as Marabá, Altamira, and Santarém, seems to confirm this logic, which stipulates that the urban centers could provide the conditions necessary for stabilizing a ready and available labor force that would then become involved, as salaried workers, in the new capital coming into the region.

The Conflicts in the Modernization of Amazonia

With this policy of occupation based on the creation of regions of intervention, the Brazilian state declared its intent (first mentioned in 1974–1975) to relativize its support to small agricultural production and to the (so-called) peasant sectors. Its option would thenceforth be through capital, disposed also to invest in private colonization programs.

Despite governmental efforts, the landholding question worsened, making it clear that the "Amazonian solution" became in itself a source of conflicts as serious as those that had always shaken the Brazilian northeast.

Making a balance of the social conflicts in the field, José de Souza Martins wrote the following on Amazonia:

> In 1971–72, only 6% of the serious conflicts took place in this region, which corresponds to 6% of the total number of victims (dead and wounded) recorded for the entire country by the National Confederation of Rural Agricultural Laborers (CONTAG). Up to 1974, land conflicts developed mainly in other regions of the country. By 1975 and 1976, however, 60% of the landholding conflicts took place in Amazonia, of which 76.5% were comprised of confrontations considered serious and with deaths or persons wounded. Not only did the

> number increase in the region more quickly than in the country as a whole, but in the interior the number of conflicts with victims increased at a vertiginous rate. Among the serious conflicts that took place in the country in 1976, 82% were in Amazonia. In the same year, 90% of the deaths which took place in these confrontations throughout the country were those in Amazonia.... If one continues to 1979, the tendency is confirmed for, in this year alone, 128 landholding conflicts were recorded in the state of Maranhão, involving more than a thousand people; in the region of Conceição do Araguaia, in the south of the state of Pará, 43 landholding disputes were recorded in the beginning of the year, 55 in July and 78 in December. (Martins 1980)

In 1981 the journal *Movimento* counted fifteen cases of assassinations of rural leaders since 1980, among which at least ten took place in the north and central-west, four of which occurred in Pará, and one in Maranhão (*Movimento* 1982).

Having assessed the importance of such confrontations—where land and labor became strategic questions for "development and national security"—and particularly their repercussions in the south of Pará, Maranhão, Goiás, and Mato Grosso, the federal government replaced the Special Coordinating Committee of the Araguaia-Tocantins (CEAT), connected to the National Institute for Colonization and Agrarian Reform (INCRA), with the Executive Land Group on the Araguaia-Tocantins (GETAT), connected to the National Security Council (NSC) and the Presidency of the Republic.

The creation of GETAT seems to have thus been a direct result of class struggles in this region, which resulted from the difficulties of access to property and exploitation of land, and clearly expressed the contradictions between antagonistic concepts about the directions of development in the region: on one side were possession of land, family, and communal labor in gardens, as well as autonomous and independent occupations; on the other were, side by side, juridically fixed private property, salaried work and its productive discipline, as well as the interests and requisites of the valuation of capital (Reis Filho 1984).

An entire vast region—between the Tocantins and Xingu valleys, east to west from Imperatriz (MA) to Altamira (PA), and from the border of Pará and Mato Grosso and the Bico do Papagaio to the capital cities of Belém and São Luis—unavoidably experienced these antagonisms.

This included in good measure the entire territory served by the Cuiabá-Santarém and Belém-Brasília highways, the penetration and settlement of which elevated the rates of annual growth of the population of Pará much above that of the country in the 1970s; it is in this decade that the Brazilian population went from predominantly rural to urban (IBGE 1980).

By 1983, the importance of the official projects on the demographic behavior of several Pará municipalities over the last few decades—such as Oriximiná, Almeirim, Marabá, Tucuruí, and Altamira—was pointed out (Tude de Souza 1983). In truth, one was not dealing with isolated or atypical patterns of behavior. Plotting of the demographic growth rates clearly shows the dislocation of the population fronts through their territories. According to the IBGE (1980), the state of Pará came to be occupied in a priority fashion in a north-south direction along the two territorial strips—the west and east—which accompanied, in an identical way, the routes defined by Highway BR-163 (Cuiabá-Santarém) and Highway 010 (Belém-Brasília).

These fronts accompanied the government and private investments that have been considered until now. In its eastern portion, demographic growth was concentrated around several investment poles, such as the Carajás Railway, the Great Carajás Program, the Tucuruí dam, the Albrás work sites, in Barcarena, and the production of bauxite (Mineração Rio do Norte) in Trombetas, as well as the municipalities cut by the Trans-Amazon Highway and by official and private colonization projects such as those of INCRA in Portel, Altamira, and Prainha or of Andrade Gutiérrez in São Felix do Xingu.

To the grandiose ranching, colonization, construction, and mineral development projects were added the waves of southern and northeastern migrants, attracted by better opportunities for their survival. To these, too, were added those who were already on their lands and had known how to conserve them:

- the indigenous populations, with their historical territories and cultural practices;
- the caboclos of the forests, with their practices in tune with natural calendars and at the mercy of the whims of the liquor-dispensing patron or the labor overseer-merchant.

Another social group in contact with these groups animates the life of interior Pará: a diffuse figure who appears suddenly and with gold and cassiterite rushes—the prospectors and their gangs of intermediaries, overseers, and patrons.

All, or almost all, were forcibly removed or pressured to leave their lands, shelters, and situations; some followed the fronts that had dispossessed them, others remained to try again. The result was that, in all the centers of the projects mentioned, the annual growth of the urban population was, for 20 years (from 1960 to 1980), much higher than the rate of growth for Belém.

Thus, while in Belém the annual growth rate from 1970 to 1980 was 3.3 percent, in municipal centers such as Tucuruí, Almeirim, Marabá, and Orix-

iminá, the annual growth rates were, respectively, 22.7, 19.7, 10.5, and 8.6 percent (IBGE 1980). All neighboring urban sectors tend to maintain these high levels of population growth (Tude de Souza 1983).

All of this means that the state of Pará's modernization and economic outfitting resulted, among other things, in the urbanization of its interior areas, thereby relativizing the historic power of the state capitals in the north (Muller and Cardoso 1977). The four municipalities cited above were all centers of some large mineral, metallurgic, or energy project.

In addition to the range of investments under direct control of large public and private capital, the prospecting sites were an important factor for attracting settlers to the state of Pará; they brought together 140,000 men distributed in Itaituba (60,000), São Felix do Xingu (30,000), and Serra Pelada (50,000), which corresponded to approximately 60 percent of the total prospector population recensused by MIRAD in 1986 in the official prospecting areas. Added to these numbers of unorganized workers were another 40,000 men installed in the areas of so-called "spontaneous" prospecting, located in areas next to those under government control by the National Department of Mineral Production (DNPM).

Thus it is not surprising that the annual demographic growth for the entire surface area appropriated by such sudden appearances of mining and mining fronts in the Xingu Valley today present rates above 15 percent (Hamelin 1986), much higher than the annual state rate of 4.6 percent released by the IBGE (1980).

The occupation of these territories in the middle Xingu Valley was, in large part, restricted to the 1970s when, with the Marabá–São Felix connection, the region was to be converted into an important penetration route. All of this region, previously included and administered within the bounds of the Altamira Pole and in part included in the agromineral sector of the Xingu-Araguaia, is today under the administration of the Superintendency of the Great Carajás Program.

It is in this last vector of occupation of the state of Pará that the Altamira Hydroelectric Complex (Babaquara-Cararaô/Juruá) will be implemented, and, with it, one more dam-building front in the Eletrobrás system.

The Brazilians of the Xingu: Colonists, Prospectors, Lumbermen, Riverine Dwellers

With the program for hydroelectric development projected for the Xingu River Basin, the set of municipalities that comprise the Altamira Pole will go through a new series of territorial, demographic, and economic transformations (with the exception of Almeirim, on the left bank of the Amazon, the center of Jari). Going upriver from its estuary on the lower Amazon, these municipalities are: Porto de Moz, Prainha, Senador José Porfírio, Altamira, and São Felix do Xingu, on the border of Mato Grosso, where the upper Xingu runs and has its source.

In the vast territory of central and southern Pará, which covers more than 400,000 km² (approximately 5 percent of the country's surface area), a wide range of activities is taking place, which, according to our previous analysis, either already comprise the economic base of the region or have been promoted by the recent capitalist development of the last two decades, with particular emphasis on eastern Amazonia.

The decisive importance of these activities is undeniable: farming and cattle ranching (e.g., cattle for slaughter, pepper, cacao, coffee), mining, and intensive forest exploitation (for timber of good quality and for charcoal). Despite this, various traditional occupations of the Amazon economy continue to be the principal means of survival for the regional population: gathering castanha, cutting rubber for the production of latex as a market product, and working the land for subsistence (manioc, corn, and beans), as well as fishing and hunting.

The total population of the six municipalities in 1985 was on the order of 220,000 inhabitants, of whom 65,000 were in the municipal centers, 3,300 in two districts (Porto Vitória and Belo Monte), and around 38,000 in prospecting areas, of which 30,000 are in an official border (Cumaru) and the rest in three spontaneous areas (Redenção, São Felix, and Altamira). The strictly rural population, settled into their lives on the farms, ranches, smallholdings, and in some villages on the banks of the main river, its tributaries, and streams, and on several of the many islands, is estimated at around 20,000 men, women, and children who live in colonies along the Trans-Amazon Highway, in 32 glebes and 18 camps that comprise the Altamira Integrated Colonization Program (PIC Altamira).

The PIC Altamira was distributed in several "trunks" along the BR-230 Highway. In Prainha, on the western extremity, the situation is one of relative success, representing the most significant portion of the resident population—11,648 inhabitants (SUCAM 1985)—and the second-largest capacity for expansion of the area harvested for foods (IBGE b); in all parts of the Altamira PIC are located clusters that have served as urban "centers" for the period of implantation and consolidation of the glebes—the nuclei of Uruará (km 180), today out of the PIC's jurisdiction, and Pacal, where the Abraham Lincoln distillery is located (km 90), and the agropolis Brasil Novo, with its 2,300 inhabitants (Hamelin 1986).

Any intervention to be made upstream from Altamira—as, for example, the Babaquara dam and lake—will certainly affect a part of these glebes and, in general, all of the left bank and slopes of the Iriri

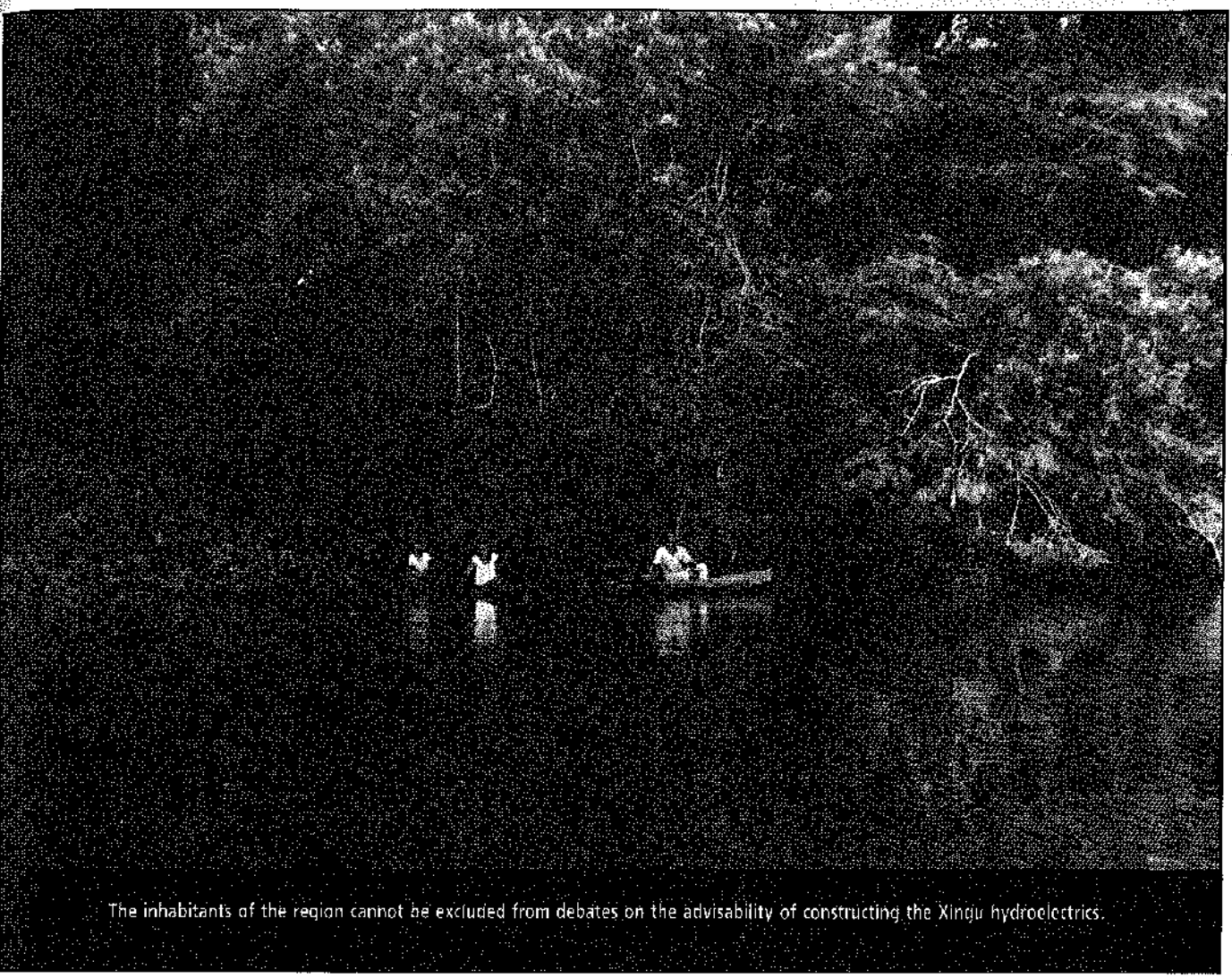


Photo: CPI/SP archives

The inhabitants of the region cannot be excluded from debates on the advisability of constructing the Xingu hydroelectrics.

River—exactly where the strip destined for colonization along BR-230 passes. Perhaps for this reason the investment promoters' option seems to be to make only the Cararaô lake public.

In the east, we have the glebes and agrovilas of the stretches of Altamira—with seven agrovilas and the rural nucleus of Leonardo da Vinci—and of Senador Porfirio, with only camps; on these stretches, the number of colonists is much smaller—around 1,100 on each—and a small portion of lots projected have been demarcated and titled, indicating the program's "embryonic" state. Next, one notes by the data available an expansion of the size of the lots and properties, with a tendency for landholding concentration on the lots above 10,000 hectares; while the extreme eastern part of the PIC, Portel, has a typically "frontier" economy, with cattle ranching and rice cultivation, and a single notable rural cluster (4,000 inhabitants), where only 5 percent of the population resides in the official colonization areas (SUCAM 1985), and the urban population itself has decreased in recent times (IBGE a).

Another kind of rural occupation is found to the south, in the municipality of São Felix do Xingu where, between 1980 and 1985, the area of rural establishments increased greatly due to the growth of large property: out of a total of 446,000 hectares recensused, 340,000 belonged to only five establishments (of the class "larger than 10,000 hectares"). There is no official colonization in the area, but this municipality was one of those that most received projects initiated by SUDAM, including one of the large private colonization projects (the Tucumã, of the Andrade Gutiérrez construction firm), as well as several mining projects.

Before all of these colonists, squatters, and riverbank dwellers settled in, various indigenous tribes were already living in this region. Today they reside in villages with ever undefined territorial rights, villages that represent important parts of the municipalities of Prainha, Altamira, Senador José Porfírio, and São Felix. One of these areas will be flooded by the Cararaô "lake": Paquiçamba, midway between Altamira and Belo Monte.

What led to the first wave of occupants more than 40 years ago was rubber: many of the so-called "rubber soldiers" went up beyond the Great Bend, entering by the Iriri River, by the middle Xingu, and by its tributaries. Castanha-nut gathering, too, was, and continues to be, a factor leading to settlement on the riverbanks and in the "centers" of the woods.

The isolated groups planted for subsistence and for communal consumption, and commercial trade came through a credit system that functioned as quasi-perpetual indebtedness, contracted with a distant rubber patron or a river merchant who went up and down the river. More recently, such social relations have been reproduced by entrepreneurs, saloon owners, and, where there are already roads, truck drivers.

Out of this pioneer period came also the mineral prospectors, today an integral part of these dynamic processes, "emerging" from the municipal economies at several points in the state of Pará, such as São Felix, Marabá, Itaituba, and especially, throughout the area of Tapajós and the Great Bend of the Xingu, where alluvial gold and cassiterite are still extracted today. These reserves account for half of the mineral deposits of the entire group of six municipalities (Ilha da Fazenda and the banks of the Bacajá, Ituna, and the Itatá). The mining companies Alterosa, Oca, Rio Jatobá, and Triunfo are operating there, and, further to the south, in the direction of São Felix, are Canópus, São José, Taboca, and Brasinor (MIRAD 1986).

In summary, where rubber, castanha, and prospecting historically made up the axes of the regional economy, today mineral production, following in the tracks of the old prospecting sites, has given rise to a reevaluation of certain areas of mineral deposits and a new form of exploitation, now corporate, of the valley's natural resources. The prospectors accounted for by the DNPM and MIRAD in 1985 amounted to nearly 40,000 men, two-thirds of whom were at the Cumaru mine, and the rest between São Felix and the Great Bend.

The legal questions and the violence that characterize the areas of mineral exploitation are so acute and widespread that prospectors' associations and unions have formed throughout Amazonia; today, according to the DNPM, the federation of these organizations includes nearly 400,000 men on the various "institutional" reserves. In the Xingu region in particular, confrontations among corporate mining, prospecting, cattle ranching, and colonization interests contribute to this climate. Several areas have already been noted, including by official reports (MIRAD 1986):

- on the Itatá River, region of the Great Bend, after 10 years of legal disputes between prospectors and the Oca Mining Company, 3,000 men were forced out in 1986 and are today taking legal action against the company in order to guarantee their presence in the area; they have organized into a cooperative for the common defense of their interests (municipality of Senador José Porfírio);
- in the Carapanã Glebe, part of the Tucumã colonization project, municipality of São Felix do Xingu, the legal disputes of the private company and the prospectors of Manelão and Gavião; in the same municipality, the conflict between squatters and about 5,000 prospectors, and the Comipa Company, on the Anajó Glebe, in 1986;
- several mining companies have concession areas superimposed on indigenous territories; in the state of Pará, according to MIRAD, there are 23 such areas, obviously increasing the potential for conflict over the use and access to such locales and their valuable resources.

Another conflict in mineral activities that affects practically all gold prospecting areas, is one between companies and the regional population brought about by the technical options for extraction and processing of the mineral that contains gold. Not only does it severely damage the slopes and banks of the streams, but the process also leaves large mercury and other heavy metal deposits in the waters running through the mining areas. The microbiologic contamination, if it occurs, will spread to precisely the areas where the regional and indigenous populations live.

Lumbermen always were numerous and highest on the economic chain in the Xingu Valley, as in other parts of eastern Amazonia and the Brazilian central-west. Having arrived with the railways, as well as the few water routes with the traditional log runs (the case of the "bays" of Marajó, Portel, and Breves Canal, for example), and financed by outside capital and at times by foreign capital, the lumber companies have greatly expanded in the last 15 years. Currently, about 75 percent of the total value of extractive production of the six municipalities consists of logs and boards of good-quality lumber (with 95 percent of this concentrated in São Felix and Portel).

Lumber exploitation is achieved through two distinct modes of organization. On the one hand, the activity is fundamental to the process of incorporation of new agricultural pasture areas, as well as to the opening up of new colonization glebes, although the commercial use of timber is complementary to the principal goal of the enterprise—as is the case in Portel, for example. On the other hand, the forest is exploited in an even more intensive form, to supply extra-regional markets and the craft industry (veneer, stone blocks, plates, bodies of vehicles), the furniture industry, and civil and naval construction—as is the case in São Felix do Xingu or Imperatriz-Açailândia, in Maranhão.

According to IBDF records (1978) and the IBGE census (1980), a schematic diagram could be traced and several estimates made of the importance of lumbering activity in the Xingu Valley and in the Altamira Pole region:

- for the entire north of the country, the lumber companies officially registered in Pará (530 productive units) represented 70 percent; two years later, in the six municipalities of the region, 33 sawmills

and furniture and craft industries were registered (11 in Portel, 9 in Altamira). Given the state standards that differentiate among small, medium, and large units, we would have in the six municipalities about twenty small and thirteen medium and large units, which allows us to estimate the labor directly employed (Cedeplar 1979);

• on the average, 10 men are needed to run each of the small sawmills (including the lumberjacks), which would total at least 200; for the intermediate units, which cut between 800 and 1,000 cubic meters per month, 30 to 80 men work; and the large units, that cut 4,000 cubic meters or more per month, could have between 400 and 500 men employed. Based on these data, it could be inferred that in 1980 the number of direct workers was on the order of 2,000 to 3,000 (Cedeplar 1979).

These emerging socioprofessional categories, salaried and integrated into the social relations of the market, find their principal source of supply and consumption in the urban areas, despite their being based in camps in the middle of the woods or in precariously placed villages at highway crossings. These contingents of lumbermen and prospectors comprise, together with the colonists of INCRA, the Indians mentioned previously, and the other riverine dwellers, the subjects of recent and future regional history. The hydroelectric developments anticipated for the Xingu Valley will make the basis for survival and reproduction of these groups inviable, by flooding lands and waterways and by expropriating strips of domain and places for work areas.

For that reason, they cannot be left out of debates, negotiations, and official calculations on the so-called "populations to be contemplated" with assistance programs, relocation, and services resulting from the project's environmental repercussions. In this case, this includes the other riverine populations: riverbank dwellers, boatmen, shell fishers, and other inhabitants, including urban dwellers, who find in the river and lake life the means for their survival and social reproduction. In the area of the Great Bend alone, more than 2,000 of these citizens have been recensused; in the urban area of Altamira, about 18 percent of the municipal population is being forced to give up their houses, lands, and streets to make way for the Cararaô reservoir—about 15,000 or more people, depending on the time when the "lake" is closed.

These urban areas, customarily more subject to temporary floodings, are also the areas of most easy access for the low-income populations; thus, it is predictable that these will increase or the existing areas will become more dense as a result of the construction works. The riverine districts represent more than a simple habitat: they are a veritable way of life through a combination of subsistence farming on the land and the river shallows by fishing, shell fishing, and water transport. The damming of Cararaô, in relation to these districts of Altamira, and of Ipixuna, in relation to the districts of São Félix, will result not only in the transference of the population to new locales, but also in the destruction of a series of strategies for reproduction, through which these riverine dwellers seek to guarantee their lives as autonomous or independent workers.

Although they will not lose their boats, hammocks, and "ice machines," the fact is that the fisherman and the river merchant will hardly have the same access to the "river" or to the same possibility for fishing, since the fish will be different or will be elsewhere. Even though they will keep some of their tools and equipment, the fishermen, among others, will be deprived of an entire productive knowledge accumulated through decades of patiently observing nature: a way of knowing the seasons and the annual rains, the fish and other animals, their burrows, their runs, their routes. These are irrecoverable losses when compared with the possibilities of re-leasing of lots, shacks, or warehouses.

If the projected works are completed for the purpose of an integral hydroelectric utilization of the Xingu, numerous portions of these groups and socioprofessional categories will be affected, with greater or lesser difficulties. We could designate the process as one of de-territorialization of regional productive activities, which include the possibility of autonomy and freedom of work in extraction and subsistence. In its place are left the few salaried work options (or even in conditions of slavery) at the mines, lumber camps, in mining companies and, mainly, in the same worksite areas, in this or in other nearby regions.

We cannot forget, still, that the occupation of the Xingu Valley, clearly delineated today, practically closes the opportunity for occupation of firm lands to the south of the Trans-Amazon Highway. On the eastern side, the Araguaia-Tocantins "front" (which was intensified, from 1975 on, along with Tucuruí and Carajás) is already being consolidated, and on the western side, Cuiabá-Santarém, the "largest gold mine" of all determines the occupation of the Tapajós.

How Much Is the Future Worth?

If what has already been defined in the first versions of Eletronorte's Cararaô-Juruá project does in fact come to fruition, several repercussions will be observed in the region's economy and society.

First, the material and social conditions of reproduction of the population directly and indirectly affected by the works will be definitively altered by the formation of the reservoir and by its future management.

Beyond the simple de-territorialization that expropriation and new management cause—whether through the necessities of the work or through the filling of the reservoir—in the last analysis, it will be impossible to reconstitute and recover the conditions of reproduction previously guaranteed (Pinto 1984).

This is the case of agricultural laborers—indemnified, relocated, and even assisted—who will never succeed in regaining their previous conditions given the very difficulties of sustaining themselves for months while waiting for the next harvest, and being thus obliged to assume a series of lasting duties for a product that is most of the time uncertain.

After the planting period, the children and the younger generations, surplus population in small production, in general end up opting for salaried work in the worksite areas, abandoning their gardens and most other forms of additional family income.

What is in play in this process is not the material losses, which are accountable and indemnifiable; rather, it is the new statutes for social reproduction of the regional population. The man who does not already have juridically established property, nor access to the material means and environmental resources on which his survival and freedom depend, has but two alternatives left: migrate in search of other lands or become proletarianized by selling his labor.

This second alternative has even been cited as one of the "positive" factors resulting from the work, frequently serving as an instrument for its legitimation before the regional and local society.

The consumption of merchandise then follows the selling of labor force, making the individual laborer one more local link to national and international accumulation of capital. The riverine dweller in this way is on a road of no return: this is the trajectory described by abstract social work in its salary/consumer-goods metamorphosis, which will make the riverine dweller an instrument for the accumulation of capital.

THE LABOR MARKET PRESSURE opened up by the works leads to a process of accelerated growth of the urban population, in the face of which offers of public services are never sufficient, making urbanization intense and precarious. All of this grows even worse depending on the type of labor policy adopted by the work contractors and by the electric company. Thus, in hypothesis, it is not difficult to foresee that the urban population of the municipalities of Altamira, Senador José Porfírio, and Portel could multiply two or three times in a period of eight to ten years. The experience of the dam-building sector shows that, in Tucuruí, at the time when the effective labor force consisted of nearly 20,000 men (1978–1979), 2,000 were contracted every month and as many were dismissed; in ten months, the entire effective labor force of the worksite area could be replenished.

What in administrative language is called turnover, "rotation," reveals difficulties and incongruencies of recruitment and salaries and, more than anything else, wears down the municipality, especially its center, and the proletarian districts that grow on the riverbanks, along the roads, and on the city's outskirts. We can add other aspects of this completely altered, almost "abnormal," life in the cities that host the large worksite areas: the provisional nature of many of the laborers' residences becomes imbued in all aspects and details of daily life, and the standards of habitability decline along with the few services for potable water and sanitation. And these add to already terrible sanitary conditions, as are seen, for example, in the communities of prospectors and peons in the area of São Félix.

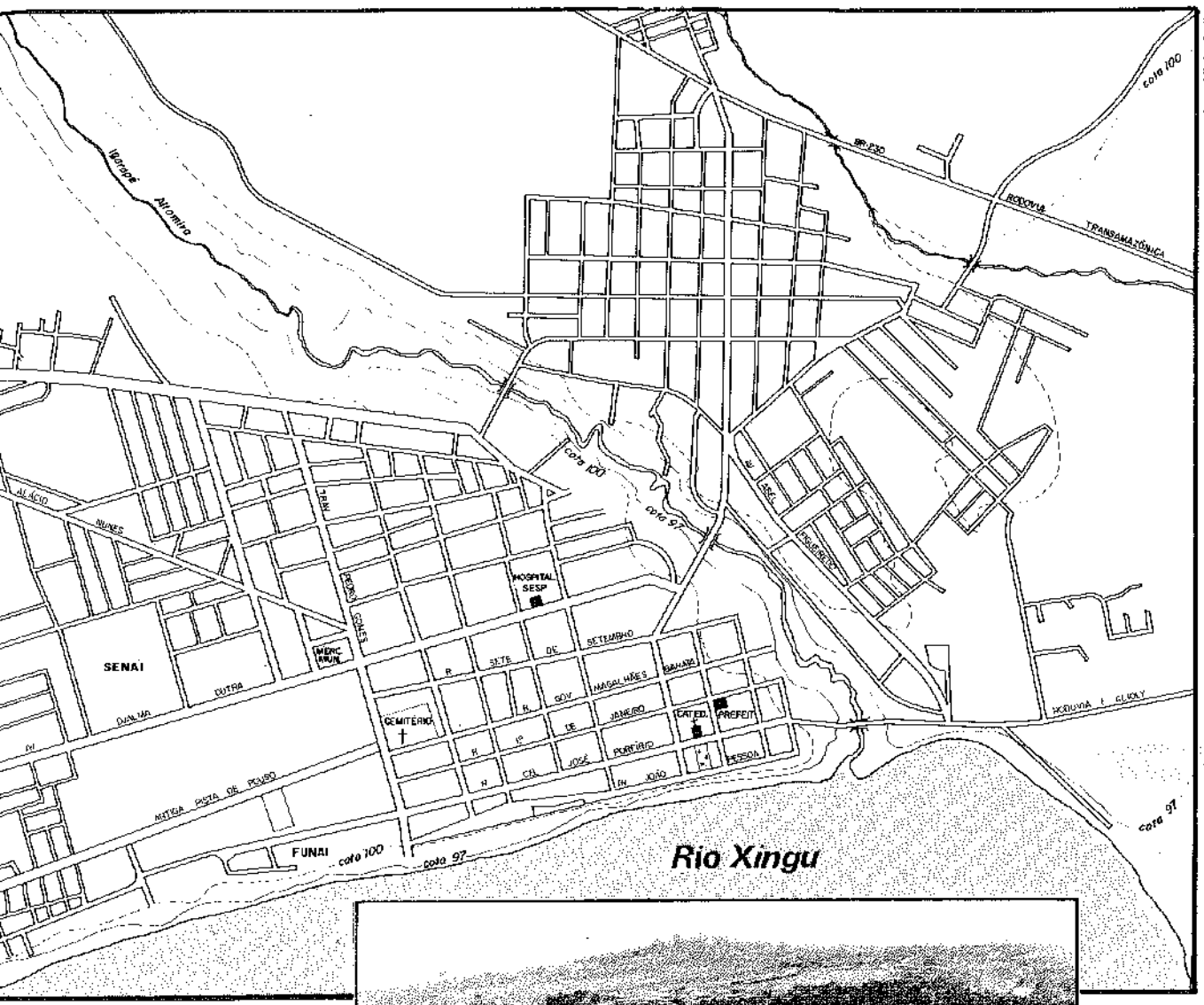
Once the work area has been initiated, together with the new categories of salaried workers, a new regional demographic matrix will be imposed for a contingent on the order of 6,000 to perhaps 10,000 single men between the ages of 18 and 30. This matrix will become established in the span of a few years, and will end up comprising more than half the number of people mobilized and attracted by the work area. Using the data from the 1985 PNAD, we can see that, in the structure recensused in the northeast and north, married persons make up, respectively, about half and two-thirds of the total.

