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Forest Management Working Paper

Computerized Data Gathering and Networking as a Control and Monitoring System for the Improvement of and Reporting on Forest Management in the Amazon: the Case of Brazil

SISPROF
Computerized and Integrated Control and Monitoring System of Forestry Resources and Products

Based on the work by:

Antonio Carlos do Prado
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Paulo José Prudente de Fontes

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"SISPROF: Computerized and Integrated Control and Monitoring System of Forestry Resources and Products"

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INDEX

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ACRONYMS/ABBREVIATIONS

a.a.	Average annual (rate)
AC	State of Acré
AD	Authorization of deforestation
ADA	Environmental Declaration Act of ITR
AM	State of Amazonas
AMF	Area of forest management
APE/AUTEX	Authorization of forest exploitation
AP	State of Amapá
APP	Area of permanent preservation
ARL/RESLEG	Area of obligatory legal forest reserve
ART	Annotation of technical responsibility
ATPF	Authorization for transportation of forest products
CETEMM/Acré	Center of Technology of Wood and Furniture
CGREF	General coordination of forest resources of IBAMA
CNPJ	National registration number of juridical personality (Income Tax)
CONAMA	National Environment Council
CPF	National registration number of physical personality (Income Tax)
CREA	Regional Council of Engineering and Architecture
CRF	Bonds of Legal Forest Reserves
CSR	Remote Sensoring Center of IBAMA
CTA (Acré)	Center of the Amazonian Workers
DIREF	Directorate of Forests of IBAMA
DITEC	Technical Divisions of IBAMA's State Executive Units
DVPF	Declaration of sale of forest products
EMBRAPA	Brazilian Agricultural Research Agency
FAO	Food and Agriculture Organization of the United Nations
FEMA/MT	Environment Foundation of the State of Mato Grosso
FINAM	Fiscal Incentive Investment Fund of Amazonia
FLONAS	National forests
FoE/Brazil	Friends of the Earth/Brazil
FUNATURA	Pro-Natureza Foundation
FUNTAC/Acré	Technology Foundation of the State of Acré
GDP	Gross domestic product
GEREX	State Executive Units of IBAMA
IBAMA	Brazilian Institute for the Environment and Renewable Natural Resources
IBGE	Brazilian Institute of Geography and Statistics
IMAZON	Institute of Man and the Environment of Amazonia
INCRA	National Institute of Colonization and Agrarian Reform
INPA	National Research Institute of Amazonia
INPE	National Institute of Space Research
IPAM	Institute of Amazon Research
IPEA	Institute of Applied Economic Research
ISPN	Society, Population and Nature Institute
ITR	Rural property land tax
LAU	Simple environmental licence of FEMA/Mato Grosso
MA	State of Maranhão
MT	State of Mato Grosso
NAMF	Nucleus of support to forest management
NGO	Non-governmental organization

OAB	Order of Lawyers of Brazil
OEMAs	State Environmental Agencies
OSTP	Other services of third parties
PA	State of Pará
PIN/PROTERRA	ex-National Integration Programme/Land Redistribution Programme
PMFS	Sustainable frest management plan
POA	Annual operational plan of PMFS
POLAMAZONIA	ex-Amazonian Pole Programme
PPG7	Pilot Programme for the Conservation of Amazonian Forests
PREVFOGO	Programme of prevention and combat to forest fires
PROARCO	Programme for the prevention and control of burnings and forest fires in the Deforestation Arch
PRODEAGRO/ Mato Grosso	Programme of Agricultural Development of Mato Grosso
PRODES	Project of estimates of deforestation in the Brazilian Amazon/INPE
RADAMBRASIL	ex-Radar of the Amazon/Brazil programme
RESLEG (or ARL)	Area of obligatory legal forest reserve
RESLEV	Area of voluntary legal forest reserve
RET	Special transportation regime
RIL	Reduced impact logging
RO	State of Rondônia
RPPN	Private natural patrimony reserve
RR	State of Roraima
RSS	Remote Sensoring System
SCA/MMA	Secretariat of Amazon Coordination of the Ministry of the Environment
SERFLO	Forest serfdom area
SFM	Sustainable forest management
SISMAD	System of control of flows and trade of wood-products of IBAMA
SISPROF	Computerized and Integrated Control and Monitoring System of Forest Resources and Products of IBAMA
SISPROT	Protocol system of IBAMA
SISREG	System of registry of IBAMA
SISTEC	System of technical and scientific names and entities of IBAMA
SISUSO	System of users and passwords of IBAMA
SIVAM	Vigilance system of Amazonia
SRF	Secretariat of federal income or receipt
SUFRAMA	Superintendency of the Free Zone of Manaus
SUDAM	Superintendency of development of Amazonia
TCA	Amazon Cooperation Treaty
TCAPMFS	Term of commitment to register PMFS
TCARL	Term of commitment of registration of legal forest reserve
TFF	Tropical Forest Foundation
TO	State of Tocantins
TRARL	Term of registration
TRMFM	Term of responsibility to maintain managed forest
UF	Unit of the Federation (States)
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UPA	Unit of annual production
UT	Unit of work of POA

1. EXECUTIVE SUMMARY

The Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) has been implementing in the last four years a broad integrated computerized system for the control and monitoring of deforestation and forest-based activities, such as forest management, obligatory forest replacement and corresponding flows of forest resources and products from extraction to forest-based industries.

Based on its past experience, IBAMA has conceived and developed the whole system and its parts, using computer software and programmes available worldwide, thus reducing costs considerably. This system, known as SISPROF, is integrated with other corporative systems of IBAMA, and is comprehensive enough to allow its dialogue and integration with (i) other federal systems of control, such as the registry of rural land properties of the National Institute of Colonization and Agrarian Reform (INCRA) and its linkages with the support system of the Rural Land Property Tax of the Secretariat of Federal Income (SRF), as well as (ii) other systems of control that have already been operated by some state environmental or forestry agencies of Brazilian states, in particular in the Amazon region.

The system, as described in this report, provides IBAMA and the federal government with a modern tool that is capable of giving more effectiveness to the enforcement of forestry and environmental legislation concerning rural land use sustainability as a whole and, in particular, more transparency and reliability in the control, monitoring and follow-up of permanent forest management activities, especially in the Amazon region, where the latter are still quite incipient and represent a tiny portion of the overall regional land use pattern.

As we try to show, from our description of the main features of the occupation and deforestation processes under way in the Brazilian Amazon, control and law enforcement for the protection of the forests are extremely difficult, due to the vastness of the area, the economic and social conditions of the expanding agricultural frontier, the poor infrastructure of the region, the large number of actors involved with deforestation and the consequent and associated practices and behaviour of those that exploit, manufacture, process and trade with forest resources and products in that region.

Although SISPROF, as we attempt to emphasize, is certainly not sufficient to more fully restrain or revert the incentives that move people towards deforestation and logging; and therefore away from a permanent productive land use activity such as forest management, the system and its controls are indispensable to (i) reduce ways and possibilities of circumventing or violating norms and rules, (ii) increase the costs associated with such actions, without at the same time imposing too heavy a burden on those that act legally and strive to engage in more sustainable (though so-far not so economically competitive) activities, and (iii) serve as a complement, or support, to other, still to come, more specific and efficient policy measures or instruments capable of really undermining or reverting the existing incentives that favour so much deforestation and discourage so much forest management.

