# CONSERVATION POLICY IN BRAZILIAN AMAZONIA: UNDERSTANDING THE DILEMMAS

Philip M. Fearnside
Coordination of Research in Ecology-CPEC
National Institute for Research
in the Amazon-INPA
Av. André Araújo, 2936
C.P. 478
69011-970 Manaus-Amazonas
BRAZIL

Fax: +55-92-642-8909

Tel: +55-92-643-1822

e-mail pmfearn@inpa.gov.br

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Summary

Conservation policy in Brazilian Amazonia is rapidly evolving. The dynamics of different interest groups affects the political economy of land use. Choices include allocation of effort between completely and partially protected areas and between creation of new conservation units versus consolidation of existing units. Tension between different levels of government, different groups of non-governmental organizations, and between the public versus private sectors are evident. While the conflicting interests of such groups present many barriers, they also offer conservation opportunities. Negotiation with indigenous peoples represents one of the most critical areas for the long-term future of natural ecosystems in the region.

KEYWORDS: Amazonia, Biodiversity, Brazil, Conservation, Forest management, Parks

# 1. INTRODUCTION

Conservation policy in Brazil's 5 million km$^2$ Legal Amazon region (Figure 1) is the subject of many ongoing controversies. Decisions made in the near future will be critical in determining the types of development that shape the landscape in wide areas in the region. Conservation policy in Amazonia is faced with a series of dilemmas in allocating scarce resources in this area. Deforestation and other forms of destruction and degradation continue at a rapid pace, closing off opportunities for conservation and for sustainable development in general. The present paper attempts to explain some of the controversies in designing conservation policies for the region. These controversies affect land both inside and outside of conservation units. On virtually every issue there exists a full complement of interest groups ready to do battle on behalf of their particular interest. Groups such as soybean farmers, for example, have agendas that conflict with those of environmental non-governmental organizations (NGOs). Each group of organizations makes its case by appealing to greater good such as biodiversity conservation or poverty alleviation. These competing appeals create 'dilemmas' for policymakers.

[Figure 1 here]

The present paper examines Brazil's conservation policies and programs in the light of an interest-based theory of the political economy of Amazonian land-use change (e.g., Rudel and Horowitz, 1993). The disparate interests of different groups help explain the plethora of programs and types of conservation units in Amazonia. Decisions presented by series of dilemmas in selecting conservation units and in the implementation process are influenced by the same interests and actors. Of particular significance is the potential importance of indigenous peoples in future conservation efforts. The paper concludes by emphasizing the need for flexibility and the opportunities presented by strategies for conflict management and negotiation.

# 2. INTERESTS AND THE POLITICAL ECONOMY OF LAND USE

## *(a) Federal, State and Municipal Governments*

Federal, state and municipal governments (Figure 2) frequently have conflicting priorities for creation of conservation units. This can thwart efforts to create any sort of unit, leading to the loss of opportunities for conservation and sustainable development. The practical solution may be to create federal units such as extractive reserves (RESEX), national parks (PNs) and national forests (FLONAs) when the land in question belongs to the Union, and state units such as sustainable-development reserves (RDS) and State Forests when it is state land. In the case of the choice between RESEX and RDS, which is a source of tension in the state of Amazonas, these forms of conservation units are essentially equivalent in terms of effect on the environment, with the exception of logging, which is permitted in community forest management projects operated in RDS and represent a greater impact on the forest than does harvesting of non-timber forest products in RESEX. Basing the choice on the level of government responsible for the land would solve this problem. As is current policy, the representatives of the state governments should be heard when federal conservation units are created within a state, and federal environmental

authorities should be heard when state units are created. Lapses from this policy can have disastrous results, as in the February 2002 announcement by the governor of Pará that he would not allow any further federal conservation units to be created in the state, following a mobilization by the mayors of municipalities where 2.3 million ha of RESEX were to be created by the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) on land that had been confiscated from *grileiros* (land swindlers) (see Pinto, 2002).

[Figure 2 here]

In some states (such as Pará) the state governments are anxious to involve the municipal governments and not to create any conservation units that the municipal governments don't want. This tendency is reinforced by legislative restrictions limiting the fraction of state-government budgets that can be used for payroll expenses, thus motivating the states to pass as many functions as possible (such as guarding reserves) to the municipal governments. Compared to state governments, municipal governments are normally more subject to local pressures from sawmill owners and other interest groups, often making the municipal governments less likely to put a priority on conservation over short-term gain. While input from the municipal governments is important in reaching decisions on both state and federal conservation units, this does not mean that municipal governments should have veto power over creation of the units.

*(b) Party Politics*

Party politics is an omnipresent consideration in decisions to establish conservation units. Particularly at the state level, environmental authorities are direct actors in generating political support for the governors who appoint them, while politicians from opposition political parties are likely to take opposing stands on conservation issues. In addition, key individuals in federal and state agencies and in non-governmental organizations (NGOs) often have ties to political parties and sometimes have electoral ambitions of their own. Each conservation unit creates winners and losers, thereby creating opportunities for vote getting among the different groups by politicians who support or oppose any given conservation proposal. Depending on the proposal, losers, such as sawmill workers, may be more numerous and/or more likely to be registered to vote than are winners such as traditional extractivists and indigenous peoples. For example, demarcation of the Javari indigenous area has been resisted by the mayors of nearby municipalities and by representatives of Amazonas in the national congress (Amazonas em Tempo, 2000).

The relevance to political constituencies is illustrated by sustainable-development reserves such as Mamirauá and Amanã (Figure 3) that are promoted by the state government of Amazonas in the Central Amazon Corridor that is to be implemented under the Pilot Program to Conserve the Brazilian Rain Forest (PP-G7). Residents in the reserves, who have preferential access to fish resources in addition to modest additional benefits from social programs, can be expected to have increased probability of voting for candidates supported by the state governor who created the reserves. On the other hand, the more long-standing and geographically widespread social organization efforts of the Catholic Church and associated organizations, such as the Pastoral Land Commission (CPT), often increase the probability of

participating residents voting for opposition candidates. This can result in those linked to opposition political parties resisting reserve-creation efforts led by the state government in the Central Amazon Corridor.

[Figure 3 here]

In addition to vote-getting opportunities among the populations directly affected by creation of a conservation unit, political advantage can also be gained by appeals to more universal interests in trying to sway voters in distant (usually urban) locations. While environmental concerns such as biodiversity and climate change are sometimes emphasized by supporters of reserves, opponents often tap the widespread belief in Brazil that the World is engaged in a permanent conspiracy to attack Brazilian sovereignty over Amazonia (e.g., Reis, 1982). A sociological survey of the population in Brazilian Amazonia revealed that 71% of respondents agreed with the statement "I am afraid Amazonia will be internationalized" and 75% agreed that "Foreigners are trying to take over Amazonia" (Barbosa, 1996). This creates a permanent temptation for any politician to denounce real or imagined threats to sovereignty, as an increased appeal to voters is always assured. Gilberto Mestrinho is best known for successful application of this tactic as a basis of political support (A Crítica, 1991a). As governor of Amazonas he even threatened to order the Military Police to machine-gun teams from the National Indian Foundation (FUNAI) if they attempted to demarcate indigenous lands in state (A Crítica, 1991b). As senator, he declared in the senate plenary that the PP-G7 ecological corridors project would "put Amazonas in a plaster cast. Why do they do this? Emptying [Amazonia] makes it easier to dominate [the region]. ..... [It is] used as a strategy for the future invasion of our sovereignty" (Adolfo, 1999). Recourse to the internationalization theory applies to all sides of the political spectrum, from conservative politicians such as Mestrinho (of the Brazilian Democratic Movement Party: PMDB) to those from the political left who, during a series of public hearing of the Amazonas State Legislature's Commission on the Environment and Amazonian affairs in October 1999, denounced the PP-G7 ecological corridors project as a trick to internationalize the region.

Even though struggles related to party politics underlie many conservation-unit controversies that are debated with appeals to patriotism and high principles, the heavy environmental costs of failure to conserve natural ecosystems are quite real. Party politics must not be allowed to impede efforts to create conservation units while opportunities still exist to do so in large areas.

### *(c) Public versus Private Sectors*

The public and private sectors each have roles to play in Amazonian conservation. Some types of activities, such as ecotourism operations, are inherently more efficient if done by the private sector. Non-governmental organizations have proved themselves to be essential intermediaries between government agencies like IBAMA and the local communities in conservation units. The Jaú National Park (with a co-management arrangement with IBAMA and Fundação Vitória Amazônica) and the Serra do Divisor National Park (with a similar arrangement with SOS Amazônia) are the best (and virtually the only) examples (Guazelli et al., 1998; SOS Amazônia, 1998).

Logging concessions are a difficult issue in public/private sector relations. Reason for caution is provided by the sad experience of southeast Asia, where private logging companies have destroyed or severely degraded large areas of tropical forest on the public lands that they are allowed to exploit through concessions (Repetto and Gillis, 1988).

## 3. CONSERVATION UNITS

### *(a) Types of Units*

Brazil has a wide array of different types of conservation units. In many cases these serve different purposes, while in others they have similar purposes but owe their origin to the different government agencies that have promoted them. Areas that are primarily for maintaining natural ecosystems without human presence (except for small areas designated for research) were formerly classed as "indirect-use areas" in Brazilian legislation, a terminology now changed to "integral-protection areas" under the National System of Conservation Units (SNUC). Federal conservation units in this category include National Parks, Ecological Reserves (formerly Ecological Stations) and Biological Reserves. By contrast, "sustainable-use areas" (formerly called "direct-use areas") promote use of renewable natural resources in the area under management regimes that are intend to sustain production while maintaining the major ecological functions of the natural ecosystem. These include national forests (FLONAs) (Rankin, 1985; Reis, 1978), which are intended for "multiple use," but predominantly designed for timber management, and extractive reserves (RESEX) (Allegretti, 1990; Fearnside, 1989a), which are intended for management of non-timber products such as rubber and Brazilnuts. In the state of Amazonas the new category called a "sustainable development reserve" (RDS) was created in 1996, where local residents zone the designated area into portions for community management of resources such as fish and timber, with a core area that is to remain untouched.

Private properties are obliged to maintain a specified percentage of their area as a "legal reserve" where approved management activities may be undertaken but which must remain under forest cover; legislative struggles are in progress to define the percentage required as a legal reserve, whether silvicultural plantations are counted as forest cover, and whether a system of trading among properties is permitted (Fearnside, 2000; ISA, 2001). Private landowners may also irreversibly commit land to conservation purposes (thereby becoming exempted from Rural Property Tax) by registering the land as an "Area of Relevant Ecological Interest." In addition, areas may be designated as Environmental Protection Areas (APAs), where land is subject to certain zoning procedures designed to limit damaging activities but where many forms of development (including urban centers) are permitted. Indigenous areas, although not classified as "conservation units," are perhaps the most critical of all land-use designations in maintaining substantial blocks of natural ecosystems in Brazilian Amazonia.

### *(b) The National System of Conservation Units (SNUC)*

Brazil's system of conservation units has evolved rapidly over the past few years, as has the force of destructive processes such as deforestation, logging and forest fires.

A new law creating a National System of Conservation Units (SNUC) was approved by the National Congress in July 2000 (Law No. 9985/2000). The law was approved after eight years of deliberation in the face of intractable differences among the various interested parties. Since approval of the law, the process of "regulamentation" (regulamentação) has been underway with a combination of the struggles among the different interest groups (Bensusan, 2001). The regulamentation process defines the specific rules and procedures that govern how the law is applied—a stage that is often as important, in practice, as the law itself. In the meantime, conservation policy is in a sort of limbo that is being taken advantage of by various groups that are anxious to stake their claims to as much Amazonian territory as possible before regulamentation is complete and the SNUC takes effect. For example, in June 2001 IBAMA hastily obtained decrees for new National Forests (FLONAs) (Folha de São Paulo, 2001), without holding the public hearings and other steps that will be required by the SNUC—a somewhat ironic situation given that IBAMA was a key agency proposing the SNUC. Such inconsistencies reflect the deep divisions within IBAMA, and among all those concerned with the environment, as to the appropriate conservation policies for Amazonia.

Various groups have been struggling to influence the SNUC, with the result that some of the most basic underpinnings are poorly defined or inconsistent. Most fundamental is what is known as the "people in parks" question, or whether human populations should be allowed to live in different types of conservation units. One group of NGOs called the "Pro-Conservation Units Group" (lead by FUNATURA and BIODIVERSITAS), supports the view that priority should be given to totally protected units (units without people), while the opposing viewpoint is held by another group that includes such organizations as the Socio-Environmental Institute (ISA), the Institute for Environmental Research in Amazonia (IPAM), the Institute for Man and the Environment in Amazonia (IMAZON), and the Amazonian Working Group (GTA). The government agencies involved have similar divisions, including the Directorate of Protected Areas (DAP) within the Ministry of the Environment (MMA), and IBAMA; the heads of these agencies support the "people in parks" side, while many of the employees who deal with the question in practice are on the other side of the issue. State governments universally favor units that maintain populations in them, and often want more intensive use of the natural resources than do their federal counterparts. Pros and cons of these positions will be discussed later on.

## 4. PROGRAMS FOR CONSERVATION

### *(a) Pilot Program (PP-G7)*

#### 1.) Overview of the PP-G7

The Pilot Program to Conserve the Brazilian Rain Forest (PP-G7) was announced by the G-7 countries at their meeting in Houston in 1990, a time at which global concern over Amazonian deforestation was at a high point and coverage appeared almost daily in the international press. Under pressure from their constituents, the G-7 leaders (Canada, France, Germany, Italy, Japan, U.K. and U.S.A.) signaled that they would commit US$1.5 billion to the program. However, with the end of the United Nations Conference on Environment and Development (UNCED, or ECO-92) in June 1992, media interest in Amazonia abruptly disappeared. By the time the PP-G7 got

underway in 1993 the G-7 countries were only willing to commit US$250 million of core funds, or one-sixth of the original amount, and even this had to extracted from the countries with considerable effort. The PP-G7 was originally expected to last for only three years, but delays in initiating several components, combined with the desire on all sides to continue the most successful activities, resulted in repeated extension of the program. Some components are expected to last to 2010.

The PP-G7 is financed by the G-7 countries and administered by the World Bank and the Brazilian government. Components include the PD/A ("Type A" demonstration projects) for small-scale sustainable development projects carried out by NGOs, extractive reserves, indigenous lands. A Sub-Program for Natural Resources (SPRN) includes environmental-economic zoning (ZEE) and strengthening of the state environmental agency (OEMA) in each of the nine states in the Brazilian Legal Amazon region. The Pro-Management Project (PROMANEJO) promotes sustainable forestry initiatives, including those in National Forests (FLONAs). Other components address management of <u>várzeas</u> (floodplains), science and technology, and a special program to combat burning. Information on the various components of the program can be found on the web sites of the Ministry of the Environment (Brazil, MMA, 2002), the World Bank (2001), and Friends of the Earth-Brazilian Amazonia (Amigos da Terra-Amazônia Brasileira, 2002).

2.) Sub-Program for Natural Resources (SPRN)

The Sub-Program for Natural Resources (SPRN) fortifies the state environmental agencies (OEMAs), including special activities within Integrated Environmental Management Project (PGAI) areas and an Ecological-Economic Zoning (ZEE) of each state. Zoning has been a particularly controversial issue, with extended negotiations between federal authorities and each state government having delayed implementation in some states. A standard methodology (Becker and Egler, 1997) was encouraged, although each state has variations upon this. Nitsch (1994) has attacked the process as inherently unviable due to internal contradictions (see rebuttals by da Costa, 1998; Schubart, 1997). Mahar (2000) has reviewed the experience Rondônia, where the state government enacted the zoning into law, thereby freezing the process and complicating adjustments to relieve problems. Despite its zoning, Rondônia continues to be one of the most environmentally destructive of the region's nine states (World Bank, 1997). In contrast, zoning provides for greater environmental protection in Acre (Acre, Programa Estadual de Zoneamento Ecológico-Econômico do Estado do Acre, 2000) and Amapá (2000), which are the two states where the current state governments favor conservation most strongly.