In addition, the very composition of these migrants is also defined by the existence of jobs filled by outside professionals, requiring an average or high level of capability and specialization. The dam-building front of the Xingu, if it is really undertaken according to plans, could come to be one of the next "shopping malls" for the country's internal migration routes—as were, in recent times, the areas of Marabá and Tucuruí, near the Xingu.

So mobilized, the population is seen and treated by the companies in terms of what the individuals do and produce "on the works." The antiquity of occupation in the locale or in regions nearby, the skills acquired in local and regional cultures—all of this will be excluded from the project's scale of values. What will take place is a forced and painful process of acculturation and, in the last analysis, of change in dominant values.

What will happen in the long run to the vast majority of the local population and those coming from outside the area? The whole historical context will change, everything will have to adapt to the social relations and codes of recognition that give life to the economy and political administration of the undertaking and, as these are dominant, the result could come closer to the business and governmental goal: a new society, salary-based, fragmented into several groups with no social identity or common projects.

In the belly of expropriation, of compulsory wage-earning and of degradation of the conditions of reproduction, the true sentiment of exclusion and social differentiation is formed, expressed in several areas and residential levels, in organized transport and in the privileges, even though precarious, of "on file" work. In the life "from inside" and in the life "on the outside" of the worksite area, the perspectives of the employee and the dweller are very different; one could have an illusory future as a salaried worker, and the other certainly has no future, because of the same work.



Art: Alicia Rolla



Photo: CPI/SP archives

...e map shows the area of Altamira ...hose parts will be flooded by the for... ...ation of the lake formed by the Carara... ...am (level 97). The flooding will mean the ...moval of the people living in stilt-... ...atform houses on the Altamira Igarapé, ... shown in the photo.

And the region? It loses an important part of its material and cultural heritage. If social groups, even in modest numbers, are relocated, many things will simply be submerged, and local memory will be lost. The extent and physical dimensions of the material losses cannot yet be specified; much less can one find an adequate monetary equivalent to make up for this loss, not to speak of various situations in which there is no outright destruction but in which perceptible alterations take place, changes in the "rules of the game," other types and uses of social capital. For example, the following will be directly affected by the first work of the Xingu program (Cararaô/Juruá):

- approximately 300 km of federal and state highways, municipal and local roads, and, above all, in the same areas of the Integrated Colonization Program (PIC);
- three prospecting sites, several farms, and 60 local sites on the Great Bend, involving 5,000 out of a total of 30,000 prospectors;
- dozens of glebes of the Altamira PIC, at Asuriní, Ituna, the Leonardo da Vinci nucleus, on the Bacajá and Bacajaí;
- water ports such as Vitória and Remanso do Portal, as well as other landing sites and warehouses along the Xingu and the present port strip of Altamira;
- a district center (Vitória) and two villages: Belo Monte—in the municipality of Senador José Porfírio, where the river will dry up almost entirely, downriver from the Juruá wall—and Ilha da Fazenda, which will be submerged; several streets of the port and riverine area of Altamira, as well as three streams that run through the city, which will rise several meters, destroying or putting houses, lands, gardens, and orchards at risk.

Most seriously, in addition to the destruction of the so-called capital itself, is the destruction of a good part of the social memory. From the farinha house to the dockyards and corrals; from the tile and brick factories to the stones and mortars to process corn; from the dwellings and utensils made with local materials to the landscape of numerous small islands, rapids, and caves—the end will be the same, if "the work comes"; the bottom of a "river" that isn't even a river anymore!

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Indigenous Peoples of the Middle Xingu

Eduardo Viveiros de Castro
Lucia M.M. de Andrade

TERRITORIAL LOSS, demographic decline, forced assimilation, or flight to the interfluves have all marked the history of the peoples of the Xingu Valley since the beginning of the seventeenth century, when the Portuguese expelled the Dutch from the Dutch forts on the lower Xingu and began the process of European occupation of the region. Inhabited by a wide variety of peoples, most of them Tupi-Guarani speakers, the region of the Xingu-Tocantins came under various phases of this history of European invasion, which began with intense activities of evangelization and subjection of the Indians. For a century (1655–1760), Jesuit missions undertook the reduction and "descent" of the Indians, an activity that consisted of gathering different tribes into the same village settlements and imposing a *lingua geral*, for evangelization and labor. Such practices, accompanied by expeditions to capture Indian laborers for the colonists, resulted in the subjugation of large segments of the indigenous population. This first period was followed by the Pombaline phase—when the missions were emptied, repression and control over the labor force were increased, and expeditions continued for "descent" of the Indians who had resisted until then—completing the process of conquest and assimilation.

The European invasion of this populous region took place in a north-south pattern, following the course of the Amazon tributaries; it faced a great obstacle in the dangerous rapids of the Xingu, which begin around the mouth of the Iriri. Up to the beginning of the twentieth century, missions and towns were concentrated on the lower Xingu, up to the Great Bend (where the Cararaô dam will be built). Only in the last few decades of the nineteenth century, with the rubber boom, did colonization reach the region of the mid-Xingu, after which the city of Altamira was formed; it is exactly in this period that the majority of the indigenous groups living there begin to be mentioned (Arara, Asurini, Parakanã, Kayapó).

In this century, we have the developmentalist surge of the 1970s, with the building of the Trans-Amazon Highway, the arrival of the "spontaneous" colonization frontier, the policy of fiscal incentives, and the incorporation of lands into the land market. And, finally, in the 1980s, the region becomes the target for "large projects": gigantic works for the production of hydroelectric energy, railways, private colonization projects, and projects for exploitation of lumber, mineral-metallurgic programs, and so on.

In this lengthy process of European invasion, entire peoples, such as the Takunyapé and the Pacajá, have disappeared. Others have resisted and migrated, such as the Wayãpi—who crossed the Amazon and settled in Amapá—and the Juruna, Xipaia, and Arara, who moved to the south in search of less accessible areas at the headwaters of rivers or in terra firma zones. The Juruna, who occupied the mouth of the Xingu, began migrating in the seventeenth century, under the pressure of Portuguese expeditions (Galvão 1979: 63).

The first reports on the Juruna date from 1625 and locate them in the region between the mouth of the Xingu and the Pacajá de Portel rivers. During the seventeenth century, Portuguese and Paulist expeditions and missionaries tried to enslave and "settle" the Juruna in villages (Oliveira 1970: 16). The first successful attempt at converting the Juruna took place in 1655 on the "River of the Jurunas" (now the Iriri River) by Jesuit priests. These missionaries convinced two large villages to relocate to the Xingu, establishing them in the region near the Porto de Moz (then called Maturú). This was interrupted in 1661 by the first expulsion of Jesuit missionaries in Maranhão (Oliveira 1970:16–18; Nimuendaju 1948a:218).

Between 1662 and 1692, several attempts to capture Indians for slavery and evangelization were recorded; more often than not, these attempts failed. At the end of the seventeenth century, however, Juruna Indians were still living in missions of the lower Xingu, although most of them had already withdrawn upriver (Oliveira 1970:21). In 1750, they were found 30 leagues from the mouth of the Xingu, divided into four small villages located on islands of the same river not very distant from the first rapids (Oliveira 1970:22). According to Oliveira, shortly afterward, still in the mid-eighteenth century, the Juruna abandoned this place and went in the direction above the rapids of the Great Bend, where the Jesuits had established the Tavaquara (or Tauaquera) mission. This mission did not last long, for the Jesuit who resided there was killed by the Indians.

Reports on these Indians in the first half of the nineteenth century still locate them on the lower Xingu (Oliveira 1970:23–24). In 1841, Father Torquato Antônio de Souza, vicar of Souzel,[1] reestab-

[1]According to Adalbert (who visited the Xingu in 1842), Souzel was

> one of the first Jesuit centers on the banks of the Xingu and its foundation, like Veiros and Pombal, is due to them . . . . The inhabitants of the three places cited above in large part are descendants of the wild Indians that the Jesuits met when they arrived, baptized, and settled in villages. The other part of the inhabitants of these villages consists of mixed bloods of these primitive inhabitants and whites; moreover, the whites are found in very small numbers among them. (Adalbert 1977:167)

Adalbert's description of Souzel gives us an idea of the economic activities developed by the new occupants of the region and of how this exploitation was organized. According

lished the Tavaquera Mission, as Adalbert describes:

> Padre Torquato Antônio de Souza appeared in this region on November 1st, 1841, for the second time raising the cross in Tavaquara, giving the name of the Imperatriz Mission to the new colony, and who by his friendly treatment and generous distribution of porcelain cups, beads, tools, etc., among the Juruna, who from time to time came down to Souzel, always attracted more Indians of his village to it, conquering their trust and baptizing them. Notwithstanding the fact he was already known for this manner by many of them much closer, he was for the first time heavily escorted to Estrada and Tavaquara where he soon succeeded in bringing together about 300 Juruna and baptized forty. And thus the mission's work was begun. (Adalbert 1977:180)

The mission, however, was abandoned a few years later (Oliveira 1970:25). In 1842, when Adalbert traveled through the region, the Juruna population was estimated by Father Torquato at around 2,000 Indians, distributed in nine villages between Tavaquara and a place one hour's distance above Piranhaquara (Nimuendaju 1948a:218; Adalbert 1977:213). By 1859, the number of Juruna, distributed in three villages, was estimated at 235 individuals (Oliveira 1970:26).

In 1884, Von den Steinen visited the region of the lower and middle Xingu, observing one more phase of the Juruna migration upriver. Steinen recorded the existence of 205 to 230 individuals, distributed in five villages and shelters between Pedra Preta (above Piranhaquara, latitude 4°40'S) and slightly above Pedra Seca (lat. 8°30'S) (Steinen, in Oliveira 1970:29). According to Nimuendaju, these Indians still maintained their independence and their original culture. The neo-Brazilian population, at this time, had still not reached the mouth of the Iriri (Nimuendaju 1948:219).

By 1896, when Coudreau visited the Xingu, the Juruna's situation had changed completely. Rubber workers had invaded the region of the middle Xingu, and the two major Juruna groups were working for them (Nimuendaju 1948a:219; Oliveira 1970:30). A group of 11 individuals worked for Raymundo Marques in Pedra Preta and another group of 30 people for the Gomes brothers, in Caxinguba (lat. 5°20'S). Two other Juruna groups seemed to have remained free from the yoke of the rubber patrons: one sought refuge slightly above Comprida Rapids; the other, led by Muratu, lived on the Great Bend at Jurucuá Rapids (Nimuendaju 1948a:219).[2] Krautler also makes reference to the village of Muratu, stating that this same Juruna leader lived on the island of Murutá, located between the rapids of Jurucuá and Paquiçamba (Oliveira 1970:31).

The Juruna, who today inhabit the region of Furo Seco/Paquiçamba Indian Area—and are threatened with losing part of their territory to the Cararaô dam reservoir—are descendants of the Muratu group. According to Fortunato Juruna, who heads this group, his family lived on the island of Murutá, maintaining sporadic contacts with "civilization" until approximately 1920 when they moved to the Dibanda stream. It was from that time on that their contacts with the national society intensified. Shortly after, this village fell victim to an influenza epidemic and was then abandoned by the survivors who came to settle in the region of Furo Seco, where part of the Juruna remain today (Affonso and Goes 1983).[3]

During the seventeenth, eighteenth, and nineteenth centuries, the Juruna fought with various indigenous groups of the region: Tacunyapé, Xipaia, Curuaia, Arara, and Kayapó. According to Nimuendaju (1948a:235), for several years the Juruna maintained relations alternately of war and peace with the Xipaia, Curuaia, and Arara. In 1842, struggles were still recorded between the Xipaia and the Juruna. But, around the mid-nineteenth century, these two peoples made an alliance, marrying among themselves and forming villages together on the Xingu River. Thus Coudreau in 1896 indicated the existence of a village of Juruna and Xipaia at Jurucuá Rapids (on the Great Bend) (Oliveira 1970:23–24).

The Xipaia—in contrast with the Juruna who, since the seventeenth century, have confronted white invaders—remained, until approximately 1880, in the region of the Iriri and Curuá rivers, free of contact with the "civilized world" (Nimuendaju 1948a:219). The first recorded contact between the Xipaia and non-Indians, however, had taken place almost a century earlier (around 1750), when the Jesuit priest Roque Hundertpfund traveled on the Xingu and Iriri rivers—when he was also visiting the Curuaia residing on the Iriri (Nimuendaju

cont. (1)

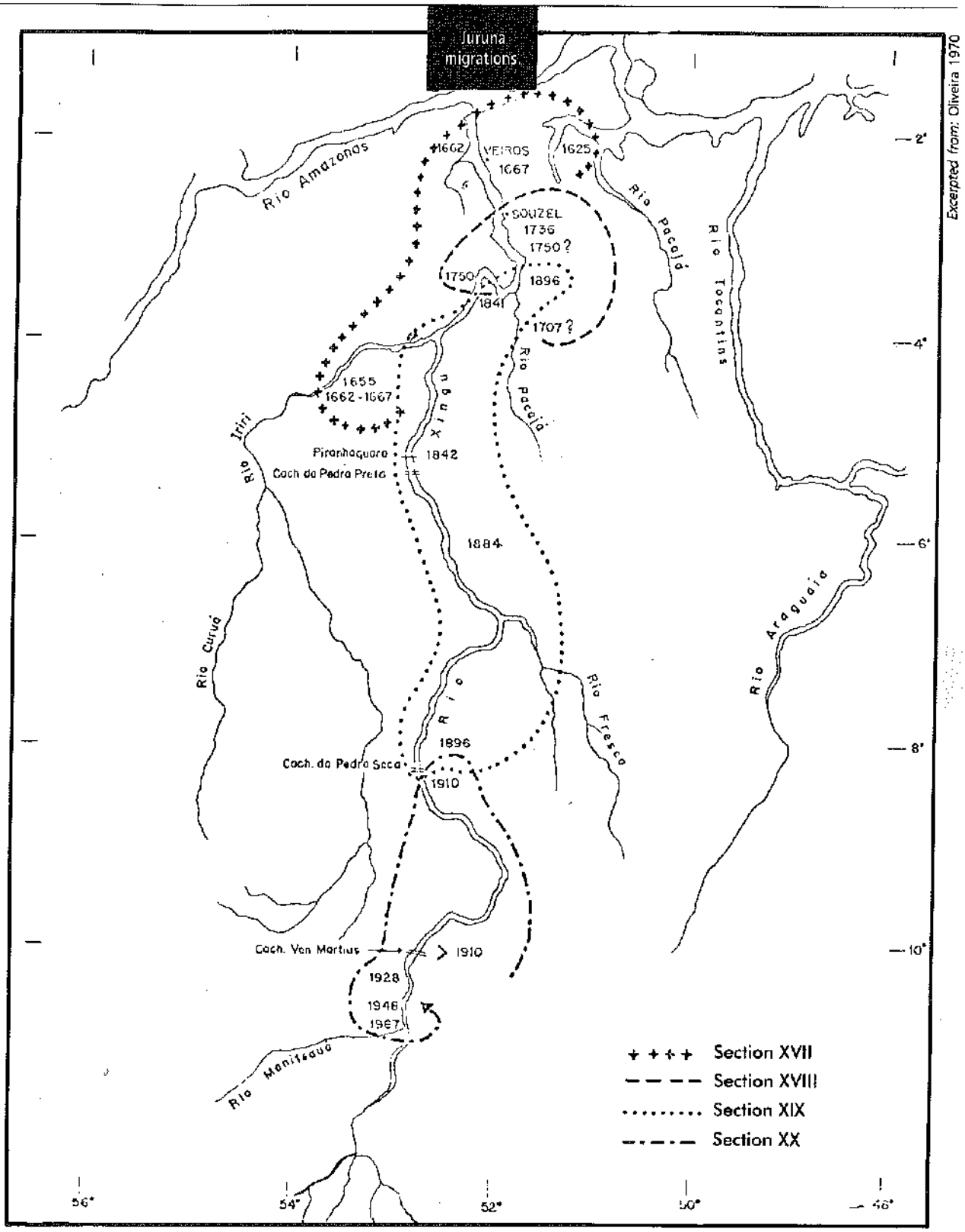
to Adalbert, Souzel was formed by about 40 to 50 mud cabins and open shelters, and, like the other places mentioned, was only inhabited for a few months out of the year:

> for the rest of the time . . . they go to their sites scattered along the banks of the river, in the winter, that is, from June to December, to work rubber . . ., and in the summer to gather sarsaparilla, copaíba balsam, cassiá and cacao. While the men are occupied in this activity in the forests, and also in hunting and fishing, the women stay at the sites to prepare farinha with which they do business. Twice a year, however, around São João and Christmas, everyone comes together in the villages . . . to trade their natural products for fabric and other simple industrial products, or to ship them to Pará. (Adalbert 1977:167–168)

On the occasions of coming together, the cities came to have from 500 to 700 inhabitants or more.

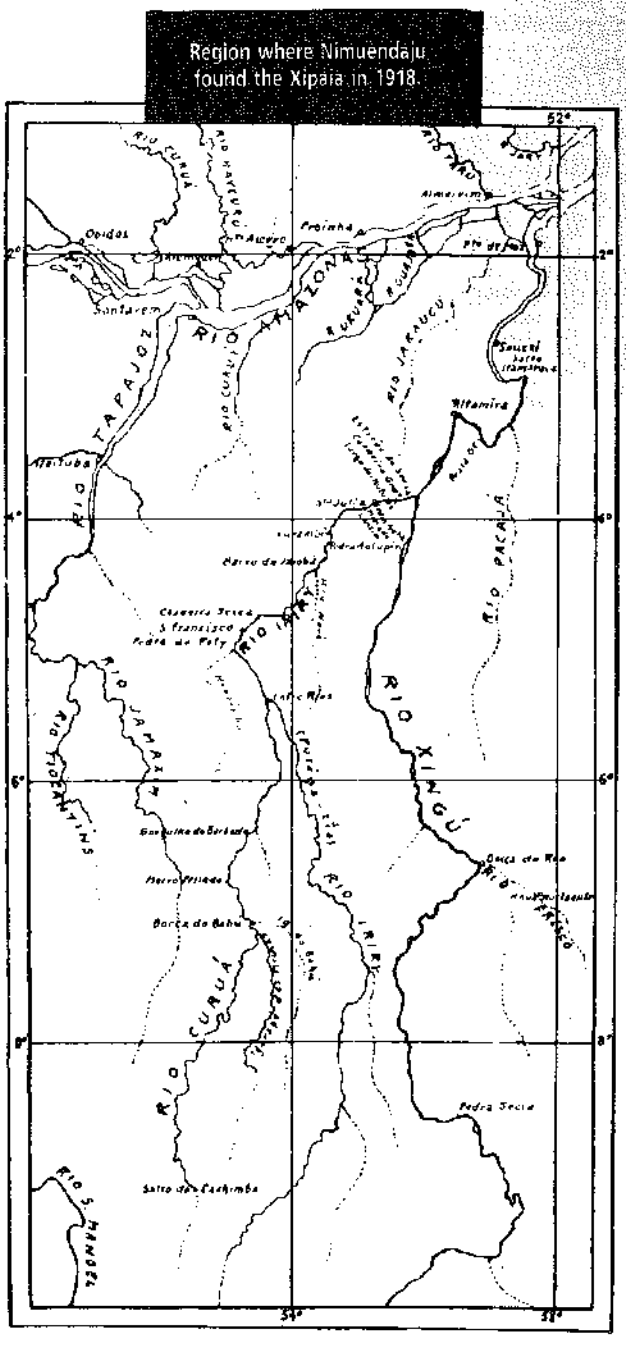
[2]The population of the four Juruna groups totaled 150 individuals (Coudreau 1977:37; Nimuendaju 1948a:219).

[3]Another group of Juruna, who were located on the middle Xingu in the nineteenth century, continued their migration upriver. In the twentieth century, conflicts were recorded between the Juruna and rubber workers, and with Kayapó, Suyá, Kamaiurá, and Trumaí Indians. In 1928, the Dyott expedition found them on a tributary of the left bank of the Xingu, slightly above Martius Rapids. Twenty years later, when the Roncador-Xingu expedition located them, they were settled at the mouth of the Manissaua-Miçu. The "contacts" with the Juruna, however, took place a year later (1949), when the Villas-Boas brothers returned to the locale. It is in this region—which is part of the Xingu National Park, created in 1961—that they have been located until today.



1948a:219–221). The Curuaia – mentioned since 1682–1685 – had been established between the Xingu and the Tapajós since the seventeenth century, but in a region much further north than that which they occupied at the end of the nineteenth century (Nimuendaju 1948a:221).

In 1885, Kayapó attacks forced the Xipaia to abandon their villages located on the great rapids of the Iriri (between lat. 4°50′ and 5°S.). They then moved in the direction of the Curuá River, establishing themselves at Gorgulho do Barbado. At this time, they entered into contact with the Curuaia, who occupied the right bank of the Curuá River (from lat. 6°30′S to 8°50′S) (Nimuendaju 1948a:221).



It is in this region of the Iriri and Curuá that Emília Snethlage, the first scientist to contact the Xipaia, found them in the first decades of the twentieth century. Snethlage made two trips to the region, the first in 1909 and the second in 1913 (Nimuendaju 1948a:219). At this time, the middle and lower courses of the Iriri were already populated by non-Indians, with approximately 1,000 people distributed between the rubber stands and the commercial houses. Rubber production was commercialized in three main nuclei: Santa Júlia, São Francisco, and Boca de Curuá—the last being the house closest to the Indian villages (CEDI, unpublished). According to Snethlage, the Xipaia had withdrawn from the civilized part of the Iriri and Curuá. Their first village was located eight days' journey from the mouth of the Curuá, and others were on the upper Iriri (Snethlage, in CEDI, unpublished). The Indians maintained regular commerce with rubber workers, trading their canoes for beads, axes, and other tools. They were occasionally recruited as crewmen in the transport of the rubber workers (Snethlage, in CEDI, unpublished).

According to Snethlage's observations, the hostility that had previously marked the relations between the Xipaia and Curuaia had been transformed into a relationship of subordination of the latter to the former; at the time the Xipaia were more numerous and had greater access to commerce (Snethlage, in CEDI, unpublished). The Curuaia, with an estimated population of 150, had in 1913 two villages on the banks of the Flecha stream, and a third located to the west of Baú, inhabited by rubber workers. The Xipaia, in turn, were divided into two local groups, one on the Iriri and the other on the Gorgulho do Barbado (Nimuendaju, in CEDI, unpublished).

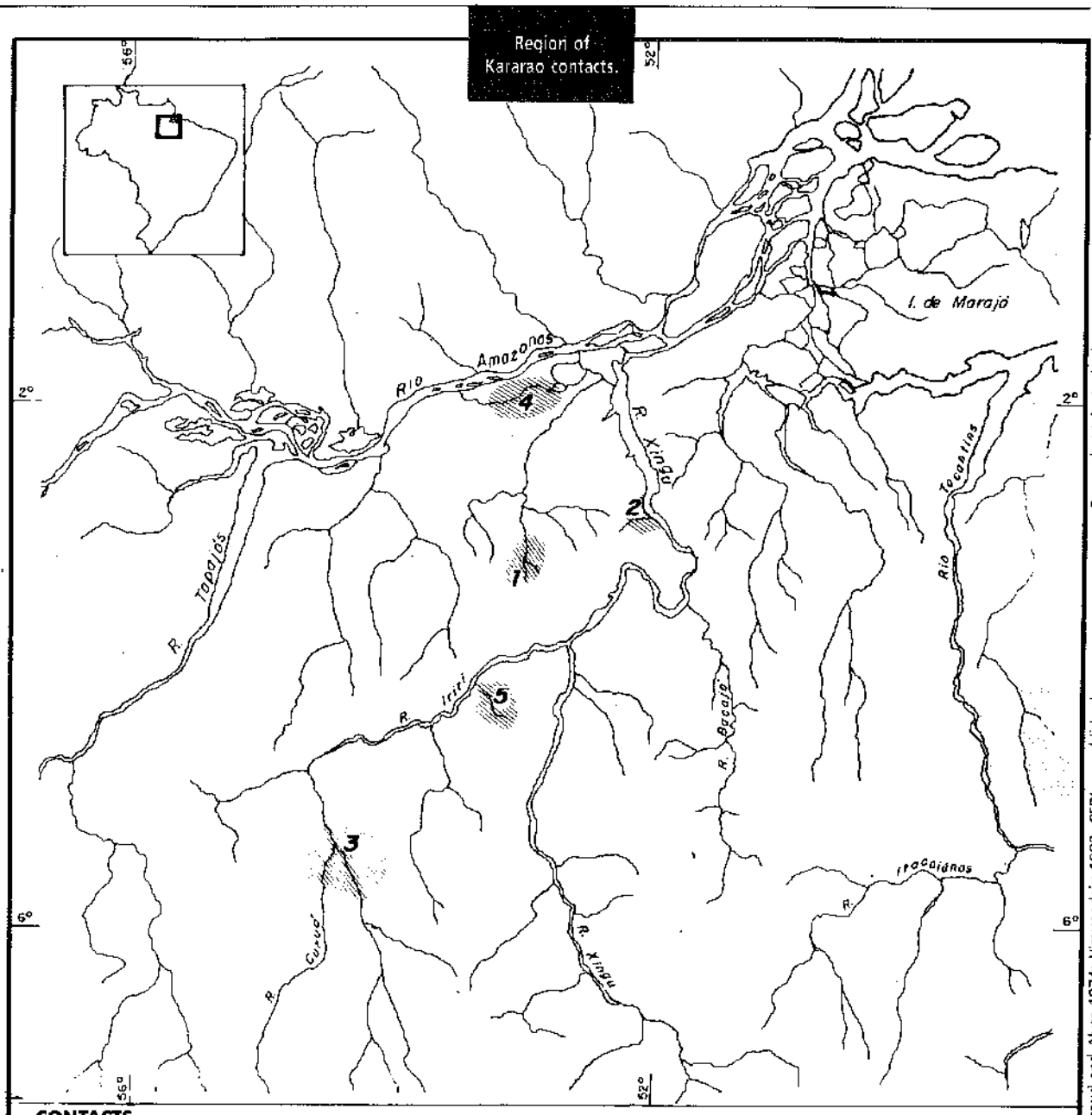
To the degree that the occupation upriver intensified, the Curuaia and Xipaia went from a sporadic commercial relationship with the whites of the region to a situation of subordination to the rubber patrons—as witnessed by Nimuendaju in 1918 and 1919 at the Boca do Baú (upper Curuá River):

> The miserable band of Sipaia that I met in 1918 and 1919 at Boca do Baú, on the upper Curuá, was in such a way under the yoke of their Christian lords that they suffered multiple restrictions in the exercise of their religion. I do not believe, however, that the social collapse of the tribe has in any way influenced their basic concepts and traditions: be that as it may, the Sipaia have not become Christians. (Nimuendaju 1981:11)

From 1918 on, the Curuaia began to enter into conflict with the Kayapó Indians. Up to then, the Kayapó had respected the limits of Curuaia territory; however, from that year on, the Kayapó began to extend their incursions to the Curuá River. In 1934, they attacked and dispersed the Curuaia; the larger group fled in the direction from the mouth of the Riozinho of the Iriri to the Tapajós; others spread out on the middle Iriri. Another group of Curuaia stayed with the Xipaia near Gorgulho do Barbado (Nimuendaju 1948a:222). The conflicts between the Xipaia-Curuaia and the Kayapó continued to be recorded during the 1950s, when the Xipaia-Curuaia came to participate in punitive expeditions (organized by rubber workers) against the Kayapó-Kararaõ (CEDI, unpublished).[4]

The Kayapó came from the fields of the Araguaia in a great movement of expansion—begun in the middle of the past century—which resulted in profound transformations in the situation of the Juruna, Xipaia, Curuaia, Arara, and the Tupi-Guarani peoples of the region—causing massive dislocations and numerous reductions of these groups. Pressured in their original habitat by the

[4]Later information on what happened to the small Curuaia and Xipaia clusters on the Iriri and Curuá rivers is not available, nor on the circumstances of their installation in the city of Altamira (CEDI, unpublished).



cattle-ranching front coming from the interior and moved by a very intense dynamic of fissioning, the Kayapó reached the middle Xingu and thereafter the Xingu-Bacajá interfluve in the first decades of this century.

At the end of the eighteenth century, the Kayapó who occupied the region of the Pau d'Arco River (tributary of the Araguaia) split in two groups. One group remained; the other, known as Pore-Kru (ancestors of the present-day Xikrin) went north to the region of the Itacaiúnas River (CEDI, unpublished).[5]

By the nineteenth century, the group from Pau d'Arco split again and the dissidents (direct ancestors of the Gorotire) moved in the direction of the Xingu and Fresco rivers. It is from this faction that all of the other present-day Kayapó groups descend, after a series of fissions (CEDI, unpublished).[6] It was from this process that the Kararaô group emerged. According to Arnaud and Alves (1974), the separation that gave rise to the Kararaô would have occurred shortly before the 1920s, when the Indians were found settled at "Casa de Pedra"

[5]The chronology of the Kayapó fissions presented in the unpublished volume of the *Levantamento dos Povos Indígenas no Brasil—Sudeste do Pará* (Xingu)/CEDI that we cite here, was established on the basis of information provided by the researchers Lux Vidal, Terence Turner, Gustaaf Verswijver, and Darrel Posey.