That is why such a system as SISPROF must be agile, modern, wide and comprehensive enough, encompassing all the stages of the productive chain of custody of forest resources and products, so that it may respond more adequately to public demands for better and more sustainable timber production activities, either at national or regional levels as well as at the level of rural or forest management units.

2. INTRODUCTION

The development of SISPROF by IBAMA derived from the need to establish a more reliable and effective modern management tool in order to improve the enforcement of legislation and better use of the country's forestry resources, particularly in Amazonia. Until then, the instruments of monitoring and control available to IBAMA were archaic and obsolete. Suffice it to say that, in the state units and offices of the Institute in the Amazon region, it was practically impossible to consolidate an "accounting balance" of inputs and outputs of forest resources and products for any timber processing unit that could, in fact, be compatible with the raw material exploitation authorizations that had been conceded by IBAMA.

Individual controls, in different stages of the productive chain, were not only conceived as isolated or tight instruments that would not allow their adequate consolidation or aggregation with controls of other stages, but were also highly vulnerable to their recorded information being easily altered (or adulterated). Most information in these controls was simply written down and recorded by pencil, not even by pen, without any safeguards or security guarantees for avoiding or making adulterations more difficult. In fact, one may say that the previous IBAMA controls on the access and use of forest resources in the country would hardly conform to established principles of legislation and commandments of regulatory norms. Given the weakness of controls one could not guarantee a high standard of responsiveness to precepts and requirements of laws and norms. In this respect, it should be noted that new legal instruments, such as the law of environmental crimes, had started to demand a more blunt and effective enforcement of its principles and determinations by the institutions of the public power that had the competence to act in the environmental area.

In the face of such a challenge, the Directorate of Forests of IBAMA started a series of studies, some four to five years ago, to develop alternative and new models of proceedings, field inspections and organization and processing of data and information in order to implement an integrated system for monitoring and controlling forest-based activities through the use of information technology, geo-processing and remote sensoring techniques, as well as the employment of a broad, central, computerized data bank.

The accumulated past experience of IBAMA in the public control of activities that exploit, use and process forest resources in the country, and in particular in Amazonia, a region subject to a wide and complex process of forest-cover losses associated with the expansion of the agriculture frontier, indicated clearly that there were strong deficiencies that needed to be defeated and that would have to be taken into account in the conception and design of any modern instrument or system of control and monitoring that intended to be effective. Among these deficiencies that conditioned the scope and comprehensiveness of the new system of control, the following should be underscored:

- the need to generate, in real time, with transparency and reliability, additional, more systematic and site-specific information on the progress of deforestation in a vast region like the Amazon: all the information capacity generated by the National Space Resarch Institute (INPE), based on a modern remote satellite source for monitoring forest cover in Amazonia, which allows the immediate development of deforestation maps in big areas still needed to be reinforced by an "on-the-spot" verification of the use of rural properties, on how the use of the different areas of landholdings evolve, and the end-uses to which these areas are dedicated. A new system of control should consider this necessity to strengthen, from information gathered in the field, the analytical and interpretation capacities of mechanisms such as those of INPE;

- the need to generate information, at the level of rural property units, on permanent preservation areas, legal forest reserve areas and other areas of environmental interest, as well as on the extension of deforested or converted areas, that could support/help or complement the action and effectiveness of other public policy instruments, such as the Rural Land Property Tax (ITR). Reformulated in 1996, and administered by the SRF, the new ITR, now a "declaratory tax" to be paid by rural landholders, would require stronger capacity on the part of the public sector to verify the information declared by tax-payers, forcing IBAMA to become better prepared for such tasks

(more particularly to help confirm to SRF the "Declaratory Environmental Acts" associated with ITR declarations and which refer to the specification of areas of "environmental interest" in rural land properties, since these areas may be exempt from a levying of the tax);

- the need to integrate this information on rural property areas destined for forestry use or environmental conservation with the registries/rosters of rural properties that must be maintained and implemented by INCRA, which is also linked to the implementation and collection of ITR;
- the need for these controls and information generated by a new system to be adequately integrated with other systems of IBAMA itself, as for example the Federal Technical Registry of Potentially Pollutant and Natural Resource User Activities, among others;
- the need for dialogue with other systems of monitoring and control of forest resource use, already developed or in process of development, by State Environmental Agencies (OEMAs) which required sufficient comprehensiveness and scope for SISPROF to propitiate better integration and partnership between the federal institution and state agencies. In this respect, in particular, one should note the need for inter-state relations (flows of transportation and commercialization of products that cross state frontiers) involving forest resources and products to be adequately controlled and monitored, which would require a wider system (preferably federal) that would allow dialogue and consolidation of information from specific state systems;
- not only because of legislation impositions, but also due to the complexity of economic relations involved in the process of deforestation and forest resource exploitation in the Amazon. Any system of monitoring and control of the access and use of these resources would need to embrace the entire "chain of custody", from the extraction in the forest to the final processing of the raw material in manufacturing units in order to increase the risks and costs of illegal operations that tend to persist in the immense Amazonian region. Such risks exist because of the existence of forces and incentives that induce resource users to look for ways of escaping or infringing norms, rules and controls, and "not to economize" on the use of the resource;
- the need to establish a sufficiently wide system capable of submitting the productive chain to a more effective control, clearly distinguishing the three, legally foreseen, basic and different sources of obtaining timber (deforestation, forest management and reforestation/forest replacement), a distinction considered indispensable to propitiate adequate conditions for a privileged or differentiated treatment to permanent productive forestry in the region, i.e. to sustainable forest management (SFM) (or, also, reforestation), since it is deforestation – and the raw material thereby derived – that undermines the incentives to move towards SFM in the Amazon region;
- linked to this differentiation and "preference" for forest management the need that the activity be submitted to a certain degree of scrutiny and verification of its performance and quality – something that nowadays is commonly required in international, regional, or national processes of "criteria and indicators" of SFM – not only insists on more transparency and accountability in the exercise of the activity but also that countries respond and report to public demands on progress towards SFM. This would call for a greater effort in building a specific part of the new system for the control of forest management plans (PMFS). The Directorate of Forests of IBAMA would assign as a priority the establishment of the "data validation module" of SISPROF and its component for the monitoring and follow-up of forest management activity in the Amazon, further providing a complementary apparatus constituted of training courses, nucleus of support to forest management, technical packages and manuals for the elaboration of management plans, and follow-up of their implementation, etc., aiming to promote and give some support to the activity.

In spite of some drawbacks in these last years such as the discontinuity in the administrative application of policies, diverse interferences and insufficient technical capacity of IBAMA, the establishment of SISPROF was initiated in 1999.

Since July 2001 the first base of the system has been installed, that of São Luis in Maranhão state, as a test-pilot for the establishment of the SISPROF data bank, and since August 2002 the bases of Cuiabá-Mato Grosso, Manaus-Amazonas, Belém-Pará, Palmas-Tocantins, Sinop-Mato Grosso and Santarém-Pará were inaugurated. This initial phase of the system's operation in Amazonia had already the ability to test the data bank module, to transfer knowledge to technicians of the management units of IBAMA, and to train personnel hired to carry out the registration of data and information in the new system.