While planning can be greatly improved by efforts using zoning to think ahead about the consequences of different development decisions, the reality observed today is quite different. The real zoning is taking place today (without discussions of impacts) through major decisions such as implantation of the development axes that are part of the Avança Brasil program (Carvalho <u>et al</u>., 2001; Fearnside, 2001a, 2002; Laurance <u>et al</u>., 2001; Nepstad <u>et al</u>., 2000). Billions of dollars are being sought in investments before the environmental studies, zoning studies, and other information has been produced and debated. Zoning is therefore being done in practice on a massive scale

without following any of the principles that guide the zoning programs now underway.

3.) Ecological Corridors

The Ecological Corridors project is designed to promote a coordinated management of the different types of conservation units and indigenous lands in a contiguous area, including the interstitial area that completes the landscape within the corridor. So far, only one corridor in Amazonia is actively being pursued (Central Amazon Corridor, centered on the Mamirauá and Amanã Sustainable Development Reserves and the Jaú National Park), although an additional four corridors outlined in early plans for the project may eventually be added. Contrary to the fears of some politicians, the corridors do not freeze development within their boundaries; rather, they can serve as an aide in obtaining assistance for sustainable development projects appropriate to these areas.

4.) Extractive Reserves (RESEX)

Extractive Reserves (RESEX), originated from a 1985 proposal by the National Council of Rubbertappers under the leadership of Chico Mendes, and have been created by the federal government as a form of conservation unit since February 1988. The area under this form of land use now totals over 3 million ha, and additional units are proposed. Extractive reserves have been criticized as condemning their residents to poverty and as financially unviable due to the low price of extractive products such as rubber and Brazilnuts (Homma, 1996). However, it is important to realize that the rationale for creating extractive reserves is environmental, rather than a means of supplying cheap rubber or of supporting a large human population (Fearnside, 1997a). This is why extractive reserves are created as conservation units by the Ministry of the Environment, rather than as settlements by the National Institute for Colonization and Agrarian Reform (INCRA) in the Ministry of Agrarian Development. It is also significant that proposals for extractive reserves originate from the extractivists themselves, rather than from government authorities. Instead of condemning the residents to poverty, the reserves offer them a better and more stable income than they could realistically expect in the absence of the reserves (Allegretti, 1996). The idea that the residents have been tricked by environmentalists into forgoing a life as prosperous farmers (e.g., Benchimol, 1992) is entirely fictitious; rather, they would more likely be forced to move to urban favelas (shantytowns) or would join the ranks of landless poor in rural areas of the region. Under the PP-G7, the RESEX project has strengthened extractive communities in the reserves, helping them with marketing and facilitating access to health, education and other services.

5.) Indigenous Lands (PPTAL)

The Integrated Project for Protection of Indigenous Populations and Lands in the Legal Amazon (PPTAL) has produced concrete achievements that affect large areas of the region. So far 29 million hectares in 53 reserves have been demarcated, out of a total of 45 million hectares in 160 reserves (Figure 4). The demarcation process in the remaining indigenous lands not included in the PPTAL has been much slower, ironically including virtually all land in the states of Mato Grosso and Rondônia (which had been excluded from the PPTAL on the grounds that they already had

funding for demarcation through the PRODEAGRO and PLANAFLORO World Bank loans, respectively). The participative demarcation methodology developed under the PPTAL, with the indigenous peoples themselves doing the demarcation rather than having the work done by a corporate contractor, has been successful both in rapid and cost-effective execution of the task and in generating organizational experience and attitudes among the members of the indigenous groups that will serve them well in defending their territories and in implementing sustainable activities within them. Problems with contracted firms resisting and undermining the indigenous supervision of the demarcation have lead to a learning process to strengthen application of the methodology over the course of the PPTAL (de Oliveira, 2001). The 160 reserves in the PPTAL program have an indigenous population of 62,000; encouraging this population to solve its own problems with a minimum of dependence on outside resources and initiative is a major achievement for conservation.

[Figure 4 here]

The PPTAL illustrates the role of the Pilot Program in achieving a goal that would have been impossible for would-be funders to approach through bilateral projects. Despite demarcation of indigenous lands being required by Brazil's 1988 constitution (Article 67), the Brazilian government has, in fact, been unwilling to spend virtually any of its own funds for this purpose. In addition, involvement of foreign countries in matters concerning indigenous peoples normally provokes a virtually allergic reaction among Brazilian diplomats and officials—any country offering funds to demarcate a list of indigenous reserves would be immediately repelled as offending Brazilian sovereignty. The Pilot Program's indigenous component met with similar resistance over the first several years of the Program, but negotiated solutions were found that have allowed Brazil to achieve great progress in completing its announced goal of demarcating all indigenous lands, albeit not by 1993 as required by the Constitution.

### *(b) PROAPAM: The "10% Project"*

On 29 April 1998, Brazilian president Fernando Henrique Cardoso announced a commitment to create totally protected areas to increase the percentage of Amazonian forest ecosystems with this level of protection to 10% by 2004. This effort was promoted by the Worldwide Fund for Nature (WWF) and the World Bank as part of the WWF "forests for life" campaign. As of 2001, totally protected areas that do not overlap with indigenous areas account for 3.6% of the Amazonian biome, while sustainable use areas represent 9.0% and indigenous lands 22.5% (Ferreira, 2001). The Program to Expand Areas of Environmental Protection (PROAPAM, also called ARPA), better known as the "10% Project," was created within the Ministry of the Environment to achieve this goal.

### *(c) Positive Agendas*

The "Positive Agendas", or a series of priorities for development and conservation that are negotiated among the different actors in each state, have been underway since 1999. This system was created by the minister of the environment in response to the upturn in deforestation rates that was underway in 1999, and became the main determinant of priorities for the Special Secretariat of Amazonia (SCA) beginning in

April 2000 (Menezes, 2001). Positive Agendas are drafted by consensus by participants in meetings that last several days in each state capital. Use of this technique in 1999 to resolve an intractable dispute over creation of an extractive reserve for Brazilnut collection on the islands in the Tucuruí reservoir is viewed as a major achievement for the positive-agendas approach. Because any participant in the meetings has effective veto power over inclusion of any item in the agenda, the results are often rather weak on environmental measures. Their advantage lies in the broad support for implementation of the recommendations that they do make.

## 5. DILEMMAS OF FOREST MANAGEMENT

### *(a) Certification versus Boycotts*

Few debates are as polarized as those surrounding the question of forest management and certification as a conservation measure, with views ranging from this as a last chance for biodiversity (e.g., Rainforest Alliance, 2001) to an environmental swindle (e.g., Laschefski and Freris, 2001). Forest certification, organized through the Forest Stewardship Council (FSC, 2001), is backed by major international conservation organizations such as WWF, Friends of the Earth (FOE) and Greenpeace, as well as by Brazilian organizations such as IMAZON, ISA and IPAM. Sustainable management is not synonymous with minimizing environmental impact and can cause significant harm to the forest ecosystems (Bawa and Seidler, 1998; Bowles et al., 1998; Robinson et al., 1999). However, substantial biodiversity can survive in managed areas (Johns, 1997) and the low-impact methods required in certified areas greatly reduce damage as compared to uncontrolled logging (Johns et al., 1996). If the baseline one sees as the alternative is untouched forest, then management is disastrous for biodiversity, whereas if it is a cattle pasture then it is much better. Whether one views this glass as “half full” or “half empty” is presently a matter of personal orientation with little basis in quantitative information. More realistic scenarios of how land-use change would progress in the region under different policy regimes, including those related to forest management, could help to reduce the disparity of conclusions on the biodiversity losses or benefits from forest management.

Certified forestry management operations have increased rapidly: Mil Madeireira (with forestry operations and sawmill in Itacoatiara, Amazonas) was certified in 1997, GETHAL (with forestry operations in Manicoré and plywood mill in Itacoatiara, Amazonas) in 2000, and CIKEL (with forestry operations in Paragominas and flooring mill in Belém, Pará) in 2001. Although the increase in certified management operations in Amazonia is a significant change, most logging in the region is still predatory, and even operations with Forestry Management Plans (PMFs) approved by IBAMA have heavy impact and poor prospects for sustainability (Cotton and Romine, 1999; Eve et al., 2000). The demand for certified timber is small but growing. Contrary to popular perception, the great majority of wood harvested in Amazonia is consumed domestically rather than being exported to international destinations. In 1997, 86-90% of the timber harvested in Brazilian Amazonia was consumed within the country, and only 10-14% was exported (Smeraldi and Veríssimo, 1999, p.16). The demand for certified timber in Europe and North America is therefore less important than the demand within Brazil. While Brazilian consumers are less demanding of certified products than their counterparts in Europe and North America.

The encouragement of an alliance of NGOs has stimulated a small domestic market, which has grown from virtually zero in 1997 (Smeraldi and Veríssimo, 1999; Amigos da Terra-Amazônia Brasileira, 2001).

Mahogany represents an important exception to generalizations about the relative weight of domestic and foreign markets. Mahogany is in a price class by itself: US$900/$m^3$ of sawn timber at the mill gate, or 3-6 times the price of other commercial species (Smeraldi and Veríssimo, 1999), and most is exported. US imports represent 60% of the global trade; the US alone imported 120,000 $m^3$ from Latin America in 1998, equivalent to 57,000 trees (Robbins, 2000). Because mahogany justifies opening logging roads to remote areas, it plays a catalytic role in driving deforestation in the region (Fearnside, 1997b). Illegal harvesting of the species also has the greatest impact on indigenous and protected areas. Efforts to ensure certified origin of this species, and to boycott non-certified products, therefore have particularly high potential for conservation benefits.

Indiscriminant boycotts of tropical timber would have the negative effect of removing the major financial rationale for setting aside substantial areas of managed forest. However, it is the real threat of such boycotts that provides a critical motivation to both governments and the timber industry to seek certification and to reduce the impact and increase the sustainability of management operations. The existence of a certification system allows the boycott threat to be focused only on operations that do not join the system.

*(b) Forest Management versus Silvicultural Plantations*

Within Brazil, the demand for wood of all types drives the pressure of logging on Amazonian forests. Contrary to popular belief, tropical forest wood is not used only or even primarily for high-value products such as furniture and musical instruments. Brazil uses tropical wood for virtually everything, including concrete forms, pallets, crates, construction, particleboard and plywood. Substituting this demand with plantation-grown wood will only take place if low-cost wood is no longer available from destructive harvesting of Amazonian forests. At present, Brazil's substantial areas of plantations are almost all managed for pulp and charcoal rather than for sawnwood (Fearnside, 1998). This could change if policies were to be implemented creating the same kinds of limitations on free access to timber resources that are needed to motivate sustainable forest management.

*(c) Sustainability versus Financial Returns*

Sustainable forest management has become a requirement of Brazilian legislation and an objective at least nominally espoused by all. However, it faces fundamental contradictions between restraining harvest rates to levels that will allow the forest to regenerate and maximizing financial returns to loggers. Loggers will destroy the resource and invest the proceeds elsewhere if doing so results in a better return on their investments, regardless of whatever sustainable management system the loggers may have promised government authorities that they would follow. Because tropical forests grow at a rate about three times lower than the returns than can be obtained from capital invested in competing activities, sustainable management will remain

illusory unless economic decision criteria are changed (Fearnside, 1989b; see also Clark, 1976).

The first cycle will always produce more valuable wood than subsequent cycles because the forest manager is able to sell the large trees that may have taken centuries to grow. Aside from the (very low) cost of initial land purchase, these large trees are available at no cost other than the expense of extraction, whereas in future cycles the operation will have to undergo a transition to selling only the amount of wood that has grown while the investor has waited and maintained the operation. Kageyama (2000) questions the sustainability of management operations on the basis of tree population biology. In addition, calculations of sustainability invariably ignore the likelihood that fires will ever enter a forest management area. Logging greatly increases the susceptibility of forest to fire entry, and once fire enters it kills trees and increases fuel loads and understory drying, thereby increasing the risk of more-damaging future fires and complete degradation of the forest (Cochrane and Schultz, 1999; Cochrane et al., 1999; Nepstad et al., 1999a,b).

Maintaining timber management as an economically viable operation beyond the first cycle requires a shift over time in the products from which value is derived, as the growth rates of the trees of the hardwood species that are harvested in the first cycle are inherently very low. This can include a shift to faster-growing timber species, as well as other potential sources of income. These other sources of income can be a key factor in the long-range planning of sustainable forest management projects and of the interest of certain groups of investors with money to invest in "hedges" against future economic and environmental changes.

The logic for one sustainable forest project (GETHAL) is described as follows by its originator (J. Forgach, personal communication, 2001). If you are going to cross a desert, then you have to know how much water, food and other supplies to take with you to complete the journey. In this case, one is embarking on a journey of 25 years for várzea (floodplain) or 30 years for terra firme (upland) areas, and the resource being spent is the hardwood timber in the forest (supplemented by some additional income from ecotourism). If the harvest rate will maintain the financial viability of the project over this time period, then the project will emerge on the other side with a standing forest (minus the large hardwood trees). The forest can then be used for pharmaceutical products, and possibly for income that may then be obtainable from carbon benefits and willingness to pay for the existence value of biodiversity. This would be supplemented by any income that could be gained from management of softwood timber species in the forest, ecotourism, etc. The internal rate of return (IRR) required is quite high (20-25%/year) to prevent the operation from eating into its capital base.

Investments for short-term gains from biodiversity are unlikely due, in part, to the wisdom of waiting for the Brazilian government to define its policies on biodiversity use. As of now, operating policies are set by "provisional measures" (medidas provisórias), or temporary presidential decrees that must be renewed every four months and which can easily change from one day to the next. Also, a scandal in 2000 over a contract signed between the Brazilian Association for the Sustainable Use of the Biodiversity of Amazonia (BIOAMAZONIA) and the Swiss-based pharmaceutical firm Novartis (Adolfo, 2000) has temporarily dampened interest in

these resources. BIOAMAZONIA is a "social organization" formed to conduct bioprospecting and related activities under the Brazilian Program of Molecular Ecology for the Sustainable Use of Biodiversity of Amazonia (PROBEM). Novartis has withdrawn, and the future leadership of BIOAMAZONIA remains undefined.

The "crossing the desert" logic applies to climate change benefits in a manner similar to biodiversity. Investment interest in carbon with a view to short-term returns is likely to be limited, given the fact that the agreement over the Kyoto Protocol reached in Bonn in July 2001 excludes credit for forest maintenance in the Clean Development Mechanism during the Protocol's first commitment period (2008-2012). However, in the longer-term, the political struggles underlying this decision can be expected to shift because the "assigned amount" (national emissions quota) of each party is renegotiated for each successive commitment period, thereby removing the advantage to key actors (especially in Europe) of forcing parties (specifically the United States) to satisfy the commitments they made in Kyoto almost entirely through relatively expensive domestic measures (Fearnside, 2001b). The negotiations over the 3 1/2-year period between the 1997 Kyoto conference and the Bonn agreement were unique because industrialized countries had agreed to specific assigned amounts (quotas) for the first commitment period before the rules were defined on such questions as inclusion of avoided deforestation in the Clean Development Mechanism. For future commitment periods, allowing inclusion of avoided deforestation would help induce countries to agree to larger commitments than they would accept in the absence of such a provision, and would therefore have a net benefit for climate. The break with past inaction represented by the Bonn agreement could convince major investors, such as pension funds, to initiate or increase investment in long-term carbon ventures. As global warming worsens and efforts to combat it become stronger and more universal, the carbon value of tropical forests can be expected to increase dramatically. This is likely to happen by the end of a 30-year forest management cycle initiated now.

### *(d) Value-Added versus Raw Materials*

A recurrent question is the extent to which forestry management operations in Amazonia should strive to supply value-added products (such as flooring or furniture), versus raw materials such as rough-sawn timber or, in the extreme, unprocessed logs. One side of this debate holds that only value-added products should be produced, such that the maximum amount of employment and financial gain remains in the region (e.g., Goodland and Daly, 1996). Business analysts often counter that much more money can be made by exporting the raw materials because processing mills abroad waste less wood and produce products with higher quality and uniformity that command substantially higher prices than do products from Amazonian mills. Repetto (1988) shows the financial logic of this position with examples from Southeast Asia. In the Amazonian context, the argument is also made that the expansion of certified low-impact forest management is limited by the amount of capital available for this purpose, and that the "green" funds available for this kind of investment would be best used for maximizing the area brought under management rather than for building and maintaining the very expensive industrial operations needed to transform the output into value-added products. Otherwise the result would be that the timber market is supplied by the predatory logging operations that dominate the scene today.