[6]With the exception of the Xikrin who, as we have seen, are descendants of the Pore-Kru (Vidal 1977).

The Kayapó who remained in the region of Pau d'Arco after the second fission were known as Irã-Amrãnhere. This group, which had its first peaceful contact with the regional population in 1859, is today extinct (Verswijver 1985:244).

on the Vermelho River (tributary of the Fresco River). Verswijver, on the other hand, believes that the Kararaô separated from the Gorotire around 1933 (Arnaud and Alves 1974:4; CEDI, unpublished). According to him, after the split, the Kararaô crossed the Xingu and traveled west, with the intent of joining up with the Kayapó-Mêkrãngnoti. Having been driven off by the Mêkrãngnoti, the Kararaô continued north, and settled between the Iriri and Curuá rivers (Verswijver, in CEDI, unpublished).

There, according to Arnaud and Alves, internal conflicts caused the Kararaô to separate into several groups. One of these groups went in the direction of the lower Xingu between the borders of the municipalities of Altamira and Poro de Moz. At the end of the 1930s, several members of this group crossed over to the right bank of the Penetecaua stream (tributary of the Jaraucu), where they entered into peaceful contact with the regional inhabitants. Shortly afterwards, the mayor of Porto de Moz (to which Jaraucu belongs), together with the Service for the Protection of the Indians, tried to fix them in a place situated in the vicinity of the municipal seat. The results were disastrous: a large number of Indians died from disease, and the survivors returned to the woods (Arnaud and Alves 1974:7–8; Nimuendaju 1982:223).

In the early 1940s, 12 survivors of this group of Kararaô emerged on a Xingu beach, at the mouth of the Tucuruí (near the city of Altamira). There they camped and were visited by several crews of boats that trafficked on the Xingu, without any incident being recorded. According to Nimuendaju (1982:227), after that:

> The Indians appeared in front of Vitória, asking that they be transported to the right bank of the Tucuruí, which they were. Once in Vitória, they were taken to a room and, when they were sleeping, the exits were closed off by armed men. The chief of the group . . . was shot to death. . . . Then, they also shot at those who were in the room—9 Indians in all, men, women, and children, died. Only one couple escaped.

In the 1950s and 1960s, the Kararaô made several incursions against the regional population. In July 1965, before one of these attacks, the SPI organized an "attraction expedition." The contact took place in September of that same year, in the village of the Guajara River, inhabited by 48 individuals. Thirty days after the contact, the SPI decided to relocate the group to the place where the assistance post was to be installed—at the confluence of the Jaraucu and the Penetecaua (Arnaud and Alves 1974:13–14).

The transferral was undertaken without any measures to provide for the health and feeding of the recently contacted Indians. After this relocation, several deaths occurred as a result of flu and hunger. In 1967, a measles epidemic raged among the Kararaô; only eight individuals survived. By 1970, they no longer existed as a group, and were found scattered in other Kayapó villages (Arnaud and Alves 1974:14–16).

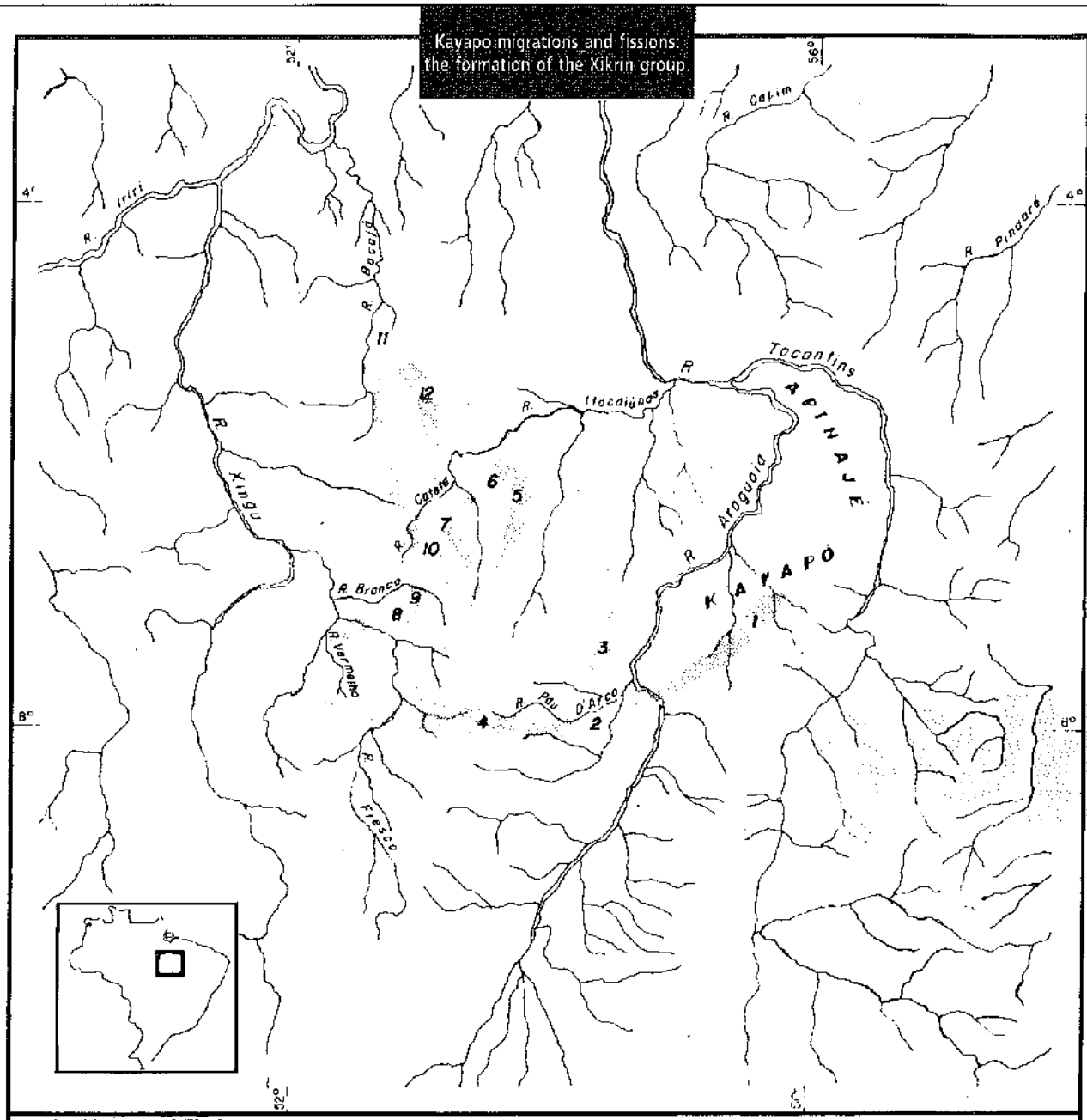
The Kararaô groups that remained in the region of the Iriri and Curuá rivers were contacted in the 1950s and in the 1970s. In 1957, the SPI intensified "pacification," attempting to locate the Kararaô who "sought to stay away from the expedition as much as possible, perhaps fearful that they would be victims of another massacre" (Arnaud and Alves 1974:6). Despite this, contact with a group of 38 Kararaô Indians was established in that same year. Several months after the encounter with the SPI fronts, the Kararaô, together with other recently contacted Kayapó Indians, were transferred "to a locale situated in the vicinity of the rubber workers' camps as these were more accessible to navigation, for the purposes of introducing them into the regional economic system (Arnaud and Alves 1974:6); there, they fell victim to outbreaks of influenza and measles.

Another Kararaô group was ignored until the opening of the Trans-Amazon Highway. Contact with the FUNAI attraction front took place in March 1971, near the Pedro Arcângelo stream, tributary of the Iriri (CEDI, unpublished). At the time, the Kararaô group had a population of 40 people and "did not understand . . . a word of Portuguese, did not possess nor seem to know how to use firearms, and showed no other cultural characteristics than those found in other Kayapó groups before being pacified" (Arnaud and Alves 1974:6–7). These were the same Kararaô who currently reside on the Kararaô Indian Reserve, located at the confluence of the Iriri and Xingu rivers.[7]

TODAY, IN THE REGION of the lower-middle Xingu, lives another Kayapó group: the Xikrin of the Bacajá. These are the descendants of the Pore-Kru who, at the end of the eighteenth century, went off in the direction of the Itacaiúnas region. There, the Pore-Kru separated into two groups: the Kokorekre, who occupied the region of the Branco River, and the Put-Karôt, who moved to the region of the Cateté (upper Itacaiúnas) (CEDI, unpublished). Later, yet another split took place when the group known as Djore separated from the Kokorekre (Vidal 1977; Verswijver 1985).

The Djore were rapidly decimated by disease and by struggles with the regional population. The Kokorekre, who began to establish trading relations with the frontier population, were also victims of disease, and suffered numerous losses as a result of a punitive expedition organized by regionals around 1910. Thus, an already weakened group of Kokorekre joined the Put-Karôt, who had withdrawn from the Cateté to the headwaters of the Itacaiúnas due to conflicts with the rubber workers (CEDI, unpublished).

[7]It is presumed that two more isolated Kararaô groups might exist in the region of the Guajara and the Jamanxim (CEDI, unpublished).



Art: Alicia Rolla

Research: Lúcia Andrade

Sources: Verswijver 1985; Vidal 1977; CEDI, unpublished

Apinajé-Kayapó Fission:

1. Kayapó—cross the Araguaia River going toward the Pau d'Arco River region.
2. Kayapó Pau d'Arco—part of the group that remains in region.
3. Pore-Kru—head for the Itacaiúnas region.
4. part of the group heads for the Fresco and Xingu rivers.
5. Kokorekre—head for the Rio Branco region.
6. Put-Karôt—head for the Cateté River region.
7. Put-Karôt—head for the headwaters of the Itacaiúnas.
8. Djore—head for the region of the Rio Vermelho.
9. Kokorekre—unite with the Put-Karôt on the upper Itacaiúnas.
10. Head for the region of the Bacajá River.
11. Xikrin of the Bacajá—part of the group that remains in the region.
12. Xikrin of the Cateté—part of the group that returns to the Cateté.

The two groups together initiated a long period of hostility with the Kayapó-Gorotire. Around 1926, fearing retaliations from the Gorotire, the Put-Karôt moved in the direction of the Bacajá region. Shortly after, between 1930 and 1940, a part of the group that had not adapted to the new locale returned to the Cateté (these are the Kayapó known as the Xikrin of Cateté; those who remained are known as the Xikrin of Bacajá) (CEDI, unpublished).

The occupation of the Bacajá basin by the Kayapó from 1926 onward resulted in the expulsion of the Tupi-Guarani groups Asuriní, Araweté, and Parakanã, who had villages in the region (CEDI, unpublished). The presence of the Asuriní in the Bacajá region was recorded in 1896 by Coudreau (1977:37):

> They say of the Asuriní that they inhabit exclusively the right bank of the area from Piranhaquara to Praia Grande. . . . The greater part of this tribe would, it seems, be on the Great Bacajá River, one

or two days from the "Bend" of the lower Xingu, but always in the center forests and never on the banks.

It is supposed that the Asuriní left the Bacajá basin more than 40 years ago, due to attacks from local settlers—probably rubber workers; rubber trapping was, at that time, one of the main economic activities of the region—relocating to the headwaters of the Piranhaquara and the Ipiaçava, where they established their villages (Muller 1987). Years later, around 1946, they had to abandon this locale because of Kayapó-Gorotire attacks in that group's expansion to the north. This time the Asuriní moved to the banks of the Ipixuna River, where they remained for a long period of time (Nimuendaju, in CEDI, unpublished). In the 1960s, the Asuriní were again victims of Kayapó incursions. This time, it was the Kayapó-Xikrin who attacked the group; there is record of one of these attacks in 1966, in the region of the Branco River, tributary of the Bacajá.

In the period between 1965 and 1970, the Asuriní were dislodged from the Ipixuna by another Tupi-Guarani group, the Araweté. They then returned to the region of the Ipiaçava and Piranhaquara streams (CEDI, unpublished). The Araweté fled from the headwaters of the Bacajá River in response to repeated Kayapó attacks. This movement, which began at the end of the 1950s, brought them to the Bom Jardim, Jatobá, and Ipixuna rivers. Viveiros de Castro observes that this movement in the direction of the Ipixuna was not uniform, for only a part of this tribe reached its headwaters 25 years ago and continued to maintain several villages on the Bom Jarim and Jatobá (Viveiros de Castro 1986:167). According to this same author, another large Araweté block—comprised of several villages—established itself in the region of the Piranhaquara, where it remained until the 1960s. At that time, in the face of new Kayapó incursions, this group divided: one part went to join up with the group of the Ipixuna, and the other relocated to the region of Bom Jardim. They thus formed two new Araweté contingents, which remained separate for another decade. Attacks by the Parakanã, however, served to reunite the group:

> A Parakanã attack made the southern block flee in the direction of the group of the Ipixuna, whose villages were also attacked by the same enemy; but both parts of the tribe only came to meet again on the banks of the Xingu, to the south of the mouth of the Ipixuna, where they decided to seek refuge there from the Parakanã. (Viveiros de Castro 1986:167)

The conflicts between the Parakanã and Araweté continued for several years; the last of these took place in February 1983, when the Parakanã attacked the Araweté village and wounded the head of the Ipixuna Post (CEDI 1985:29).[8]

The presence of the Parakanã in the region between the Bacajá and Xingu rivers is relatively recent. One of the Parakanã groups had moved to this region around 1976 in search of refuge, having fled from the FUNAI attraction fronts that were making contact with other Parakanã segments since the beginning of the 1970s. Thus, in November 1977, the Parakanã, who had relocated to the forests of the Bacajá River, entered into conflict with the Xikrin who lived there (CEDI 1985:28) and, later, with the Araweté.

The traditional habitat of the Parakanã was found to the east of the Bacajá, in the region of the Anapu, Pacajá, Pacajazinho, Pucuruí, Tapirapé, and Cajazeiras rivers and their tributaries, the Middle and Right rivers (CEDI 1985:20). In the 1920s, their presence was also recorded on the left bank of the Tocantins River above Alcobaça (Nimuendaju 1948b:207)—the present-day city of Tucuruí.

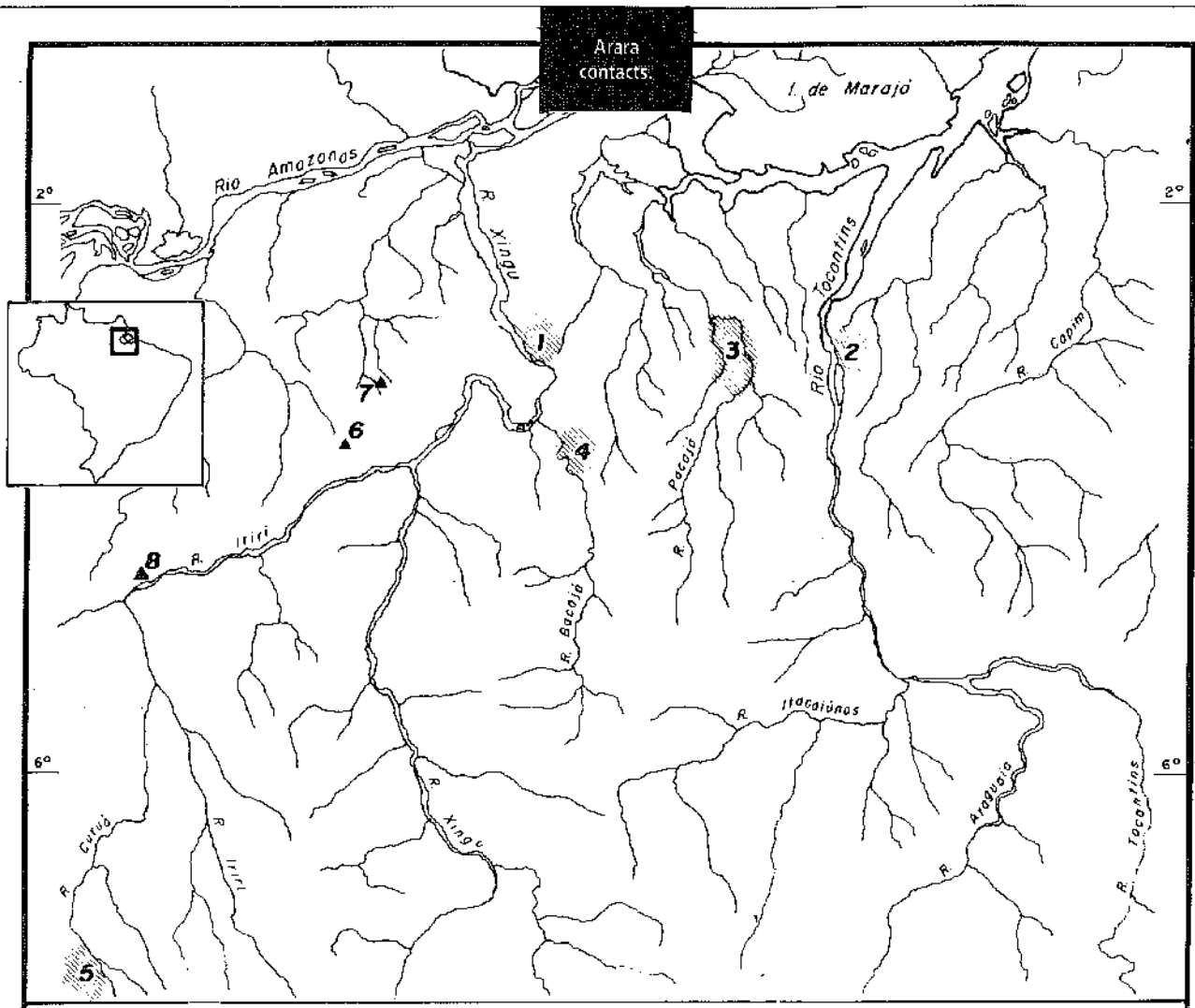
In 1927, with the reinitiation of the works on the Tocantins railway—which cut through the territory of the Parakanã—the conflicts between the Indians and local settlers increased. Begun in 1895 and partially completed only around 1945, this railway was built to provide transport for castanha nuts produced in the region of the middle Tocantins River, connecting Tucuruí to Jacundá. The Parakanã made several attacks, some quite violent, on the railway workers and also on the cat hunters, nut gatherers, and game hunters of the region (CEDI 1985:24). Those responsible for the railway, in turn, organized punitive expeditions against the Indians (Nimuendaju 1948b, 1982).

In 1928, the SPI created the Pucuruí Attraction Post, on the left bank of the stream with the same name, next to km 67 of the Tocantins railway, with the objective of providing security for the railway workers (CEDI 1985:26). The contacts, always sporadic, between the SPI officials and the Parakanã attest to the permanence of the Parakanã in that region until the early 1960s, when they returned to the interior of the forests. The next reports on these people date from the 1970s, when the region where they had sought refuge was cut by the Trans-Amazon Highway.

Before reaching the Tocantins River, in the 1920s, the Parakanã appeared on the Pacajá River above Portel. It is in this locale, in 1910, that they are first reported (Nimuendaju 1948b:206). The Parakanã's arrival to the Pacajá region resulted in the expulsion of the Arara-Pariri Indians, who occupied the region of the Iriuaná, a tributary of the Pacajá (Nimuendaju 1948b:206). Faced by Parakanã attacks, the Arara-Pariri sought refuge among the neo-Brazilians (Nimuendaju 1948b:224). According to Nimuendaju, in 1926 this group was reduced to half a dozen Indians and, in 1932, only a couple of children were left, suffering from the last stages of tuberculosis.

The first reports on the Arara, however, date from

[8]The Araweté had been contacted by FUNAI in 1976.



▲ exact locale of contact ▨ region of contact

1. 1861 and 1862: An Arara group enters into peaceful contact with rubber tappers.
2. 1869: The Western Arara group emerges on the Tocantins River and maintains peaceful contact with the local population.
3. 1880–1910: The Arara-Pariri group enters into contact with region population in search of refuge from Parakana attacks.
4. 1917: An Arara group settles in the Bacajá River and begins to work for regionals.
5. 1918: Signs of Arara presence are found on the Curuá River.
6. 1981: Contact of southern Arara with the FUNAI attraction front.
7. 1983: Contact of northern Arara group with the FUNAI attraction front.
8. 1987: Present Cachoeira Seca Post of the Arara attraction front. It was here that the last contacts with isolated Arara groups were made.

Art: Alicia Rolla
Research: Lúcia Andrade
Sources: CEDI, unpublished; Coudreau 1977; Nimuendaju 1948b

the nineteenth century (Nimuendaju 1948b:223)[9] In 1869, about 500 Indians from the group that Nimuendaju called the Western Arara appeared peacefully on the right bank of the Tocantins (lat. 3°S). They probably lived in the region to the west of the Trocará Mountains. In 1873, Bishop D. Macedo Costa took several members of the group to the capital. In 1889, Ehrenreich noted that several survivors of this Arara group were found scattered in residential clusters along the left bank of the

[9]The anthropologist Menget established the existence of six subgroups that all belonged to the same ethnic and linguistic unit of Arara: the Txikão (of the Ronuro River, on the upper Xingu), the Yarumã (of the Suiá-Miçu, also on the upper Xingu), the Apiaká (coming from the Tocantins and settling on the Anapu and Pacajá rivers), the Arara group of the left bank of the Xingu (already in contact with the population of Altamira in the beginning of the century), the "Wild Arara" (of the upper Curuá, on the Ituquí), and the Arara-Pariri, to whom we have already made reference. According to Menget's information, cited in the Arara chapter of the unpublished volume of the series *Povos Indígenas no Brasil – CEDI*, the Arara inhabited the region of the upper Xingu, between Teles Pires and the Tapajós, until approximately 1850, when Kayapó attacks forced them to migrate north. They came to the region of the Iriri, where they stayed temporarily, descending along both banks of the Xingu. In this locale, they separated, one part going on to the Tocantins River, while others

cont. (9)

remained to the west of the Xingu. The Tocantins group, after conflicts with Kayapó and Karajá bands, migrated through the valley of the Araguaia, returning to the upper Xingu by the trail of the Suiá-Miçu River. It is possible that this group was an ancestor of the present-day Arara-Txikão of the Xingu Indian Park. This hypothesis on the migrations of the Arara would explain the various references to small groups of these people that appeared in the nineteenth and twentieth centuries at different points of a vast area between the Tapajós and Tocantins, establishing sporadic contacts with the regional population, as we shall see.

Tocantins, up to the city of Cametá. The last information on this group dates from 1897; at that time, about 15 survivors lived on the Ararinha stream, a little below Breu Branco (Nimuendaju 1948b:223).

On the lower Xingu, the Arara were seen for the first time in 1853. In 1861–1862, they descended below the Great Bend, where they maintained for some time peaceful contacts with rubber workers. At the time, they totaled 343 adults. In December 1862, however, they attacked the Juruna by surprise and disappeared shortly after (Nimuendaju 1948a:223).

Around 1884, the Arara occupied the region to the west of the Xingu, from the mouth of the Iriri to below, without contact with the regional population (Nimuendaju 1948a:223). In his voyage to the Xingu in 1896, Coudreau did not succeed in locating the group, but did provide some information about them:

> On the Hill of the Araras [on the Xingu between the Great Bend and Piranhaquara], on the right bank, one can still make out the brush of an old campsite of these nomadic Indians. One day, a little more than 10 years ago, they left, without saying anything, exchanging their temporary location for an unknown destiny.
>
> About the Araras, one only has very vague information. It is said that they live wandering through the forests; on one side, to the Tocantins; on the other, to the Curuá of Ituqui. From time to time they come out of their central forests and are then seen crossing the Xingu from one bank to another, in groups that at times are small, at times large. It has also happened that various Arara, usually women, live with the Juruna or with civilized people. (Coudreau 1977:28)

Around this time (the late nineteenth century) the Arara abandoned the left bank of the Xingu and went toward the headwaters of the Curuatinga (the main branch of the Curuá River), where they were violently persecuted by the rubber workers. Nimuendaju thought that it was these attacks that led the Arara to withdraw from the left bank of the lower Iriri (Nimuendaju 1948a:224). Conflicts with rubber workers were also recorded in the early twentieth century. In 1917, the Arara tried, in vain, to make peaceful contacts with rubber workers a bit above the São Francisco.

The last reports on this group date from 1918, when traces of the Arara were seen on the left bank of the Curuá of the Iriri (lat. 7°30'S) (Nimuendaju 1948a:224). According to Nimuendaju, Arara survivors were also living on the left bank of the Iriri, between the Curambé and Rio Novo streams, where settlers several times found traces of their passage (Nimuendaju, in CEDI, unpublished). And, in fact, as is observed in CEDI (unpublished), it was exactly in this place that the FUNAI attraction front located the Arara in the 1970s.

Still in the first decade of this century, another Arara band settled on the right bank of the Bacajá River (lat. 3°40'S). This group, with a population of 30, worked for settlers, who used them in expeditions against the Asuriní (Nimuendaju 1948a:224). In the 1920s, they were affected by a Spanish flu epidemic and the survivors were removed by the owner of the rubber plantation to the city of Altamira. The Arara who currently reside in Altamira, together with the Xipaia and Curuaia, are probably descendants of this group (CEDI, unpublished).

From the 1940s on, a series of conflicts between local settlers and the Arara began,[10] a process that resulted in the confinement of this group to the Iriri region (CEDI, unpublished). The relations of the indigenous peoples of this region and the surrounding society—which, until the 1970s, were above all with agents of the extractivist sector, limited in terms of population and with little in the way of financial resources—came to change radically with the construction of the Trans-Amazon Highway. From this time on, the rubber workers and cat hunters gave way to cattle-ranching projects, colonization, and mining, which appeared together with the FUNAI "attraction fronts," the official indigenist arm of the occupation frontiers. Thus the Arara (whose village, in the 1970s, was located a short distance—about 3 km—from the "cutting" of the future highway) came to have new persecutors: the FUNAI attraction teams, which looked for isolated groups over a period of 11 years, until 1981–1983, when contact was made (CEDI, unpublished).

Not only were the Arara the target of FUNAI attraction fronts; the agency, in this period, also contacted several other peoples: in 1971, the Asuriní; in 1976, the Araweté; in 1984, the last Parakanã. Today, there appears to be only one unknown group remaining on the upper Iriri, in an area adjacent to Arara territory, and two Kayapó groups on the Curuá. The "contact and pacification" of each one of these people meant, in many cases, an initial drastic reduction in population due to epidemics; and, in all cases, it invariably led to the reduction of their lands. Through the control of their territorial movements, the fixing of their settlements near the FUNAI assistance posts (together with the joining of smaller subgroups until they scattered in the territory of the tribe into single spatial groupings), and the progressive articulation of a greater dependence on agricultural products and industrial merchandise, extensive portions of their original territories were liberated formally or informally for white occupation.

The implantation of the Xingu Hydroelectric Complex is the "crowning" phase of this process,

[10] Conflicts were recorded in 1943, 1944, 1961, 1963–1965, and 1967 (CEDI, unpublished).

completing an impetus begun in the 1970s. Creating conditions for what the planners call "integrated regional development" ["the objective of 'protection and betterment of the environment' is practically incorporated into the objective of 'integrated regional development'" [Eletrobrás 1986:5-4]], that is, establishing the infrastructure for the occupation of the area by large mineral and agroindustrial projects and turning the lands of the region into valuable market commodities, will, in the best of hypotheses, define a new level in the process of territorial confinement of the indigenous peoples who live there. At the same time, it will greatly facilitate the vulnerability of these territories, whether by granting easier access to indigenous lands, by making them out to be politically empty spaces on which to unload the land conflicts that are arising with the anticipated closing of the peasant frontier, or, finally, through the "modernizing" injection of financial resources in indigenous areas via FUNAI, the result or objective of which is the articulation of a maximum economic dependency of the indigenous peoples, preparing the way for the "integration" of these peoples—that is, their subjection, as if they were enemy nations conquered in a war and not integral parts of Brazilian society with aboriginal historic rights over their lands. These lands, by being strange to the logic of individually alienable and appropriatable merchandise, are also not simply the means of production for a specific socioeconomic formation, but are *territories*: indispensable and insubstitutible political and symbolic spaces, a priori conditions for the continued existence of the peoples who occupy them.

Hence, to define the relation between works such as the Altamira Complex and the indigenous societies that they threaten as being a relation of "environmental impact" is a particularly naïve or hypocritical way of dismissing the *political* dimension of the process.

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The Juruna on the Middle Xingu

Lucia M M. de Andrade

THE HISTORY OF THE CONTACT between the Juruna and white invaders begins in the seventeenth century with the European occupation of the lower Xingu. In 1625, the presence of the Juruna at the mouth of this river was recorded for the first time. In that same century, however, attacks by invaders forced the Juruna to seek refuge in less accessible areas on the middle, and later on the upper, Xingu. In the seventeenth and eighteenth centuries, the Juruna faced slave-raiding expeditions and conversion attempts by Jesuit missionaries; in the nineteenth and early twentieth centuries, they were under the yoke of the rubber patrons; now, they find themselves threatened by the "largest national project at the end of this century and the beginning of the next" (Eletrobrás 1986:6–91): the hydroelectrics of the Xingu River. The major population cluster of the Juruna on the middle Xingu live in the Paquiçamba Indian Area, on the Great Bend, which will be partially flooded by the reservoir of the Cararaô hydroelectric dam.

The presence of the Juruna in the region of the Great Bend has been recorded since the eighteenth century. The group that gave rise to the Juruna who today inhabit the Paquiçamba Indian Area in 1896 lived on the island of Murutá, located on the Great Bend between the Juruquá and Paquiçamba rapids. According to the testimony of Fortunato Juruna, leader of the Paquiçamba group, his family lived on the island of Murutá until approximately 1920, when they moved to the Dibanda stream. It was there that their contacts with the regional population intensified. Shortly after, this village fell victim to an influenza outbreak and was abandoned by the survivors, who came to settle in the region of the present-day reserve. Another part of the group, however, scattered out along the Xingu (Affonso and Goes 1983).