From July 1999 to August 2002, SISPROF has counted on the support of Project UNDP/BRA/97-044 - "Sustainable Forest Development", which provided the initial development and implementation of the system in Amazonia. During this period the geo-processing component was incorporated into the system, but it has not yet been implemented in the operation bases, since a standard geo-referenced base for IBAMA has to be established for the whole Amazon region, with the specified software and applications to be used. This work is currently under development by the Remote Sensoring Center (CSR) of IBAMA and is expected to be ready and fully operational in July 2003.

In mid-2002, IBAMA signed a contract with the Federal University of Lavras-Minas Gerais State in order to speed up the establishment and operation of SISPROF in the whole of Amazonia. After the contract was signed, and from September 2002, eight more operational bases were inaugurated in the region: Porto Velho-Rondônia, Ji-Paraná-Rondônia, Vilhena-Rondônia, Juina-Mato Grosso, Marabá-Pará, Macapá-Amapá, Boa Vista-Roraima and Rio Branco-Acré. There still are eight bases to be established: Tefé-Amazonas, Barra do Garças-Mato Grosso, Alta Floresta-Mato Grosso, Paragominas-Pará, Redenção-Pará, Altamira-Pará, Imperatriz-Maranhão and Ariquemes-Rondônia, totalling 23 bases that have been proposed for operation in Amazonia. With these 23 bases IBAMA will cover the capital cities of almost 550 municipalities, distributed across nine states of Legal Amazonia within a maximum radius of 200 km.

SISPROF was officially launched in November 2002 by the Minister of the Environment, through Normative Instruction no. 11 of 27/11/2002. At the same time the stamp of forest origin for timber products was also instituted, and a period of 120 days was given to IBAMA to regulate its use.

In the following section of this report, and in order to single out the factors that mostly constrain the model or pattern of use of its forest resources, an attempt is made to give the reader a comprehensive view of the complexity of the Brazilian Amazon and of the occupation process of its territory and development of its economy. Although the description may be a bit long, it is believed it was necessary to highlight better the degree of difficulties to be confronted by an apparatus of control and monitoring of all activities involved with the use and disuse of forest resources in the region.

It should be noted here that the year 1996/1997 is taken as the base-year for the majority of statistical data and information, as well as for most comparisons, inferences or analytical-descriptive interpretations, because this is the year to which the published available information of the agricultural census of IBGE (1996) refers. So, even using other secondary sources of information, we have tried to extract from them the data that were closer to that year.

In section 4, a more detailed description of SISPROF is presented, including its three basic pillars (geo-processing, data bank and data validation) of the instruments, computerized equipment and software needed to run the system, as well as the proceedings for planning and processing information and data concerning the control and monitoring of deforestation, forest management, forest replacement and of the flows of transportation and commercialization of forest resources and products (together with respective licences and authorizations), until the final issuance of the stamps of forest origin.

In section 5, we describe how the system is being used to monitor PMFS and to report on their implementation, the necessary instruments for the control of the activity, the mechanisms of support to forest management that have been instituted by IBAMA, as well as the advantages that the system presents for those who carry out the activity in the field.

Section 6 presents estimates of the costs of SISPROF and of the "transaction costs" incurred by forest management activity because of the control mechanisms imposed on it, and especially the impacts or increases in costs that derive from SISPROF.

The last section presents the conclusions and recommendations of the entire work.

3. THE BRAZILIAN AMAZON: SOME FEATURES OF THE STUDY AREA

3.1 Legal Amazon – definition and forest cover

Located in South America, Brazil has a territorial surface of 851 million ha, of which approximately 560 million ha are covered by native forests and other wooded vegetation. Of this total, more than two-thirds are formed by the Amazonian tropical rain forest and the rest by transition forests, cerrados, caatinga, Atlantic coast forest and its associated ecosystems (see Box 1, Brazilian and Amazonian Ecosystems)

From a political-administrative point of view, the country is divided into five big geographical regions (Table 3.1). The northern region, which has the largest surface, occupies an area of more than 358 million ha. Together with the centre-west region, both occupy 64 per cent of Brazilian territory. Notwithstanding this, the population of this enormous territorial space corresponds to only 15 per cent of the total population of the country. The high population concentration in Brazil occurs in the northeast and southeast regions, that together make up 29 per cent of the national territory, and where nowadays 71 per cent of Brazilians live.

Table 3.1: Brazil – Area and population per region – 1996 and 2000

Region	Area (ha)	% of Brazil	Population 1996 (inhabitants)	Population-2000 (inhabitants)	% of Brazil
North	385,296,700	45.25	11,288,259	12,900,704	7.59
Centre-West	160,644,500	18.87	10,500,579	11,636,728	6.85
Northeast	155,391,700	18.25	44,766,851	47,741,711	28.12
Southeast	92,457,400	10.86	67,000,738	72,412,411	42.65
South	57,630,000	6.77	23,513,736	25,107,616	14.78
Brazil	**851,420,500**	**100.00**	**157,070,163**	**169,799,170**	**100.00**

Source: IBGE, 1996; IBGE – Censo de População 2000 in STCP

Two geographical concepts of Amazonia are used in Brazil - Classical Amazonia and Legal Amazonia (see Map 3.1). Classical Amazonia corresponds to the northern region of Brazil and includes seven states (Acré, Amapá, Amazonas, Pará, Rondônia, Roraima and Tocantins), the total area of which is 120 million ha smaller than Legal Amazonia.

The Brazilian Legal Amazon corresponds to a region legally defined for purposes of regional planning and public policy with a total area of 510 million ha (an area that is sufficiently large to accommodate all of western Europe), encompassing all of the northern region and parts of the centre-west and northeastern regions. Legal Amazonia includes a total of seven states (Acré, Amapá, Amazonas, Pará, Rondõnia, Roraima and Tocantins) and parts of two other states (Maranhão and a very small part of Goiás State, which is not included in Table 3.2).

The total surface of forests and other forested-land of Brazil is of the order of 560 million ha, and is equivalent to 14.5 per cent of the world forest cover. While the world average per person of forest surface is 0.6 ha, with great variations per country, the Brazilian average reaches 3.3 ha per person (2000) but also shows strong variations according to the region of the country. The crossing of the data on total forest area of the states of the northern region (Classical Amazonia), cf. Table 3.2, with the data on regional population (Table 3.1, for 1996) shows that the north has a per capita rate of forest surface of 30.3 ha, which is almost tenfold the national average and 50 times bigger than the world average.