The employment and income from value-added products is the reason for Brazil's prohibition since 1965 of exporting raw logs. While the reduced attractiveness to investment capital for value-added operations is evident, there is an environmental (as well as a social) rationale for favoring investments of this type. This is the effect of the environmental damage of increased logging, whether it be calculated per unit of investment absorbed, per job created, or as a percentage profit including both monetary and environmental effects. A hypothetical illustration is given in Table 1; while a raw-materials strategy is more profitable in financial terms, the value-added option can be preferable if social and environmental indicators are included, depending on the values assigned to these other considerations.

[Table 1 here]

In the example in Table 1, the value of environmental damage is critical: if it is less than US$650/ha, then the raw-materials strategy gives a better result in terms of profit as percent return on monetary plus environmental investment, but if it is greater than US$650/ha, then the value-added strategy is preferable. Which case reflects reality depends on the baseline: the "glass half-empty" versus "glass half-full" orientation of the beholder. If the operation is viewed as having saved the managed hectare from deforestation, then the "environmental cost" is negative (i.e., there is an environmental benefit) and the raw-materials strategy is preferable. However, if the impacts are simply totaled without this assumed benefit (i.e., the baseline case is unaltered forest), then the environmental cost will exceed US$650/ha and the value-added strategy will be preferable. Some indications of the monetary value of the environmental damage of logging point to values well in excess of US$650/ha. Considering only harvesting (not management for the full cycle), the Legal Amazon's 1990 logging emission of 61 million t C from harvesting 24.6 million $m^3$ of logs (Fearnside, 1997c) corresponds to 2.48 t C/$m^3$ of logs or 74.4 tC emission/ha logged at 30 $m^3$/ha (i.e. US$1488/ha harvested if one assumes a willingness to pay for carbon value of US$20/tC). For forest under management, considering the logging emission parameters prevailing in the region (Fearnside, 1995, p.316) at 38 $m^3$/ha in a 30-year cycle, equilibrium carbon stocks under sustainable management correspond to a loss of 14.9 tC/ha managed (including regenerating areas) when compared to unlogged forest, a gain of 18.0 tC/ha compared to unsustainably logged forest (if assumed not to degenerate subsequent to logging), and a gain of 187.6 tC/ha compared to deforested areas. At US$20/tC, these carbon values correspond to –US$298, +US$360, and +US$3752, respectively. The willingness-to-pay for forest maintenance would be higher if biodiversity benefits were included in addition to carbon (see Fearnside, 1997b, 1999b). If a monetary value were assigned to employment creation, then the critical value would shift in favor of the value-added strategy accordingly.

### *(e) Private Properties versus Forest Concessions*

Private initiatives are increasingly prominent in discussions of conservation policy in Amazonia. While creation of conservation units can be proposed for some areas, the vast areas of remaining forest outside of any existing units always leaves the question of what to do with the rest. Efficiency is a concern: as compared to the government,. private operations are more efficient at many of the tasks involved. Of course, supervision is needed to ensure that private forestry management operations play their

expected role in conservation. The viability of private initiatives bears a relation with conservation units, since the low price of timber is a key factor discouraging investment in sustainable management. The price will only increase when supply declines relative to demand. Wood from sustainable management will always be at a disadvantage so long as the supply of cheap logs from unsustainable harvesting is essentially infinite. This can be changed by creation of conservation units that make large areas of forest off-limits to logging and by strict enforcement of Brazil's existing forestry regulations. Actions must be taken now to avoid the alternative of waiting until the forest is almost all destroyed before scarcity and rising prices motivate conservation of the remaining fragments.

The National Forest Program (PNF) was decreed on 22 April 2000 in honour of the 500th anniversary of Brazil's "discovery" by Portugal. This program includes a goal of greatly increasing the area of FLONAs in order to supply the internal and export markets from sustainable management in these areas. About half of the 15.2 million ha of FLONAs in Amazonia overlap with indigenous areas, reducing the amount available for management to 8 million ha. The PNF hopes to have 20 million ha under management within 10 years, and the area under FLONAs would be expected to total 50 million ha to achieve the goal of supplying the market (Deusdará Filho, 2001, p.395). A total of 115 million ha, or 23% of the Legal Amazon, is suitable for creation of FLONAs in that it is neither indigenous land, a conservation unit, deforested, or inaccessible (Veríssimo et al., 2000).

As compared to management in private land, forest concessions in public land, such as FLONAs, offer the concession holder the "trip across the desert" but not the reward at the other side. Effects counteracting this disadvantage from the investor's point-of-view are release from the need to commit capital to land purchase and the expectation of government protection in defending the land from invasion.

Another arrangement is essentially a sale of wood rather than a concession. In the Tapajós FLONA, a 2700-ha forestry-management experiment initiated by the International Tropical Timber Organization (ITTO) has been conceded for a five-year period to CEMEX, a company with a flooring mill in Santarém (84 km by paved road from the area). The company pays R$6/m$^3$ of logs (equivalent to US$2.40 as of July 2001), with the right to harvest 30 m$^3$/ha. The cost to the sawmill is therefore 30 X R$6 = R$180/ha, or about six times the purchase price of forested areas with access only slightly less favorable along the BR-163 Highway between Rurópolis and the Pará/Mato Grosso border. Because the mill only uses three species of tree, the amount of high-quality timber of these species is insufficient to supply the permitted 30 m$^3$/ha, leading to the temptation to invade neighboring areas in the FLONA to remove valuable wood. Concession systems must be designed with the full management and economic cycle included. Concessions must be long-term in order to provide motivation to use sustainable methods, preferably subject to periodic inspections and renewals over the course of the concession's term (Poore et al., 1989, pp.197-202).

## 6. DILEMMAS IN SELECTING CONSERVATION UNITS

### *(a) New Conservation Units versus Consolidation of Existing Units*

Despite the conventional wisdom that "paper parks" are a great evil, they do, in fact, play an important role in the process of conservation in Amazonia. By decreeing areas as reserves of the various different kinds in advance of having government funds to adequately "implant" the units, a process is set in motion that can later lead to obtaining these resources. If one were to wait to have adequate funds for implantation before decreeing the reserve, the practical result would be that very few reserves would be created because the government rarely has even the minimum funding necessary for its own operational expenses. As the frontier approaches, the cost increases dramatically, and invasions make reserve creation politically impossible. Often (but not always) just the presence of the paper park deters many invaders. The Tapajós FLONA provides an example: the least-affected portion of the area is the southern portion, where there has been almost no investment by the government in guarding, research, forest management and community development programs. The mere existence of a conservation unit has a substantial inhibiting effect on deforestation.

At the same time that the system of conservation units must be rapidly expanded, with due attention to provisions for public consultation and other requirements of the SNUC, the government's responsibility to defend and maintain existing units must be fulfilled. The grave state of degradation and illegal invasion of some existing units points to the need for forceful action on the part of government authorities to avert the complete destruction of these units (e.g., Fearnside and Ferreira, 1985; Rosa and Ferreira, 2000). Examples of these include the Jamarí and Bom Futuro FLONAs in Rondônia and the Serra do Divisor National Park in Acre.

*(b) Well-Funded versus Low-Cost Conservation Units*

Given the always-inadequate nature of funds and personnel for reserve creation, the dilemma is always present whether to use the available resources to create a few well-funded reserves or many inexpensive ones. The idea of holding off on stimulating demand for conservation units until more resources are available, thereby avoiding the creation of unrealistic expectations on the part of local populations, is a formula for doing nothing. Only by stimulating the demand of the local populations will the various government agencies involved be moved to create the areas and later to provide them with infrastructure and programs for improving the living standards of their populations.

A case in point is provided by the Central Amazon corridor, where várzea (floodplain) makes up most of the "interstitial" area (i.e., that between established conservation units). A much stronger demand exists for establishment of Sustainable Development Reserves (RDS), such as Mamirauá and Amanã, for management of fisheries in the várzea than is the case for terra firme (upland) areas, or even for forest management in the várzea areas. Just the act of creating the RDS and closing the várzea lakes in it to entry of "peixeiros" (large fishing boats from outside the area) has instant support from the local population. This can be used to leverage support for the RDS as a whole, even if no funding is provided for the wide range of programs associated with a reserve like Mamirauá. Activities in new RDS reserves in these areas could begin with fisheries and only later move into use of other resources in the várzea, later followed by terra firme. The risk of raising hopes while remaining unable to deliver can be reduced if less is promised. The cost can be modest: Amanã

has only eight employees for an area of 2.35 million ha, larger than the Brazilian state of Sergipe.

*(c) Location Near to or Far from the Deforestation Frontier*

The choice of locations for creation of conservation units greatly influences the cost of establishing and maintaining the units. Locations near areas of active deforestation are usually much more expensive on all counts, in addition to being likely to have political resistance to reserve creation. In terms of establishing substantial areas of conservation units, it is therefore wise to give greater priority to reserves far from the frontier. One factor in favor of reserves near the deforestation front is the rarity of existing units protecting samples of several vegetation types along the transition between forest and cerrado (central Brazilian savanna) that is the current location of the "arc of deforestation." A second factor is the likelihood that these areas would otherwise be cut in the near future if in the absence of conservation units, thereby contributing to the "additionality" of avoiding deforestation in these areas as a contribution to reducing emissions of greenhouse gases (Fearnside, 1999a). In addition, the political attractiveness of spreading PP-G7 resources as evenly as possible among states would tend to work against concentrating resources in certain states (such as Amazonas) where large areas of potential conservation units are located far from the present frontier. On balance, priority should be placed on rapid expansion of conservation units in relatively unthreatened areas far from the deforestation front.

*(d) Allocation of Effort between Completely and Partially Protected Areas*

The "people in parks" debate is central to the question of how effort is allocated between completely and partially protected areas. At one end of a spectrum, arguments in favor of concentrating efforts in a few well-protected areas see the future as an inexorable march towards environmental degradation, with inhabited reserves only slightly postponing the time when these areas will arrive at their endpoint of virtually complete desolation (e.g., Terborgh, 1999). Those in favor of placing priority on inhabited areas see creation of large areas under total protection as politically unviable, as tending to cause injustices for traditional populations already living in the areas selected, and as ultimately offering less protection for nature because they lack the popular support of local inhabitants who can defend the forests from invaders more effectively than government-paid guards (Schwartzman et al., 2000a; see critiques by Terborgh, 2000 and by Redford and Sanderson, 2000 and reply by Schwartzman et al., 2000b). Although hunting and other activities by traditional peoples can reduce biodiversity as compared to uninhabited forest, the convergence of many objectives between those seeking to secure the land rights of traditional peoples and those primarily concerned with biodiversity conservation offers great scope for alliances with gains for both interest groups (Redford and Stearman, 1993). Debates on this controversial topic are collected in Kramer et al. (1997) and Brandon et al. (1998).

A certain tension is evident among various governmental and non-governmental actors in their priorities for creating sustainable-use areas such as RESEX, FLONA and RDS units, versus totally protected areas such as national parks, biological reserves and ecological reserves (formerly ecological stations). The promise of

Brazilian president Fernando Henrique Cardoso of increasing the area of Amazonian forest under total protection to 10% by 2004 would be most easily achieved by creating new sustainable-use conservation units, each one with a participatory zoning process that will include delimitation of a totally protected "core" area, surrounded by zones from which various forms of sustainable extraction will be done by the local communities. The core areas can count towards the 10% goal (the current strategy of PROAPAM). This strategy helps gain the support of local communities and counter fears of some state governments that conservation would inhibit development and would take the form of "creating conservation units just to create them."

*(e) Relative Weight of Factors in Selecting Reserve Locations*

The relative weight of factors considered in selecting reserve locations can greatly affect the choices made. One set of factors is biological, such as the representativeness of the ecosystems included in a proposed unit and the contribution that this makes to overall objectives of securing at least some area of each of the existing vegetation types (e.g., Fearnside and Ferraz, 1995; Ferreira, 2001; Ferreira et al., 2001). In 1990, Conservation International (CI) organized an event in Manaus known as "Workshop 90" to apply information on diversity and endemism in different plant and animal taxa, soils, and the level of biological knowledge of different regions in order to locate priority areas for conservation (Rylands, 1990). One problem is that many parts of the region are poorly known, and those that are well known because of proximity to the major research institutes in Manaus and Belém are found to be the most diverse simply as an artifact of being better studied (Nelson et al., 1990). The crossing of poor knowledge with high diversity therefore results in nearly the whole region being identified as high priority (Veríssimo et al., 2001: 450-455).

When the degree of threat is added as a criterion, the large areas of remaining forest in Brazilian Amazonia lead this area to receive a lower rating than highly threatened areas elsewhere in Brazil, such as the Atlantic forest and remains of the cerrado (Dinerstein et al., 1995). The logic of "triage" can result in little or no effort being allocated to securing areas far from current frontiers. The "hotspots" of endemism in Atlantic forest and the slopes of the Andes also lead to giving higher priority to these areas than to Brazilian Amazonia (Myers et al., 2000).

Using the goal of obtaining protection of at least 10% of each landscape type (based on vegetation and soil) with a prioritization based on vulnerability (a function of distance from roads, settlement areas and existing deforestation), connectivity (including proximity to indigenous areas and sustainable-use areas), Ferreira (2001) has developed a procedure for identifying priority areas for establishment of new conservation units. Additional social criteria (along with biological priorities similar to those of Workshop 90) were applied at a workshop held in Macapá in 1999, resulting in identification of 265 "extreme-priority" areas and 105 "very high-priority" areas (ISA et al., 1999). This is the basis of the system currently used by the National Program of Biological Diversity (PRONABIO) establishing priorities for reserve creation.

Other relevant factors include the existence of traditional peoples, level of community organization, and the defensibility of proposed areas that is provided by natural boundaries and natural barriers to invasion (Peres and Terborgh, 1995). An additional

set of factors may be termed "opportunistic factors." These include opportunities for reserve creation that frequently arise, irrespective of biological and social factors. The ability of Paulo Nogueira Neto (1991) to capitalize on such opportunities played a key role in creating Brazil's system of ecological stations in the 1970s and 1980s. An example of a contemporary opportunity is the abolition of the Superintendency for Development of the Amazon (SUDAM) in 2001, which raises the question of the future of that agency's 72,000-ha experimental forest management area in Curuá-Una (e.g., Dubois, 1971). The area is apparently already threatened with invasion by illegal loggers. Since this is federal land, it could be converted to a FLONA with relative ease.

## 7. DILEMMAS IN THE IMPLANTATION PROCESS

### *(a) Policies on Removal and Compensation of Occupants and Invaders*

Thinking on conservation unit establishment and management has evolved greatly in recent years, with increasing acceptance of traditional populations continuing to live within the conservation units that are created in the areas they inhabit. However, this does not solve the problem of dealing with invaders who enter these units later. If these invaders are rewarded with special access to government settlement and assistance programs, a perverse incentive is put in place that encourages further illegal invasions. A firm hand with invaders is therefore indicated, and a clear distinction must be maintained between "occupants" who were in the area prior to creation of the conservation unit and "invaders" who arrive afterwards. More delicate situations arise where the inhabitants of successful conservation units invite relatives and friends from areas outside of the reserve (often just a matter of moving from one side of a river to the other).

Removal of population, to which IBAMA gives the Orwellian term "desintrusão" (literally: "unintrusion"), is controversial because of the need to provide for the population removed and the chronic lack of funds for the agencies responsible for the different types of reserves. World Bank resettlement policies are stricter than those applying to programs funded entirely from domestic Brazilian sources, with the result that reserve creation efforts that include funding from the World Bank often exclude any cases where removal of invaders from reserves would be necessary. For example, the Raposa Serra do Sol indigenous area in Roraima was removed from the list of areas to be demarcated under the PP-G7's PPTAL program because compliance with World Bank resettlement policies would make the demarcation unviable and thereby block the entire PPTAL effort. Ironically, the World Bank's resettlement policies had been strengthened in response to (well-deserved) criticism over lack of adequate provision for largely tribal populations displaced by the Narmada Dams in India (e.g., Morse et al., 1992), but had the unintended result of denying indigenous peoples in Amazonia protection against invasion of their land.

### *(b) Relation of Poverty Alleviation to Conservation*

Poverty alleviation has an important role in conservation policy, but it is important to define clearly the relationship between the two for the purposes of allocating resources. Both the British and the German governments have firm policies that all conservation efforts they fund must include poverty alleviation.