In addition to the group of the Paquiçamba Indian Area, there are two more Juruna population clusters. One of them is formed by four families who live near, but outside, the area demarcated by FUNAI, on the right bank of the Xingu. These families are located in the following places: on the island of Cajueiro, on the island of Neris, near the Maia Rapids, and in the place called Deserto, below the mouth of the Bacajá River (Trevisan, in CEDI, unpublished).

The third nucleus is formed by the family of Manoel Raimundo da Silva, known locally as Manduca Caboclo. This group is found in the place known as Gaviãozinho, on the right bank of the Xingu, above the mouth of the Iriri (Trevisan, in CEDI, unpublished). Other families are probably scattered along the lower and middle Xingu, as well as in the city of Altamira, where they live with the Xipaia and Curuaia (CEDI, unpublished) (see box on p. 142).

No one knows for sure the present-day Juruna population; it is estimated that it might be around 100 (CEDI, unpublished). As was stated above, the main cluster is found in the Paquiçamba Indian Area. On this reserve, the dwellings are situated on the banks of the Xingu and the Seco stream, relatively distant from each other, which does not prevent families from maintaining close relations and cooperating in subsistence activities (CEDI, unpublished).

The Juruna of Paquiçamba cultivate gardens in the vicinity of their houses, where they plant manioc, sweet manioc, yams, potatoes, sweet potatoes, corn, and pineapple (Affonso and Alves 1983:11). They also hunt and fish for subsistence, fishing in the Xingu River and its streams. Complementary to these activities, they gather various products such as babassú, bacaba, açaí, cupuaçú, and castanha, which is generally for selling. They even commercialize rubber, the extraction of which is done on terra firma and mainly on the islands—where the stands of rubber trees are concentrated—that are located outside the Paquiçamba Indian Area. Sporadically, FUNAI assists the Juruna in the commercialization of their products; this assistance is limited to support in the sale of castanha and rubber and to medical and hospital assistance in the city of Altamira (Affonso and Goes 1983:12).

Outside the Paquiçamba Indian Area, the Juruna are found in families mixed with settlers. All have gardens and all plant rice, potatoes, and bananas. They also raise animals, such as chickens and ducks, complementing their diet with hunting and fishing. They also commercialize rubber and castanha, which they gather near their houses, selling them to the merchants of Altamira and occasionally to FUNAI (Trevisan, in CEDI, unpublished).

The land situation of the Paquiçamba Indian Area has still not been totally regularized.[1] Despite the fact

[1]The administrative process of Brazil's recognition of indigenous lands can be divided logically into five phases, and it is only after these five phases are concluded that the possession of land by Indians becomes as documented as the titles of domain held by whites, with full acceptance and recognition by the state and municipal authorities (Oliveira 1987:vii). The initial condition, that of *nonidentified lands*, corresponds to a veritable "zero point" of the demarcation process, a situation in which the Brazilian state has still done nothing in positive terms and little is known of the indigenous group (Oliveira 1987:vi). The second phase, *identification*, refers to the areas that have had some primary form of recognition on the part of FUNAI. The third step corresponds to the act of *delimitation*; in this case, there exists an administrative act, recognized by law or decree, that establishes the physical limits of a determined area and recognizes it as destined for the Indians. It is on the basis of the delimitation act that the state proceeds with the physical demarcation of an indigenous area (Oliveira 1987:vii). The next phase is *homologation*; the power of homologation is restricted to the Presidency of the Republic, being executed through decree. Finally, the fifth step, *regularization*, includes the action of registering indigenous land in the Service of Patrimony of the Union (SPU) and in local land registry offices.

Although the Statute of the Indian (Law No. 6.001, of 12/19/73) established a period of five years for demarcation of *all* indigenous lands, today the areas effectively regularized represent only 3.88 percent (in extent) of indigenous territories, and include less than 10 percent of the total population (Oliveira 1987:x).

that the reserve was officially created in 1984 (by Presidential Decree No. 89.489), until the beginning of 1987, it had still not been demarcated (Ohashi 1987). In December 1986, a FUNAI team was on location to undertake the physical demarcation of the area. After 14 days on the reserve, however, this team only completed part of the demarcation of the perimeter, and the head of the group sent by FUNAI warned in his report that "technically it was not possible to follow precisely the data contained in the description of the perimeter" (Ohashi 1987:4). According to him, the descriptive memorandum of the area did not correspond to the reality found in the field. Thus, he says that because of this distortion, the physical demarcation could not faithfully comply with the information of the presidential decree that created the Paquiçamba Indian Area (Ohashi 1987:4–6).

The Paquiçamba Indian Area has 6,000 hectares and a 33-km perimeter. The borders of this reserve

The Xipaia and Curuaia

The Xipaia live with the Curuaia Indians in the region of the middle Curua River, middle Iriri and Xingu, as well as in the city of Altamira. The estimated population for these various groups is around 180 (CEDI, unpublished). On the urban perimeter of Altamira, the Xipaia, Curuaia, and also some Juruna occupy a lot known as São Sebastião, in the district of Recreio. The Indians who live there make their living from gardens that they cultivate along the Xingu River (Lamas, in CEDI, unpublished). Several even work as fishermen and crewmen, and others in FUNAI's assistance headquarters in Altamira. FUNAI's support to this group is as yet unsystematic and relatively recent, consisting mainly of medical assistance given at FUNAI headquarters in Altamira. The land title of the Vila São Sebastião lot has not been made official up until today, despite the fact the Indians have asked FUNAI to take measures in this direction since 1981 (CEDI, unpublished).

In the region of the middle Curuá, the Xipaia-Curuaia occupy several points along the river, in the places known as Entre Rios, Cachoeira São Geraldo, Geraldo, Taperas, Pontão, Cachoeira do Marco, Cajueiro, Madalena, Favela, Cachoeira do Curupité, and Lubisu. In this same region, the Brasinor Mining Company has been operating since late 1983, with several mechanized mines (CEDI, unpublished).

In 1984, the Xipaia and Curuaia got into conflict with the mining company, which refused to recognize that area as indigenous territory. Alerted by the reports of Padre Angelo Pansa concerning these conflicts, the Second Regional Delegacy of FUNAI sent a team to the Curuá River in May 1985 to delimit the Xipaia and Curuaia areas of occupation in that region. The result of this team's work was a proposal for delimiting this territory, which from then on came to be called the Curuá Indian Area, with 13,000 hectares. Nevertheless, until 1987, two years after this proposal was presented, the Curuá Indian Area was still not delimited (CEDI 1987, unpublished).

On the other hand, the 1985 FUNAI survey was limited to the locations of Cajueiro, Marco, and Favela, thus excluding the groups located upriver (in the vicinity of the Limão stream), and downriver (Entre Rios). The location of these nuclei, and the village of Cajueiro, in the area of interest of the Brasinor Mining Company, could lead to an exacerbation of conflicts between the Indians and the company. There is no information on the measures that FUNAI plans to take to avoid such confrontations, nor about its intentions regarding land titling for other areas of indigenous occupation on the Curuá and Iriri rivers (CEDI, unpublished).

The presence of Xipaia-Curuaia families has also been noted on the middle Iriri River, where they are living in the following places: Amaro Velho, Liberdade, São Vicente, Nova Olinda, Yucatã, Limoeiro, Anajás, and Garimpo Rio Novo. On the Xingu, there are two other families located at Paratizinho and Cachoeira do Jabuti. Other Xipaia-Curuaia individuals even live in the cities of the region: Belém, Santarém, Marabá, and São Félix do Xingu (Pansa, in CEDI, unpublished).

Certainly the effects of the implantation of the hydroelectrics of the Xingu will be felt in all the Xipaia-Curuaia centers. According to the inventory studies prepared by CNEC (1980), the implantation of a hydroelectric is foreseen on the Iriri River, 406 km (by river) from the city of Altamira (coordinates 04°44'30"S and 54°36'30"W). This project would produce 380 mW of power (CNEC 1980:6.130) and have a reservoir of 4,606 km² (CNEC 1980:6.129), which would flood the territories occupied by the Xipaia and Curuaia Indians, including the Curuá Indian Area. This fact, however, is not mentioned in CNEC's evaluation of the "interferences" of the hydroelectric utilization of the Iriri (CNEC 1980:6.138).□

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do not include all of the sites occupied by these Indians; as we have seen, several other Juruna inhabit islands and streams on the banks of the Xingu which, despite their very nearness to the Paquiçamba Indian Area, were not included in the demarcated area. The islands situated in front of the settlement of Fortunato, where he and his kinsmen gather rubber, also were excluded from the delimitation. Similarly, the village of Manduca Caboclo, located near the Koatinemo Indian Area, does not have its lands regularized (CEDI, unpublished).

In 1986, the Paquiçamba Indian Area was in-

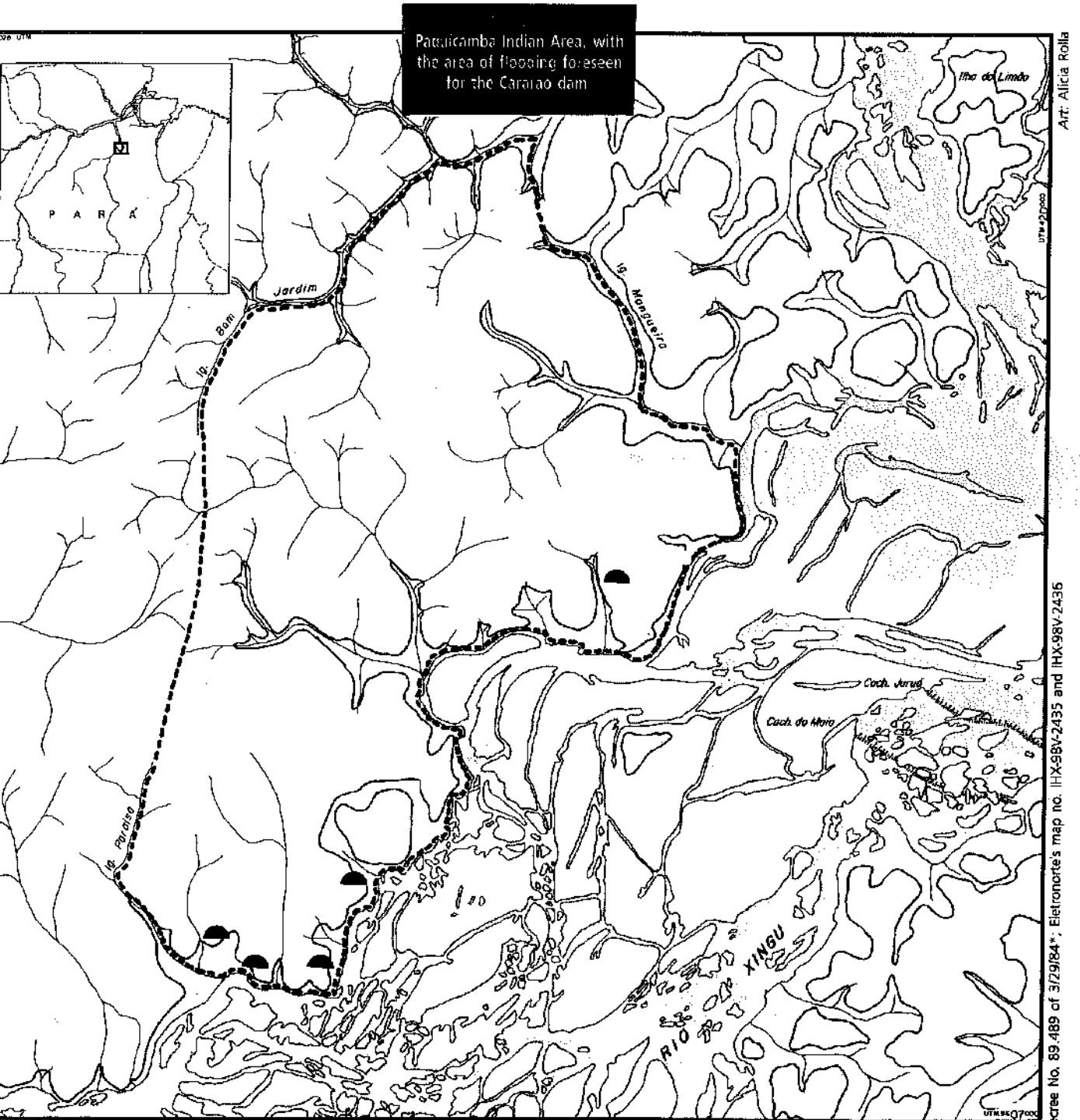


Photo: CPI/SP archives



Juruna children in the Paquicamba Indian Area.



Fortunato, one of the elder leaders of the Juruna.



Manoel Juruna still does not know when he and his family will have to leave the place where they now live.



Manoel Juruna's residence is located in the part of the Paquicamba Indian Area that will be flooded by the Cararao dam.

vaded. In that year, a FUNAI team verified the existence of a camp of settlers and two gardens on the banks of the Bicho stream, inside the reserve. The report also mentions the presence of invaders with installations in the region of the Bom Jardim stream, to the west of the Indian Area (Ferreira 1986:3).

The Juruna people are the most directly threatened by the Altamira Hydroelectric Complex. The eventual building of the Cararaô and the Juruá dams (first phase of the project) will flood a large part of Juruna territory, making the permanence of these people in the region that they have inhabited since the eighteenth century impossible.

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The Arara

Marnio Teixeira Pinto

Introduction

SINCE THE PAST CENTURY, the Indians of the region of the left bank of the Xingu River have been known by the generic name of Arara, a designation probably based on motifs that the Indians used in tattooing their faces.

Scattered reports on Arara Indians, however, provided either by the regional population or by Xipaia Indians, referred to tribal populations located at very different geographical points, suggesting either a reasonably large population in the territory or a variety of groups to which the same term applied.

The economic history of the southern region of the state of Pará between the middle and end of the nineteenth century, with its cycle of expansion in rubber extraction and immense migratory flow resulting from major droughts in the northeast in the same period, very probably led to the dislocation of these Indians, who gradually withdrew more and more into the forest, abandoning the periodic contacts they had with the regional population and even with the town of Altamira.

At the end of the 1940s, one could no longer get any information on any Indian recognized regionally as "Arara"; at the time, they were Indians whose extinction was held as certain.

There is information—very confused, however—that in 1964 the Villas-Boas brothers, when they sought contact with a Kayapó subgroup, located a small group of "Arara" Indians in the region that today is to the north of the Trans-Amazon Highway, around km 70, near a stream called Penetecaua. However, they did not make any contact with them.

The 1970s, in turn, put the Arara on the agenda of the national political scene, disclosing the reality of the contradictions between Brazil's developmentalist strategy as a whole and that of Amazonia in particular, and the internationally celebrated but domestically masked governmental policy for protecting the indigenous populations, projected in Law 6.001 of 12/19/78.

Contact

With the initial works in the construction of the Trans-Amazon Highway—coinciding with the arrival of new colonists to the Altamira region—a group of Indians came to resist the aggressions that they directly suffered, as for example in the several times they were received by bullets from colonists' or highway workers' shotguns, or indirectly through the cutting of the forest and the dangerous approach of machines and strange people to the places where they had their houses and plantations.

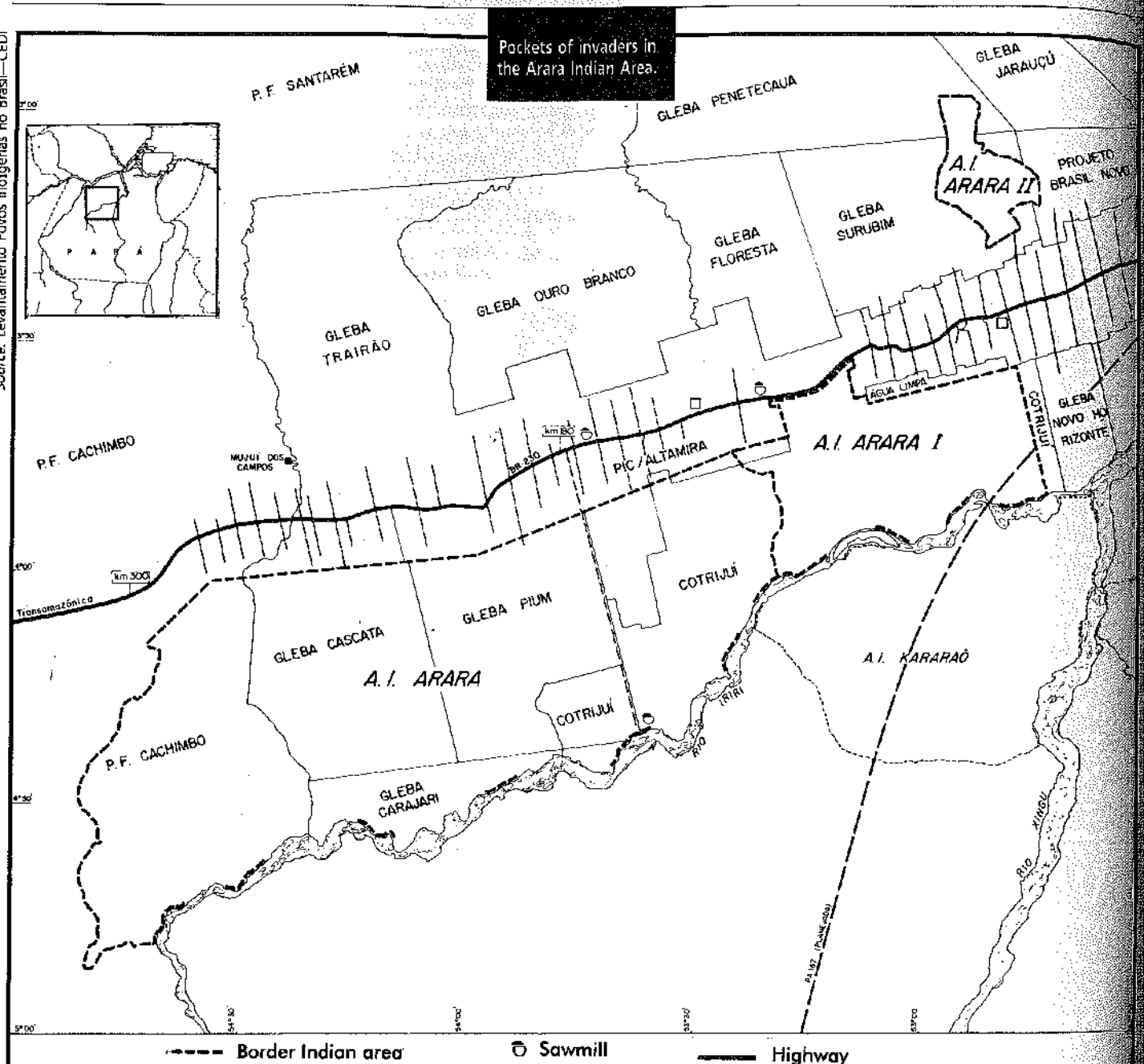
In 1971, FUNAI created an attraction front which, given the *"urgency of the pacification of the Indians to avoid damages to the works and projects in progress,"* came to penetrate systematically into the territory where it was believed that the village could be found: in the region to the north of the Trans-Amazon Highway, around km 92. With the invasion of their lands by the first attraction front teams, the Indians always fled, abandoning their gardens, houses, and tools. Several villages were found, practically all of them recently inhabited. The veritable "Indian hunt" promoted by the attraction team only succeeded in convincing the Indians of the aggression they would suffer and the need to continue their flight.

The lack of success in the attraction of these Indians was so great that the attraction front was deactivated on numerous occasions. The team's workers eventually came to merely accompany the construction work that had not been suspended. But many times, also, it was necessary to reactivate the attraction front, with its members returning to penetrate the forest in search of the Indians.

STILL IN THIS TIME PERIOD, numerous conflicts among Indians, colonists, and highway workers were recorded. The tension in the region grew when, in 1974, an immense portion of the territory inhabited by the Indians was conceded, with the approval of the ministries involved, to the Grain Cooperative of Ijuí (Cotrijuí). But it was only from 1976 onward that the need for interdiction of the area began to be mentioned. It was in that year that the Indians became nationally known through newspaper stories in several of Brazil's capitals; these reports described the way that three CPRM workers who penetrated into the territory in search of minerals were killed.

The drama surrounding the case was due to the descriptions of the mutilations made on the workers' bodies. What was omitted was the fact that months before, in a clash with skin hunters, at least 12 Indians had been hit by gunfire. In 1976, too, the Indians shot at attraction front workers who supported the works of Cotrijuí in the opening of a trail at km 120 of the highway, going south toward the Iriri River.

It was realized, however, that the attraction front could not be dealing with only one group, given the information on the Indians' appearance and clashes with colonists in very short intervals of time but in places very far apart. But only in 1979 were two attraction teams created, one for the north and the

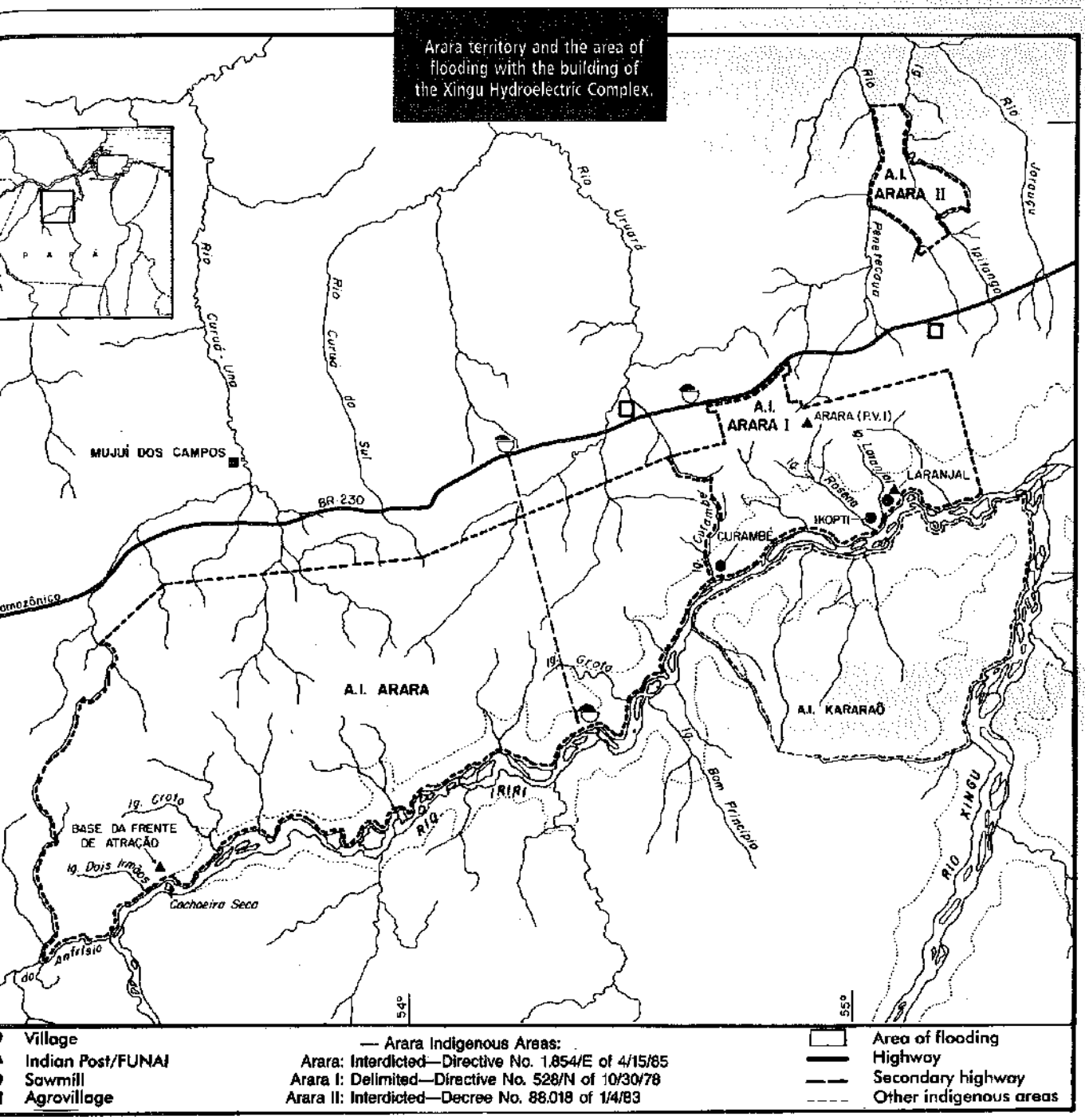


other for the south of the Trans-Amazon Highway. It was believed then that these Indians were the last remnants of the lost Arara, so feared in the past by the Xipaia and Curuaia Indians for the violent way they fought their traditional enemies, the Kayapó and the Juruna.

Also in this time period, studies were initiated for the Altamira Hydroelectric Complex. Several times clearings were opened up inside tribal territory, very near the Arara malocas, by CNEC workers arriving in helicopters. For its part, Cotrijuí continued to open trails and roads around km 120 of the highway, hence between km 80 and 160, which was by then interdicted in its projection to the south, in the direction of the Iriri River (Port. No. 5,281/N of 10/30/78). The second Arara attack on the attraction team dates from this period, again causing deactivation of the team.

The reactivation of the front in 1980 marked a change in attitude in the attraction of the Arara; the goal came to be territorial protection principally for the group located to the south of the Trans-Amazon Highway. To the north, around km 80, the Penetecaua Front established a permanent base; to the south, Vigilance Post No. 1 (VP 1) was created on the southern limit of the road near km 120. The Indians reacted only in the south, attacking VP 1 on one occasion.

Progressively accepting the trinkets offered, the Arara of the south visited VP 1 in February 1981 and came to frequent it thereafter. To the north, however, contact was lost in 1980 and only made



again in 1983, in a definitive way, when Decree No. 88.018 of 1/4/84 also interdicted the area to the north.

The intention to settle the two groups in the same area led FUNAI in 1983 to initiate the work for transferring the northern group to a point inside the area interdicted to the south, which was done in early 1984.

Location, Population, and Land Situation

Since 1984, therefore, the two Arara groups have inhabited the same area to the south of the Trans-Amazon. The first group transferred, from the north to the south, had their village located initially on the banks of a small stream of the Iriri River, on the southern border of the interdicted area. Shortly thereafter, a new transfer put the northern group closer to the place where the group contacted to the south was going to be taken.

It was FUNAI's intention to create conditions for the gradual approximation of the two groups in order to facilitate the operational management of its assistance activities, ignoring entirely the true nature of the marked differences between the two groups (see "Social Situation," further on).

Today, the two villages are about one hour's distance from each other by boat. The larger village, headquarters of the Arara Indian Post, has a population of 64 and is located on the banks of the Laranjal stream, which is also the name of the village;

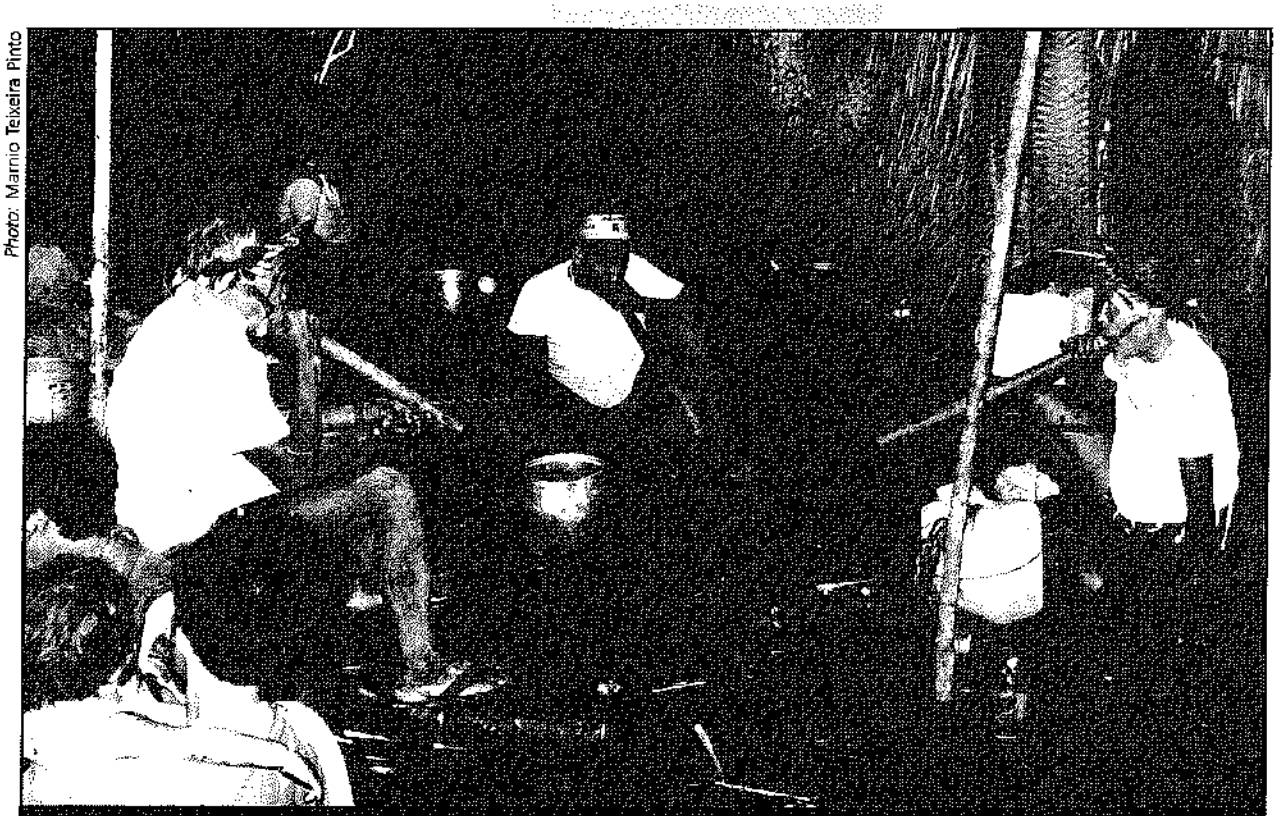


Photo: Marnio Teixeira Pinto

A moment in a hunting ritual: the household heads play musical instruments, drink, and exchange gifts before the hunters arrive.

this is the village of the Arara Indians contacted in the southern area. The other village is comprised of only 22 people who dwell in a single communal house representing the entire group contacted to the north of the Trans-Amazon; this group is called Ikopti, the name of an Arara old man who died shortly after contact.