Table 3.2: Brazilian Legal Amazonia – surface (ha) and forest cover

States	(A) Surface (1)	(B) Original area of forests (2)	(B)/(A) %	(C) Original area of cerrados (3)	(C)/(A) %	(D) Other biomas (4)	(D)/(A) %
Acré	15,314,900	15,239,400	99.5	- 0 -	-	75,500	0.5
Amapá	14,345,300	13,415,300	93.5	930,000	6.5	- 0 -	-
Amazonas	157,782,000	153,112,200	97.0	140,000	0.3	4,529,800	2.7
Maranhão	33,336,500	14,576,600	43.7	16,458,230	49.3	2,301,670	7.0
Mato Grosso	90,680,600	41,567,900	45.8	42,200,000	46.5	6,912,700	7.7
Pará	125,316,400	118,357,100	94.4	5,800,000	4.6	1,159,300	1.0
Rondônia	23,851,200	21,221,400	88.9	1,640,960	6.9	988,840	4.2
Roraima	22,511,600	17,242,500	76.6	3,982,500	17.7	1,286,600	5.7
Tocantins	27,842,000	3,032,500	10.9	24,809,500	89.1	- 0 -	-
Total	**510,980,500**	**397,764,900**	**77.8**	**95,961,190**	**18.8**	**17,254,410**	**3.4**

Sources: (1) IBGE, 1996 ; (2) INPE, Desflorestamento 1995-97: it refers to forest physiognomies - dense and open rain forests, transition forests, cerrados, areas of contact, seasonal forests and wooded savannas – data adapted by the author from Nepstad, D. *et al.*, (3) data adapted by the author from Andrade, E. B. and from Menezes, M.A.; (4) obtained from residue.

According to Funatura[1] and Schubart[2], the forest cover types of the almost 398 million ha of the Amazonian tropical forest are divided into 79 per cent of dense non-flooded tropical rain forests (*terra firme* forests), 10 per cent of open non-flooded tropical rain forests (*terra firme* forests), 2 per cent of flooded tropical rain forests (*varzea* forests, periodically flooded, and *igapó* forests, permanently flooded), 6 per cent of open vegetation cover types (such as the savannas, *varzea* fields and *campinaranas*) and the rest (almost 3 per cent) constituted by aquatic vegetation, rivers and lakes.

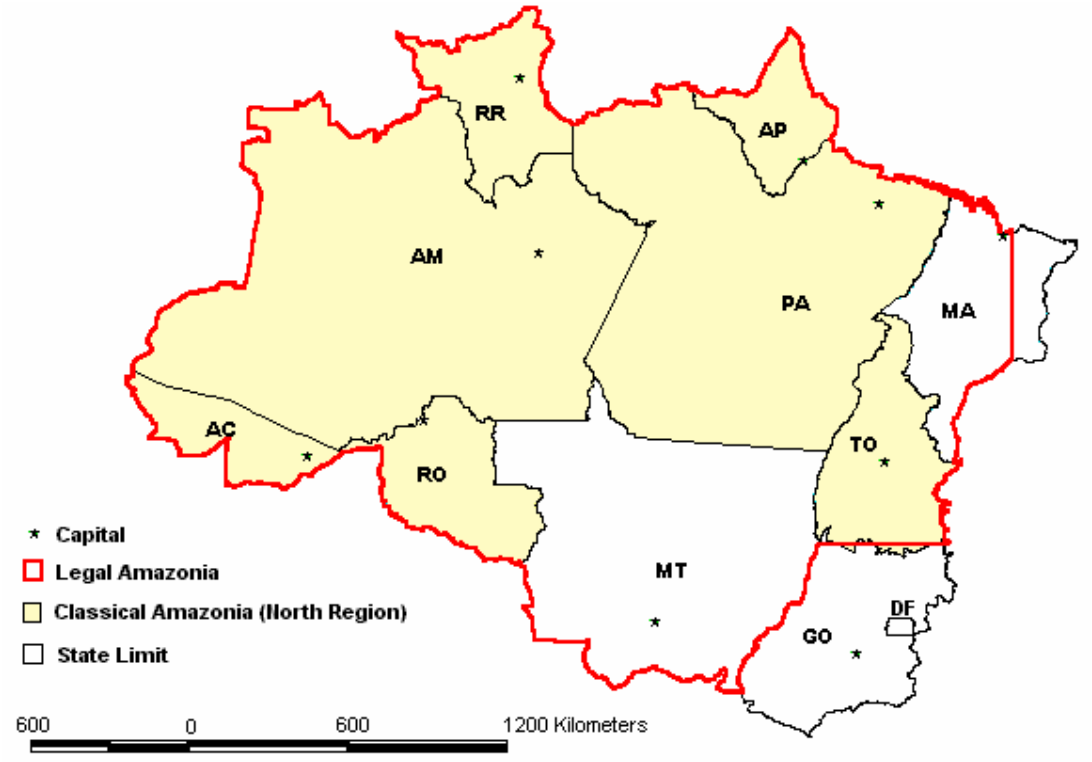
Therefore, the dense and open tropical rain forests, flooded and non-flooded, constitute the most representative forest cover of Legal Amazonia and are equivalent in area to 30 per cent of the tropical rain forests of the world, besides being considered as the richest ecosystem of the earth in terms of bio-diversity.

3.2 Population dynamics

Based on Sawyer, D.[4], and on the wide-ranging analytical work carried out by the Society, Population and Nature Institute (ISPN) about demography and quality of life in Amazonia, it is possible to summarize the main characteristics and trends of the population dynamics of the region that have major relevance for the understanding of the association of such dynamics with the process of deforestation in the region, in the last three decades (1970-1996).

Composing the framework of the spacial distribution of population in the region, which may be seen in maps 3.2 and 3.3, five main trends, as put forward by the cited author, describe the dynamics of the population in Amazonia in the last 30 years, and must influence future outcomings of the complex relationship between population and deforestation in the region:

Map 3.1: Brazilian Amazonia, classical Amazonia (north region) and Legal Amazonia



Box 1

Brazilian and Amazonian ecosystems

As per the study carried out by the Ministry of the Environment, "Brazilian Ecosystems and the Main Macro-Vectors of Development – Subsidies to the Planning of Environmental Management", in 1995[3], the country may be divided into nine major sets of ecosystems, understood as territorial macro-units for analysis and planning, and which aggregate certain basic characteristics that constitute a background for environmental management.

Given the Brazilian environmental complexity, the nine sub-spaces were defined, basically, according to ecological conditions reflected by the predominant original vegetation and by the geographical position that they occupy, except the *Pantanal*, a region that has its own geo-morphological characteristics. The nine ecosystems were defined independently of the political-administrative division and according to regionalization criteria already employed. The nine units were denominated relative to the geographical and/or phyto-ecological region, always preceded by the word "ecosystem", considering ecosystem as a generic term with respect to the diverse levels of organization of the biosphere.

The nine main Brazilian ecosystems are the following: 1. The Amazonian ecosystems; 2. The ecosystems of the cerrados region; 3. The ecosystems of the *Pantanal*; 4. The ecosystems of the caatingas region and of decidual forests of the northeast; 5. The ecosystems of the middle-north; 6. The ecosystems of the region of semi-decidual seasonal forests; 7. The ecosystems of the Brazilian pine region; 8. The ecosystems of the extreme south; 9. The ecosystems of the coastal regions and of the Atlantic forest.

We present below only a brief description of the Amazonian ecosystems and of the ecosystems of the Cerrados region, since they are the main ones encompassed by the region defined as "Legal Amazon", the main object of this work.

1. Amazonian ecosystems: the Amazonian ecosystems are dominated by the tropical *Perenifolia* or rain forest, which represents the Brazilian portion of the "Hylea" of Humboldt and Bompland. They still constitute the largest body of tropical forest of the planet, conditioned by a hot equatorial humid and super-humid climate, where rain precipitation is far superior to potential evapo-transpiration.