If poverty alleviation were the sole criterion for judging project success, then establishing and supporting conservation units would not be the activity of choice. One could always delimit a few hectares of favela area in a large city such as Manaus and provide it with programs for health, education, and small-scale income generation at much less cost per family saved from poverty than in the case of providing similar services to far-flung communities in Amazonian conservation units. The same amount of funding will always relieve more poverty in an urban setting. The rationale for spending the money in conservation units instead is environmental: poverty alleviation in conservation units can have large environmental benefits, whereas environmental benefits of poverty alleviation in urban settings are small or even negative. The question of "Sustainable development for whom?" must always be answered, and when dealing with conservation policy the answer must always be "For those who protect the environment."

In allocating money for poverty alleviation in conservation units, the question invariably arises as to whether one should expand areas to the maximum as quickly as possible, with minimal investment in social services and income-generating activities, or whether a better level of services should be provided to a smaller population. As mentioned earlier, the environmental justification of the reserves makes maximization of area a better goal at the present time. Rather than concentrating large amounts of resources on a few selected communities, it would be better to raise living standards in steps: everyone in a conservation unit should first be brought up to a subsistence level before promoting higher-income activities.

One question that must be faced squarely is that of the population that is excluded from conservation unit areas. An example is provided by fisheries resources in RDS units in the state of Amazonas, such as Mamirauá and Amanã. To what extent should funds for reserve creation be used to alleviate the impact on fishermen from Manaus, Manacapuru and Tefé who are excluded? While it is often claimed that there are plenty of fish for everyone, it is more accurate to say that there will be a loss to those excluded. "Peixeiros" (large fishing boats from outside of the area) are inherently predatory because this type of harvesting is economically rational in an open-access situation (i.e., the "Tragedy of the Commons", sensu Hardin, 1968). The overall fish catch from the protected lakes will improve because productivity increases under community management and because the alternative of open access is non-sustainable (McGrath, 2000; McGrath et al., 1994; Pires et al., 1996).

The amount of fish that can be taken from natural ecosystems in Amazonia is limited, whereas the demand is, for practical purposes, infinite, given the region's 20-million population and the availability of refrigerated transport to markets throughout Brazil and the World. The question, then, is for whom this resource will be used. Arguments for giving the rights to local residents include their role in protecting the environment, in addition to common principles of self-determination.

The fishermen who are excluded will take jobs away from others when they compete for the limited amount of employment in manual tasks available in Manaus and other urban centers. Therefore, in terms of poverty relief, this represents a reduction in the balance of poverty-alleviation net benefits.

*(c) Priority of Actions in Buffer Zones versus in Conservation Units*

The relative priority to be given to actions in buffer zones versus in actions inside the conservation units themselves is often discussed (e.g., Sayer, 1991). Amazonian conservation units differ significantly from the stereotype of a pristine nature reserve as an island surrounded by a sea of poverty. Rather, the conservation units contain traditional populations, who often do not differ so greatly from those in adjoining areas outside of the reserves. However, in some cases dense non-traditional populations are located adjacent to reserves, such as the settlement areas along two sides of the Tapajós FLONA. In these cases, however, providing services to the buffer zone would represent a virtual black hole for funds, since the populations are large and funds are limited. At the same time, there are demands greatly exceeding the capacity of funding for people who are already in the Tapajós FLONA, both in traditional areas along the Tapajós River and in an enclave of settlement within the reserve (Communidade de São Jorge). In general the presence of people in conservation units makes buffer-zone management less critical in Amazonia than in other parts of the world.

The placement of totally protected areas adjacent to settlements, and vice versa, increases the risk of the protected areas being invaded. One way to avoid this is by placing FLONAs or other sustainable-use areas to serve as buffers between settlement areas and reserves. The state of Acre is following this strategy along the southern side of the BR-364 Highway between Rio Branco and Cruzeiro do Sul. Unfortunately, the state of Amazonas, on the other side of the highway, has not taken similar measures to contain expansion of the BR-364 deforestation front.

## 8. NEGOTIATION WITH INDIGENOUS PEOPLES

Negotiation with indigenous peoples is a crucial area for Amazonian conservation policy that has hardly begun. Indigenous lands represent much greater areas of natural ecosystems than do all of the types of conservation units combined, and the future fate of indigenous lands will therefore be the dominant factor in the ultimate fate of these ecosystems. So far, indigenous peoples have had a much better record of maintaining the natural ecosystems around them than have other populations in Amazonia. However, it is important to realize that indigenous peoples are not inherently conservationist, as is sometimes assumed, and that they can be expected to respond to the same economic stimuli that induce other actors to destroy and degrade forests. This would be a great error from the point of view of the well-being of the indigenous groups themselves, in addition to its impact on global environmental concerns such as biodiversity and climate. It is precisely the ability of indigenous peoples to defend and maintain their forests that gives them an as-yet unremunerated role in providing environmental services (Fearnside, 1997d). In order to chart their future, they need to see that their conservationist role is valuable and is also the source of their support.

So far the rewards of this role have been restricted to the modest benefits of special programs such as the PP-G7. These include the PPTAL program for demarcation of indigenous lands. The PROMANEJO program has financed a certified forest management project for the Xikrin tribe, which had its first harvest in 2000. The Demonstration Projects for Indigenous Peoples (PDPI) Project expects to apply the

Demonstration Project Type A (PD/A) model to sustainable development projects in indigenous areas in the near future. Sustainable community-level projects such as these need to be encouraged on a wider scale, but, as is also the case with similar projects throughout the PP-G7 program, a critical lack is an understanding by the recipients that the reason for their receiving these benefits is environmental, and that they therefore need to maintain and strengthen their ability to provide environmental services.

## 9. CONCLUSIONS

The need for flexibility in dealing with the numerous dilemmas in defining conservation policy in Amazonia is evident. Involvement of local peoples is increasingly showing itself to be a key to success of conservation efforts, including the definition and defense of totally protected zones within conservation units that include uses of renewable resources. The balance of responsibility and authority among the different levels of government is a source of tension in creation of new conservation units. Inherent conflicts of interest among these and other actors are inescapable, making effective negotiation and conflict management fundamental to conservation policy. Managing the conflicts can create opportunities for enhancing biodiversity. Indigenous peoples have played a critical role in maintaining substantial areas of Amazonian ecosystems, and negotiations and appropriate development programs for these peoples will be critical for the long-term future of these peoples and their forests. The rapid pace of deforestation and other forms of destruction is closing off opportunities for conservation and for sustainable use both inside and outside of conservation units. This means that Brazil must act now to define priorities and proceed with expanding and reinforcing its system of conservation units in Amazonia.

## 10. GLOSSARY

BIOAMAZONIA: Brazilian Association for the Sustainable Use of the Biodiversity of Amazonia

CI: Conservation International

EIA/RIMA: Environmental Impact Study/Report on Impact on the Environment

IBAMA: Brazilian Institute for the Environment and Renewable Natural Resources

FLONA: National Forest

FOE: Friends of the Earth

FUNAI: National Foundation of the Indian

INPA: National Institute for Research in the Amazon

ISA: Socio-Environmental Institute

ITTO: International Tropical Timber Organization

NGO: Non-Governmental Organization

OEMA: State Environmental Agency

PD/A: Demonstration Project Type "A"

PDPI: Demonstration Projects for Indigenous Peoples

PGAI: Integrated Environmental Management Project

PP-G7: Pilot Program to Conserve the Brazilian Rain Forest

PPTAL: Project for Protection of Indigenous Populations and Lands in the Legal Amazon

PROAPAM: Program for Expansion and Consolidation of a System of Protected Areas in the Amazon Region of Brazil

PROBEM: Brazilian Program of Molecular Ecology for the Sustainable Use of Biodiversity of Amazonia

PROMANEJO: Pro-Management Project

PRONABIO: National Program of Biological Diversity

RDS: Sustainable Development Reserves

RESEX: Extractive Reserve

SNUC: National System of Conservation Units

SPRN: Sub-Program for Natural Resources

SUDAM: Superintendency for the Development of the Amazon

TNC: The Nature Conservancy

WWF: Worldwide Fund for Nature

ZEE: Ecological-Economic Zoning

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# FIGURE LEGENDS

Figure 1. Forest and non-forest areas in Brazil's Legal Amazon Region.

Figure 2. States in Brazil's Legal Amazon Region and cities mentioned in the text.

Figure 3. Projects and reserves mentioned in the text

Figure 4. Indigenous areas in Brazil's Legal Amazon Region.

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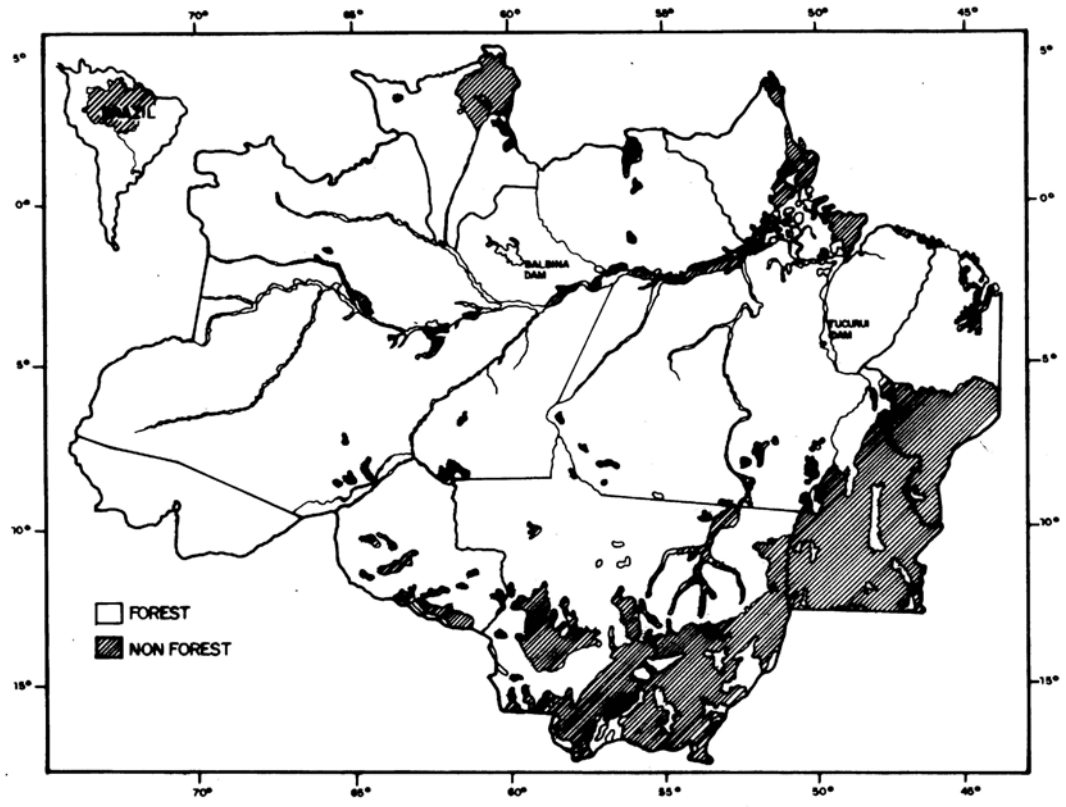
Table 1: HYPOTHETICAL COMPARISON OF VALUE-ADDED PRODUCTS VERSUS RAW MATERIALS FROM FOREST MANAGEMENT

| Item | Units | Value-added products | Raw materials | Source |
|---|---|---|---|---|
| FINANCIAL INDICATORS | | | | |
| Area exploited | ha | 1 | 1 | (a) |
| Monetary expense | US$/ha harvested | 4264 | 1315 | (b) |
| Volume exploited | $m^3$/logs/ha harvested | 30 | 30 | (c) |
| Volume sold | $m^3$ product/ha | 5.25 | 10.5 | (d) |
| Price | US$/$m^3$ product | 1074 | 215 | (e) |
| Gross return | US$/ha | 5639 | 2255 | (f) |
| Net monetary return | US$/ha | 1374 | 941 | (f) |
| Profit | % return on monetary investment | 32 | 72 | (f) |
| SOCIAL INDICATORS | | | | |
| Local employment | jobs/100 ha degraded/year | 0.58 | 0.12 | (g) |
| ENVIRONMENTAL INDICATORS | | | | |
| Environmental impact of investment | ha exploited/ US$1000 invested | 0.2 | 0.8 | (f) |
| Environmental impact per job created | ha exploited/ job | 1.7 | 8.6 | (f) |
| Environmental damage | US$/ha | 650 | 650 | (h) |
| Cost (monetary + environmental) | US$/ha | 4914 | 1965 | (f) |
| Net return (monetary + environmental) | US$/ha | 724 | 291 | (f) |

| | | | | |
|---|---|---|---|---|
| Profit (% return on monetary + environmental investment) | % | 15 | 15 | (f) |

(a) Assumed 1 ha (equal for both systems) for purposes of comparison.
(b) All costs from Schneider et al., 2000: 39): for raw-materials, extraction variable cost US$7.59/$m^3$, assumed all wood harvested is used; Processing variable cost US$24.58/$m^3$ logs; Transport in logged area US$1.3/km, assumed average 2.5 km (i.e., 2500-ha concession in square form Transport on paved road US$0.10/$m^3$, assumed 84 km distance (i.e., FLONA Tapajós); Value-added processing cost assumed five times greater, other costs assumed equal.
(c) Volume permitted (e.g., FLONA Tapajós contract).
(d) Logs to sawnwood (raw materials) conversion 35% (Schneider et al., 2000: 38); value added assume of raw-materials value.
(e) Prices from Schneider et al., 2000: 39 for sawnwood (US$/$m^3$ product): high value 280, medium valu low value 158; assume proportions of 30 $m^3$ logs/ha first-cycle harvest as 20% high value, 40% medi value, 40% low value; value-added prices assumed five times higher.
(f) Calculated from above
(g) Employment for raw materials based 258 $m^3$ of logs/year/job under sustainable management (Schneider et al., 2000: 44, based on Barreto et al., 1998, Veríssimo et al., 1992); value-added employment is assumed to be 5 times greater.
(h) For the parameters used here, US$650/ha is the critical value at which switchover occurs between the strategies, value-added being preferable if environmental damage exceeds US$650/ha. For example, a US$1000/ha the profit (% return on monetary + environmental investment) is 7% for the value-added strategy versus -3% for raw-materials strategy, while at environmental cost levels exceeding US$1400 both strategies are negative, with the raw-materials strategy being more negative.

Fig. 1


70°
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0°
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10°
15°
BALBINA DAM
TUCURUI DAM
FOREST
NON FOREST
70°
65°
60°
55°
50°
40°

# CONSERVATION POLICY IN BRAZILIAN AMAZONIA: UNDERSTANDING THE DILEMMAS

Philip M. Fearnside
Coordination of Research in Ecology-CPEC
National Institute for Research
in the Amazon-INPA
Av. André Araújo, 2936
C.P. 478
69011-970 Manaus-Amazonas
BRAZIL

Fax: +55-92-642-8909

Tel: +55-92-643-1822

e-mail pmfearn@inpa.gov.br

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Summary

Conservation policy in Brazilian Amazonia is rapidly evolving. The dynamics of different interest groups affects the political economy of land use. Choices include allocation of effort between completely and partially protected areas and between creation of new conservation units versus consolidation of existing units. Tension between different levels of government, different groups of non-governmental organizations, and between the public versus private sectors are evident. While the conflicting interests of such groups present many barriers, they also offer conservation opportunities. Negotiation with indigenous peoples represents one of the most critical areas for the long-term future of natural ecosystems in the region.

KEYWORDS: Amazonia, Biodiversity, Brazil, Conservation, Forest management, Parks

## 1. INTRODUCTION

Conservation policy in Brazil's 5 million km$^2$ Legal Amazon region (Figure 1) is the subject of many ongoing controversies. Decisions made in the near future will be critical in determining the types of development that shape the landscape in wide areas in the region. Conservation policy in Amazonia is faced with a series of dilemmas in allocating scarce resources in this area. Deforestation and other forms of destruction and degradation continue at a rapid pace, closing off opportunities for conservation and for sustainable development in general. The present paper attempts to explain some of the controversies in designing conservation policies for the region. These controversies affect land both inside and outside of conservation units. On virtually every issue there exists a full complement of interest groups ready to do battle on behalf of their particular interest. Groups such as soybean farmers, for example, have agendas that conflict with those of environmental non-governmental organizations (NGOs). Each group of organizations makes its case by appealing to greater good such as biodiversity conservation or poverty alleviation. These competing appeals create 'dilemmas' for policymakers.