Of the two areas guaranteed provisionally to the Arara, the one belonging to the northern group is now entirely invaded, which makes any attempt to keep it interdicted impossible in practice. The southern area, however, also has pockets of invaders—lumbermen, prospectors, and squatters. It is in this area that efforts at demarcation and expulsion of invaders are being concentrated today, for the purpose of preserving the tribal territory. It is, nevertheless, the area most threatened by flooding, due to its location on the banks of the Iriri River, because it has a land surface marked predominantly by shallows that form numerous streams and small watercourses.

Another kind of threat has figured prominently in the case of the Arara: that caused by the licensing of prospecting on their lands, licenses given by former FUNAI workers in Altamira, who have fortunately been removed, hopefully for good, from any influence in the future of these Indians.

Social Situation

The Arara, a Carib-speaking people, are still too little known for us to be able to evaluate all of the implications and consequences of the contact that has been forced on them.

It is known that, from the point of view of population, the phase of contact between 1980 and 1983—that is, the years in which the attraction front came to exercise a presence more in protecting the territory than in searching for Indians in the interior of the forest—was not marked by great losses among the Arara. The flu outbreak that affected the southern area group killed seven people, but these are the only deaths attributed to the post-contact epidemiological situation. On the other hand, the total number of births continues to be relatively high. In January 1987, we counted 16 children—among a population of 63—among the southern area Arara with probable age of up to six years, which represents 25 percent of the population. These 16 children, moreover, would have been born after the consolidation of contact in 1981.

It would be more complicated to analyze the consequences of contact from the social and cultural point of view. It is still only possible to know very little of the precontact way of life and how the Arara themselves perceive their new situation. It is certain, however, that their small population of 86 people could not serve as a mark of their virtual disappearance as an ethnic group (which was often popularly claimed), much less of their supposed imminent disorganization as a self-regulated and defined sociopolitical system. Their social emphasis on family units and on small, residential clusters makes the Arara a highly flexible group

resistant to the pressures of contact that have been imposed on them until now.

The larger Arara village—that of the Laranjal stream—is today comprised of only two main houses organized around an elderly man. The houses are autonomous economic units, organized internally by ties of obligation among the several nuclear families living there to the "head" of the maloca. There are no ties of obligation from one house to another, and it is only during the festivals commemorating the great hunts that the two houses participate together in the same activity. Such festivals have come to be more frequent in the last two years; the oldest man and other members of the single house of the other Arara village participated.

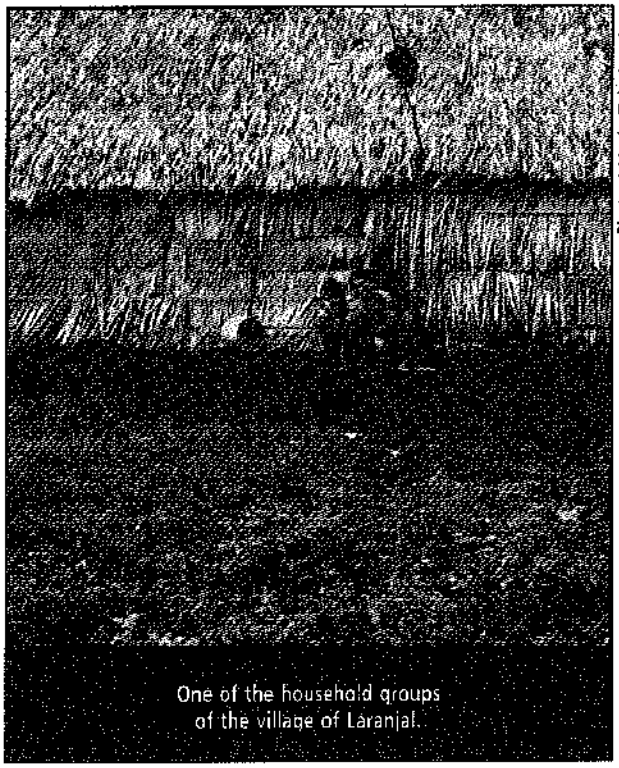


Photo: Mário Teixeira Pinto

One of the household groups of the village of Laranjal.

These days, it is possible to note a serious situation of internal tension in the southern Arara group, a situation provoked by the "option" given by FUNAI that some of the Indians come to live at the VP 1, very near the Trans-Amazon Highway, and not together with the rest of the group. This "option" was sustained in the beginning—in an entirely premature, disconnected, and misguided way—by agricultural projects, the supra-economic intent of which was to permanently settle part of the Arara at the problematic points of their territory. It is interesting to note that there are reports of Arara Indians who, given the nearness and the intense contact with southern colonists of km 120, have already begun to frequent evangelical cults. This fact shows the dimension and impact of the irreparable influences to which the Indians will be subjected over a short period of time. Added to this is the fact that, for the Indians, the "option" to move to the VP 1 signifies a greater possibility of acquiring material goods—through the commercialization of production—which has led to a double dependency: on the goods themselves and on FUNAI as a supplier of these goods. It will be possible to perceive the real problems involved by living next to the VP 1.

Two other aspects present in FUNAI's initiatives deserve mention. First, it is worth remembering that our knowledge of the Arara is still too precarious for us to be able to know, even if in summary fashion, the nature and the relations involved in their economic processes. Such a difficulty makes the agricultural projects in the phase of implantation essentially risky enterprises, perhaps even lethal for the groups over the medium and long term.

Second, the hurried manner in which the projects were initiated has unleashed a process of disputes for leadership—leaders are weak among the Arara but fundamental for ritual life—which has created undesirable situations for the Indians themselves.

Perspectives

In the material presented in this chapter, it can easily be noted that the two Arara groups are still not in a stable social situation. Whether it be in their economic life, with the necessary process of recognizing the resources still available to them in the part of the territory that was left over for them, or whether it be in their ritual life, which only a short time ago has come to be valued again in all its known manifestations, the Arara have certainly gone through a reevaluation of their present situation—internally, in re-creating situations of joint participation of domestic units, and externally, in gradually learning their relationships with FUNAI and with other non-Indians.

All new interferences that do not seek to guarantee basic conditions for the improvement of the Arara according to their own expectations will bring with them the risks of definitively undermining the efforts of the Arara themselves for their survival throughout so many years of conflicts, changes, and successive attempts at reorganization of tribal life.*

*At the end of 1987, contact with a group of isolated Indians was consolidated in a place called Cachoeira Seca, on the southwestern border of Arara Area I (south). This was a group for which contact had been expected, whose existence had been noted since the time of attraction of the southern Arara group. It is, in fact, another Arara subgroup, and there is even information on the mutual recognition among people of both groups. The population of this group must be about 20 people; probably they are the remnants of another local Arara group separated from the rest for still unknown historical reasons.

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The Kararaô of the Iriri River

Lux Boelitz Vidal

The Kararaô are a Kayapó group that split off from the Gorotire possibly in the 1930s.* After this event, all the other Kayapó groups resulting from this fission became known by this denomination. Here, we will consider only the Kararaô group of the Iriri River. This group, which inhabited the region between the Xingu and Iriri rivers, where they remained practically ignored until the opening of the Trans-Amazon Highway, were contacted by FUNAI in 1971. At that time, the group consisted of 38 individuals. In 1973, they were transferred to the Kararaô Indian Reserve, which covers the region of dense forest at the confluence of the Iriri and Xingu.[1] The delimitation of the reserve includes the Baliza (tributary of the Xingu) and Mossoró (tributary of the Iriri) streams, as well as a dryline connecting their headwaters. The Kararaô Indian Post, 285 km by river from Altamira, is accessible in six hours' travel by motorboat (there is no local landing strip).

After an unsuccessful pacification, these Indians lost several of their population to disease, and a certain number of Indians left the village. The imbalance between the sexes came to create a situation *sui generis*, a village of women who fished and hunted. This led FUNAI to try, unsuccessfully, to transfer the population of that post to other Kayapó villages. Today, they are 58 individuals and have

*We still have not had the opportunity to visit this group. This survey was prepared on the basis of data presented in the "Kararaô" chapter of the Southeast Pará (Xingu) volume of the series *Levantamento dos Povos Indígenas no Brasil* from CEDI (unpublished) and information obtained from the FUNAI assistance headquarters in Altamira in April 1987.

[1]The Kararaô Indian Reserve was created in 1971 (Decree No. 68914 of 7/13/71) with about 224,000 hectares.

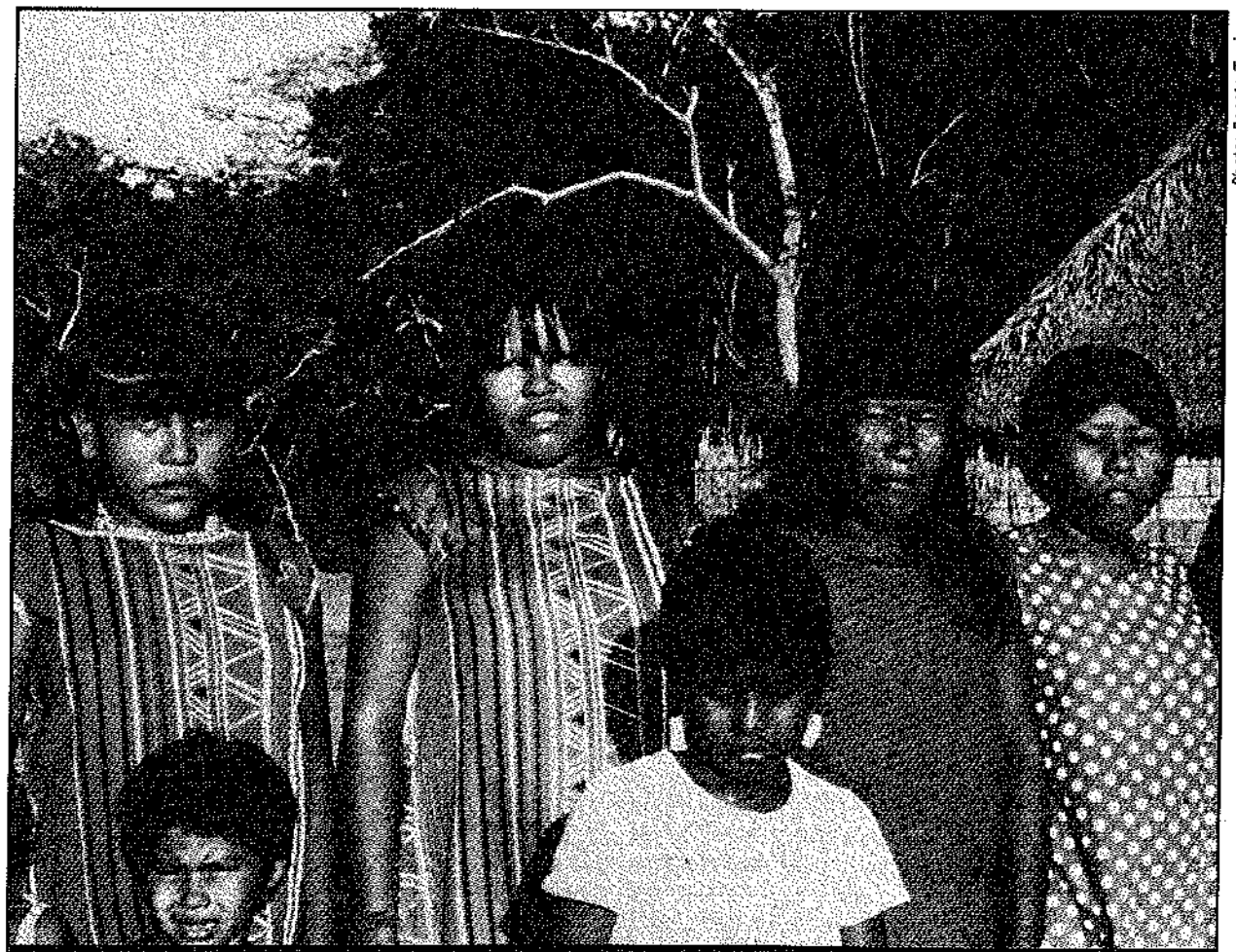
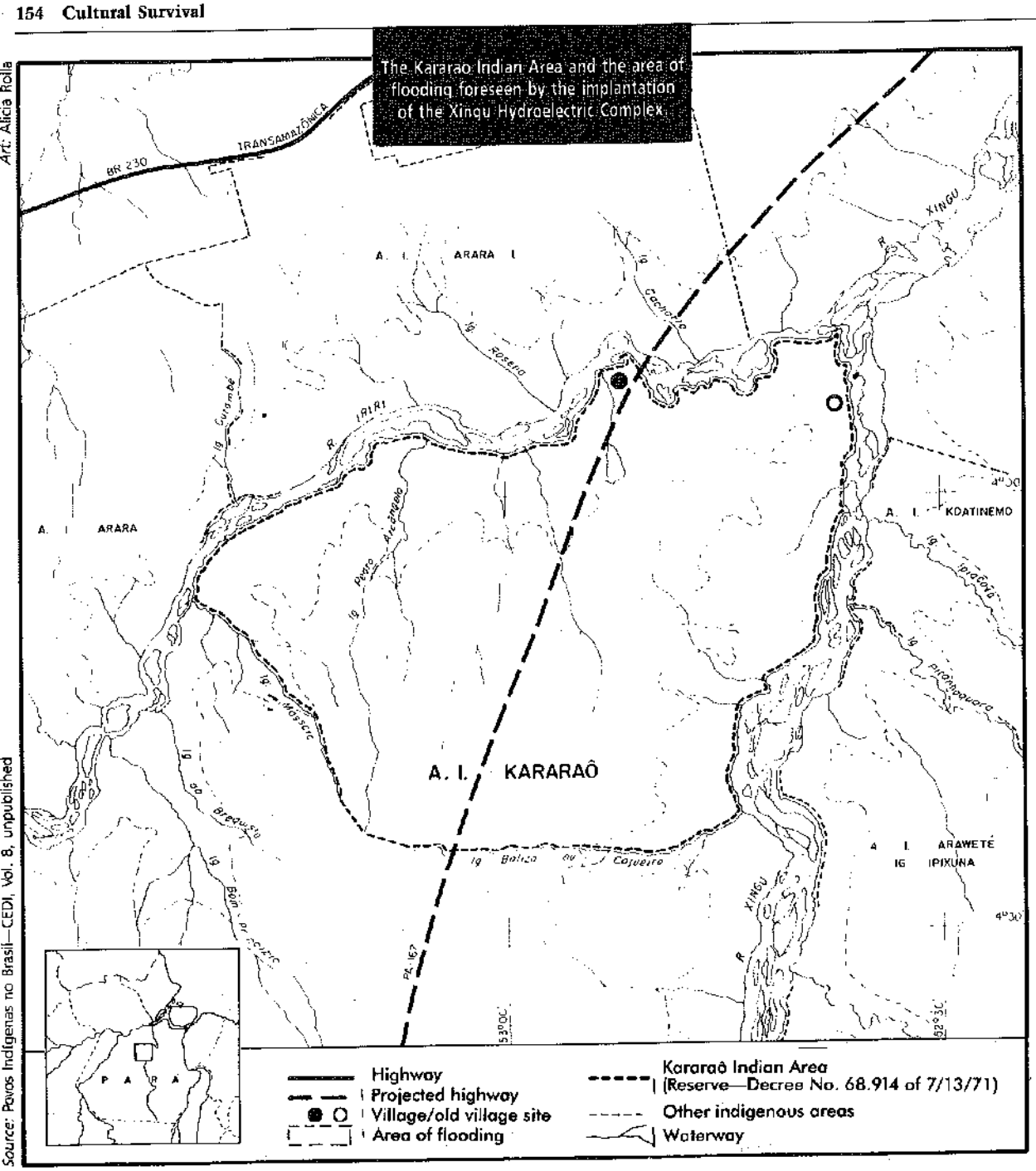


Photo: Renato Trevisan

The adult female population is an absolute majority in the Kararao village; after contact, many men died or left the village.



Art: Alicia Rolla

Source: Povos Indígenas no Brasil—CEDI, Vol. 8, unpublished

partially recovered their population balance.

The old FUNAI post and the village built in 1973 on floodlands were transferred to terra firma in 1981 after a flood. This greatly improved the health of the group, which had been precarious in that village.

The village is comprised of five adobe and thatch-roofed houses lined up along the river, in addition to the houses of the post, an infirmary, and a school.

As a supplement to their traditional subsistence activities, the Indians gather and sell castanha nuts directly to Altamira.

Land Situation

Delimited by decree, the reserve has never been physically demarcated. In May 1979, the Kararaô of Iriri were transferred to the Bacajá post. The attempt failed, and the Kararaô were subsequently taken back to their reserve. This perhaps may explain the observation by the authors of the *Hydroelectric Inventory Studies of the Hydrographic Basin of the Xingu* when they refer to the fact that the hydroelectric dam at Babaquara in "Alternative A" will mean the flooding of 70 percent of the reserve: "It is known that the reserve is being deactivated" (CNEC 1980:6.49)—which does not correspond to the truth.

Presently, the Kararaô are opposed to any transferrence and the possibility of losing 70 percent of their traditional territory is one of their greatest concerns in relation to the construction of the dam.

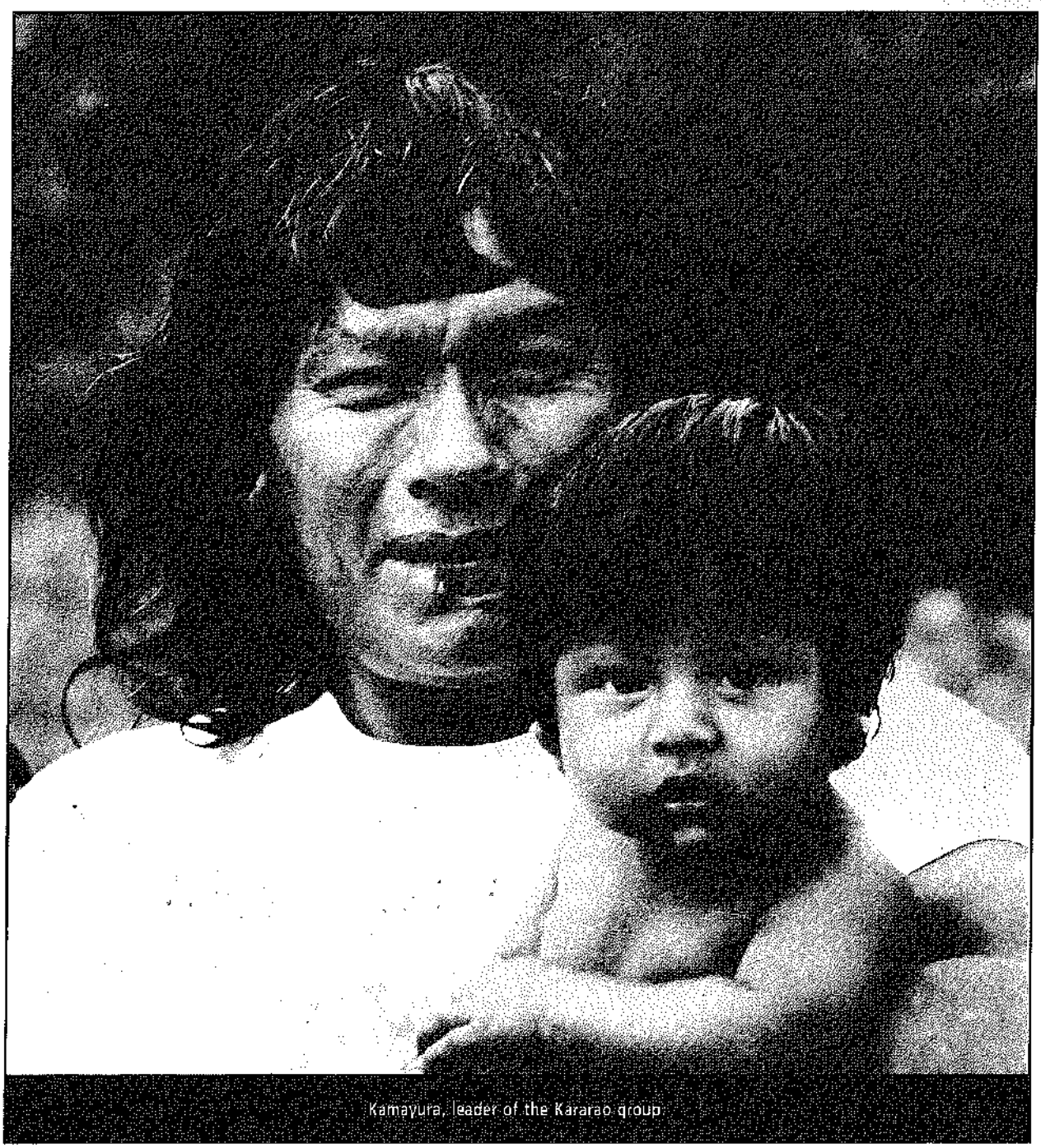


Photo: José Maria Spricis

Kamayura, leader of the Kararao group

The Kararaô are the Kayapó subgroup that suffered the most in the times of the so-called "pacification." In addition to the group of the indigenous reserve of the Iriri, everything indicates that two groups still exist that have not been contacted; in these circumstances, there is little information available about them. Supposedly, one of these groups occupies the region of the lower Guajará, in the municipality of Prainha (Pará); the other would be located between the Jamanxim and Curuá rivers (CEDI, unpublished).

In July 1987, the Xikrin of Bacajá identified a village cluster which, according to them, is probably Kararaô, on the middle Branco River, tributary of the left bank of the Bacajá (see map on page 154). They have not, however, entered into direct contact with them.

All of these Indians are the remaining survivors of three groups that were "pacified" between 1930 and 1960 and are today extinct. During that time, only 14 Indians were gathered together who reside today with the other Kayapó villages (Catete, Bacajá, and Trincheira). In summary, just in this century, three Kararaô groups have been "pacified" and literally exterminated.

It is absolutely necessary to guarantee the existence of the remaining Kararaô as an autonomous people and to preserve the integrity of their territory.

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Photo:

Indigenous Peoples of the Xingu-Bacaja

In 1985, the proposal for creating the Xingu-Bacajá Indian Area – prepared by the anthropologists Lux Vidal, Regina Müller, Antonio Carlos Magalhães, and Eduardo Viveiros de Castro – was presented to FUNAI. This reserve includes the territory of four indigenous peoples: Asuriní, Araweté, Parakanã of Bom Jardim, and Xikrin of Bacajá.

The proposal for a continuous area for these four peoples seeks to guarantee the integrity of their territories, avoiding the creation of "corridors" among the different areas which would facilitate future invasions. As the Xikrin and Parakanã Indians are included in the Project for Support to Indigenous Communities/Carajás Iron Ore Project, the Companhia Vale do Rio Doce has endorsed the proposal for the Xingu-Bacajá Indian Area, transmitting it to the president of FUNAI on 27 November 1985 (CVRD/GTMAK 471/85, 11/27/85).

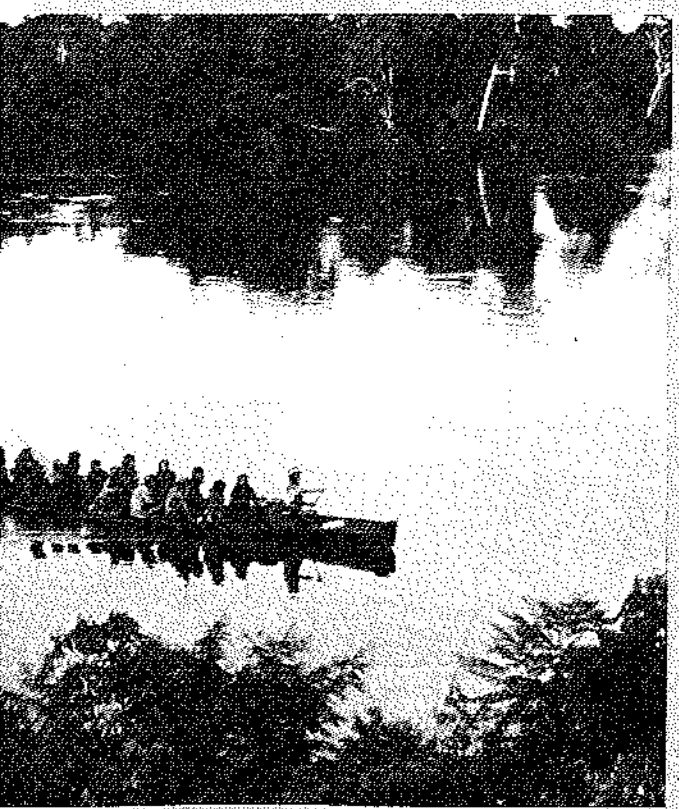
Currently the land situation of each group's territories differs. The territory of the Xikrin Indians, known as the Bacajá Indian Area, has been delimited and physically demarcated with 192,126 hectares (CEDI/Museu Nacional 1987). The demarcation made in 1979, however, is contested by the Xikrin because it excludes hunting-and-gathering areas and their principal castanha trees (CEDI, unpublished); also, the village of Trincheira is located outside the delimited area (Vidal 1985).

The Koatinemo Indian Area, inhabited by the Asuriní Indians, has merely been identified. In 1986, the proposal for delimitation of the area with 288,600 hectares was approved by the Interministerial Work Group (Opinion No. 128 of 10/15/86). However, the area has not yet been homologated by the Presidency of the Republic (CEDI/Museu Nacional 1987; Müller, personal communication).

The Araweté had their territory interdicted by FUNAI decree in 1987 with an area of 985,000 hectares (Portaria PP/4.101 of 12/30/87). In the same year, FUNAI interdicted the Apyterewa Indian Area, inhabited by the Parakanã (Port. No. 3.632 of 11/6/87). The interdicted area, however, excludes on its northern border the region between the Bom Jardim and São José streams, which, according to the anthropologist Antonio Carlos Magalhães, is an area of perambulation for the Parakanã that ought to be included in the reserve to be demarcated (Magalhães 1985).

In 1986, the Directorate of Indigenous Patrimony (DPI/FUNAI) prepared a document (Descriptive Memorandum, DPI/FUNAI, 9/26/86) proposing the interdiction of 240 km² located between the Koatinemo and Araweté/Ipixuna Indian areas (western border) and the Bacajá Indian Area (eastern border). The objective of this proposal was to guarantee the inclusion of the "corridor" between the indigenous areas, thus preventing future invasions. Until the present, however, the interdiction of that region has not been legalized.□

Lux Vidal



The Kayapó-Xikrin on the Bacajá River.

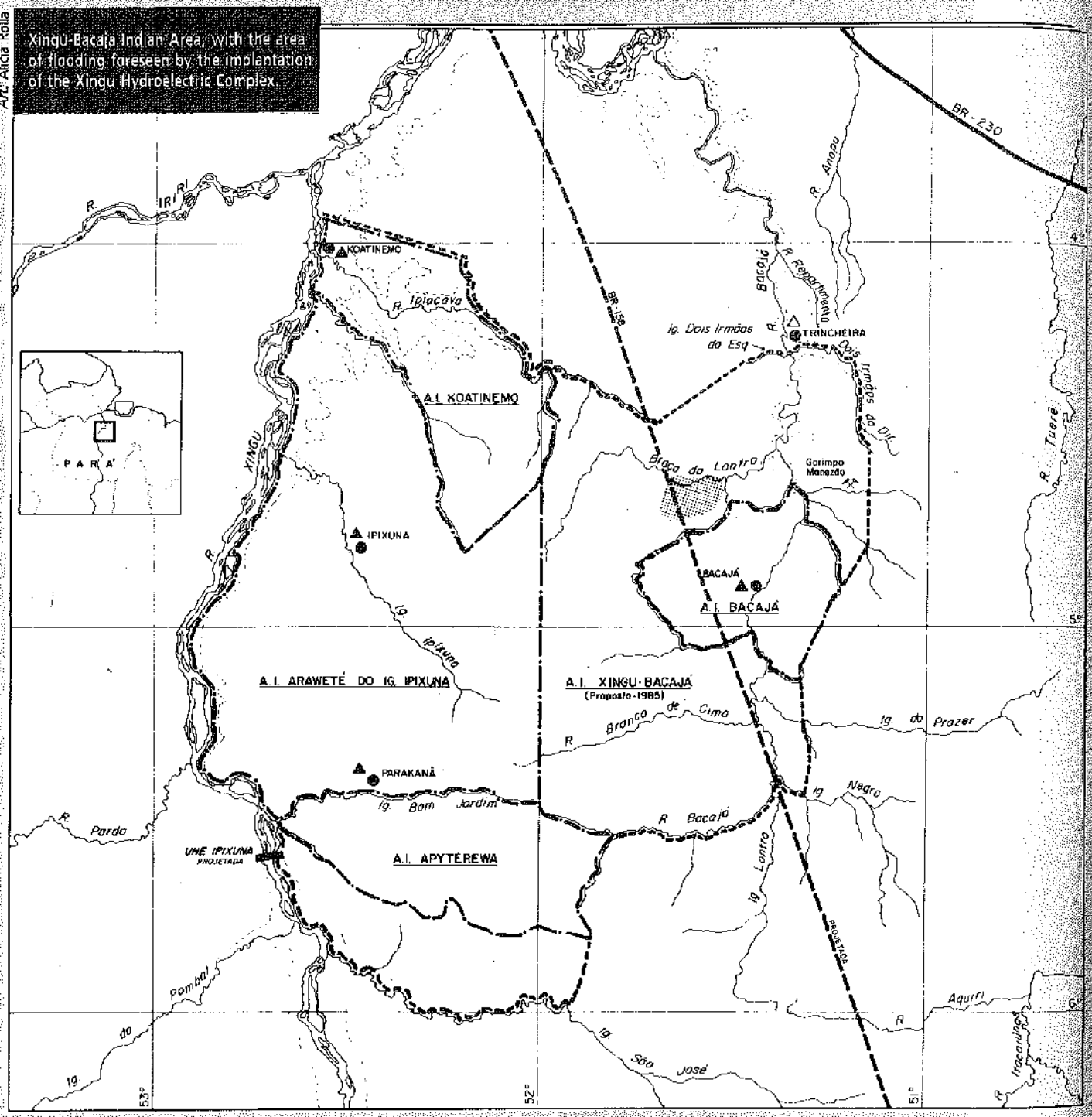
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Highway
Projected highway
Village/old village site
Indian post/old Indian post
Area of flooding
Waterways
Approximate location of isolated Kayapó groups
Indian areas:
AI Koatinemo: Asurini, identified, Parecer 128, 10/15/86
AI Arawetê of Igarapé Ipixuna: Arawetê, interdicted, Directive FUNAI/PP4.101, 12/30/87
AI Apyterewa: Parakanã of Bom Jardim, interdicted, Directive 3.632, 11/6/87
AI Bacajá: Xikrin, delimited with physical demarcation, Directive FUNAI 380/N, 6/26/76
AI Xingu-Bacajá: Asurini, Arawetê, Xikrin, and Parakanã of Bom Jardim, CVRD proposal 1985

The Kayapó-Xikrin of Bacajá

Lux Boelitz Vidal

In the Xingu Hydroelectric Complex's direct area of influence are three groups of the Kayapó tribe, of the Gê linguistic family. These groups are the product of various historical schisms, a traditional practice among these Indians. Always forming new villages, they maintain a certain demographic equilibrium, conquering new territories and natural resources and, at the same time, conserving their sociopolitical structure.