Three big morphological sets, related to regional geology, compose the relief of Amazonian ecosystems: in the centre, the interior planes and the central Amazon depression; to the south, the meridional Amazon, the Araguaia-Tocantins river depressions, the plateaus of the Tapajós-Xingu rivers and of the Parecis, the residual plateaus of oriental Amazon and meridional Amazon; to the north, the northern Amazon depression and the plateaus of Amazonas-Orinoco and Negro-Jari rivers, as well as the residual plateaus of northern Amazon.

The great geological diversity of the Amazonian ecosystems, linked to the differentiated relief, resulted in the formation of various classes of soils, with emphasis on alluvial and hydro-morphic soils, yellow-latossol and red-yellow latossol, and podzolic soils.

The dense rain forests, represented/characterized by *terra firme* forests, *várzea* forests (periodically flooded) and *Igapó* forests (permanently flooded) represent the core area of the "Hylea", ranging from the northern Amazonian depression, a major part of the Amazonas-Orinoco plateau, and for almost all of central-Amazonian depression to east of Meridian 70.

The open rain forests characterize an area of climatic transition, less humid, and are also known as *terra firme* forests, *várzea* forests and *Igapó* forests, according to the topographic position that they occupy and the river geo-morphology aspects. They occupy a major part of the southern Amazonian and the Araguaia-Tocantins depressions, as well as the drained areas by the courses of the Javari, Juruá, Purus and Madeira rivers.

The *várzea* fields of the Amazon river, from the merging of the Solimões and Purus, to the islands of its delta, have special importance. The natural fields of Roraima (known as Esteppe-Savannas) occur in the southern extreme of the Branco and Tacutu river basins. The *campinarana*, the vegetation of which defines a specific phyto-ecological region, spreads in spots along the basin of the high-medium Negro river. The transition area mainly characterizes the strip near pre-Amazonia. The Amazonian ecosystems occupy a surface area of 400,508,200 ha. It is estimated that the waters and native vegetation still cover 90 per cent of the whole area of these ecosystems.

2. Ecosystems of the *cerrados* region: the *cerrado* is the Brazilian variant of the class of vegetation formation originally called savanna by Olviedo, when he characterized the Venezuelan "llanos". Ecologically speaking, the Brazilian *cerrados* characterize a set of environmental factors that confer individuality to central Brazil.

The interaction of morpho-climatic, structural and lythological factors results in the compartmentalization of this area into big geo-morphological units, distributed in differentiated altitude levels: *chapadas*, plateaus and layers elaborated in diverse erosive phases can be found separate from the high courses of the rivers that form the basins of the Amazon, of the Sâo-Francisco and of the Prata, originating in the Araguaia-Tocantins, the high and medium São-Francisco and the high Paraguay depressions.

The dominant soils of the plane and smooth-ondulated areas of the *chapadas* and plateaus are the dark-red latossols, the concretionary soils and quartz sands. In the mountainous and/or desicated areas, there are the podzolic, cambissols and litolic soils. The plyntossols and gleys are found in the depressed areas subject to periodical flooding.

The vegetation of the cerrados – *latu sensu* – presents a varied physiognomy. The Cerradão is a dense tree-formation. The cerrado – *strictu sensu* – is constituted by tortuous trees, relatively short, intertwined by bushes. In the cerrado fields, the trees and bushes are spaced. The clean fields, or cerrado fields, occur in depressed, badly drained areas, and are poorly endowed with woody vegetation.

The ecosystems of the *cerrados* region occupy a surface of 189,027,800 ha. It is estimated that the natural vegetation of cerrados, fields and forests represents 76 per cent of the total area of these ecosystems, although a major part of the remainder are already altered. The table below summarizes the main vegetation types of the nine groups of Brazilian ecosystems mentioned here.

Main Brazilian ecosystem and vegetation types			
Ecosystems	**Vegetation types**	**Original area (ha)**	**% of total country area**
Amazonian	Dense and open rain forests, *várzea* fields, esteppe savanna (Roraima fields), campinaranas, palm-tree forests, bamboo forests, transition areas and others.	400,508,200	47.1
Cerrados	Cerradão, cerrado, cerrado-fields, clean fields, river-margin woods and veredas	189,027,800	22.2
Pantanal	Cerrados, cerrado-fields, clean fields, chacos	15,488,400	1.8
Caatingas	Caatinga arboreal, caatinga bush-arboreal, bush caatinga, decidual forests	93,939,100	11.0
Mid-north	Dense rain forest, seasonal forests, contacts with cerrado and seasonal forests, contacts with cerrado and caatinga	16,420,100	1.9
Seasonal semi-decidual forests	Seasonal semi-decidual forests, transition areas with decidual forests, Atlantic forest and cerrado.	51,883,400	6.1
Brazilian pine forests	Mixed rain forest or Araucária forests, grass fields	22,036,300	2.6
Extreme–south	Fields, savannas, seasonal forests, esteppes and esteppe-savannas	20,387,500	2.4
Coastal areas and Atlantic forest	Mangroves, coastal fields, dense and open rain forests, altitude fields and others.	41,508,800	4.9
TOTAL		**851,199,600**	**100.0**

Incomplete demographic transition: in spite of having fallen (from 7.9 children per woman in 1970, to 4.2 in 1991), the total fecundity rate of the Amazon continues to be the highest in Brazil (the average of the country was 2.9 in 1991). On the other hand, regional life expectancy increased from 53.8 years in 1970 to 68.4 years in 1991; a bigger increase than the country's life expectancy as a whole, which grew from 53.7 years in 1970 to 66.3 in 1991. The lower mortality rate in the Amazon is due to such factors as reduced demographic density, direct access to abundant natural resources as a means of survival, abundance of water, etc. The combination of high fecundity and lower mortality than the national averages means that the vegetative growth rate of the Amazonian population continues to be relatively high (2 per cent per annum, compared to 1.5 per cent for Brazil as a whole).

Decrease of inter-regional migration: until the mid-1980s, migrations from other regions to the Amazon were relatively intense, but even so the net migration surpluses to the region contributed less than the vegetative growth of the population, (migration flows in the 1970s and 1980s represented 35 per cent and 41 per cent, respectively, of total regional population growth in these periods). The migration surpluses decreased significantly in the second half of the 1980s, and the beginning of the 1990s. The reasons for the fall in inter-regional migration to the Amazon are linked to the suspension of big colonization projects and public construction works, to the tightening of land conflicts, disillusion with access to lands, malaria epidemics, scarcity of capital to invest in migration, etc.