[Figure 1 here]

The present paper examines Brazil's conservation policies and programs in the light of an interest-based theory of the political economy of Amazonian land-use change (e.g., Rudel and Horowitz, 1993). The disparate interests of different groups help explain the plethora of programs and types of conservation units in Amazonia. Decisions presented by series of dilemmas in selecting conservation units and in the implementation process are influenced by the same interests and actors. Of particular significance is the potential importance of indigenous peoples in future conservation efforts. The paper concludes by emphasizing the need for flexibility and the opportunities presented by strategies for conflict management and negotiation.

## 2. INTERESTS AND THE POLITICAL ECONOMY OF LAND USE

### *(a) Federal, State and Municipal Governments*

Federal, state and municipal governments (Figure 2) frequently have conflicting priorities for creation of conservation units. This can thwart efforts to create any sort of unit, leading to the loss of opportunities for conservation and sustainable development. The practical solution may be to create federal units such as extractive reserves (RESEX), national parks (PNs) and national forests (FLONAs) when the land in question belongs to the Union, and state units such as sustainable-development reserves (RDS) and State Forests when it is state land. In the case of the choice between RESEX and RDS, which is a source of tension in the state of Amazonas, these forms of conservation units are essentially equivalent in terms of effect on the environment, with the exception of logging, which is permitted in community forest management projects operated in RDS and represent a greater impact on the forest than does harvesting of non-timber forest products in RESEX. Basing the choice on the level of government responsible for the land would solve this problem. As is current policy, the representatives of the state governments should be heard when federal conservation units are created within a state, and federal environmental

authorities should be heard when state units are created. Lapses from this policy can have disastrous results, as in the February 2002 announcement by the governor of Pará that he would not allow any further federal conservation units to be created in the state, following a mobilization by the mayors of municipalities where 2.3 million ha of RESEX were to be created by the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) on land that had been confiscated from *grileiros* (land swindlers) (see Pinto, 2002).

[Figure 2 here]

In some states (such as Pará) the state governments are anxious to involve the municipal governments and not to create any conservation units that the municipal governments don't want. This tendency is reinforced by legislative restrictions limiting the fraction of state-government budgets that can be used for payroll expenses, thus motivating the states to pass as many functions as possible (such as guarding reserves) to the municipal governments. Compared to state governments, municipal governments are normally more subject to local pressures from sawmill owners and other interest groups, often making the municipal governments less likely to put a priority on conservation over short-term gain. While input from the municipal governments is important in reaching decisions on both state and federal conservation units, this does not mean that municipal governments should have veto power over creation of the units.

*(b) Party Politics*

Party politics is an omnipresent consideration in decisions to establish conservation units. Particularly at the state level, environmental authorities are direct actors in generating political support for the governors who appoint them, while politicians from opposition political parties are likely to take opposing stands on conservation issues. In addition, key individuals in federal and state agencies and in non-governmental organizations (NGOs) often have ties to political parties and sometimes have electoral ambitions of their own. Each conservation unit creates winners and losers, thereby creating opportunities for vote getting among the different groups by politicians who support or oppose any given conservation proposal. Depending on the proposal, losers, such as sawmill workers, may be more numerous and/or more likely to be registered to vote than are winners such as traditional extractivists and indigenous peoples. For example, demarcation of the Javari indigenous area has been resisted by the mayors of nearby municipalities and by representatives of Amazonas in the national congress (Amazonas em Tempo, 2000).

The relevance to political constituencies is illustrated by sustainable-development reserves such as Mamirauá and Amanã (Figure 3) that are promoted by the state government of Amazonas in the Central Amazon Corridor that is to be implemented under the Pilot Program to Conserve the Brazilian Rain Forest (PP-G7). Residents in the reserves, who have preferential access to fish resources in addition to modest additional benefits from social programs, can be expected to have increased probability of voting for candidates supported by the state governor who created the reserves. On the other hand, the more long-standing and geographically widespread social organization efforts of the Catholic Church and associated organizations, such as the Pastoral Land Commission (CPT), often increase the probability of

participating residents voting for opposition candidates. This can result in those linked to opposition political parties resisting reserve-creation efforts led by the state government in the Central Amazon Corridor.

[Figure 3 here]

In addition to vote-getting opportunities among the populations directly affected by creation of a conservation unit, political advantage can also be gained by appeals to more universal interests in trying to sway voters in distant (usually urban) locations. While environmental concerns such as biodiversity and climate change are sometimes emphasized by supporters of reserves, opponents often tap the widespread belief in Brazil that the World is engaged in a permanent conspiracy to attack Brazilian sovereignty over Amazonia (e.g., Reis, 1982). A sociological survey of the population in Brazilian Amazonia revealed that 71% of respondents agreed with the statement "I am afraid Amazonia will be internationalized" and 75% agreed that "Foreigners are trying to take over Amazonia" (Barbosa, 1996). This creates a permanent temptation for any politician to denounce real or imagined threats to sovereignty, as an increased appeal to voters is always assured. Gilberto Mestrinho is best known for successful application of this tactic as a basis of political support (A Crítica, 1991a). As governor of Amazonas he even threatened to order the Military Police to machine-gun teams from the National Indian Foundation (FUNAI) if they attempted to demarcate indigenous lands in state (A Crítica, 1991b). As senator, he declared in the senate plenary that the PP-G7 ecological corridors project would "put Amazonas in a plaster cast. Why do they do this? Emptying [Amazonia] makes it easier to dominate [the region]. ..... [It is] used as a strategy for the future invasion of our sovereignty" (Adolfo, 1999). Recourse to the internationalization theory applies to all sides of the political spectrum, from conservative politicians such as Mestrinho (of the Brazilian Democratic Movement Party: PMDB) to those from the political left who, during a series of public hearing of the Amazonas State Legislature's Commission on the Environment and Amazonian affairs in October 1999, denounced the PP-G7 ecological corridors project as a trick to internationalize the region.

Even though struggles related to party politics underlie many conservation-unit controversies that are debated with appeals to patriotism and high principles, the heavy environmental costs of failure to conserve natural ecosystems are quite real. Party politics must not be allowed to impede efforts to create conservation units while opportunities still exist to do so in large areas.

### *(c) Public versus Private Sectors*

The public and private sectors each have roles to play in Amazonian conservation. Some types of activities, such as ecotourism operations, are inherently more efficient if done by the private sector. Non-governmental organizations have proved themselves to be essential intermediaries between government agencies like IBAMA and the local communities in conservation units. The Jaú National Park (with a co-management arrangement with IBAMA and Fundação Vitória Amazônica) and the Serra do Divisor National Park (with a similar arrangement with SOS Amazônia) are the best (and virtually the only) examples (Guazelli et al., 1998; SOS Amazônia, 1998).

Logging concessions are a difficult issue in public/private sector relations. Reason for caution is provided by the sad experience of southeast Asia, where private logging companies have destroyed or severely degraded large areas of tropical forest on the public lands that they are allowed to exploit through concessions (Repetto and Gillis, 1988).

## 3. CONSERVATION UNITS

### *(a) Types of Units*

Brazil has a wide array of different types of conservation units. In many cases these serve different purposes, while in others they have similar purposes but owe their origin to the different government agencies that have promoted them. Areas that are primarily for maintaining natural ecosystems without human presence (except for small areas designated for research) were formerly classed as "indirect-use areas" in Brazilian legislation, a terminology now changed to "integral-protection areas" under the National System of Conservation Units (SNUC). Federal conservation units in this category include National Parks, Ecological Reserves (formerly Ecological Stations) and Biological Reserves. By contrast, "sustainable-use areas" (formerly called "direct-use areas") promote use of renewable natural resources in the area under management regimes that are intend to sustain production while maintaining the major ecological functions of the natural ecosystem. These include national forests (FLONAs) (Rankin, 1985; Reis, 1978), which are intended for "multiple use," but predominantly designed for timber management, and extractive reserves (RESEX) (Allegretti, 1990; Fearnside, 1989a), which are intended for management of non-timber products such as rubber and Brazilnuts. In the state of Amazonas the new category called a "sustainable development reserve" (RDS) was created in 1996, where local residents zone the designated area into portions for community management of resources such as fish and timber, with a core area that is to remain untouched.

Private properties are obliged to maintain a specified percentage of their area as a "legal reserve" where approved management activities may be undertaken but which must remain under forest cover; legislative struggles are in progress to define the percentage required as a legal reserve, whether silvicultural plantations are counted as forest cover, and whether a system of trading among properties is permitted (Fearnside, 2000; ISA, 2001). Private landowners may also irreversibly commit land to conservation purposes (thereby becoming exempted from Rural Property Tax) by registering the land as an "Area of Relevant Ecological Interest." In addition, areas may be designated as Environmental Protection Areas (APAs), where land is subject to certain zoning procedures designed to limit damaging activities but where many forms of development (including urban centers) are permitted. Indigenous areas, although not classified as "conservation units," are perhaps the most critical of all land-use designations in maintaining substantial blocks of natural ecosystems in Brazilian Amazonia.

### *(b) The National System of Conservation Units (SNUC)*

Brazil's system of conservation units has evolved rapidly over the past few years, as has the force of destructive processes such as deforestation, logging and forest fires.

A new law creating a National System of Conservation Units (SNUC) was approved by the National Congress in July 2000 (Law No. 9985/2000). The law was approved after eight years of deliberation in the face of intractable differences among the various interested parties. Since approval of the law, the process of "regulamentation" (regulamentação) has been underway with a combination of the struggles among the different interest groups (Bensusan, 2001). The regulamentation process defines the specific rules and procedures that govern how the law is applied—a stage that is often as important, in practice, as the law itself. In the meantime, conservation policy is in a sort of limbo that is being taken advantage of by various groups that are anxious to stake their claims to as much Amazonian territory as possible before regulamentation is complete and the SNUC takes effect. For example, in June 2001 IBAMA hastily obtained decrees for new National Forests (FLONAs) (Folha de São Paulo, 2001), without holding the public hearings and other steps that will be required by the SNUC—a somewhat ironic situation given that IBAMA was a key agency proposing the SNUC. Such inconsistencies reflect the deep divisions within IBAMA, and among all those concerned with the environment, as to the appropriate conservation policies for Amazonia.

Various groups have been struggling to influence the SNUC, with the result that some of the most basic underpinnings are poorly defined or inconsistent. Most fundamental is what is known as the "people in parks" question, or whether human populations should be allowed to live in different types of conservation units. One group of NGOs called the "Pro-Conservation Units Group" (lead by FUNATURA and BIODIVERSITAS), supports the view that priority should be given to totally protected units (units without people), while the opposing viewpoint is held by another group that includes such organizations as the Socio-Environmental Institute (ISA), the Institute for Environmental Research in Amazonia (IPAM), the Institute for Man and the Environment in Amazonia (IMAZON), and the Amazonian Working Group (GTA). The government agencies involved have similar divisions, including the Directorate of Protected Areas (DAP) within the Ministry of the Environment (MMA), and IBAMA; the heads of these agencies support the "people in parks" side, while many of the employees who deal with the question in practice are on the other side of the issue. State governments universally favor units that maintain populations in them, and often want more intensive use of the natural resources than do their federal counterparts. Pros and cons of these positions will be discussed later on.

## 4. PROGRAMS FOR CONSERVATION

### *(a) Pilot Program (PP-G7)*

#### 1.) Overview of the PP-G7

The Pilot Program to Conserve the Brazilian Rain Forest (PP-G7) was announced by the G-7 countries at their meeting in Houston in 1990, a time at which global concern over Amazonian deforestation was at a high point and coverage appeared almost daily in the international press. Under pressure from their constituents, the G-7 leaders (Canada, France, Germany, Italy, Japan, U.K. and U.S.A.) signaled that they would commit US$1.5 billion to the program. However, with the end of the United Nations Conference on Environment and Development (UNCED, or ECO-92) in June 1992, media interest in Amazonia abruptly disappeared. By the time the PP-G7 got

underway in 1993 the G-7 countries were only willing to commit US$250 million of core funds, or one-sixth of the original amount, and even this had to extracted from the countries with considerable effort. The PP-G7 was originally expected to last for only three years, but delays in initiating several components, combined with the desire on all sides to continue the most successful activities, resulted in repeated extension of the program. Some components are expected to last to 2010.

The PP-G7 is financed by the G-7 countries and administered by the World Bank and the Brazilian government. Components include the PD/A ("Type A" demonstration projects) for small-scale sustainable development projects carried out by NGOs, extractive reserves, indigenous lands. A Sub-Program for Natural Resources (SPRN) includes environmental-economic zoning (ZEE) and strengthening of the state environmental agency (OEMA) in each of the nine states in the Brazilian Legal Amazon region. The Pro-Management Project (PROMANEJO) promotes sustainable forestry initiatives, including those in National Forests (FLONAs). Other components address management of <u>várzeas</u> (floodplains), science and technology, and a special program to combat burning. Information on the various components of the program can be found on the web sites of the Ministry of the Environment (Brazil, MMA, 2002), the World Bank (2001), and Friends of the Earth-Brazilian Amazonia (Amigos da Terra-Amazônia Brasileira, 2002).

2.) Sub-Program for Natural Resources (SPRN)

The Sub-Program for Natural Resources (SPRN) fortifies the state environmental agencies (OEMAs), including special activities within Integrated Environmental Management Project (PGAI) areas and an Ecological-Economic Zoning (ZEE) of each state. Zoning has been a particularly controversial issue, with extended negotiations between federal authorities and each state government having delayed implementation in some states. A standard methodology (Becker and Egler, 1997) was encouraged, although each state has variations upon this. Nitsch (1994) has attacked the process as inherently unviable due to internal contradictions (see rebuttals by da Costa, 1998; Schubart, 1997). Mahar (2000) has reviewed the experience Rondônia, where the state government enacted the zoning into law, thereby freezing the process and complicating adjustments to relieve problems. Despite its zoning, Rondônia continues to be one of the most environmentally destructive of the region's nine states (World Bank, 1997). In contrast, zoning provides for greater environmental protection in Acre (Acre, Programa Estadual de Zoneamento Ecológico-Econômico do Estado do Acre, 2000) and Amapá (2000), which are the two states where the current state governments favor conservation most strongly.

While planning can be greatly improved by efforts using zoning to think ahead about the consequences of different development decisions, the reality observed today is quite different. The real zoning is taking place today (without discussions of impacts) through major decisions such as implantation of the development axes that are part of the Avança Brasil program (Carvalho <u>et al</u>., 2001; Fearnside, 2001a, 2002; Laurance <u>et al</u>., 2001; Nepstad <u>et al</u>., 2000). Billions of dollars are being sought in investments before the environmental studies, zoning studies, and other information has been produced and debated. Zoning is therefore being done in practice on a massive scale

without following any of the principles that guide the zoning programs now underway.

3.) Ecological Corridors

The Ecological Corridors project is designed to promote a coordinated management of the different types of conservation units and indigenous lands in a contiguous area, including the interstitial area that completes the landscape within the corridor. So far, only one corridor in Amazonia is actively being pursued (Central Amazon Corridor, centered on the Mamirauá and Amanã Sustainable Development Reserves and the Jaú National Park), although an additional four corridors outlined in early plans for the project may eventually be added. Contrary to the fears of some politicians, the corridors do not freeze development within their boundaries; rather, they can serve as an aide in obtaining assistance for sustainable development projects appropriate to these areas.

4.) Extractive Reserves (RESEX)

Extractive Reserves (RESEX), originated from a 1985 proposal by the National Council of Rubbertappers under the leadership of Chico Mendes, and have been created by the federal government as a form of conservation unit since February 1988. The area under this form of land use now totals over 3 million ha, and additional units are proposed. Extractive reserves have been criticized as condemning their residents to poverty and as financially unviable due to the low price of extractive products such as rubber and Brazilnuts (Homma, 1996). However, it is important to realize that the rationale for creating extractive reserves is environmental, rather than a means of supplying cheap rubber or of supporting a large human population (Fearnside, 1997a). This is why extractive reserves are created as conservation units by the Ministry of the Environment, rather than as settlements by the National Institute for Colonization and Agrarian Reform (INCRA) in the Ministry of Agrarian Development. It is also significant that proposals for extractive reserves originate from the extractivists themselves, rather than from government authorities. Instead of condemning the residents to poverty, the reserves offer them a better and more stable income than they could realistically expect in the absence of the reserves (Allegretti, 1996). The idea that the residents have been tricked by environmentalists into forgoing a life as prosperous farmers (e.g., Benchimol, 1992) is entirely fictitious; rather, they would more likely be forced to move to urban favelas (shantytowns) or would join the ranks of landless poor in rural areas of the region. Under the PP-G7, the RESEX project has strengthened extractive communities in the reserves, helping them with marketing and facilitating access to health, education and other services.