The Kayapó lead sedentary lives in circular-shaped villages, with a clear division between public space (the central plaza) and private space (the houses). Around their permanent villages they cultivate gardens of, basically, manioc, sweet potatoes, and corn. But they are also seminomadic; they roam their territory for weeks, even months, in the dry season, surviving on the resources of the forest and of the cerrado: game, fish, honey, fruits, coconuts, castanhas, and palm cabbage. They also use this time to stock up on medicinal plants, embiras, palm fibers, and bamboo for making their artifacts. In these trips, an entire village moves together or, more often today, divides into age-class groups, or the mens' society, while the women stay in the village. The different Kayapó groups, whose population can vary from 40 to 60, speak the same language and possess the same customs. Each community, however, forms a more or less autonomous entity from the political, economic, and social point of view. Each group has its own history of migrations, schisms, and, consequently, its own history of contact. Each group has developed survival tactics following the so-called "pacification" and confinement in their respective reserves. In addition to the three groups that will be directly affected by the Xingu hydroelectrics, there are ten other Kayapó groups in the southeast of Pará, located in the middle Xingu, Iriri, and Itacaíunas basins, who will also suffer the impacts of these works.

The Xikrin of the Bacajá Indian Post

The Indians' village is located on the left bank of the middle Bacajá River, tributary of the right bank of the Xingu, municipality of Senador José Porfírio, state of Pará (coordinates 4°55'00"S and 51°26'20"W).

The region is covered by dense forest and, for the time being, is only exploited by the Indians. Depending on the season, game and fish are abundant. The Indians cultivate good gardens using the slash-and-burn technique, and produce manioc cereal in large quantities; these foods, together with a continuous harvest of various kinds of bananas, provide their basic nutrition throughout the year.

The distance between the village and the city of Altamira, headquarters of the FUNAI assistance agency, is one hour by plane, or three to four days by motorboat, depending on the season.

The total population in April 1987 was 159 people. In 1984, several Indians were transferred to the Xikrin village of Cateté, and in 1985, a split occurred in which four families moved to Trincheira, on the middle Bacajá, where they built a new village (see map, p. 158).

For the time being, the vast riverine area that extends from the village of Bacajá to Trincheira, including the banks of the river, is still untouched, without any sign of occupation except for a much-developed gold mine located on the banks of the Manezão River.

History of Contact

The group that today is called the Xikrin of Bacajá had its beginnings when the ancestors of the Xikrin, who inhabited the region between the Araguaia and the upper Paraupebas, moved in about 1926 to the north into the region of the Bacajá River, fearing retaliations from the Kayapó-Gorotire, with whom they were at war.

Shortly after, the group split and one part returned to the region of the Cateté River (tributary of the Itacaíunas River), thence forming the Xikrin of the Bacajá and Cateté.

These two groups, as usually happens, came to have a hostile relationship fed by the political rivalry that created the schism and a constant wish to unite by force the kin-groups separated by that schism. In 1952, a group from Bacajá joined the group from Cateté shortly before its first contact and pacification at the Las Casas Indian Post near Conceição do Araguaia. In 1954, another group from Bacajá approached the village of Cateté and a portion of the group, about 60 individuals, remained to become part of it.

In 1968 an attempt was made to unite the two groups, but the Indians of the Bacajá, demonstrating their wish to remain autonomous, remained in that region.

Contact between the frontiersmen of the SPI and the Xikrin of Bacajá took place on 13 November 1959 very near the mouth of the Golosa stream on the Bacajá River. The Indians fell victim to epidemics; many died, and the Indians once again sought refuge in the woods.

In 1961, another SPI front contacted them on the Carapaña stream on the right bank of the Bacajá,

where they had a large village. Much later, the Xikrin settled at the old SPI post, called Francisco Meirelles, below the Dois Irmãos stream (see map, p. 158). The Kararaô Indian Mauré (today one of the chiefs of the village of Trincheira) participated in this pacification and married a Xikrin woman. In 1965, they were finally transferred to the village known today as Flor do Caucho.

In the early 1970s, the Xikrin began to receive FUNAI assistance through the Kararaô base of Altamira, which directed the attraction fronts created with the opening of the Trans-Amazon Highway. At the end of 1971, an airstrip at that post was completed.

History of the Demarcation of the Reserve

In 1976, the FUNAI team that was working under the agreement with RADAM for the selection of indigenous areas proposed a reserve of 181,650 hectares (FUNAI/DNPM/RADAM BRAZIL Agreement 1976). The RADAM/FUNAI team's proposal, coordinated by Aviation Major Saul Carvalho Lopes, was the result of an evaluation made on the basis of a simple flight over the area, with no onsite survey and without the participation of the Indians.

In 1979, the reserve was demarcated by Setag, a firm from Goiânia (FUNAI/DPI, Demarcation Plan for the Bacajá Indian Area 9/18/84, FUNAI–Process BSB/4728/79). The Xikrin contested the demarcation in progress because the northern, southern, and eastern borders left out their principal castanha trees along the river and their fishing areas and the western border excluded hunting-and-gathering areas.

On evaluating the demarcation, the DGPI/FUNAI engineer proposed to increase the area and asked for a work group to study the new borders. Since the Asuriní and Araweté areas were about to be delimited at that same time, the work group created by Decree No. 627/E of 10/15/79 had the job of defining the borders of the Bacajá area and the areas to be interdicted for the Asuriní and Araweté, as well as for the isolated group (the Parakanã of Bom Jardim, now contacted and settled in villages). At that time, the work group proposed a single, continuous area called the "Koatinemo-Ipixuna-Bacajá Indian Areas," including the four groups.

With regard to the Bacajá area, the proposal widened the area at all of its borders, from the headwaters of the Bacajá River to the middle Bacajá, and a bit above the old SPI post.

The 1979 proposal was put on file in 1983 and the Bacajá Reserve was dismembered from the Araweté and Asuriní Indian areas. Of the 498,125 hectares proposed as the Bacajá Reserve, 192,125 hectares have already been demarcated and 306,000

Notes on the Xikrin and Their Environment

William Fisher

WHILE KNOWN POPULARLY as inhabitants of the savanna and terra firma of the Amazon region, many Gê Indian groups are intimately influenced in their daily activities by riverine conditions. The Bacajá Xikrin are such an example. The purpose of this section is to convey an idea of some of the important ways in which the Xikrin interact with their surroundings.

The Xikrin have been great wanderers in their recent past and have conserved an extensive knowledge of the terrain extending up and down the Bacajá River from their present-day village location. They were familiar with the site of this village long before they actually settled there because it lay on the fording place of the trail formerly used to make war on other tribes living to their west, particularly the Asuriní. However, their extensive knowledge of riverine and inland topography has made little difference in their choice of village location. In fact, along the Bacajá River, as attested by past evidence of aboriginal and backwoods settler's vestiges, there are only a limited number of suitable settlement sites abutting the river. This is due, above all, to the pattern of rainy season flooding that makes the position of the river's margins unpredictable, due to seasonal fluctuation of the water level. A fairly level expanse for settlement with not overly steep access to the river's edge is another limitation.

Locations that meet these inflexible criteria are few and far between. On most sites, one can find numerous potsherds and stone axe heads confirming previous occupation by Indians. Many sites also feature fruit trees—mango and, especially, lemons—planted by a previous wave of Brazilian settlement, presumably during the peak of the rubber boom. These sites have long since lain dormant and, in fact, the present Bacajá site was previously the site of the now disbanded Brazilian settlement known as Flor do Caucho.

Despite the difference between the subsistence patterns and organization of non-Gê indigenous groups (assuming that the presence of ceramics reveals a non-Gê origin), and those of Brazilian backwoods people, rubber tappers, and the present Xikrin occupants, all chose settlement spots that were not merely similar but *identical*. The evidence is incontrovertible that when the community is oriented toward year-round use of river resources, including the use of fish and a strategic monitoring of the water course as well as the use of water transport (which the Xikrin enthusiastically adopted after contact), the fluctuation of water level eliminates all but a few selected locations as be-

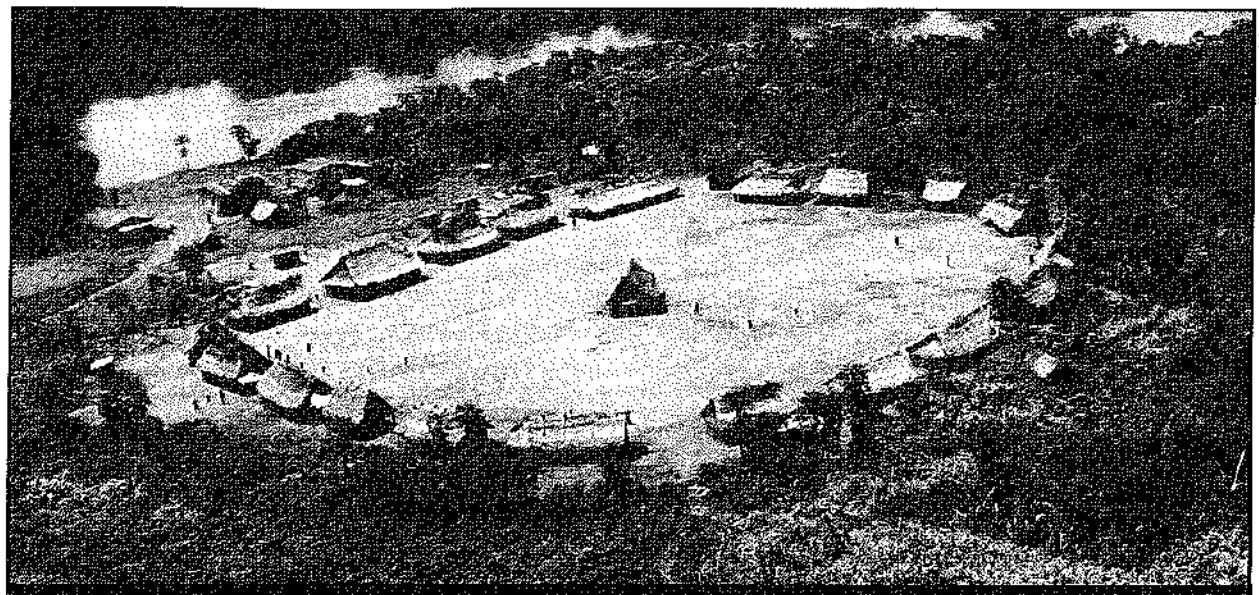


Photo: William Fisher

The Kayapo-Xikrin village, located on the banks of the Bacajá River.

hectares are areas of increase.

Currently, the demarcated area does not correspond to the area of effective occupation. The Xikrin hunt and fish beyond the established borders and their castanha trees are outside the reserve, along the Bacajá River, both upriver and downriver.

The Xikrin and Kararaô of Trincheira

This group of 36 people separated from the Bacajá post in June 1985, building a new village on the middle Bacajá, a short distance from the old SPI post.

ing suitable for human settlement.

The present village of Bacajá has remained in the same location for more than 20 years, and good land for cultivation remains within close proximity. The Xikrin have begun reusing old garden sites that were left fallow; apparently there has been no decrease in yields noted as a result of site recycling.

One must be aware that FUNAI has encouraged the Xikrin to sell their surplus garden products, particularly corn and manioc flour, at the regional market in Altamira. This emphasis on the market value of crops seems to be having two main effects: an increase in land under cultivation and a heavier emphasis on monocropping.

The introduction of a market motive, even if done with the good intention of making possible the acquisition of more manufactured goods desired by the Indians, could backfire, reducing the amount of food available to the community and increasing the Indians' workload and, ultimately, even chiefly authority. In the long run, increased amounts of cleared land per year and the increased reliance on monocropping could force the Xikrin to search for suitable agricultural land at a much greater distance from their village, with negative consequences for other tribal activities.

The typical Xikrin garden is circular: sweet potatoes occupy the center, surrounded by manioc plants, papayas, and other minor cultigens. Corn is planted everywhere since it is harvested after only a few months, before other plants mature. The garden periphery is often ringed with banana plants, and yams are allowed to grow practically anywhere, being so aggressive that they may even scale the forest trees along the garden's edge.

The Xikrin depend about equally on hunting and fishing for their protein supply. They prefer to use shotguns for hunting, although they use bows and arrows with sufficient skill and accuracy to kill small birds and fish. They use nylon lines and hooks for fishing, although during the dry season they might employ the techniques of timbo fish poison in small creeks away from the river channel.

Both game and fish are still relatively abundant, within a day's walk from the village. However, in the rainy season meat and fish returns diminish significantly and, in fact, fishing practically ceases between January and March, although occasional forays are made into the flooded forests in search of piranha or pacu feasting under loaded fruit trees. They compensate for this lack with an increase in agricultural products, especially corn, and they also make much use of the then plentiful wild fruits, especially Brazil nuts, pequi, hog plum, and inga pods.

In part the Indians relieve the pressure on game within the proximity of the villages by launching most of their hunting parties from some point along the Bacajá River, both above and below their village location. The hunting party proceeds in a direction perpendicular to the river bank and returns in an arc to the same spot. This is most

(more)

Thus, the historical occupation of this area by the Xikrin remains confirmed. The group plants good gardens and also obtains food by hunting and fishing. They live in very isolated conditions: one day's travel by boat from the Bacajá post and two days' travel from Altamira. They visit the city for medical treatment and to sell salted fish. The price of fish, however, makes these trips more and more difficult, given that they cannot count on the support of FUNAI, which does not have a post in Trincheira (it doesn't even have a landing strip). The Indians, although they do not want a FUNAI worker stationed in the village, feel they need assistance for health and education, as well as a minimum of support for purchasing fuel and tools.

This group, no doubt, occupies a strategic place on the northern border of the area effectively utilized by the Xikrin, acting almost as a vigilance post, preventing all intrusions of invaders from upriver. Two FUNAI signs have been put on the riverbank, downriver from the village, declaring the region as being for the exclusive use of the Indians.

The two leaders of this village are mixed sons of a Kararaô and a "civilized" woman who, although of indigenous physical appearance, was captured by these Indians at the age of 12 and has lived among them for more than 25 years. At the time of pacification, with the rapid extinction of the group, she returned with her five children to live with the "civilized people." She still lives today on the banks of the Xingu at Boa Vida, downriver from Altamira, where we had the opportunity to meet her in April 1987. Her sons live in the village of Trincheira — Tucum, married to a woman from the region, and Mauré, married to a Xikrin woman. The two other families are from the Bacajá Indian Post. These Indians need to have a guarantee of demarcation of their lands, which FUNAI has still not done.

The Gold Mines

Since 1980, there has been a gold mine along the Manezão River, tributary of the right bank of the Bacajá (see map, p. 158). This region of Manezão is located in indigenous territory despite its having been put outside the limits of demarcation, due to a topographical error, as we shall explain below.

This gold mine, which we visited in April 1987, has two airstrips; several lots of open pits were being intensively exploited by manual and semimechanized methods. Depending on the time of the year, between 300 and 1,000 men work there. Several categories of people work there simultaneously: prospectors, who only own the open pits, and their workers, who earn based on the percentage of gold extracted; the more powerful owners, who have purchased lots; owners of the airstrips and aircrafts, which are the only means of communication with Altamira; and owners of local commerce,

effective when greater distances may be traveled by water away from the village, and the Indians have come to rely fairly heavily on motorized canoe transport for trips once or twice weekly in which almost all adult males participate. Although the region still offers rich possibilities for the hunter, some changes are evident. In the past, herds of wild peccaries roamed the area and even intruded into the village itself. The Indians claim that, formerly, fishing yields were even greater, and they blame the installation of a gold mining outfit far upstream at the headwaters of the Bacajá River.

In certain seasons, they organize expeditions with the express purpose of collecting various forest products. In addition to those mentioned above, coconut oil from the babassu palm is diligently pursued and has even been collected for the purpose of barter with other Kayapó villages. They also collect the copious egg deposits left by the river turtles in the sandbars that appear along the river course during the dry season in August and September. By far the most important collected item is Brazil nuts, which in the recent past represented the preponderant source of revenue for the village. Brazil nut groves exploited by the Indians are spread out along both sides of the Bacajá River, extending well inland. Many of the groves extend far beyond the reserve borders in both the upstream and downstream directions. As with other economic activities, collecting groups are organized by political factions. During these expeditions men also take advantage of the relatively unhunted regions around the Brazil nut groves and always return to the village with a large supply of meat, especially land turtles and tapir, in addition to the harvested nuts.

Since mid-1986 this situation has changed, however. Occupying land claimed by the Xikrin, the directors of a gold prospecting outfit operating along the southern border of the reserve have been sending monthly payments to the tribe in order to head off any explosive confrontations. This new income has made it possible for the Xikrin to plan annual Brazil nut collecting trips, which may last several weeks, with a view solely to the needs of the community in order to provide such things as food, raw materials for ritual items, and other objects of Indian manufacture.

In 1985 a group of approximately 40 persons split from the Bacajá main village and established its own settlement a full day's journey by motorized transport downstream, almost on level with the former site of the Xikrin before their move to their current location. From this location, more accessible by boat to Altamira, the group hopes to have more success marketing and trading agricultural products and salted fish in return for money and manufactured goods.

This brief and superficial account of land and resource use by the Xikrin of Bacajá would not be complete without calling attention to one of the important aspects of subsistence activities among



Photo: William Fisher

Kayapo-Xikrin Indians dancing during a festival.

shops, restaurants, and nightclubs, as well as a mining company with a DNPM permit, an office, and salaried workers exploring throughout the region. The gold mine is not comprised exclusively of men; miners' families live there, too. Despite a facade of tranquility, the atmosphere can become violent, and several deaths have been reported.

In the past the Indians have had skirmishes with the prospectors, and in 1983 several Indians even came to work at the mine. In 1987, one of the owners of the gold mine, a resident of Altamira, paid the Indians a monthly wage of 25,000 cruzados

the Xikrin: their significance as indexical information. Indices, following Peirce's tripartite division, in contrast to icons and symbols, are caused by, or are part of, that which they indicate. This relates to the fact that among the Xikrin different social categories and groups adhere to a fairly strict division of labor vis-à-vis one another. If a men's association performs an activity together, such as clearing a garden area or hunting, this displays the fact—to themselves as well as to others—that they exist as a unified and cohesive group. The category's cultural charter is ideological or metaphysical, but it may only play a part in the social life of the tribe once it is given a specific weight and content. In this way it is inevitably self-validating, for if a group succeeds in carrying out joint activities, then it becomes the incarnation of a social category; if not, it does not exist as a group. This is true on different levels of contrast, and in this age of radio contact between Kayapó villages one notes the coordination of activities between villages that are without benefit from either a subsistence or resource perspective. Often one questions whether a particular activity should be viewed as being most efficient from a subsistence or from an information point of view. In many cases the fact that an activity is performed at all is of equal importance to its outcome in terms of food or raw material value, for it is thus that social structure and personal identity are validated. How else can one explain the persistence of "collective" hunts, in which one may hear the participants harping on the difficulty of getting any game at all with so many participants in the same area and in which one is under no obligation to share one's kill with other hunting party members simply because they took part in the same expedition? Beyond this, the limited available data show that solitary hunters tend to fare better than those that go en masse on the same day to hunt in the same section of forest. The reason for the persistence of this "collective" pattern, even in the face of evidence of a more efficient way of doing things from a purely caloric or nutritional point of view, is to be found in the way that Xikrin social structure is articulated.

If the preceding is an example of the indexical value of subsistence activities, the Xikrin are also aware of their symbolic force. In order to discourage reserve invaders on the northern and southern limits, members of one of the men's factions chopped down strips of vegetation along the riverbanks, near the upstream and downstream reserve limits, in preparation for garden planting. The distance of the gardens from one another and from the main village did not make good sense in strict subsistence terms, but their presence conveyed a consciously formulated message that sent an unmistakable message to interlopers: gardens are a symbol of habitation; this is our land and we are living here. Thus even if the gardens were never harvested, they would have served their purpose and the message they contained transmitted as long as their physical existence persisted. □

to promote "good neighbor" relations, provided the community with four to five air passes per month to Altamira when necessary, and from time to time gave them clothing or food. This situation, for the time being, gives an impression of apparent calm in the relationship between the Indians and the gold miners of Manezão—a situation that we consider precarious. FUNAI has not taken any measures; rather, it accepts this semidependence of the Indians and, in addition, controls the money. The Indians, however—at least the leaders—must have some control over the resources because the head of the FUNAI assistance center told us that the Xikrin were spending all the money on "nonsense." This goes to show that FUNAI is not able to maintain a dialogue with the Indians to establish an adequate program for applying these resources. There is another gold mine, further away, at the headwaters of the Bacajá, on the branch that goes to the Bom Jardim River, and the Indians state that prospectors interested in new places to mine have contacted them to ask for permission to go on the Bacajá, which, for the time being, has not been granted. In addition to the illegal invasion of the indigenous territory, another serious problem is the abuse of mercury in the exploitation of gold—there is no monitoring or environmental control. At the Manezão mine, by 1987, more than 700 kilos of this chemical had already been used.

Problems Relating to the Demarcation of the Reserve

In the first place, the area demarcated for the Xikrin of Bacajá, based on only an aerial survey done in 1976, does not correspond even minimally to the territory occupied by these Indians.

On the other hand, the FUNAI work group that conducted an onsite study in 1975 was in the village and traveled by boat to Altamira, surveying all places occupied by the Indians. On the basis of this survey, the work group proposed a continuous indigenous area that included four groups: Xikrin, Asuriní, Araweté, and Parakanã. This proposal was filed away in 1983.

In reference to the Manezão River, which ought to have been included in the reserve, the following took place: at the time of the demarcation, while one group of workers were beginning the demarcation in the woods, the other began its work starting at the river, from the mouth of the Manezão. At a certain point, the two groups should have met, but this did not happen. The group in the woods, which included the old owner of the Manezão gold mine, went down the Chapeuzinho River, reaching the mouth of the river 80 km south of the Manezão. Finally, and in a totally arbitrary manner, this river was selected as the northern border of the reserve, in reference to the indigenous area on the right bank of the Bacajá. The area between the Chapeuzinho and the Manezão, which includes the Carapanã River, a traditional habitat of the Xikrin, ought to be included regardless, and with urgency, in the reserve of the Bacajá Indian Post and before the prospectors decide to expand their explorations.

In October 1985, in view of the need to demarcate an area adequate for the four groups inhabiting the region between the Xingu and the Bacajá, the anthropologists who worked with them presented a joint proposal to FUNAI for demarcating a *common and continuous area* for the Asuriní Indians of the Xingu, the Araweté of the Ipixuna, the Parakanã of Bom Jardim, and the Xikrin of the Bacajá. The proposal was justified by the relevant FUNAI documents: FUNAI/BSB/0707/79, with a detailed map, and by the recent studies and surveys done in that area on these indigenous groups in relation to the demarcation and guarantee of their lands.

This proposal was endorsed by the CVRD in a letter sent to the president of FUNAI on 27 November 1985,[1] and by FUNAI itself, at least verbally, in a meeting held in Brasília the day before. At that time, the Indigenous Lands Group of the Ministry of Agrarian Reform and Development was also informed of the proposal presented to FUNAI.

In the village of the Bacajá, on 6 February 1986, I participated in a formal meeting at the house of the chief, Onça, during which the Indians again demonstrated their concerns about the borders of their reserve, which they consider very small, and asked how they could accompany and activate official consideration of the new proposal. On the other hand, there was total support from the group from Trincheira. The superintendent of FUNAI in Belém at that time also pronounced in favor of the proposal, given the possibility of the construction of the Xingu Hydroelectric Complex, which would create major problems for all the region's Indians. Consequently, on 7 October 1986, FUNAI's Department for Indigenous Patrimony prepared a document for interdiction of the lands located between the four groups mentioned—called a "corridor"—for the purpose of removing any pretense on the part of invaders. The document also designated that, for the purpose of administrative control, the area in question would be denominated the "Xingu-Bacajá Indian Area" under the Regional Administration of Altamira/Fourth Regional Superintendency (Process FUNAI/BSB/3951/85).

The Impact of Building the Xingu Hydroelectrics

The reservoir of the Cararaô-Juruá dam complex

[1]The Xikrin of the Bacajá, as well as the Parakanã of Bom Jardim, are assisted by the Project for Support to the Indigenous Communities, of the Carajás Iron Ore Project, through an agreement between CVRD and FUNAI. The Xikrin of the Bacajá were only included in the project in 1985, and then exclusively for the questions of health and land demarcation. Both Dr. João Paulo Botelho Vieira and the anthropologist Lux Vidal were in Bacajá in 1985, 1986, and 1987, and prepared detailed reports for CVRD and FUNAI on the situation of this Kayapó community. In April 1987, Lux Vidal traveled by boat from the Bacajá Indian Area to Altamira and visited the village of Trincheira.



Photo: Vincent Carelli

Two generations of Kayapo-Xikrin on the Bacaja

will affect the lands of the Indians of Trincheira, but it should not directly affect the villages of the Bacajá post. What one can expect instead are indirect impacts, especially if the Xingu-Bacajá Reserve is not demarcated in time. For the time being, this region is still not inhabited by non-Indians but, with the beginning of the hydroelectric works, this situation is bound to change radically. One can expect a great population pressure in the direction of the Indian reserves, both along the Bacajá River and its tributaries, and in the direction of the corridor that separates the several groups cited. This means that the traditional territories of these Indians will shrink drastically; the native flora and fauna will recede, too, which will irreversibly affect the lives and social organization of these communities, as well as bring health problems.

Summary of the Proposal for the Xingu-Bacajá Indian Area

Considering:

- that there are presently two Xikrin groups, those of the Bacajá post and those of Trincheira;
- that the Indians occupy all lands along the Bacajá River up to the Right and Left Dois Irmãos streams (to the north of the present reserve) and up to the Black stream (to the south of the present reserve) – areas where they have castanha trees, hunting, fishing, and gathering areas;
- that the Manezão gold mine is inside the Xikrin territory and presents a constant threat to these Indians;
- that everything indicates that to the east of the reserve there is infiltration by new gold-panning sites;
- that, in the near future, two large-scale hydroelectrics will be built on the Xingu, flooding a vast area and causing an uncontrollable rush to the higher lands, which will bring about the colonization of the region;
- that there is a mining project for that area;
- that highway construction projects, such as BR-158 and BR-222, are affecting the areas of the Xikrin groups;

- that there is an effective demographic increase of the group;
- that the reserve demarcated is extremely small;

and considering, especially:

- that for the time being there are no concrete establishments in that region which facilitate demarcation;
- that there are available resources from the CVRD for the demarcation of this area;

it is proposed that the 1979 FUNAI proposal be reactivated, establishing a continuous area for the four indigenous groups that live between the Xingu and the Pacajá de Portel with some modifications:

1) increase the area to the south, due to the recent pacification of the Parakanã group of Bom Jardim;
2) make the southern limit of the Bacajá River the Black stream, as it is on the 1979 proposal map and not as it has in fact been demarcated (the Faveiro stream);
3) include in the eastern border the headwaters of the Chapeuzinho, Carapanã, and Manezão rivers.

The Asuriní of the Xingu

Regina Müller

History and Location

The first reports on the Indians who live between the left bank of the Bacajá River and the right bank of the Xingu River, denominated Asuriní, date from the past century (Nimuendaju 1948:225; Coudreau 1977:32).

Nimuendaju recorded an attack against a local person by the Asuriní in 1894 at a place called Praia Grande, above the mouth of the Bacajá River, tributary of the right bank of the Xingu. Coudreau states that in 1896, the Asuriní attacked at two points: at the Serra do Passahy and again at Praia Grande.

The banks of the Xingu since then have been called the "land of the Asuriní" by the inhabitants of the city of Altamira, located on the middle course of the same river, and by most other dwellers of the region, suggesting its inaccessibility due to the hostility of the Indians who occupied it (Lukesch 1976:11; Cotrim Soares 1971:3).

In 1932, at the mouth of the Bom Jardim stream, another tributary of the Xingu's right bank, the Asuriní killed another local person, according to Nimuendaju. Again according to Nimuendaju and Coudreau, on the banks of the Bacajá there were confirmed conflicts between whites and Indians called Asuriní. These conflicts have been confirmed by present-day Asuriní. According to several adults, based on what their parents told them, the villages were attacked by whites who set fire to the houses.

Thus, one is dealing with a vast region in which the presence of the Asuriní Indians has been recorded—that is, from the confluence of the Bacajá and Xingu rivers to above the mouth of the Bom Jardim stream, on the Xingu.