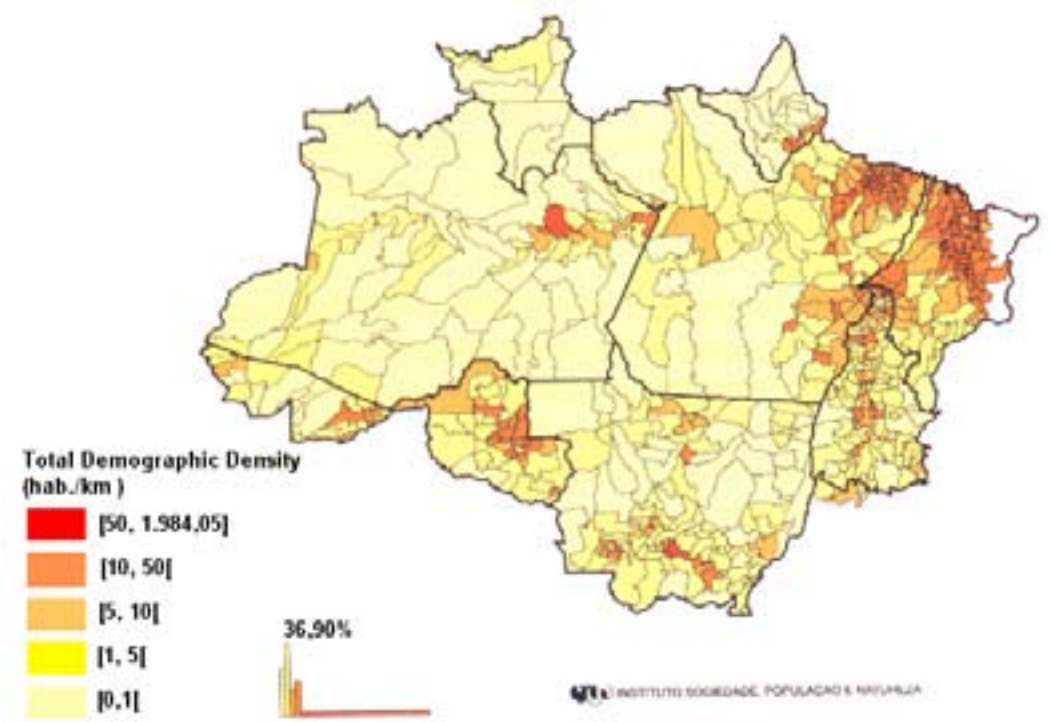
Increase of intra-regional mobility: nowadays, instead of migration from other regions to Amazonia, there is great population mobility inside the region.

This intra-regional mobility is destined for urban areas of all sizes, placer-minings, new settlements (mainly in Roraima, in the north of Mato Grosso and south of Amazonas) and is due, in part, to the instability of existing settlements and to the search for survival opportunities, as well as being connected to high demographic growth in the areas of origin. Associated with this intra-regional migration there is the temporary mobility of labour (mainly male) due to the seasonality of agriculture production, cattle-ranching and extractivism, to the regional calendar of deforestation tasks, to civil construction works and other

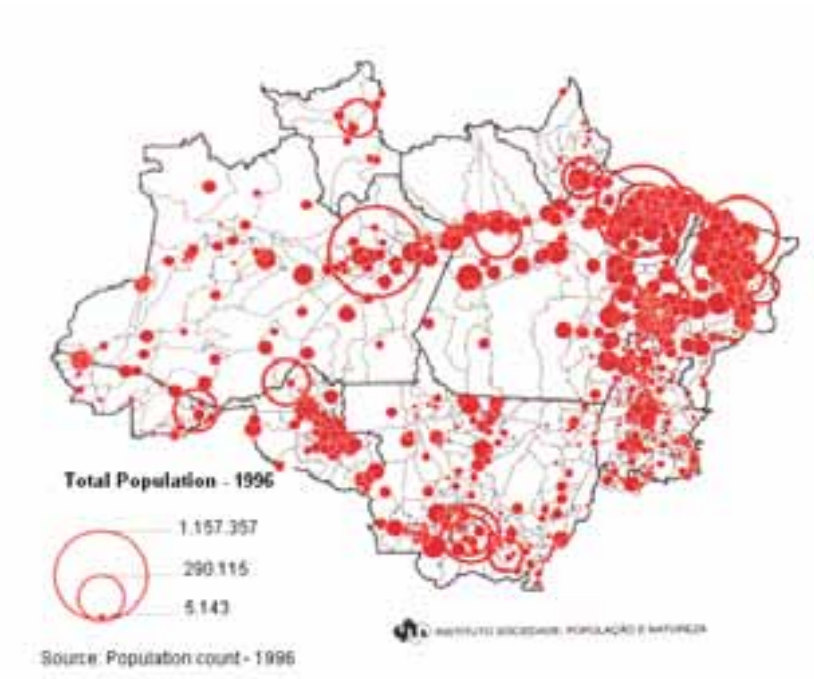
activities. The temporary mobility has been facilitated by improvements in the systems of infrastructure and transportation.

Accelerated and generalized urbanization: one of the most outstanding characteristics of Amazonia, nowadays, is the occurrence of an accelerated and generalized urbanization of the agriculture frontier, the population of which is around 60 per cent urban and continues to increase. The urban population of Legal Amazonia is today 12 million people – which means a great consumer market that demands agricultural products, industrialized products and urban services – and which is concentrated in a few big cities (above 500 thousand inhabitants – Belém, Manaus, Cuiabá, São Luís), and in some tens of small and medium cities (from 20 to 250 thousand inhabitants), mainly in the region of the deforestation arch, in the northeast of Pará, in the centre of Maranhão, along the Amazon river and in the region of Manaus.

Map 3.2: Total demographic density – 1996



Map 3.3: Total population – 1996



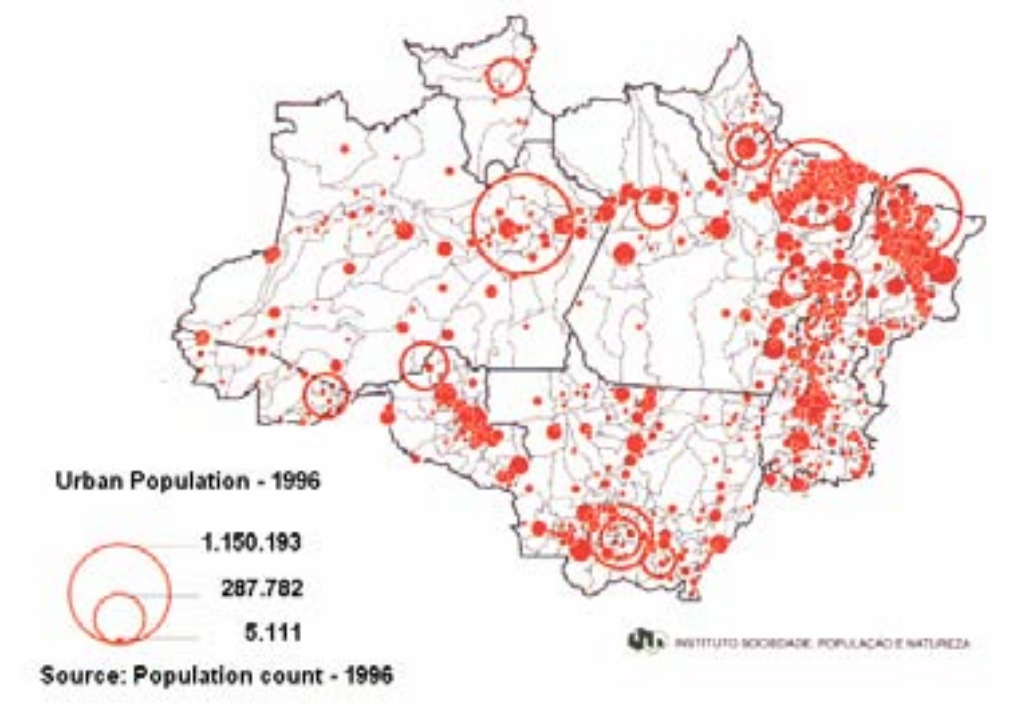
Sources: MMA, "Causas e dinâmica do desmatamento na Amazonia"