5.) Indigenous Lands (PPTAL)

The Integrated Project for Protection of Indigenous Populations and Lands in the Legal Amazon (PPTAL) has produced concrete achievements that affect large areas of the region. So far 29 million hectares in 53 reserves have been demarcated, out of a total of 45 million hectares in 160 reserves (Figure 4). The demarcation process in the remaining indigenous lands not included in the PPTAL has been much slower, ironically including virtually all land in the states of Mato Grosso and Rondônia (which had been excluded from the PPTAL on the grounds that they already had

funding for demarcation through the PRODEAGRO and PLANAFLORO World Bank loans, respectively). The participative demarcation methodology developed under the PPTAL, with the indigenous peoples themselves doing the demarcation rather than having the work done by a corporate contractor, has been successful both in rapid and cost-effective execution of the task and in generating organizational experience and attitudes among the members of the indigenous groups that will serve them well in defending their territories and in implementing sustainable activities within them. Problems with contracted firms resisting and undermining the indigenous supervision of the demarcation have lead to a learning process to strengthen application of the methodology over the course of the PPTAL (de Oliveira, 2001). The 160 reserves in the PPTAL program have an indigenous population of 62,000; encouraging this population to solve its own problems with a minimum of dependence on outside resources and initiative is a major achievement for conservation.

[Figure 4 here]

The PPTAL illustrates the role of the Pilot Program in achieving a goal that would have been impossible for would-be funders to approach through bilateral projects. Despite demarcation of indigenous lands being required by Brazil's 1988 constitution (Article 67), the Brazilian government has, in fact, been unwilling to spend virtually any of its own funds for this purpose. In addition, involvement of foreign countries in matters concerning indigenous peoples normally provokes a virtually allergic reaction among Brazilian diplomats and officials—any country offering funds to demarcate a list of indigenous reserves would be immediately repelled as offending Brazilian sovereignty. The Pilot Program's indigenous component met with similar resistance over the first several years of the Program, but negotiated solutions were found that have allowed Brazil to achieve great progress in completing its announced goal of demarcating all indigenous lands, albeit not by 1993 as required by the Constitution.

*(b) PROAPAM: The "10% Project"*

On 29 April 1998, Brazilian president Fernando Henrique Cardoso announced a commitment to create totally protected areas to increase the percentage of Amazonian forest ecosystems with this level of protection to 10% by 2004. This effort was promoted by the Worldwide Fund for Nature (WWF) and the World Bank as part of the WWF "forests for life" campaign. As of 2001, totally protected areas that do not overlap with indigenous areas account for 3.6% of the Amazonian biome, while sustainable use areas represent 9.0% and indigenous lands 22.5% (Ferreira, 2001). The Program to Expand Areas of Environmental Protection (PROAPAM, also called ARPA), better known as the "10% Project," was created within the Ministry of the Environment to achieve this goal.

*(c) Positive Agendas*

The "Positive Agendas", or a series of priorities for development and conservation that are negotiated among the different actors in each state, have been underway since 1999. This system was created by the minister of the environment in response to the upturn in deforestation rates that was underway in 1999, and became the main determinant of priorities for the Special Secretariat of Amazonia (SCA) beginning in

April 2000 (Menezes, 2001). Positive Agendas are drafted by consensus by participants in meetings that last several days in each state capital. Use of this technique in 1999 to resolve an intractable dispute over creation of an extractive reserve for Brazilnut collection on the islands in the Tucuruí reservoir is viewed as a major achievement for the positive-agendas approach. Because any participant in the meetings has effective veto power over inclusion of any item in the agenda, the results are often rather weak on environmental measures. Their advantage lies in the broad support for implementation of the recommendations that they do make.

## 5. DILEMMAS OF FOREST MANAGEMENT

### *(a) Certification versus Boycotts*

Few debates are as polarized as those surrounding the question of forest management and certification as a conservation measure, with views ranging from this as a last chance for biodiversity (e.g., Rainforest Alliance, 2001) to an environmental swindle (e.g., Laschefski and Freris, 2001). Forest certification, organized through the Forest Stewardship Council (FSC, 2001), is backed by major international conservation organizations such as WWF, Friends of the Earth (FOE) and Greenpeace, as well as by Brazilian organizations such as IMAZON, ISA and IPAM. Sustainable management is not synonymous with minimizing environmental impact and can cause significant harm to the forest ecosystems (Bawa and Seidler, 1998; Bowles et al., 1998; Robinson et al., 1999). However, substantial biodiversity can survive in managed areas (Johns, 1997) and the low-impact methods required in certified areas greatly reduce damage as compared to uncontrolled logging (Johns et al., 1996). If the baseline one sees as the alternative is untouched forest, then management is disastrous for biodiversity, whereas if it is a cattle pasture then it is much better. Whether one views this glass as “half full” or “half empty” is presently a matter of personal orientation with little basis in quantitative information. More realistic scenarios of how land-use change would progress in the region under different policy regimes, including those related to forest management, could help to reduce the disparity of conclusions on the biodiversity losses or benefits from forest management.

Certified forestry management operations have increased rapidly: Mil Madeireira (with forestry operations and sawmill in Itacoatiara, Amazonas) was certified in 1997, GETHAL (with forestry operations in Manicoré and plywood mill in Itacoatiara, Amazonas) in 2000, and CIKEL (with forestry operations in Paragominas and flooring mill in Belém, Pará) in 2001. Although the increase in certified management operations in Amazonia is a significant change, most logging in the region is still predatory, and even operations with Forestry Management Plans (PMFs) approved by IBAMA have heavy impact and poor prospects for sustainability (Cotton and Romine, 1999; Eve et al., 2000). The demand for certified timber is small but growing. Contrary to popular perception, the great majority of wood harvested in Amazonia is consumed domestically rather than being exported to international destinations. In 1997, 86-90% of the timber harvested in Brazilian Amazonia was consumed within the country, and only 10-14% was exported (Smeraldi and Veríssimo, 1999, p.16). The demand for certified timber in Europe and North America is therefore less important than the demand within Brazil. While Brazilian consumers are less demanding of certified products than their counterparts in Europe and North America.

The encouragement of an alliance of NGOs has stimulated a small domestic market, which has grown from virtually zero in 1997 (Smeraldi and Veríssimo, 1999; Amigos da Terra-Amazônia Brasileira, 2001).

Mahogany represents an important exception to generalizations about the relative weight of domestic and foreign markets. Mahogany is in a price class by itself: US$900/$m^3$ of sawn timber at the mill gate, or 3-6 times the price of other commercial species (Smeraldi and Veríssimo, 1999), and most is exported. US imports represent 60% of the global trade; the US alone imported 120,000 $m^3$ from Latin America in 1998, equivalent to 57,000 trees (Robbins, 2000). Because mahogany justifies opening logging roads to remote areas, it plays a catalytic role in driving deforestation in the region (Fearnside, 1997b). Illegal harvesting of the species also has the greatest impact on indigenous and protected areas. Efforts to ensure certified origin of this species, and to boycott non-certified products, therefore have particularly high potential for conservation benefits.

Indiscriminant boycotts of tropical timber would have the negative effect of removing the major financial rationale for setting aside substantial areas of managed forest. However, it is the real threat of such boycotts that provides a critical motivation to both governments and the timber industry to seek certification and to reduce the impact and increase the sustainability of management operations. The existence of a certification system allows the boycott threat to be focused only on operations that do not join the system.

*(b) Forest Management versus Silvicultural Plantations*

Within Brazil, the demand for wood of all types drives the pressure of logging on Amazonian forests. Contrary to popular belief, tropical forest wood is not used only or even primarily for high-value products such as furniture and musical instruments. Brazil uses tropical wood for virtually everything, including concrete forms, pallets, crates, construction, particleboard and plywood. Substituting this demand with plantation-grown wood will only take place if low-cost wood is no longer available from destructive harvesting of Amazonian forests. At present, Brazil's substantial areas of plantations are almost all managed for pulp and charcoal rather than for sawnwood (Fearnside, 1998). This could change if policies were to be implemented creating the same kinds of limitations on free access to timber resources that are needed to motivate sustainable forest management.

*(c) Sustainability versus Financial Returns*

Sustainable forest management has become a requirement of Brazilian legislation and an objective at least nominally espoused by all. However, it faces fundamental contradictions between restraining harvest rates to levels that will allow the forest to regenerate and maximizing financial returns to loggers. Loggers will destroy the resource and invest the proceeds elsewhere if doing so results in a better return on their investments, regardless of whatever sustainable management system the loggers may have promised government authorities that they would follow. Because tropical forests grow at a rate about three times lower than the returns than can be obtained from capital invested in competing activities, sustainable management will remain

illusory unless economic decision criteria are changed (Fearnside, 1989b; see also Clark, 1976).

The first cycle will always produce more valuable wood than subsequent cycles because the forest manager is able to sell the large trees that may have taken centuries to grow. Aside from the (very low) cost of initial land purchase, these large trees are available at no cost other than the expense of extraction, whereas in future cycles the operation will have to undergo a transition to selling only the amount of wood that has grown while the investor has waited and maintained the operation. Kageyama (2000) questions the sustainability of management operations on the basis of tree population biology. In addition, calculations of sustainability invariably ignore the likelihood that fires will ever enter a forest management area. Logging greatly increases the susceptibility of forest to fire entry, and once fire enters it kills trees and increases fuel loads and understory drying, thereby increasing the risk of more-damaging future fires and complete degradation of the forest (Cochrane and Schultz, 1999; Cochrane et al., 1999; Nepstad et al., 1999a,b).

Maintaining timber management as an economically viable operation beyond the first cycle requires a shift over time in the products from which value is derived, as the growth rates of the trees of the hardwood species that are harvested in the first cycle are inherently very low. This can include a shift to faster-growing timber species, as well as other potential sources of income. These other sources of income can be a key factor in the long-range planning of sustainable forest management projects and of the interest of certain groups of investors with money to invest in "hedges" against future economic and environmental changes.

The logic for one sustainable forest project (GETHAL) is described as follows by its originator (J. Forgach, personal communication, 2001). If you are going to cross a desert, then you have to know how much water, food and other supplies to take with you to complete the journey. In this case, one is embarking on a journey of 25 years for várzea (floodplain) or 30 years for terra firme (upland) areas, and the resource being spent is the hardwood timber in the forest (supplemented by some additional income from ecotourism). If the harvest rate will maintain the financial viability of the project over this time period, then the project will emerge on the other side with a standing forest (minus the large hardwood trees). The forest can then be used for pharmaceutical products, and possibly for income that may then be obtainable from carbon benefits and willingness to pay for the existence value of biodiversity. This would be supplemented by any income that could be gained from management of softwood timber species in the forest, ecotourism, etc. The internal rate of return (IRR) required is quite high (20-25%/year) to prevent the operation from eating into its capital base.

Investments for short-term gains from biodiversity are unlikely due, in part, to the wisdom of waiting for the Brazilian government to define its policies on biodiversity use. As of now, operating policies are set by "provisional measures" (medidas provisórias), or temporary presidential decrees that must be renewed every four months and which can easily change from one day to the next. Also, a scandal in 2000 over a contract signed between the Brazilian Association for the Sustainable Use of the Biodiversity of Amazonia (BIOAMAZONIA) and the Swiss-based pharmaceutical firm Novartis (Adolfo, 2000) has temporarily dampened interest in

these resources. BIOAMAZONIA is a "social organization" formed to conduct bioprospecting and related activities under the Brazilian Program of Molecular Ecology for the Sustainable Use of Biodiversity of Amazonia (PROBEM). Novartis has withdrawn, and the future leadership of BIOAMAZONIA remains undefined.

The "crossing the desert" logic applies to climate change benefits in a manner similar to biodiversity. Investment interest in carbon with a view to short-term returns is likely to be limited, given the fact that the agreement over the Kyoto Protocol reached in Bonn in July 2001 excludes credit for forest maintenance in the Clean Development Mechanism during the Protocol's first commitment period (2008-2012). However, in the longer-term, the political struggles underlying this decision can be expected to shift because the "assigned amount" (national emissions quota) of each party is renegotiated for each successive commitment period, thereby removing the advantage to key actors (especially in Europe) of forcing parties (specifically the United States) to satisfy the commitments they made in Kyoto almost entirely through relatively expensive domestic measures (Fearnside, 2001b). The negotiations over the 3 1/2-year period between the 1997 Kyoto conference and the Bonn agreement were unique because industrialized countries had agreed to specific assigned amounts (quotas) for the first commitment period before the rules were defined on such questions as inclusion of avoided deforestation in the Clean Development Mechanism. For future commitment periods, allowing inclusion of avoided deforestation would help induce countries to agree to larger commitments than they would accept in the absence of such a provision, and would therefore have a net benefit for climate. The break with past inaction represented by the Bonn agreement could convince major investors, such as pension funds, to initiate or increase investment in long-term carbon ventures. As global warming worsens and efforts to combat it become stronger and more universal, the carbon value of tropical forests can be expected to increase dramatically. This is likely to happen by the end of a 30-year forest management cycle initiated now.

### *(d) Value-Added versus Raw Materials*

A recurrent question is the extent to which forestry management operations in Amazonia should strive to supply value-added products (such as flooring or furniture), versus raw materials such as rough-sawn timber or, in the extreme, unprocessed logs. One side of this debate holds that only value-added products should be produced, such that the maximum amount of employment and financial gain remains in the region (e.g., Goodland and Daly, 1996). Business analysts often counter that much more money can be made by exporting the raw materials because processing mills abroad waste less wood and produce products with higher quality and uniformity that command substantially higher prices than do products from Amazonian mills. Repetto (1988) shows the financial logic of this position with examples from Southeast Asia. In the Amazonian context, the argument is also made that the expansion of certified low-impact forest management is limited by the amount of capital available for this purpose, and that the "green" funds available for this kind of investment would be best used for maximizing the area brought under management rather than for building and maintaining the very expensive industrial operations needed to transform the output into value-added products. Otherwise the result would be that the timber market is supplied by the predatory logging operations that dominate the scene today.

The employment and income from value-added products is the reason for Brazil's prohibition since 1965 of exporting raw logs. While the reduced attractiveness to investment capital for value-added operations is evident, there is an environmental (as well as a social) rationale for favoring investments of this type. This is the effect of the environmental damage of increased logging, whether it be calculated per unit of investment absorbed, per job created, or as a percentage profit including both monetary and environmental effects. A hypothetical illustration is given in Table 1; while a raw-materials strategy is more profitable in financial terms, the value-added option can be preferable if social and environmental indicators are included, depending on the values assigned to these other considerations.

[Table 1 here]

In the example in Table 1, the value of environmental damage is critical: if it is less than US$650/ha, then the raw-materials strategy gives a better result in terms of profit as percent return on monetary plus environmental investment, but if it is greater than US$650/ha, then the value-added strategy is preferable. Which case reflects reality depends on the baseline: the "glass half-empty" versus "glass half-full" orientation of the beholder. If the operation is viewed as having saved the managed hectare from deforestation, then the "environmental cost" is negative (i.e., there is an environmental benefit) and the raw-materials strategy is preferable. However, if the impacts are simply totaled without this assumed benefit (i.e., the baseline case is unaltered forest), then the environmental cost will exceed US$650/ha and the value-added strategy will be preferable. Some indications of the monetary value of the environmental damage of logging point to values well in excess of US$650/ha. Considering only harvesting (not management for the full cycle), the Legal Amazon's 1990 logging emission of 61 million t C from harvesting 24.6 million $m^3$ of logs (Fearnside, 1997c) corresponds to 2.48 t C/$m^3$ of logs or 74.4 tC emission/ha logged at 30 $m^3$/ha (i.e. US$1488/ha harvested if one assumes a willingness to pay for carbon value of US$20/tC). For forest under management, considering the logging emission parameters prevailing in the region (Fearnside, 1995, p.316) at 38 $m^3$/ha in a 30-year cycle, equilibrium carbon stocks under sustainable management correspond to a loss of 14.9 tC/ha managed (including regenerating areas) when compared to unlogged forest, a gain of 18.0 tC/ha compared to unsustainably logged forest (if assumed not to degenerate subsequent to logging), and a gain of 187.6 tC/ha compared to deforested areas. At US$20/tC, these carbon values correspond to –US$298, +US$360, and +US$3752, respectively. The willingness-to-pay for forest maintenance would be higher if biodiversity benefits were included in addition to carbon (see Fearnside, 1997b, 1999b). If a monetary value were assigned to employment creation, then the critical value would shift in favor of the value-added strategy accordingly.