On the other hand, the name *Asuriní* has been attributed to different Tupi groups of the region (Müller et al. 1979:1), about whom there have been reports through other groups such as the Juruna, from whose language the name Asuriní was derived (*asonéri*="red" [Nimuendaju 1948:225]), and the Xikrin of the Bacajá and Cateté, who call them *kuben-kamrekti* (="red Indians" [Nimuendaju 1948; Vidal 1977:28, 37]).

According to the Xikrin of the Bacajá, the Kubenkamrekti are the Araweté, present-day neighbors of the Asuriní (Müller et al. 1979:21).

Up to the time of contact, in 1971, these two groups, and probably also the Parakanã Indians, were known by the same name: Asuriní. The FUNAI attraction front and Father Anton Lukesch, who contacted the group in question, considered that the Indian inhabitants of the banks of the Ipixuna stream, at the time, were Asuriní, when, in fact, this area had been recently occupied by the Araweté.

At any rate, it can be said that the territory of Asuriní occupation, over the last 50 years, covered the region referred to, but came to be restricted by the invasion of other indigenous groups that were, for their part, dislocated from their traditional territories. According to Viveiros de Castro, the Araweté were dislocated from the headwaters of the Bacajá about 25 years ago, pushed out by the Kayapó and Parakanã (1984:111).

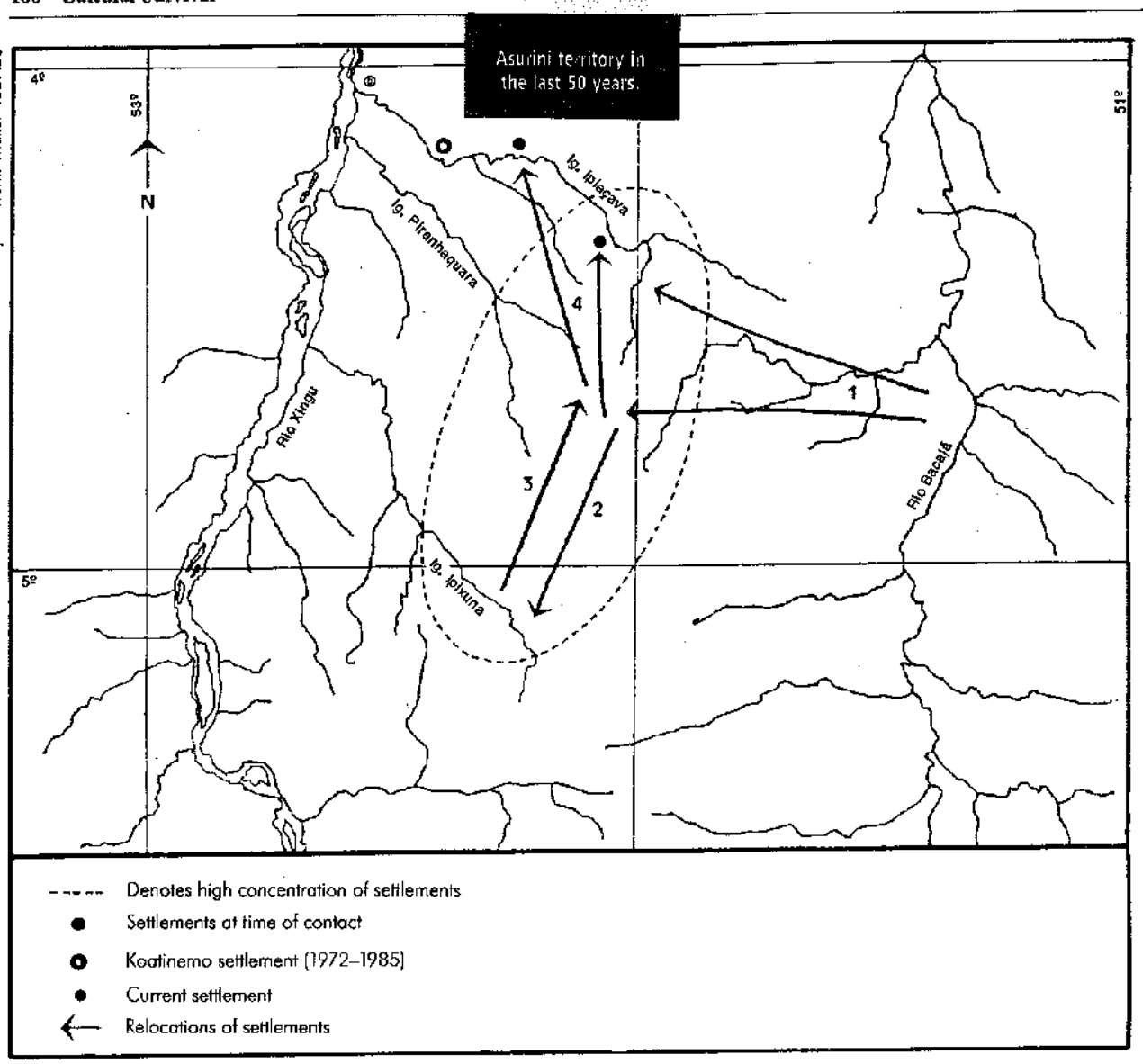
The relocations of Asuriní villages in this period can be reconstructed based on Asuriní statements, noting that, until the beginning of the 1970s, the area where the villages were located covered the headwaters of the Ipiaçava, Piranhaquara, and Ipixuna streams. Thus, we are dealing with a central area between the Xingu and Bacajá rivers.

In this area, the villages have moved to the south or to the north, depending on the presence and attacks of the Kayapó and Araweté. At the end of the 1960s, this area of village location expanded its border to the north, because part of the group decided to establish contact with the whites who were then on the Ipiaçava, in search of an ally to confront enemy attacks.

Ever since they were dislocated from the banks of the Bacajá, moreover, the reasons for their moves have been pressures from whites or enemy groups, and their approach toward the banks of the Xingu can also be attributed to this factor. As Nimuendaju had classified them, the Asuriní were traditionally a tribe of the inner forest (1948:225).

The Asuriní would have left the Bacajá River basin more than 40 years ago—victims, as I have said, of attacks by local settlers, probably rubber gatherers, for the extraction of rubber was one of the main economic activities of that time. On the other hand, they were also under attack from the Kayapó during that group's expansion north around 1936 (Nimuendaju 1948:225). The Kayapó, moreover, attacked the Asuriní in the 1960s (the Xikrin of the Bacajá and Cateté). Thus, the period in question could be considered one of intermittent warfare among the various groups of the region.

About 40 years ago, the Asuriní made their villages on the headwaters and near small tributaries of the Piranhaquara stream, called *Ipium yh* (*ipium* = "black fly"; *yh* = "water"), and on the



Excerpted from: Müller 1987:38

headwaters of the Ipiaçava stream, called *Baureí*, as well as next to its small tributaries. For many years, the Asuriní also inhabited the area of the headwaters of the Ipixuna, called *Ipirauyh*.

The area occupied by the Asuriní extended even more to the south of the banks of the Ipixuna, since they name six other Xingu tributaries in the direction of its sources.

One can see that the central area between the Xingu and Bacajá river basins, where the Asuriní villages were located, represented a kind of refuge from enemy groups, who came to occupy more and more of their territory, and against attacks by whites, as dangerous as their traditional enemies.

With the building of the Trans-Amazon Highway in the early 1970s and, consequently, due to the presence of the "attraction fronts" (official and missionary) that were organized to contact them, the Asuriní were surrounded. On one side were the Kayapó, on the banks of the Bacajá River; on another, the Araweté, on the banks of the Ipixuna stream; and on yet another, the whites, who were reaching them by the Xingu and its right bank tributaries. Between the enemies, against whom they were at a disadvantage in the times immediately prior to contact, and the whites, who at that time were leaving tools and seemed not to want to attack them, the Asuriní had no other way out except to agree to live with the whites and put an end to the warfare that had been debilitating them for several years.

In April 1971, they were contacted by Fathers Anton and Karl Lukesch; shortly afterwards, however, FUNAI assumed the contact through the "front" led by Antonio Cotrim Soares (Cotrim Soares 1971:5). With the contact, an Asuriní village that united at least two local groups was formed on the banks of the Ipiaçava stream, where it remained until 1985. The Asuriní village is today located on the right bank of the Xingu, below the mouth of the Ipiaçava stream. Since 1972, there has been an indigenous post, called Koatinemo, next to the village, presently under the Fourth Regional Superintendency of FUNAI in Belém.

Land Situation

The Asuriní area is not demarcated, despite the 16 years that have passed since the first proposal for delimiting the territory. In 1971, Cotrim had established the following limits for demarcation:

> North—left bank of the Lages stream, located on the right bank of the Xingu River; East—the left bank of the Lages stream, up to its sources, thence following a dryline in the direction of the sources of the Ipiaçava stream, located in a southeast position, following the dryline until reaching the sources of the Piranhaquara stream; South—the right bank of the Piranhaquara stream, situated on the right bank of the Xingu River. (Cotrim Soares 1971:32)

In 1972, FUNAI's General Department for Studies and Research (DGEP) proposed the delimitation of an area totaling 947,500 hectares, called the Asuriní Reserve, which was set aside for the Asuriní contacted on the Ipiaçava stream, isolated groups, and the Xikrin of the Bacajá (Process No. 10711.M.I./S COM/BSB/72. The name and justification for the reserve were due to the fact that, at the time, it was thought that in addition to the group of the Ipiaçava, other Asuriní groups inhabited the region up to the banks of the Ipixuna stream. There were really Asuriní villages on the Ipixuna, but as has already been said before, they were pushed out by the Araweté.

The extent of the area common to the "Tupi and Kayapó groups" proposed by the DGEP/FUNAI was justified by the presence of isolated groups between the Bacajá, Xingu, and Ipixuna rivers: approximately 2,107 people among all groups existing there.

The delimitation proposal for creating the reserve, however, was changed into a proposal for interdiction which came to be elaborated into a draft for decree of the President of the Republic.

Five years went by and neither Cotrim's proposal for the demarcation of the Asuriní area nor the proposal for interdiction by the DGEP/FUNAI were realized. Instead, in 1976, two areas were delimited through the RADAM/FUNAI agreement and were set aside as the Koatinemo (Asuriní) and Bacajá (Xikrin) Indian reserves.

The area delimited for the Asuriní was for 75,050 hectares, between the Ipiaçava and Piranhaquara streams. Fortunately, this time, this was also not demarcated. It would have excluded the region of the old villages on the headwaters of these rivers, and would not have taken into account the group's territorial occupation.

In 1979, a new proposal was prepared for interdiction of an area of 2,391,600 hectares as the first step to creating a common reserve for the Asuriní, Araweté, Xikrin, and isolated groups existing in the region (Process FUNAI/BSB/no. 3832/78). This proposal was made by the 1979 work group (Decree No. 627/E) that had been created on the basis of the activities of the "Project for Recuperation of the Asuriní of the Koatinemo."

This area covers the entire Xingu-Bacajá interfluve, from approximately the Ipiaçava stream to the Bom Jardim stream, tributary of the Xingu River, and the entire Bacajá River from the Dois Irmãos stream (Müller et al. 1979:50–51).

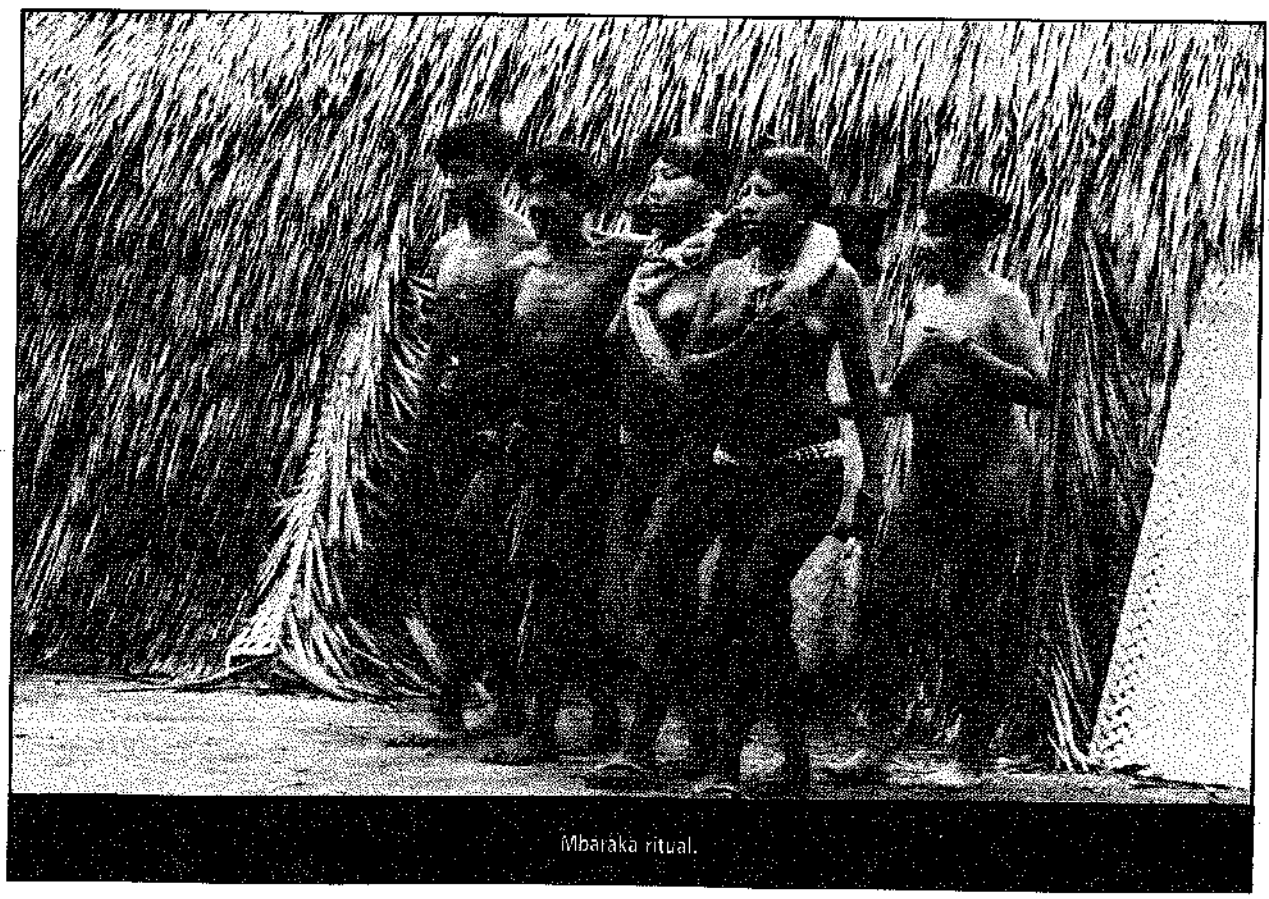


Photo: Frederico F. Ribeiro

Mbaraka ritual.

One of the goals of the proposal for a reserve of contiguous indigenous areas was to prevent leaving a "corridor" between the areas of the Indians of the Xingu (Asuriní and Araweté) and those of the Bacajá (Xikrin), which might facilitate invasions, and include the territory of still unknown Indians. These were the Parakanã, contacted in 1983 and 1984 between the headwaters of the Bom Jardim stream and the Bacajá River. The proposal even took into consideration the diminution of the Asuriní and Araweté Indian areas due to the flooding from the hydroelectric development of the Xingu River basin. Since 1976, research had been underway by CNEC, commissioned by Eletronorte, to prepare for building the Xingu Hydroelectric Complex.

The 1979 work group proposal, however, gathered dust in FUNAI's archives. In 1982, through my initiative (when I was working for the agency) and that of the anthropologist Eduardo Viveiros de Castro, in collaboration with FUNAI, the joint demarcation of the Asuriní and Araweté areas was proposed—that is, the demarcation of their outer borders, since these are contiguous territories (Process FUNAI/BSB/no. 3832/78).

The Asuriní area proposed for this demarcation was based on the delimitation made in 1979 by the "Project for Recuperation of the Asuriní of the Koatinemo" and included the headwaters of the Ipiaçava and Piranhaquara streams, with an approximate land area of 288,600 hectares. This proposal, however, was also forgotten.

Between 1983 and 1984, FUNAI's General Department for Indigenous Patrimony (DGPI) prepared various drafts of decrees with their respective maps and descriptive accounts of delimitation for the official consideration of the processes, following the orders of FUNAI's president who, at the time, proposed to speed up the demarcation of indigenous lands. Among these decrees were the Asuriní and Araweté areas, dismembered from the area common to most other groups in the region and from each other, despite their being contiguous. The Asuriní area delimited at this time corresponds to the 1979 proposal.

Today the situation is as follows: the Asuriní area was approved in 1986 by the Interministerial Group created by Decree 88.118—that is, it is in the phase of demarcation (it lacks the decree of homologation) at the same time that, once again, the demarcation of an area common to the Asuriní and Araweté groups, to the Parakanã, and to the Xikrin of the Bacajá is being disputed. With the contact with the Parakanã and their inclusion, along with the Xikrin, in the assistance program for the indigenous peoples affected by the Carajás Iron Ore Project, this proposal is being defended by the anthropological consultants of the Carajás project.

Demography

Having suffered demographic reduction prior to contact, and only recently (from 1984) showing a slight population growth (approximately 10 percent), the Asuriní still continue to be threatened with extinction.

The present population totals 59 people, although in 1982 it had gone down to 52.

The population decline of the group began with the Kayapó attacks, became more pronounced with the attacks of the Araweté, and became critical at the time of contact with whites. This contact brought disease epidemics that reduced the population by more than 50 percent over a decade.

In 1971, the Asuriní population was approximately 100 individuals; in 1974, 58; in 1976, 60; and in 1977, 55. This number remained unchanged until 1980, when there were no deaths and no births; it dropped to 53 in 1981, when two Asuriní died and the birth rate continued to be zero. In 1982, another Asuriní died, bringing the group down to 52 individuals. At the end of this year, however, there was one birth and the Asuriní population once again was at 53.

In the first years of contact with whites, the Asuriní suffered a marked population decrease, the causes of which were described in 1971 by the frontiersman Cotrim: flu and malaria epidemics and precarious medical assistance due to the slowness of the operations (1971:6). Once they were settled at the FUNAI post and with perhaps more regular assistance, the decrease continued, but less markedly, and there was even a period of relative stability between 1975 and 1976. Between 1977 and 1980, the population stabilized—since in 1978 and 1979, the "Project for Recuperation of the Asuriní of Koatinemo" had been developed (Müller and Labonia 1977).

The decrease after 1976 was due principally to tuberculosis, and the assistance given by the recuperation project successfully reduced the cases of death by tuberculosis from six in 1976–1977 to two in 1978–1979.

The demographic situation of the Asuriní is more complex, however, due to the low birth rate (one of the birth control practices is abortion, there being two proven cases between 1976 and 1982).

Nineteen eighty saw no deaths, but also no births. In 1981, after a year's interruption of the recuperation project, one man died of disease and another perished in a rifle accident. In this year, there were again no births among the Asuriní. Thus, in 1980 and 1981, the birth rate was zero. Since the year of contact, however, this low rate has been constant, as verified by the data below:

1971	0	1977	1
1972	0	1978	1
1973	1	1979	1
1974	1	1980	0
1975	1	1981	0
1976	1	1982	1

Even before contact, birth rate control among the Asuriní could be verified by the low percentage of the infant population in 1971 and by the cases of

childless women. In the year of contact, Cotrim recorded an infant population that represented only 7.8 percent of the total (1971:11). Of 26 adult women, only 10 bore children, and of 7 women older than 45, only one bore children.

Among the causes of this control, the Asuriní cite the attacks of enemy groups who stole their children and forced them to flee. The demographic pyramid shows a constriction in the age brackets corresponding to the years 1966–1971, when conflicts occurred with the Xikrin and Araweté.

It can be estimated that half a century ago—that is, around 1930—the Asuriní population was at around 150 individuals. From that time to the year of contact, the population decrease was due to attacks by enemy groups and, thereafter, a low birth rate, which has been verified.

The birth rate among the Asuriní follows cultural rules such as generational polyandric marriage (the marriage of a woman with a younger and an older husband) for the existence of offspring. One of the justifications that the Asuriní give for birth rate control is that the nonexistence of the young husband impedes the generation of children in the society's ideal terms. Another ideal rule for procreation is the age of the women, varying between 20 and 25 years for the birth of the first child. There is also a tendency for the children of a nuclear family not to exceed two individuals.

Along with these patterns are other cultural factors that ought to be related to birth rate control. The birth of a child depends on the capacity and the availability of the domestic group to assume the tasks of sustaining the nuclear family of the newborn, for the Asuriní have to comply with abstentions required of the father (especially of the younger father) in post-natal seclusion, and on the mother of the child, which prevent them from doing any productive activity. In the newborn's first months of life, one could say that the couple and the child are sustained by the domestic group, for the parents remain for the greater part of the time dedicated to the child.

The birth rate control is also related to certain proscriptions, such as prohibiting having sexual relations during shamanistic rituals and corn planting.

Despite the introduction of medical assistance, which reduced the mortality rate, there was no increase of population during the recuperation project, due to the behavior of the Asuriní in the face of changes in their demography beginning at least 40 years ago: behavior related to maintenance of their values, practices, and traditional social structure. Until 1982, their traditional lifestyle had not been weakened by the accelerated population decline. It could even be affirmed that, if on the one hand the Asuriní were threatened with extinction in terms of their numbers, on the other there was a marked affirmation of group values and world view through their rituals and their obedience to traditional child-bearing rules.

From 1984 on, the birth rate increased (three births in 1984 and 1986, two in 1985), confirming, then, changes in this aspect of the Asuriní's social and cultural life. Despite this, however, deaths continued to occur and the population, which could have surpassed 60 individuals with this birth rate, actually amounts to 59, the last birth having taken place in February 1987.

Thus, one is dealing with a slight demographic growth, for the population is still threatened by diseases such as tuberculosis.

The fragility of the Asuriní in terms of their physical survival is such that the building of dams and subsequent flooding of their lands may be considered causes of their future extinction as a people.

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The Araweté

Eduardo Viveiros de Castro

The Araweté are a Tupi-Guarani people numbering 168 persons (February 1988) who inhabit a single village at the Ipixuna Indian Attraction Post (coordinates 4°45′40″ and 52°30′15″), on the left bank of the middle Ipixuna, a tributary of the right bank of the Xingu, municipality of Senador José Porfírio, state of Pará.[1] The Ipixuna is a blackwater river, with numerous rapids, that runs southeast to northwest from the Xingu-Bacajá water divide. Its bed is rocky and the actual Araweté territory has numerous granitic formations and small outcrops of stone, with cacti, bromeliads, and agaves on their tops. The dominant vegetation throughout the area, however, is one of semihumid tropical forest, where the trees rarely surpass 25 meters in height; great quantities of shrubs and vines make a walk in this "forest of vines" of the Ipixuna region difficult. Game is abundant due to the large variety of fruit-bearing trees, as is the population of jaguars and forest cats, which led to the penetration of the Ipixuna by animal skin hunters ("cat hunters") in the 1960s and consequently to the "discovery" of the Araweté. The Ipixuna River does not appear to be exceptionally abundant in fish.

Rainfall is very marked, with a dry season that extends from April-May to November-December, and a rainy season in the remaining months. In the dry season, the Ipixuna becomes difficult to navigate, exposing extensive sandbanks and forming stagnant waterholes that are good for fishing with timbo. In the rainy season, which is at its most intense in the month of February, the river rises five or more meters in relation to the minimum level reached in October-November. The rains are the time of an important seasonal movement among the Araweté, the "corn ripening" (*awaci motiarã*), a change from the village to the woods in the months between the planting and the gathering of green corn. The economy and social morphology of these people are a direct function of the corn cycle and of the rainy/dry season opposition.

[1]The Araweté do not name themselves by any ethnonym. The most specific term they use is *bide* ("human being," "people," "us"). The term *Araweté* is an invention of the frontiersman J.E. Carvalho.

The Araweté are the remaining survivors of a population of hunters and horticulturists of the terra firma forest who, about 25 years ago, moved from the region of the headwaters of the Bacajá River in the direction of the Xingu. Since then, they have occupied an area between the basins of the Bom Jardim River (called "São José" on some maps) to the south, and the Piranhaquara to the north, which includes the Canafístula, Jatobá, and Ipixuna rivers. The Xingu forms the western limit of their territory and is never surpassed. For a long time, the Xingu-Bacajá dividing line has not been crossed to the east because it marks the beginning of a region that the Araweté identify with the feared Kayapó-Xikrin of the Bacajá post. Much less have they ventured beyond the Bom Jardim, where a Parakanã group (the same group that attacked them in 1976–1977 and 1983) was recently "contacted." The region of the Asuriní, another traditional enemy of the Araweté, begins from the right bank of the Piranhaquara. The area most intensely exploited by the group, in its present conditions of dependence on the FUNAI post, covers a strip of about 50–60 km on each side of the Ipixuna, from the mouth to the headwaters.

This area does not show any significant invasions or occupations until now. After the decline in cat hunting expeditions (the skin trade was prohibited in 1967, and in 1970 FUNAI began to send teams of frontiersmen to the Ipixuna), the only non-Araweté found there have been about a dozen "riverine dwellers," poor peasants, and rubber tappers who live on the banks of the Xingu and in the dependency of a traveling "patron."

The territorial situation of the Araweté, however, is far from being secure. Not only is their area of present occupation not even delimited by FUNAI despite repeated proposals for an Araweté reserve and for the joint demarcation of the Araweté, Asuriní, and Xikrin territories, but also three major threats configure in their near future: the flooding of parts of their territory (and their village) with the building of the Xingu Hydroelectric Complex; the implantation of the Carajás Iron Ore Project, which encompasses the Araweté territory on its eastern border (the maps of the Great Carajás Program that indicate mineral-forest resources and propose agricultural zoning simply ignore the existence of the Araweté); and the approach of mining and cattle-ranching activities on their southern and eastern borders.

Although it belongs to the municipality of Senador José Porfírio, the Araweté area is influenced by the two major poles of the municipal centers of Altamira to the northwest and São Félix do Xingu to the south. Altamira grew at an extremely rapid rate with the construction of the Trans-Amazon Highway and it is the headquarters of the FUNAI delegacy responsible for the Ipixuna post. Those Araweté with more serious illnesses are taken there, and it is from there that visitors, services, and goods going to the village leave. Altamira is a fundamental symbol in the Araweté imagination: a place of abundance, it is also a focus for the ill-

ness that kill them. São Félix do Xingu is one of the most rapidly growing cities in Pará (hence, in Brazil), and the municipality is a critical area of frontier expansion. It is the headquarters for intense mining activities (gold and cassiterite), both independent and contracted, and of several large colonization and cattle-ranching projects. With the completion of the road that connects it to Redenção, the risk of invasion to the Araweté area will increase significantly. The southern and eastern frontiers of Araweté lands are the most vulnerable because they are constantly threatened by mineral prospectors who go up the Bacajá and Bom Jardim; until now, however, the prospectors have stayed away from the Araweté.

It is exactly at the time of "contact" (1976) and their permanent settlement in a restricted area that a "closed" concept of territory begin to emerge for the Araweté. Thus, on the one hand, the establishment of a single village next to the FUNAI post breaks with the traditional *modus vivendi* that consisted of several simultaneous villages covering a wide extent of territory, but with an average population smaller than that of the present village; the dependency on the post also diminished the radius of local group movement. On the other hand, living with Western concepts of territoriality transmitted directly or indirectly by whites and their objective situation of geographical enclosure (for they are already aware that there are many whites beyond their immediate world) have led to the gradual emergence of a concept of closed and exclusive territoriality, thus consecrating a new historical situation, creating the fact of an "Araweté territory," which still awaits recognition by the nation-state.

THE ARAWETÉ HAVE a very simple material culture similar to the Tupi-Guarani. Their marked technical and craft simplicity seems only to be surpassed by the nomadic Guajá, Sirionó, and Xetá, to whom they have been compared. In its very simplicity, their material culture does not allow a specific comparison to any other Tupi-Guarani group. In addition, certain items and unexpectedly complex usages—such as the *arɑy* rattle of the shamans, plaitwork of ariríte strips re-covered with cotton, and above all the four-piece feminine attire—are exclusively Araweté. The absolute predominance of the cultivation of corn over manioc also distinguishes them from other Amazonian Tupi—and makes them similar to the Guarani, who are said to have possessed a "religion of corn." One may add that the Araweté are the only known Tupi-Guarani people to utilize the narcotic *parikâ* (*Payikã*, Anadenanthera peregrina), mostly consumed by tribes of other linguistic affiliations to the north of the Amazon.

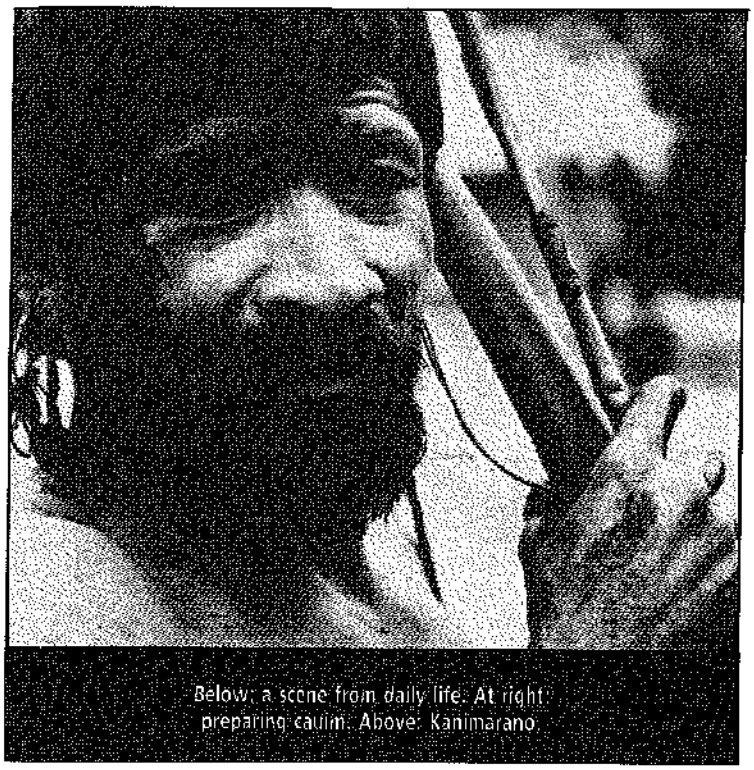
The Araweté are a people of short stature (on the average 1.6 meters for men, 1.5 meters for women), generally light-skinned, with hair and eyes between black and light nut-brown. The men have thick beards and usually let them grow in goatees; they go naked and only depilate the eyebrows. Traditionally (i.e., before the use of shorts), they tied up the prepuces of their penises with a cord. The women wear a four-piece attire (belt, outside skirt, arm sling blouse and headcloth)—used all together only after birth—woven in native cotton and tinted with urucú.