The fixation of rural population: notwithstanding the intense urbanization of Legal Amazonia, around 8 million inhabitants still remain in the rural areas of the region, a considerable population that keeps on growing

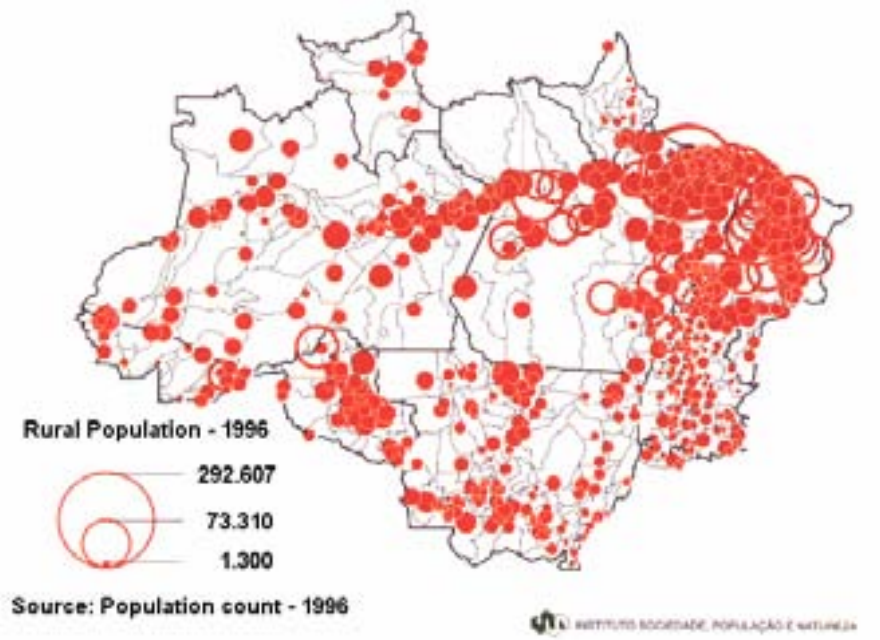
Maps 3.4 and 3.5 show that rural population is more concentrated where urban population is concentrated. It should be noted that there still is a reasonable diversity in the composition of this rural population in its distribution in the region: family producers (peasantry, shifting cultivators, based on household labour), farmers and rural producers (forms of production that rely on the hiring of waged labour) are concentrated in Maranhão and in all of the deforestation arch region, while the so-called traditional/extractivist populations, like the rubber-tappers, Brazil-nut gatherers, fishermen, riverains and others are found in more remote areas. There still are around 300,000 indigenous people (a population that is growing in the Amazon) that occupy a total area of more than 100 million ha (20 per cent of Legal Amazonia) in reserves distributed all over the region.

The relationships between population and deforestation are complex. Examples of this complexity in the Amazon are: (i) in Amazonia, for example, demographic density does not correspond to anthropogenic pressure in a linear form: the rural exodus of low-environmental impact extractivist or agricultural populations may point to risks of introducing predatory agricultural or timber exploitation activities; the fixation of rural population means that, contrary to the past, many rural producers are interested in the sustainability of their lands, and so it is less likely that they move on to new frontiers opened by timbermen if they are displaced by the expansion of cattle-ranching or soya bean crops; (ii) the urban population also interacts in a complex form with deforestation: a) on the one hand, migration to cities diminishes the direct pressure on the forest (in Amazonas, the concentration of population in Manaus – because of the free-trade zone – contributes to the low level of deforestation in the state; b) on the other, the growth of cities creates a demand for food, raw material, energy and transport, that stimulate deforestation.

Map 3.4: Urban population – 1996



Map 3.5: Rural population – 1996



Source: MMA, "Causas e dinâmica do desmatamento na Amazônia"

Finally, although population growth exerts a certain pressure on deforestation, the effects are not always direct and linear. The effects of regional population increase on deforestation cannot be seen as Malthusian (cf. Margulis and Reis[5]).

3.3 Soils, climate and present use of land in Legal Amazonia

3.3.1 Soils

A good part of the preoccupation, at national and world levels, about the deforestation process under way in the Amazon is due to ecological and environmental consequences, present and potential, that result from the use of the region's natural resources. In this context, for the last three or four decades, the development of agriculture and cattle-raising, as practised in Amazonia, has been one of the most important factors that determine environmental disturbances and impacts in the region, to a great extent because the expansion of these activities, carried out through clear-cutting and conversion of forests for the establishment of crops and pastures, has been an important, if not the major, determining factor of deforestation in the region.

Amid this process, the question of whether the agricultural development of the Amazon can be sustainable or not has been widely debated, and is still a controversial issue, particularly in respect of the aptitude or agricultural potential of the region's soils.

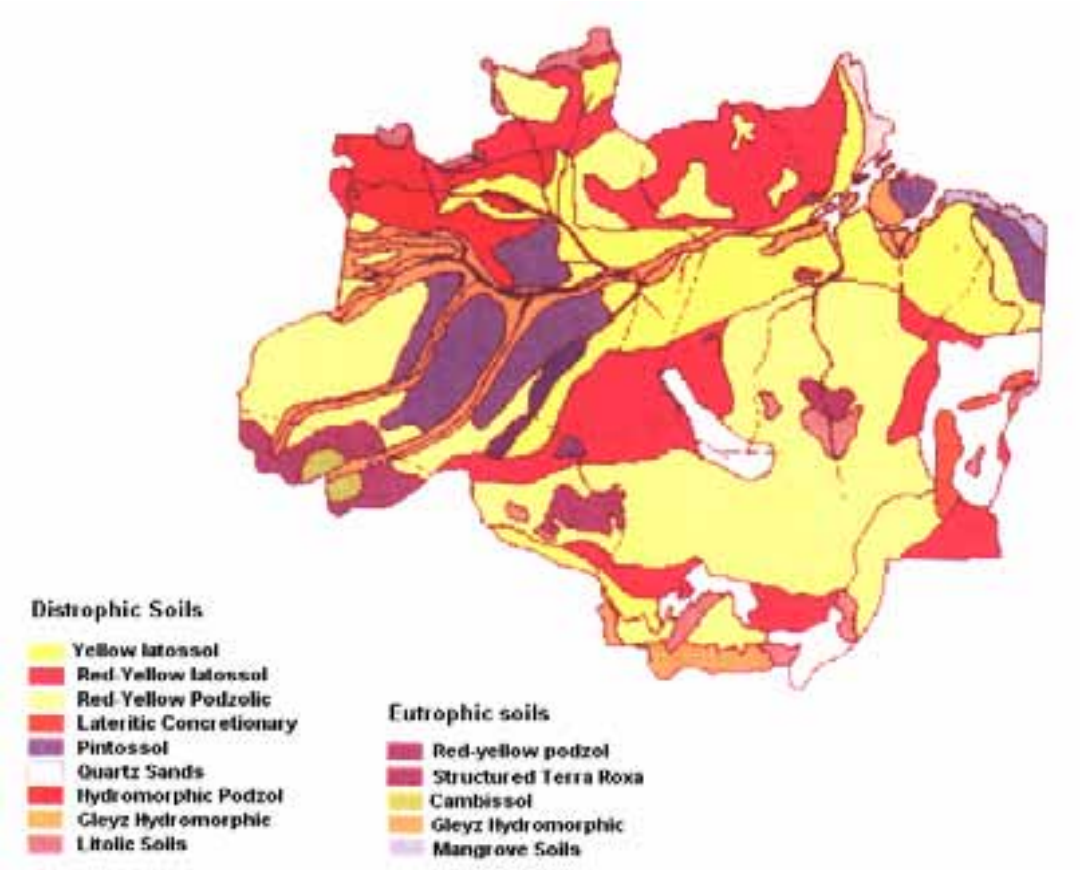
Although part of the controversy is due to the scarcity of more detailed knowledge on the types of soils, and their real extensions in the immense region, and without the pretension to exhaust the theme, one may say that only one statement seems to have unanimity among the specialists on tropical soils: that only 8 to 10 per cent of the Amazon's soils have high natural fertility (around 40 million ha, constituted of eutrophic soils, that do not show any limitation in the physical or chemical structures – see map 3.6).