### *(e) Private Properties versus Forest Concessions*

Private initiatives are increasingly prominent in discussions of conservation policy in Amazonia. While creation of conservation units can be proposed for some areas, the vast areas of remaining forest outside of any existing units always leaves the question of what to do with the rest. Efficiency is a concern: as compared to the government,. private operations are more efficient at many of the tasks involved. Of course, supervision is needed to ensure that private forestry management operations play their

expected role in conservation. The viability of private initiatives bears a relation with conservation units, since the low price of timber is a key factor discouraging investment in sustainable management. The price will only increase when supply declines relative to demand. Wood from sustainable management will always be at a disadvantage so long as the supply of cheap logs from unsustainable harvesting is essentially infinite. This can be changed by creation of conservation units that make large areas of forest off-limits to logging and by strict enforcement of Brazil's existing forestry regulations. Actions must be taken now to avoid the alternative of waiting until the forest is almost all destroyed before scarcity and rising prices motivate conservation of the remaining fragments.

The National Forest Program (PNF) was decreed on 22 April 2000 in honour of the 500th anniversary of Brazil's "discovery" by Portugal. This program includes a goal of greatly increasing the area of FLONAs in order to supply the internal and export markets from sustainable management in these areas. About half of the 15.2 million ha of FLONAs in Amazonia overlap with indigenous areas, reducing the amount available for management to 8 million ha. The PNF hopes to have 20 million ha under management within 10 years, and the area under FLONAs would be expected to total 50 million ha to achieve the goal of supplying the market (Deusdará Filho, 2001, p.395). A total of 115 million ha, or 23% of the Legal Amazon, is suitable for creation of FLONAs in that it is neither indigenous land, a conservation unit, deforested, or inaccessible (Veríssimo et al., 2000).

As compared to management in private land, forest concessions in public land, such as FLONAs, offer the concession holder the "trip across the desert" but not the reward at the other side. Effects counteracting this disadvantage from the investor's point-of-view are release from the need to commit capital to land purchase and the expectation of government protection in defending the land from invasion.

Another arrangement is essentially a sale of wood rather than a concession. In the Tapajós FLONA, a 2700-ha forestry-management experiment initiated by the International Tropical Timber Organization (ITTO) has been conceded for a five-year period to CEMEX, a company with a flooring mill in Santarém (84 km by paved road from the area). The company pays R$6/m$^3$ of logs (equivalent to US$2.40 as of July 2001), with the right to harvest 30 m$^3$/ha. The cost to the sawmill is therefore 30 X R$6 = R$180/ha, or about six times the purchase price of forested areas with access only slightly less favorable along the BR-163 Highway between Rurópolis and the Pará/Mato Grosso border. Because the mill only uses three species of tree, the amount of high-quality timber of these species is insufficient to supply the permitted 30 m$^3$/ha, leading to the temptation to invade neighboring areas in the FLONA to remove valuable wood. Concession systems must be designed with the full management and economic cycle included. Concessions must be long-term in order to provide motivation to use sustainable methods, preferably subject to periodic inspections and renewals over the course of the concession's term (Poore et al., 1989, pp.197-202).

## 6. DILEMMAS IN SELECTING CONSERVATION UNITS

### *(a) New Conservation Units versus Consolidation of Existing Units*

Despite the conventional wisdom that "paper parks" are a great evil, they do, in fact, play an important role in the process of conservation in Amazonia. By decreeing areas as reserves of the various different kinds in advance of having government funds to adequately "implant" the units, a process is set in motion that can later lead to obtaining these resources. If one were to wait to have adequate funds for implantation before decreeing the reserve, the practical result would be that very few reserves would be created because the government rarely has even the minimum funding necessary for its own operational expenses. As the frontier approaches, the cost increases dramatically, and invasions make reserve creation politically impossible. Often (but not always) just the presence of the paper park deters many invaders. The Tapajós FLONA provides an example: the least-affected portion of the area is the southern portion, where there has been almost no investment by the government in guarding, research, forest management and community development programs. The mere existence of a conservation unit has a substantial inhibiting effect on deforestation.

At the same time that the system of conservation units must be rapidly expanded, with due attention to provisions for public consultation and other requirements of the SNUC, the government's responsibility to defend and maintain existing units must be fulfilled. The grave state of degradation and illegal invasion of some existing units points to the need for forceful action on the part of government authorities to avert the complete destruction of these units (e.g., Fearnside and Ferreira, 1985; Rosa and Ferreira, 2000). Examples of these include the Jamarí and Bom Futuro FLONAs in Rondônia and the Serra do Divisor National Park in Acre.

*(b) Well-Funded versus Low-Cost Conservation Units*

Given the always-inadequate nature of funds and personnel for reserve creation, the dilemma is always present whether to use the available resources to create a few well-funded reserves or many inexpensive ones. The idea of holding off on stimulating demand for conservation units until more resources are available, thereby avoiding the creation of unrealistic expectations on the part of local populations, is a formula for doing nothing. Only by stimulating the demand of the local populations will the various government agencies involved be moved to create the areas and later to provide them with infrastructure and programs for improving the living standards of their populations.

A case in point is provided by the Central Amazon corridor, where várzea (floodplain) makes up most of the "interstitial" area (i.e., that between established conservation units). A much stronger demand exists for establishment of Sustainable Development Reserves (RDS), such as Mamirauá and Amanã, for management of fisheries in the várzea than is the case for terra firme (upland) areas, or even for forest management in the várzea areas. Just the act of creating the RDS and closing the várzea lakes in it to entry of "peixeiros" (large fishing boats from outside the area) has instant support from the local population. This can be used to leverage support for the RDS as a whole, even if no funding is provided for the wide range of programs associated with a reserve like Mamirauá. Activities in new RDS reserves in these areas could begin with fisheries and only later move into use of other resources in the várzea, later followed by terra firme. The risk of raising hopes while remaining unable to deliver can be reduced if less is promised. The cost can be modest: Amanã

has only eight employees for an area of 2.35 million ha, larger than the Brazilian state of Sergipe.

*(c) Location Near to or Far from the Deforestation Frontier*

The choice of locations for creation of conservation units greatly influences the cost of establishing and maintaining the units. Locations near areas of active deforestation are usually much more expensive on all counts, in addition to being likely to have political resistance to reserve creation. In terms of establishing substantial areas of conservation units, it is therefore wise to give greater priority to reserves far from the frontier. One factor in favor of reserves near the deforestation front is the rarity of existing units protecting samples of several vegetation types along the transition between forest and cerrado (central Brazilian savanna) that is the current location of the "arc of deforestation." A second factor is the likelihood that these areas would otherwise be cut in the near future if in the absence of conservation units, thereby contributing to the "additionality" of avoiding deforestation in these areas as a contribution to reducing emissions of greenhouse gases (Fearnside, 1999a). In addition, the political attractiveness of spreading PP-G7 resources as evenly as possible among states would tend to work against concentrating resources in certain states (such as Amazonas) where large areas of potential conservation units are located far from the present frontier. On balance, priority should be placed on rapid expansion of conservation units in relatively unthreatened areas far from the deforestation front.

*(d) Allocation of Effort between Completely and Partially Protected Areas*

The "people in parks" debate is central to the question of how effort is allocated between completely and partially protected areas. At one end of a spectrum, arguments in favor of concentrating efforts in a few well-protected areas see the future as an inexorable march towards environmental degradation, with inhabited reserves only slightly postponing the time when these areas will arrive at their endpoint of virtually complete desolation (e.g., Terborgh, 1999). Those in favor of placing priority on inhabited areas see creation of large areas under total protection as politically unviable, as tending to cause injustices for traditional populations already living in the areas selected, and as ultimately offering less protection for nature because they lack the popular support of local inhabitants who can defend the forests from invaders more effectively than government-paid guards (Schwartzman et al., 2000a; see critiques by Terborgh, 2000 and by Redford and Sanderson, 2000 and reply by Schwartzman et al., 2000b). Although hunting and other activities by traditional peoples can reduce biodiversity as compared to uninhabited forest, the convergence of many objectives between those seeking to secure the land rights of traditional peoples and those primarily concerned with biodiversity conservation offers great scope for alliances with gains for both interest groups (Redford and Stearman, 1993). Debates on this controversial topic are collected in Kramer et al. (1997) and Brandon et al. (1998).

A certain tension is evident among various governmental and non-governmental actors in their priorities for creating sustainable-use areas such as RESEX, FLONA and RDS units, versus totally protected areas such as national parks, biological reserves and ecological reserves (formerly ecological stations). The promise of

Brazilian president Fernando Henrique Cardoso of increasing the area of Amazonian forest under total protection to 10% by 2004 would be most easily achieved by creating new sustainable-use conservation units, each one with a participatory zoning process that will include delimitation of a totally protected "core" area, surrounded by zones from which various forms of sustainable extraction will be done by the local communities. The core areas can count towards the 10% goal (the current strategy of PROAPAM). This strategy helps gain the support of local communities and counter fears of some state governments that conservation would inhibit development and would take the form of "creating conservation units just to create them."

*(e) Relative Weight of Factors in Selecting Reserve Locations*

The relative weight of factors considered in selecting reserve locations can greatly affect the choices made. One set of factors is biological, such as the representativeness of the ecosystems included in a proposed unit and the contribution that this makes to overall objectives of securing at least some area of each of the existing vegetation types (e.g., Fearnside and Ferraz, 1995; Ferreira, 2001; Ferreira et al., 2001). In 1990, Conservation International (CI) organized an event in Manaus known as "Workshop 90" to apply information on diversity and endemism in different plant and animal taxa, soils, and the level of biological knowledge of different regions in order to locate priority areas for conservation (Rylands, 1990). One problem is that many parts of the region are poorly known, and those that are well known because of proximity to the major research institutes in Manaus and Belém are found to be the most diverse simply as an artifact of being better studied (Nelson et al., 1990). The crossing of poor knowledge with high diversity therefore results in nearly the whole region being identified as high priority (Veríssimo et al., 2001: 450-455).

When the degree of threat is added as a criterion, the large areas of remaining forest in Brazilian Amazonia lead this area to receive a lower rating than highly threatened areas elsewhere in Brazil, such as the Atlantic forest and remains of the cerrado (Dinerstein et al., 1995). The logic of "triage" can result in little or no effort being allocated to securing areas far from current frontiers. The "hotspots" of endemism in Atlantic forest and the slopes of the Andes also lead to giving higher priority to these areas than to Brazilian Amazonia (Myers et al., 2000).

Using the goal of obtaining protection of at least 10% of each landscape type (based on vegetation and soil) with a prioritization based on vulnerability (a function of distance from roads, settlement areas and existing deforestation), connectivity (including proximity to indigenous areas and sustainable-use areas), Ferreira (2001) has developed a procedure for identifying priority areas for establishment of new conservation units. Additional social criteria (along with biological priorities similar to those of Workshop 90) were applied at a workshop held in Macapá in 1999, resulting in identification of 265 "extreme-priority" areas and 105 "very high-priority" areas (ISA et al., 1999). This is the basis of the system currently used by the National Program of Biological Diversity (PRONABIO) establishing priorities for reserve creation.

Other relevant factors include the existence of traditional peoples, level of community organization, and the defensibility of proposed areas that is provided by natural boundaries and natural barriers to invasion (Peres and Terborgh, 1995). An additional

set of factors may be termed "opportunistic factors." These include opportunities for reserve creation that frequently arise, irrespective of biological and social factors. The ability of Paulo Nogueira Neto (1991) to capitalize on such opportunities played a key role in creating Brazil's system of ecological stations in the 1970s and 1980s. An example of a contemporary opportunity is the abolition of the Superintendency for Development of the Amazon (SUDAM) in 2001, which raises the question of the future of that agency's 72,000-ha experimental forest management area in Curuá-Una (e.g., Dubois, 1971). The area is apparently already threatened with invasion by illegal loggers. Since this is federal land, it could be converted to a FLONA with relative ease.

## 7. DILEMMAS IN THE IMPLANTATION PROCESS

### *(a) Policies on Removal and Compensation of Occupants and Invaders*

Thinking on conservation unit establishment and management has evolved greatly in recent years, with increasing acceptance of traditional populations continuing to live within the conservation units that are created in the areas they inhabit. However, this does not solve the problem of dealing with invaders who enter these units later. If these invaders are rewarded with special access to government settlement and assistance programs, a perverse incentive is put in place that encourages further illegal invasions. A firm hand with invaders is therefore indicated, and a clear distinction must be maintained between "occupants" who were in the area prior to creation of the conservation unit and "invaders" who arrive afterwards. More delicate situations arise where the inhabitants of successful conservation units invite relatives and friends from areas outside of the reserve (often just a matter of moving from one side of a river to the other).

Removal of population, to which IBAMA gives the Orwellian term "desintrusão" (literally: "unintrusion"), is controversial because of the need to provide for the population removed and the chronic lack of funds for the agencies responsible for the different types of reserves. World Bank resettlement policies are stricter than those applying to programs funded entirely from domestic Brazilian sources, with the result that reserve creation efforts that include funding from the World Bank often exclude any cases where removal of invaders from reserves would be necessary. For example, the Raposa Serra do Sol indigenous area in Roraima was removed from the list of areas to be demarcated under the PP-G7's PPTAL program because compliance with World Bank resettlement policies would make the demarcation unviable and thereby block the entire PPTAL effort. Ironically, the World Bank's resettlement policies had been strengthened in response to (well-deserved) criticism over lack of adequate provision for largely tribal populations displaced by the Narmada Dams in India (e.g., Morse et al., 1992), but had the unintended result of denying indigenous peoples in Amazonia protection against invasion of their land.

### *(b) Relation of Poverty Alleviation to Conservation*

Poverty alleviation has an important role in conservation policy, but it is important to define clearly the relationship between the two for the purposes of allocating resources. Both the British and the German governments have firm policies that all conservation efforts they fund must include poverty alleviation.

If poverty alleviation were the sole criterion for judging project success, then establishing and supporting conservation units would not be the activity of choice. One could always delimit a few hectares of favela area in a large city such as Manaus and provide it with programs for health, education, and small-scale income generation at much less cost per family saved from poverty than in the case of providing similar services to far-flung communities in Amazonian conservation units. The same amount of funding will always relieve more poverty in an urban setting. The rationale for spending the money in conservation units instead is environmental: poverty alleviation in conservation units can have large environmental benefits, whereas environmental benefits of poverty alleviation in urban settings are small or even negative. The question of "Sustainable development for whom?" must always be answered, and when dealing with conservation policy the answer must always be "For those who protect the environment."

In allocating money for poverty alleviation in conservation units, the question invariably arises as to whether one should expand areas to the maximum as quickly as possible, with minimal investment in social services and income-generating activities, or whether a better level of services should be provided to a smaller population. As mentioned earlier, the environmental justification of the reserves makes maximization of area a better goal at the present time. Rather than concentrating large amounts of resources on a few selected communities, it would be better to raise living standards in steps: everyone in a conservation unit should first be brought up to a subsistence level before promoting higher-income activities.

One question that must be faced squarely is that of the population that is excluded from conservation unit areas. An example is provided by fisheries resources in RDS units in the state of Amazonas, such as Mamirauá and Amanã. To what extent should funds for reserve creation be used to alleviate the impact on fishermen from Manaus, Manacapuru and Tefé who are excluded? While it is often claimed that there are plenty of fish for everyone, it is more accurate to say that there will be a loss to those excluded. "Peixeiros" (large fishing boats from outside of the area) are inherently predatory because this type of harvesting is economically rational in an open-access situation (i.e., the "Tragedy of the Commons", sensu Hardin, 1968). The overall fish catch from the protected lakes will improve because productivity increases under community management and because the alternative of open access is non-sustainable (McGrath, 2000; McGrath et al., 1994; Pires et al., 1996).