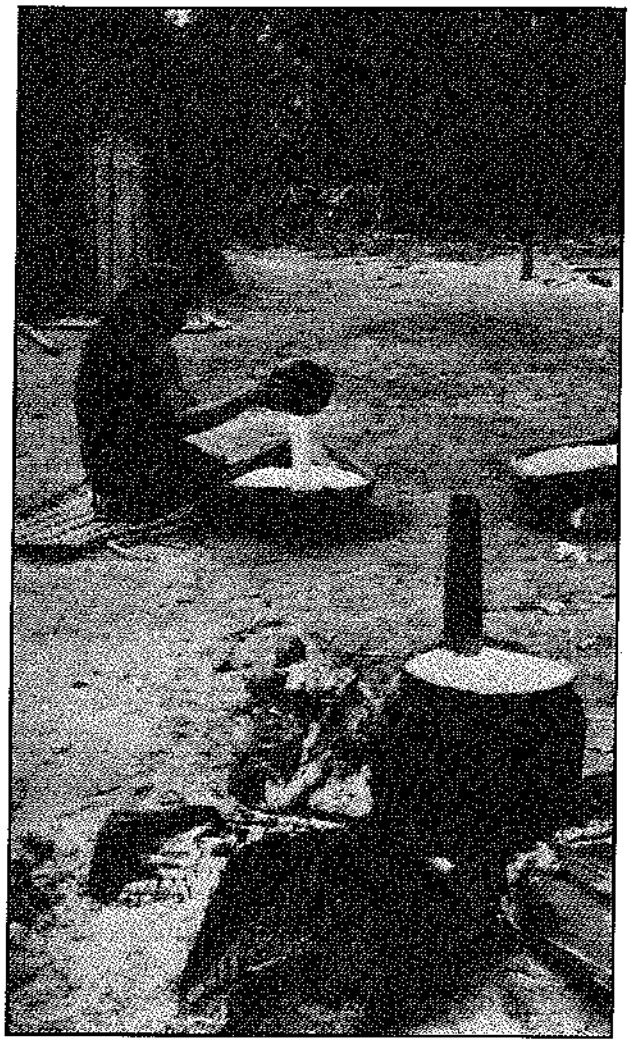
Agriculture is the basis of Araweté subsistence. The two main products of their gardens are corn (four varieties), consumed from March to November and manioc (three varieties) during the rest of the year. Other important cultigens are sweet potato (eight varieties), yams (seven varieties), and sweet manioc (three varieties). They also plant cotton (two varieties) in the gardens, tobacco (gardens and villages), *curauá* for making rope (village), papaya (idem), banana (six varieties, gardens and village), pineapple (village), calabash plants (idem), black sedge (idem), and urucú (village).

Corn clearly predominates over manioc (*madi'da*) in Araweté concept and practice. Manioc is only consumed when the stocks of corn have been exhausted and the green corn has not yet been gathered—that is, in the rainy season and above all during the expedition for "ripening the corn" in the forest. The "garden" (*ka*)—that is, the garden made annually by slash-and-burn techniques—is the corn garden (*awaçi'dipã* = "support soil for corn") interspersed, with greater or lesser density, with manioc, yams, potatoes, and so on. The corn is consumed, depending on the time of the year, in the form of roasted cobs, green corn porridge, corn cereal, sweet porridge, a corn mixture, and alcoholic porridge (fermented by mastigation). The pounded corn is the base for *iyi*, a thick soup of cooked meat that accompanies certain kinds of game; with the corn mixture, *namo pi re* (mush) is made. This mixture, made of mature corn, toasted and pounded, is the basic cereal, being consumed for nine months out of the year. The bitter or alcoholic corn beverage (*kãĩ'dɑ*), in turn, is the focus for the major Araweté ceremony, which is performed several times a year between June and October—that is, during the dry season.

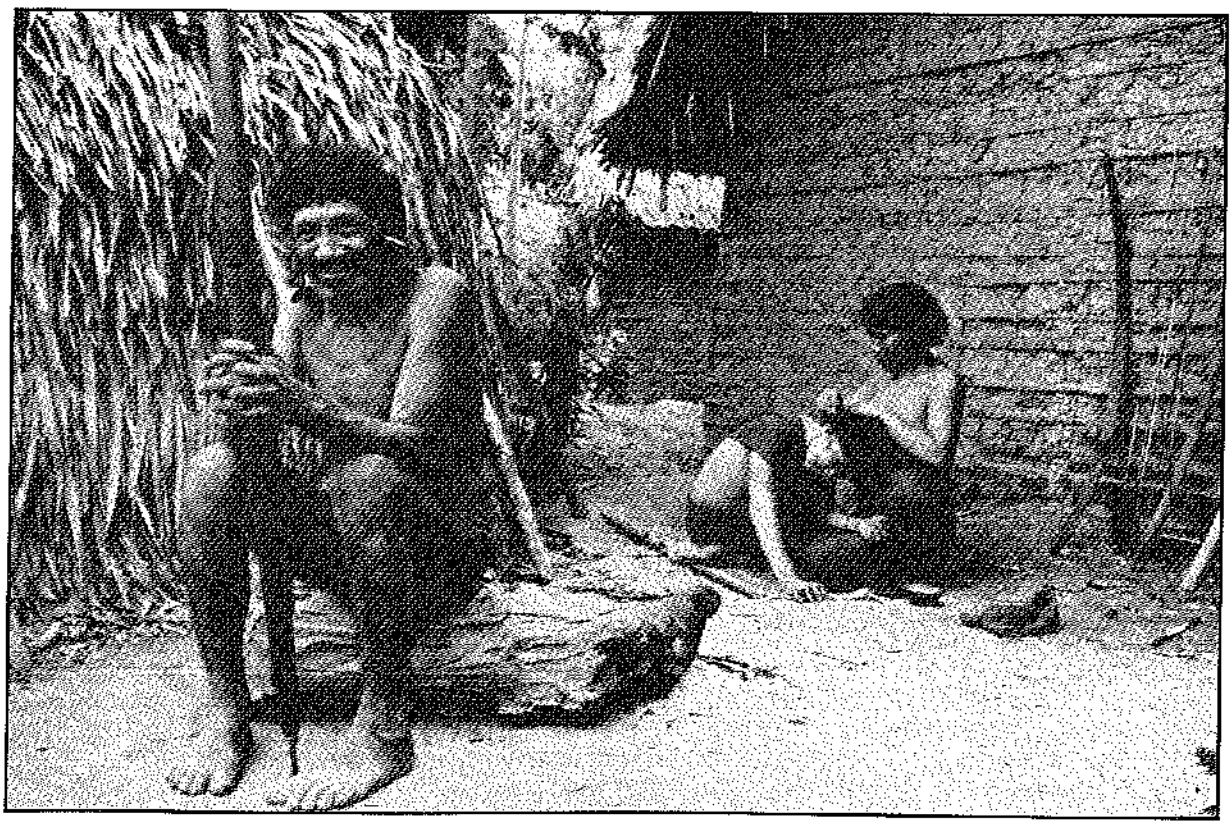
Manioc, scraped on paxiúba palm roots and squeezed by hand, dries in the sun or on a grill and is consumed as dry mass cereal or as tapioca bread (steeped manioc cereal—*farinha-puba*—was introduced by whites). Although the Araweté appreciate the products made with this plant, they say that they consume them in the rainy season "because there is no more corn" or "because there is no green corn yet," which clearly indicates its subordinate role. Sweet potato, yams, and sweet cassava are consumed cooked or roasted. And, if corn is planted of necessity by all households, in always sufficient quantities to last through the dry season and to be used ceremonially, the other products are planted quite variably in quantity from year to year and from house to house. A good portion

Photos: Eduardo Viveiros de Castro





Below: a scene from daily life. At right: preparing caulim. Above: Kanimarano.



of the potatoes, yams, manioc, and sweet cassava is gathered in gardens planted up to two years before (*ka pe*).

The tools used to clear the gardens are fire, iron axes, and machetes; the digging-stick is used in planting. The gardens are on the average 1.5 hectares in size, but the real size of each will vary according to the unit of production involved—a single household/domestic group or a residential section. The Araweté gardens are often cluttered with poorly burned trunks and branches; apparently, they don't take much care with the burning. Manioc, sweet cassava, cotton, tobacco, and bananas are planted in their own sections of the garden, on the periphery of the corn. The potatoes and yams are dispersed throughout the corn, in bunches at regular intervals.

GAME HUNTING IS THE OBJECT of intense cultural investment for the Araweté, who do not define it as "work." In heaven, the well-traveled world of the dead and of the gods, there is no agriculture, for the plants grow by themselves; but everyone in heaven hunts. The gods are hunters, not horticulturists.

Hunting defines a male space, and the garden, as a corn garden, a female space—for corn is planted by the women and the garden is cut by the men "for their women who in exchange make cotton hammocks for them" (an equivalence between difficult tasks of lengthy duration). The Araweté hunt a greater quantity of animals than is usual among other Tupi-Guarani and they seem to have fewer food restrictions, general or specific, than others. In rough order of (nutritional) importance, we have: turtles (white and red), armadillos, curassows, jacus, agouti, peccary, boar, howler monkey, nail monkey, paca, deer, tinamou, macaw, toucan, trumpeter, jaós, macuco, and tapir. The toucan, macaw, harpy eagle and smaller eagle, curasso, japú, and two kinds of cotingideos (cotingas) are also sought for their feathers for arrows and ornaments. The red and blue-and-yellow macaws and parrots are raised as pets (*temimã*) in the village. The harpy (*kanõho*), if captured alive, is kept in a cage. Felines, vultures, snakes, and frogs are not eaten.

The turtles and armadillos are less hunted than "gathered," given that firearms are not necessary (the generic word for hunting is simply *iatã* ["to walk"] or *yokã* ["to kill"]; for turtles and armadillos, the word *katĩ* ["to look for"] is used). The turtle is available in any season of the year, although it is associated with life in the woods and the rainy season—when the big fruit (*arãho*, a sapotacea) ripen, which fatten and enlarge their livers, a delicacy for the Araweté. The turtles can be kept as a food reserve for the lean times and are the object of collective, ceremonial hunts. The armadillos are an important food in the beginning of the dry season, when they are fatter.

Araweté hunting weapons are the bow of fiddlewood—admirably well worked, a source of pride for the Araweté when compared with Asuriní and Parakanã weapons—and three kinds of arrows (bamboo lance tip, which can be up to 70 cm long; howler monkey bone tip; and fire-tempered wooden tip. The first, which is for larger game and for war, is decorated with harpy feathers; the others, with curassow feathers).

Although, according to the Araweté, the introduction of firearms in 1982 might have represented an increase in the capacity to hunt game, in 1983 it obligated them to cover a wider radius of territory in their hunts, due to the flight or exhaustion of the animal population near the village. Similarly, shotguns led them to split up the larger bands of hunters into smaller units, on the hunts for the *cauim* ceremonies—as much due to the noise of the firearms as to the risk of accidents. The popularity of flashlights (which the sale of craftwork permitted), associated with the "20" cartridge belts, made the paca, an animal hunted at night, an important source of food.

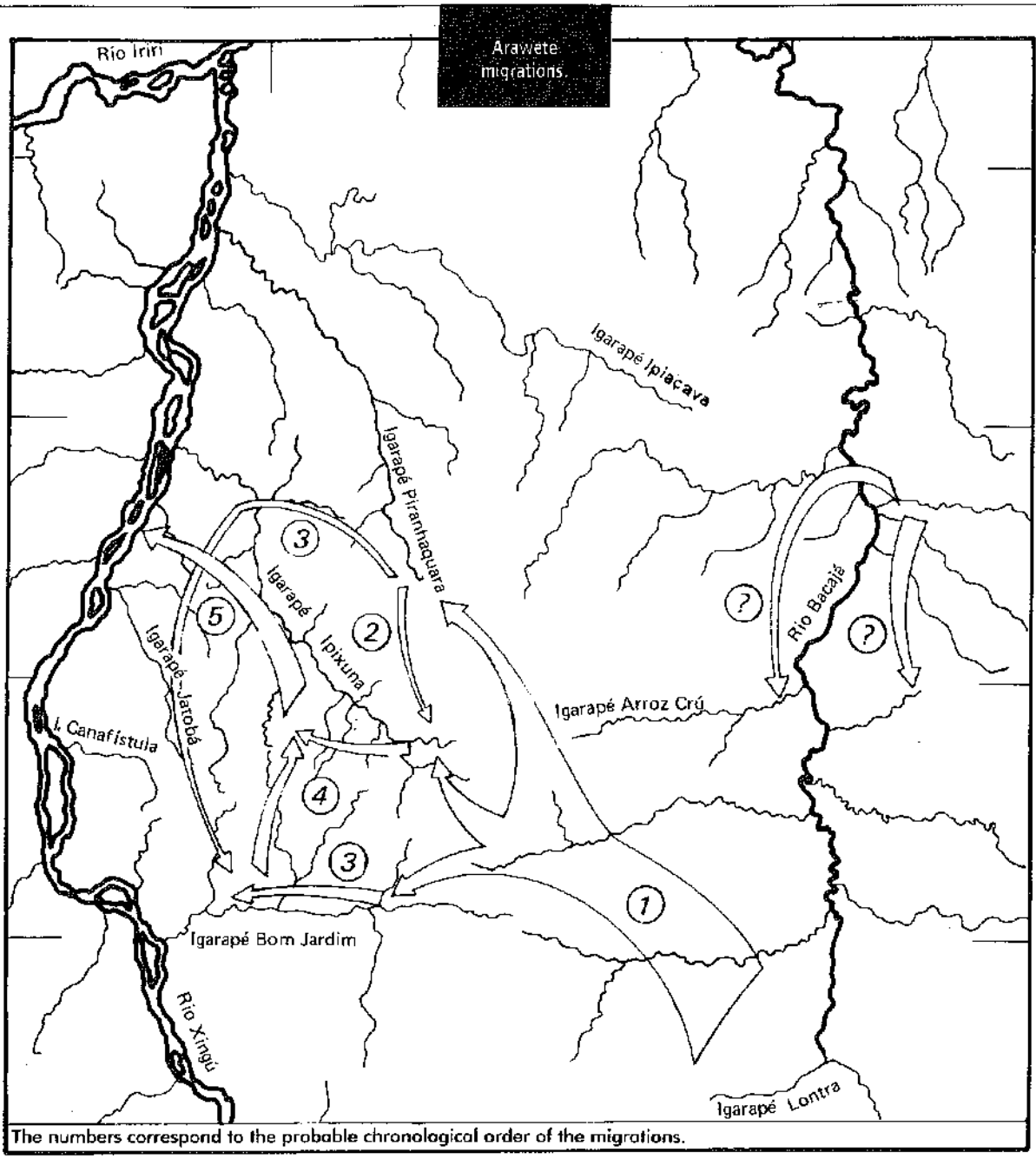
Fishing is divided into two well-defined periods: the season for "hitting (killing) the fish" (*pïdã nopĩ me*), in which timbo is used (October–November), and the months of daily fishing, with bow and arrow and line. Fishing with timbo splits the village up into small groups, which camp out at the waterholes of the Ipixuna and nearly dry streams. Men and women participate, and the fish is grilled. The kind of fish sought in this form of fishing is the large traira (*pïdã oho* = "big fish"). The daily fishing, which increases in frequency depending on how the waters of the rivers go down, is done by preference with hook and line. Young boys and girls between five and fifteen years old are the most assiduous fishers, and the product of their efforts contributes substantially to the feeding of the village. Although fish is a highly valued food, it is less so than game, and fishing is a derivative activity for the adult men. In addition to collective fishing with timbo, however, all men participate in fishing with the *hara*, a spindle-shaped trap operated manually and made of babassu switches, used in lakes during the dry season, which demands numerous teams.

The Araweté consume almost all the principal species of fish found in the Ipixuna: the large traira, tucunaré, surubi, curimbatá, matrinxã, piau, piranha, pacu, curupité, and dogfish. They don't eat the pirarar, stingray, or catfish. Jejus, tomoatá, and crabs of the small lakes are highly appreciated. They eat eels and alligators.

The majority of the older Araweté do not know how to swim, nor do they build canoes. Drinking and cooking water is taken by the women from open pools on the sandy banks of the rivers and streams, or at the flooded stands of cabbage palm.

Gathering is an important activity in the Araweté economy. Its principal products are:

(1) honey, for which the Araweté have a refined classification, with at least 45 kinds of honey, bees, and wasps—edible or not. It is associated with a



Excerpted from: Viveiros de Castro, Eduardo: *Arawete: Os Deuses Canibais* (Rio de Janeiro: Jorge Zahar/ANPOCS), 1986, p. 169

ceremonial dispersion of the village in the forest and is the object of expeditions in which the women have an important role. Although obtained by male work, honey, in contrast to meat, is consumed first and in larger quantity by the women.

(2) cabbage palm, consumed with honey during a ceremony, also the object of collective expeditions.

(3) bacaba palm.

(4) castanha, an important food during the rainy season. The Araweté are not, however, big collectors of castanha and the castanha trees are often cut down for their honey.

(5) babassu coconut, eaten or used as a binding element for urucú, and to soften the wood for bows.

(6) cupuassú.

(7) several fruits of minor importance in the diet, such as the golosa, the big fruit, cajá, ingá, bacuri, and sapucaia.

(8) freshwater turtle eggs, the object of family excursions in September; the small number of beaches on the Ipixuna do not favor this activity.

(9) palm grubs, eaten toasted.

Gathering is an activity done by both sexes and generally by married couples (except for honey). Several kinds of vines, leaves, and medicinal roots are also gathered.

Among the other resources necessary to the Araweté way of life, one can list: the leaves and branches of babassu for houses, mats, baskets, and other objects; sheathing of babassu, inajá, and cabbage palm leaves for the troughs (*ipe*) that serve as receptacles; two kinds of cane for the long arrow; bamboo switches and other branches for sieves and the shaman's rattle; the wild calabash for the dance rattle; special woods for pestles, axe handles, bows,

arrow points, posts and beams for houses, chisels, and digging sticks; embiras and vines; and clay for the simple Araweté ceramics.

BEFORE MOVING TO THE REGION of the Ipixuna, the Araweté lived on the headwaters of the Bacajá River. At the end of the 1950s, repeated attacks by the Kayapó made the Araweté seek the Bom Jardim and Jatobá, and finally, more to the north, the Ipixuna rivers, where they clashed with and eventually pushed out the Asuriní. They always point to the east and southeast as the direction of their ancestral villages; it is there that the "center of the earth" (*iwi pitẹ*) is, that today is the domain of the enemies. A somewhat obscure tradition says that the Araweté, before reaching the headwaters of the Bacajá, crossed two big rivers, wide like the Xingu, to the east. I do not have the data that permit me to affirm these as being the Pacajá River or the Tocantins.

The Araweté movement in the direction of the Ipixuna was not uniform, however. Only a part of the tribe reached its headwaters 25 years ago and continued maintaining several villages in the more southern area of Bom Jardim (*Ipẹ oho* river = "big trough"), on the Canafístula (*Kãñĩnadï-no ní* = "river of Kãñĩnadï-no"), and on the Jatobá (*Iriwawã nipã* = "river of the bridge"). It was this part of the tribe that struck the Asuriní villages long-established on the Ipixuna. Another great Araweté block, comprised of several villages, settled in the region of the Piranhaquara, to the north, and maintained very tenuous contacts with another group for 10 years. At the end of the 1960s, this group, faced by new Kayapó attacks, divided: one group went to join the group of the Ipixuna, which had abandoned the southern villages and concentrated in old Asuriní territory; another, larger group, crossed the Ipixuna on its lower course and won the region of the Bom Jardim to the south. Thus, two new Araweté blocks were formed, separated for another dozen years. A Parakanã attack made the southern block flee in the direction of the Ipixuna group, whose villages were also attacked by the same enemy; but both parts of the tribe only came to meet again on the banks of the Xingu, to the south of the mouth of the Ipixuna, where they decided to seek refuge there from the Parakanã. The present Araweté population is comprised of the survivors of the Kayapó and Parakanã attacks and postcontact epidemics; the history of the last 20 years is marked by a significant demographic decline.

There are many indications, however, that the Araweté did not make a simple move from the headwaters of the Bacajá to the region of the Ipixuna. The middle and lower courses of the Bacajá and their tributaries are recognized and named as a site of older villages (dating from the 1920s and 1940s, judging by the ages of the people who were born there): the *Pireicẹi* ("eel"), *Marupai*, and the *Pakãñã* and *Pakaya'ï* rivers, which correspond to the Brazilian toponyms "Bacajá" and "Bacajaí," but the form of which seems to me genuinely Araweté. The oldest identifiable movement of the tribe, then, would have been from the middle to the upper Bacajá, and later to the Xingu region.

The number of villages built by the Araweté from approximately 1945 to 1976 is surprisingly high: about 60 villages, for the whole of the tribe, in these 30 years. There were times when six or seven villages coexisted; the average is four. My estimate is that the total Araweté population must not have surpassed 300 in this period. The average population of the villages would then be 60, in the times of relative peace. The Kayapó attacks are responsible for the successive divisions of the tribe in geographically semi-isolated blocks; in exchange, these would have provoked some fusions of villages. In the second place, these attacks would have diminished the average time of a village's occupation.[2] Finally, the main factor in the decision to move a village was death; the Araweté abandoned a village as soon as a death befell them. They built another village nearby, so that the old gardens could still be used while new ones were planted. The portability and simplicity of Araweté material equipment certainly facilitated their marked mobility.

Araweté contact with the whites was moderate prior to the 1970s. At least 50 years ago, a group of whites massacred 13 Araweté on the waters of the Bacajá; the whites are still known today as *Karamạ-riropïnã*, "the killers of Karamạ-ri" (one of the victims). Epidemics of probable origin from the whites were also rife among the Araweté while they were still on the Bacajá. And the custom of getting iron axes in the abandoned brush suggests a relatively old ecological "symbiosis," although marginal.

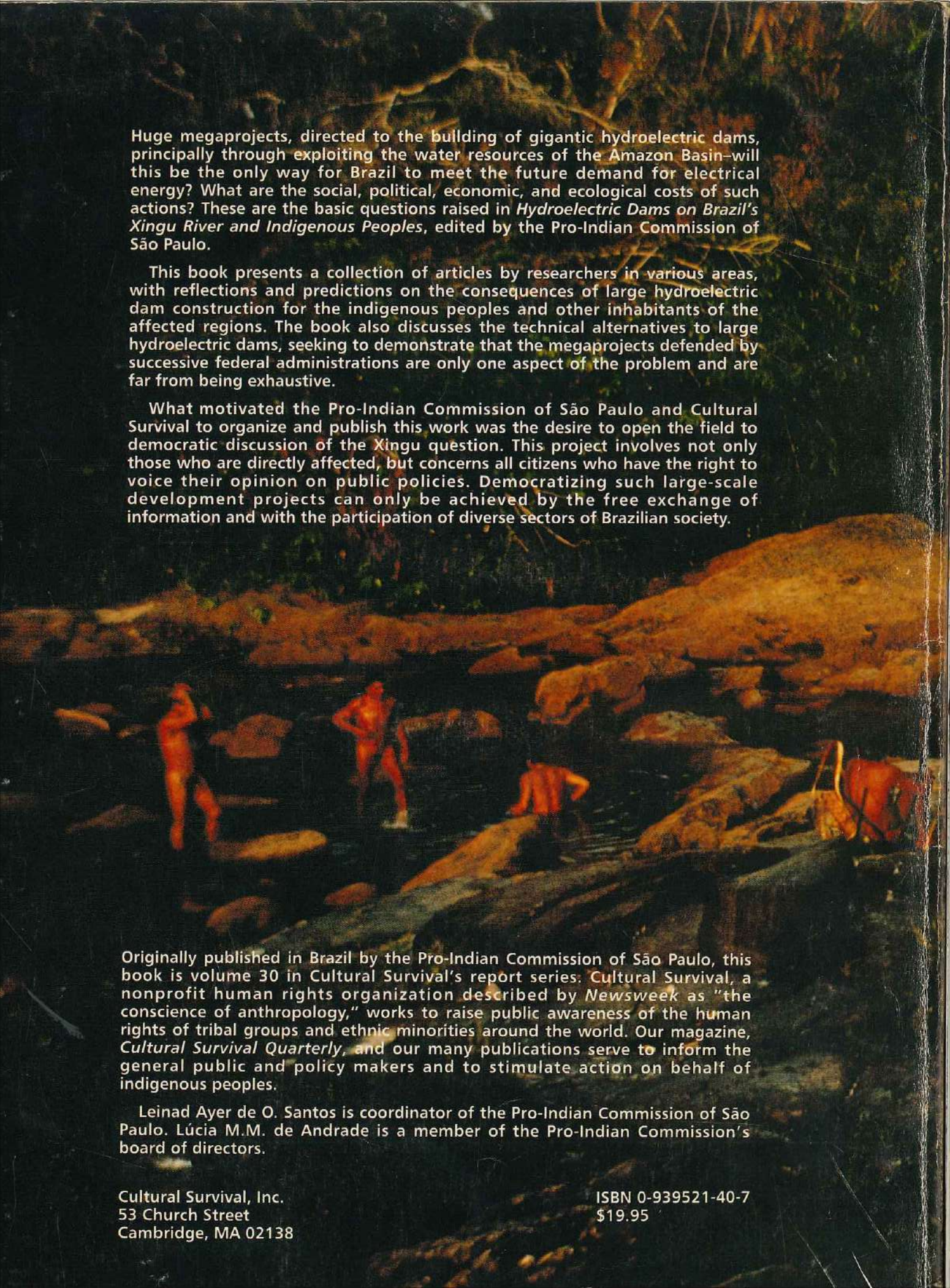
But the adult men state that they only really came to see whites when they reached the Ipixuna—that is, it was only there that they had nonwarlike interaction with them. Present on the Ipixuna in large numbers in the 1960s and 1970s, the cat hunters were encouraged by the "patrons" since 1967 (when the hunting of cats was prohibited) to give presents to the Indians. They came to visit several villages, drinking *cauim* and even, according to the Indians, sleeping there. This did not prevent several armed conflicts, with casualties on both sides.

From 1970 on, FUNAI, alerted by a "trip" that several Araweté had made to the banks of the Xingu (taken there by a friend and cat hunter), and in view of repeated reports of Indians in the region, began the works of "attraction" of the Indians in the region between the Ipiaçava and the Bom Jardim. In 1971, the Asuriní were located. The Araweté had brief en-

[2] In times of relative security, this seems to have been four years, judging by the difference of age among people who were born in the same village. The Araweté always moved when the gardens came to be at a dangerous distance away, to avoid the risk of enemy ambush.

counters with frontiersmen, but did not allow them to visit their villages. In 1974, FUNAI built a post and cleared gardens on the upper course of the Ipixuna, 100 km from its mouth, at an abandoned Araweté village. But it was only in 1976 that contact was established. In the beginning of that year, the Parakanã attacked on the upper Ipixuna and on the Bom Jardim, leading the Araweté villages of both rivers to flee in the direction of the Jatobá. A part of the group sought the banks of the Xingu, where it camped at the garden of a "river-dweller." The attraction front met them there in May 1976, finding them in the worst health conditions. The frontiersmen then convinced the Indians to move to the attraction post. They made a trip by land that lasted 22 days; the majority were too weak to talk and many (about 30) died on the trail or were abandoned. At the end of the year, a Parakanã attack on a village that still existed on the Jatobá led this group to join with the group at the post. There, all the Araweté who had survived the Parakanã, the epidemics, and the walk, stayed until 1978, when the Indians and the frontiersmen decided to move to the middle Ipixuna River, due to a new attempt by the Parakanã to attack in late 1977. They then built two villages, which in 1981 merged into one, at the new post—and there they have remained until today.[3]

[3]In September 1987, seven Araweté were contacted inside the area of the Xikrin of the Cateté. Of these seven, three died in that same year. The survivors were taken by FUNAI to the area of the Ipixuna post. There are still about three uncontacted Araweté families in the region between the Bacajá and Cateté rivers (Isabelle Giannine, personal communication).



Huge megaprojects, directed to the building of gigantic hydroelectric dams, principally through exploiting the water resources of the Amazon Basin–will this be the only way for Brazil to meet the future demand for electrical energy? What are the social, political, economic, and ecological costs of such actions? These are the basic questions raised in *Hydroelectric Dams on Brazil's Xingu River and Indigenous Peoples*, edited by the Pro-Indian Commission of São Paulo.

This book presents a collection of articles by researchers in various areas, with reflections and predictions on the consequences of large hydroelectric dam construction for the indigenous peoples and other inhabitants of the affected regions. The book also discusses the technical alternatives to large hydroelectric dams, seeking to demonstrate that the megaprojects defended by successive federal administrations are only one aspect of the problem and are far from being exhaustive.

What motivated the Pro-Indian Commission of São Paulo and Cultural Survival to organize and publish this work was the desire to open the field to democratic discussion of the Xingu question. This project involves not only those who are directly affected, but concerns all citizens who have the right to voice their opinion on public policies. Democratizing such large-scale development projects can only be achieved by the free exchange of information and with the participation of diverse sectors of Brazilian society.

Originally published in Brazil by the Pro-Indian Commission of São Paulo, this book is volume 30 in Cultural Survival's report series. Cultural Survival, a nonprofit human rights organization described by *Newsweek* as "the conscience of anthropology," works to raise public awareness of the human rights of tribal groups and ethnic minorities around the world. Our magazine, *Cultural Survival Quarterly*, and our many publications serve to inform the general public and policy makers and to stimulate action on behalf of indigenous peoples.

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