The amount of fish that can be taken from natural ecosystems in Amazonia is limited, whereas the demand is, for practical purposes, infinite, given the region's 20-million population and the availability of refrigerated transport to markets throughout Brazil and the World. The question, then, is for whom this resource will be used. Arguments for giving the rights to local residents include their role in protecting the environment, in addition to common principles of self-determination.

The fishermen who are excluded will take jobs away from others when they compete for the limited amount of employment in manual tasks available in Manaus and other urban centers. Therefore, in terms of poverty relief, this represents a reduction in the balance of poverty-alleviation net benefits.

*(c) Priority of Actions in Buffer Zones versus in Conservation Units*

The relative priority to be given to actions in buffer zones versus in actions inside the conservation units themselves is often discussed (e.g., Sayer, 1991). Amazonian conservation units differ significantly from the stereotype of a pristine nature reserve as an island surrounded by a sea of poverty. Rather, the conservation units contain traditional populations, who often do not differ so greatly from those in adjoining areas outside of the reserves. However, in some cases dense non-traditional populations are located adjacent to reserves, such as the settlement areas along two sides of the Tapajós FLONA. In these cases, however, providing services to the buffer zone would represent a virtual black hole for funds, since the populations are large and funds are limited. At the same time, there are demands greatly exceeding the capacity of funding for people who are already in the Tapajós FLONA, both in traditional areas along the Tapajós River and in an enclave of settlement within the reserve (Communidade de São Jorge). In general the presence of people in conservation units makes buffer-zone management less critical in Amazonia than in other parts of the world.

The placement of totally protected areas adjacent to settlements, and vice versa, increases the risk of the protected areas being invaded. One way to avoid this is by placing FLONAs or other sustainable-use areas to serve as buffers between settlement areas and reserves. The state of Acre is following this strategy along the southern side of the BR-364 Highway between Rio Branco and Cruzeiro do Sul. Unfortunately, the state of Amazonas, on the other side of the highway, has not taken similar measures to contain expansion of the BR-364 deforestation front.

## 8. NEGOTIATION WITH INDIGENOUS PEOPLES

Negotiation with indigenous peoples is a crucial area for Amazonian conservation policy that has hardly begun. Indigenous lands represent much greater areas of natural ecosystems than do all of the types of conservation units combined, and the future fate of indigenous lands will therefore be the dominant factor in the ultimate fate of these ecosystems. So far, indigenous peoples have had a much better record of maintaining the natural ecosystems around them than have other populations in Amazonia. However, it is important to realize that indigenous peoples are not inherently conservationist, as is sometimes assumed, and that they can be expected to respond to the same economic stimuli that induce other actors to destroy and degrade forests. This would be a great error from the point of view of the well-being of the indigenous groups themselves, in addition to its impact on global environmental concerns such as biodiversity and climate. It is precisely the ability of indigenous peoples to defend and maintain their forests that gives them an as-yet unremunerated role in providing environmental services (Fearnside, 1997d). In order to chart their future, they need to see that their conservationist role is valuable and is also the source of their support.

So far the rewards of this role have been restricted to the modest benefits of special programs such as the PP-G7. These include the PPTAL program for demarcation of indigenous lands. The PROMANEJO program has financed a certified forest management project for the Xikrin tribe, which had its first harvest in 2000. The Demonstration Projects for Indigenous Peoples (PDPI) Project expects to apply the

Demonstration Project Type A (PD/A) model to sustainable development projects in indigenous areas in the near future. Sustainable community-level projects such as these need to be encouraged on a wider scale, but, as is also the case with similar projects throughout the PP-G7 program, a critical lack is an understanding by the recipients that the reason for their receiving these benefits is environmental, and that they therefore need to maintain and strengthen their ability to provide environmental services.

## 9. CONCLUSIONS

The need for flexibility in dealing with the numerous dilemmas in defining conservation policy in Amazonia is evident. Involvement of local peoples is increasingly showing itself to be a key to success of conservation efforts, including the definition and defense of totally protected zones within conservation units that include uses of renewable resources. The balance of responsibility and authority among the different levels of government is a source of tension in creation of new conservation units. Inherent conflicts of interest among these and other actors are inescapable, making effective negotiation and conflict management fundamental to conservation policy. Managing the conflicts can create opportunities for enhancing biodiversity. Indigenous peoples have played a critical role in maintaining substantial areas of Amazonian ecosystems, and negotiations and appropriate development programs for these peoples will be critical for the long-term future of these peoples and their forests. The rapid pace of deforestation and other forms of destruction is closing off opportunities for conservation and for sustainable use both inside and outside of conservation units. This means that Brazil must act now to define priorities and proceed with expanding and reinforcing its system of conservation units in Amazonia.

## 10. GLOSSARY

BIOAMAZONIA: Brazilian Association for the Sustainable Use of the Biodiversity of Amazonia

CI: Conservation International

EIA/RIMA: Environmental Impact Study/Report on Impact on the Environment

IBAMA: Brazilian Institute for the Environment and Renewable Natural Resources

FLONA: National Forest

FOE: Friends of the Earth

FUNAI: National Foundation of the Indian

INPA: National Institute for Research in the Amazon

ISA: Socio-Environmental Institute

ITTO: International Tropical Timber Organization

NGO: Non-Governmental Organization

OEMA: State Environmental Agency

PD/A: Demonstration Project Type "A"

PDPI: Demonstration Projects for Indigenous Peoples

PGAI: Integrated Environmental Management Project

PP-G7: Pilot Program to Conserve the Brazilian Rain Forest

PPTAL: Project for Protection of Indigenous Populations and Lands in the Legal Amazon

PROAPAM: Program for Expansion and Consolidation of a System of Protected Areas in the Amazon Region of Brazil

PROBEM: Brazilian Program of Molecular Ecology for the Sustainable Use of Biodiversity of Amazonia

PROMANEJO: Pro-Management Project

PRONABIO: National Program of Biological Diversity

RDS: Sustainable Development Reserves

RESEX: Extractive Reserve

SNUC: National System of Conservation Units

SPRN: Sub-Program for Natural Resources

SUDAM: Superintendency for the Development of the Amazon

TNC: The Nature Conservancy

WWF: Worldwide Fund for Nature

ZEE: Ecological-Economic Zoning

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# FIGURE LEGENDS

Figure 1. Forest and non-forest areas in Brazil's Legal Amazon Region.

Figure 2. States in Brazil's Legal Amazon Region and cities mentioned in the text.

Figure 3. Projects and reserves mentioned in the text

Figure 4. Indigenous areas in Brazil's Legal Amazon Region.

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Table 1: HYPOTHETICAL COMPARISON OF VALUE-ADDED PRODUCTS VERSUS RAW MATERIALS FROM FOREST MANAGEMENT

| Item | Units | Value-added products | Raw materials | Source |
|---|---|---|---|---|
| FINANCIAL INDICATORS | | | | |
| Area exploited | ha | 1 | 1 | (a) |
| Monetary expense | US$/ha | 4264 | 1315 | (b) |
| Volume exploited | harvested $m^3$/logs/ha | 30 | 30 | (c) |
| Volume sold | harvested $m^3$ product/ha | 5.25 | 10.5 | (d) |
| Price | US$/$m^3$ product | 1074 | 215 | (e) |
| Gross return | US$/ha | 5639 | 2255 | (f) |
| Net monetary return | US$/ha | 1374 | 941 | (f) |
| Profit on monetary investment | % return | 32 | 72 | (f) |
| SOCIAL INDICATORS | | | | |
| Local employment | jobs/100 ha degraded/year | 0.58 | 0.12 | (g) |
| ENVIRONMENTAL INDICATORS | | | | |
| Environmental impact of investment | ha exploited/ US$1000 invested | 0.2 | 0.8 | (f) |
| Environmental impact per job created | ha exploited/ job | 1.7 | 8.6 | (f) |
| Environmental damage | US$/ha | 650 | 650 | (h) |
| Cost (monetary + environmental) | US$/ha | 4914 | 1965 | (f) |

| | | | | |
|---|---|---|---|---|
| Net return (monetary + environmental) | US$/ha | 724 | 291 | (f) |
| Profit (% return on monetary + environmental investment) | % | 15 | 15 | (f) |

(a) Assumed 1 ha (equal for both systems) for purposes of comparison.
(b) All costs from Schneider et al., 2000: 39): for raw-materials, extraction variable cost US$7.59/m$^3$,
assumed all wood harvested is used; Processing variable cost US$24.58/m$^3$ logs;
Transport in logged area US$1.3/km, assumed average 2.5 km (i.e., 2500-ha concession in square format);
Transport on paved road US$0.10/m$^3$,
assumed 84 km distance (i.e., FLONA Tapajós); Value-added processing cost
assumed five times greater, other costs assumed equal.
(c) Volume permitted (e.g., FLONA Tapajós contract).
(d) Logs to sawnwood (raw materials) conversion 35% (Schneider et al., 2000: 38); value added assumed 50
of raw-materials value.
(e) Prices from Schneider et al., 2000: 39 for sawnwood (US$/m$^3$ product): high value 280, medium value 23
low value 158; assume proportions of 30 m$^3$ logs/ha first-cycle harvest as 20% high value, 40% medium
value, 40% low value; value-added prices assumed five times higher.
(f) Calculated from above
(g) Employment for raw materials based 258 m$^3$ of logs/year/job under sustainable management
(Schneider et al., 2000: 44, based on Barreto et al., 1998, Veríssimo et al., 1992);
value-added employment is assumed to be 5 times greater.
(h) For the parameters used here, US$650/ha is the critical value at which switchover occurs between the two
strategies, value-added being preferable if environmental damage exceeds US$650/ha. For example, at
US$1000/ha the profit (% return on monetary + environmental investment) is 7% for the value-added
strategy versus -3% for raw-materials strategy, while at environmental cost levels exceeding US$1400/ha
both strategies are negative, with the raw-materials strategy being more negative.

Fig. 1

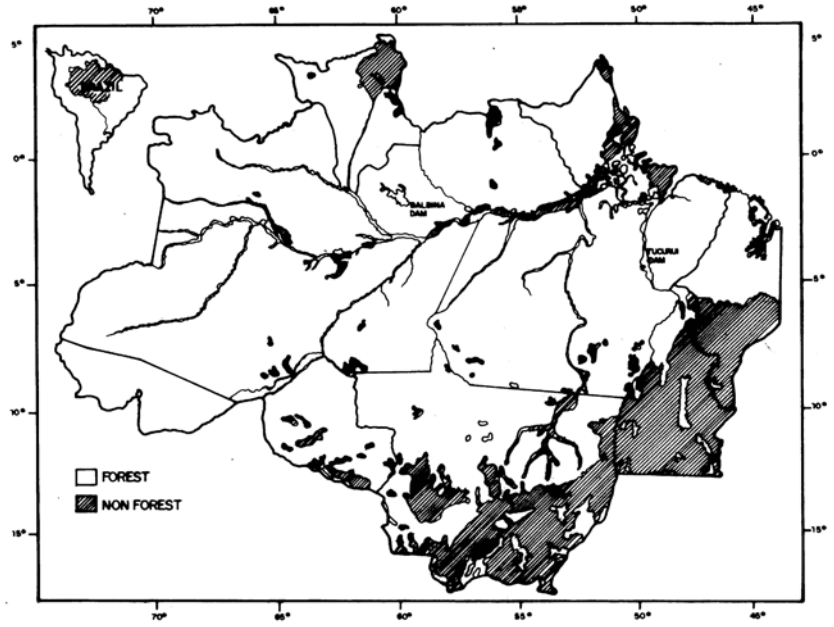

Fig. 2


RORAIMA
AMAPÁ
Rio Negro
Amazon River
Belém
Manacapurú
Manaus
Santarém
Tefé
Itacoatiara
Paragominas
PARÁ
MARANHÃO
AMAZONAS
Manicoré
Cruzeiro do Sul
ACRE
Rio Branco
BR-364 Highway
TOCANTINS
RONDÔNIA
MATO GROSSO
Legal Amazon
State boundary
Highway
River
City
Cuiabá
N
0 100 200 300 Km

Fig. 3

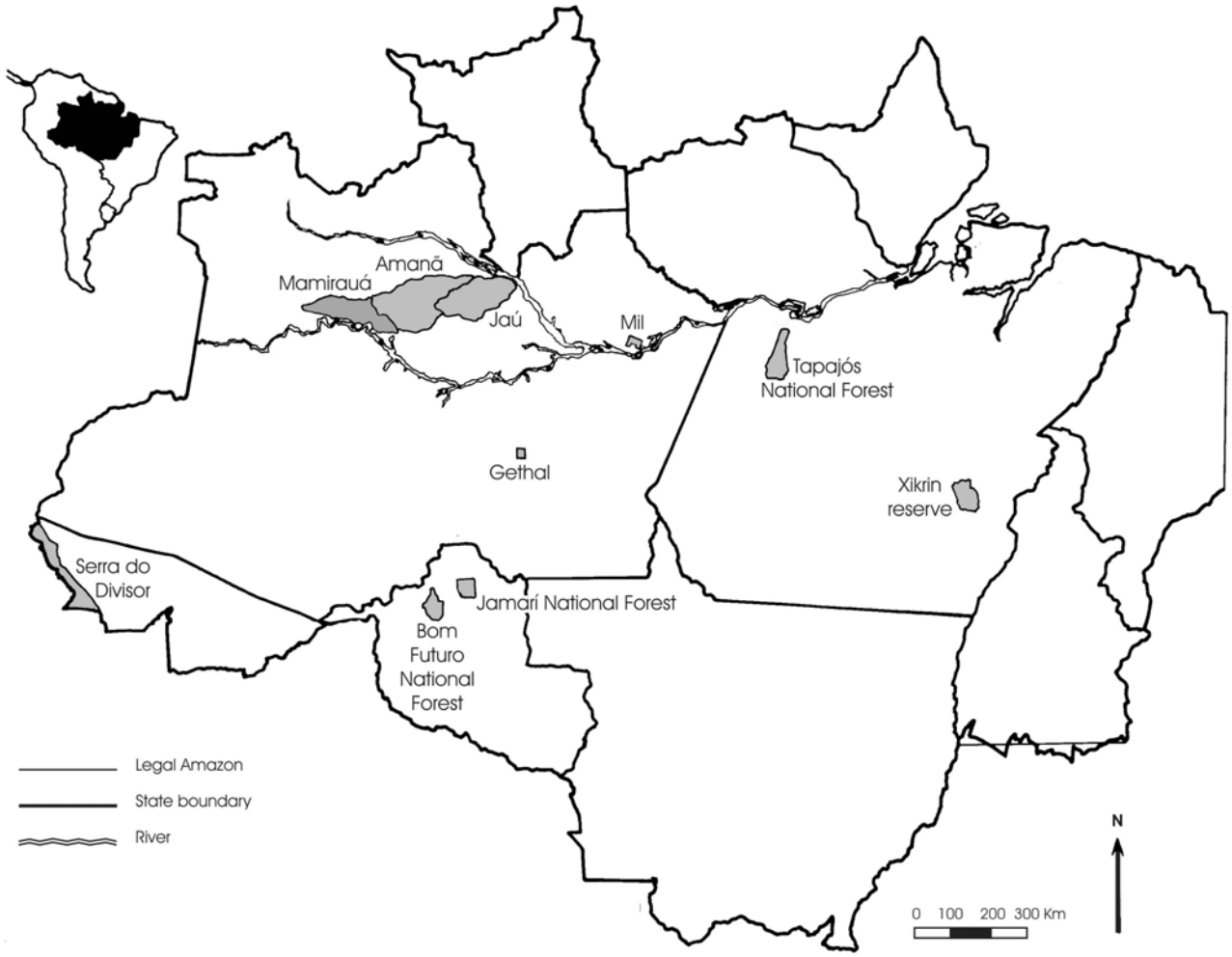
Amanã
Mamirauá
Jaú
Mil
Tapajós
National Forest
Gethal
Xikrin
reserve
Serra do
Divisor
Jamarí National Forest
Bom
Futuro
National
Forest
Legal Amazon
State boundary
River
N
0 100 200 300 Km

Fig. 4