For the rest, the opinions are contradictory or polarized. For example, in a recent study sponsored by the World Bank[6], the authors state: "there is ample literature highlighting the *low agricultural potential of the most part of the Amazon* (Goodland and Irwin, 1975; Moran, 1981; Smith, 1981; Cochrane and Sanchez,

1982; Hecht *et al.*, 1988; Mattos and Uhl, 1994). Schubart (1999), for example, concludes that approximately 90 per cent of Amazonian soils *are acid, chemically poor and* have excessive humidity, which favours in a significant way the development of disease and plague...” (our underscoring).

On the other hand, authors like Andrade, E.[7] state that: “from the edaphic point of view, the Amazonian soils *in their great majority (56 per cent) have high agriculture aptitude*, and, maintaining the adequate management indexes, they can show very good productivity for crops and cattle-raising. Approximately 36 per cent of some classes of soils that show an unbalanced physical structure and low rates of base-saturation are inadequate for agricultural practice. Around 8 per cent of the soils (40 million ha) are made of eutrophic soils, that do not show any limitation in the physical or chemical structure, but generally are located in areas with easy relief, which makes mechanization difficult, and part of them are located in zones where transportation means are precarious (Silva, 1981 and Alvin, 1994)” (our underscoring).

Map 3.6: Distribution of the main classes of soil in the Amazon



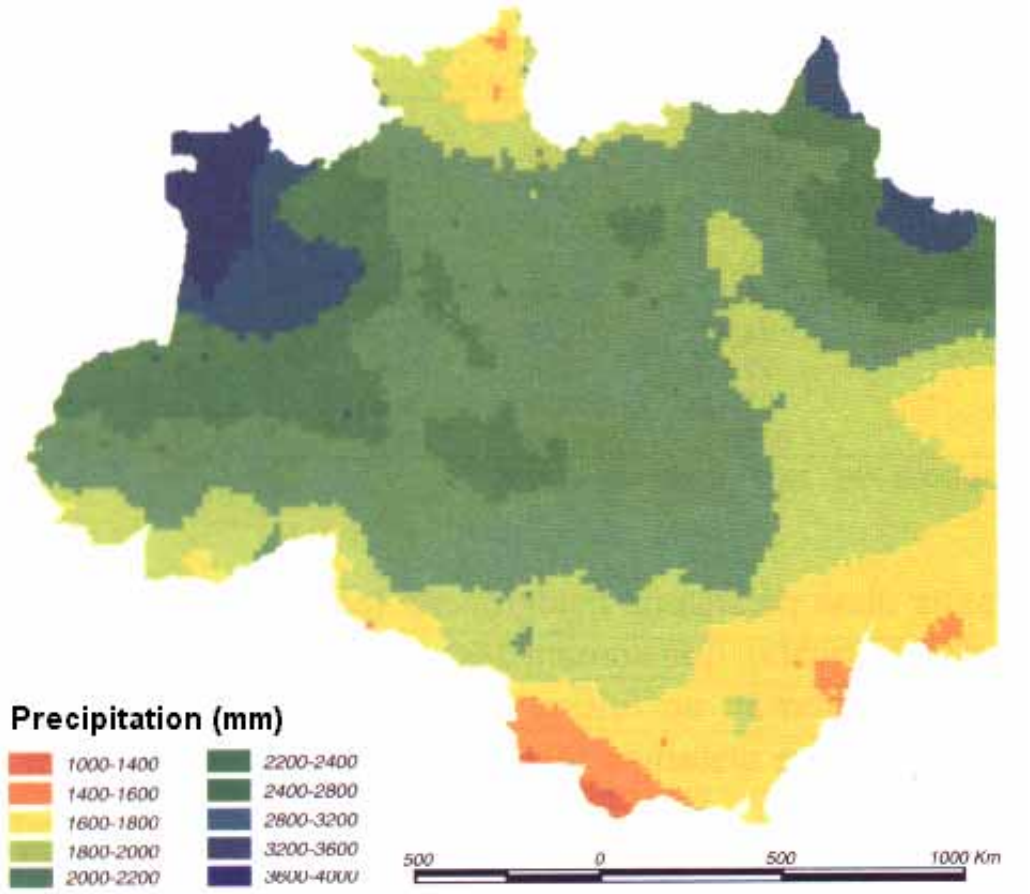
Yet, according to this author, "in all states of the region soils with good physical structure predominate, and although they may have *low natural fertility*, if deficiencies are corrected with the specific fertilizers, the productivity of the crops has been showing satisfactory economic results. Independently of the use to which the soils of the Amazon are destined, the sustainability of the production systems will be conditioned according to the employment of efficient conservation practices against erosion, mainly in the more mountainous areas and to adequate processes of management, where the use of coverage plants is important for the success of the agricultural projects" (our underscoring).

3.3.2 Climate

More recent scientific discussions and evidence have emphasized the role of climate and its influences in the determination of agricultural production in the Amazon. The quoted study of the World Bank[6] mentions the recent work of Chomitz and Thomas[8], in which the authors verified that pluviosity has a negative effect on agricultural productivity in Amazonia. The two authors attempt to show that the influence of infrastructure (road network, markets, communications) on the increase in agriculture productivity in Amazonia is relative: as per their analyses, depending on the activity being located in a high rainfall zone, the productivity and permanence of crops may not respond to the existence of infrastructure, i.e., infrastructure will not guarantee the economic feasibility of the crops. Chomitz and Thomas identified three major rainfall zones with significant influences on the performance of agriculture in the Amazon (see map 3.7).

The pattern of humidity and water availability in Legal Amazonia tends to a gradient in which rainfall, from 1,000 mm in the south, grows in a northwest and northeast direction, reaching annual averages up to 3,000 mm. In a general way, the Amazon region is characterized by the following basic climatic components: high precipitation that features a rainy season, with an average of 2,000 mm/year, that is extended for 180 days; high relative humidity of the air that marks this rainy period; and monthly average temperature, around 26°C, without variation higher than three degrees among the different months of the year.

Map 3.7: Main rainfall zones of Amazonia



According to Andrade, E. (op.cit), in the more humid areas of Amazonia, the development of a more technified agriculture, and on an entrepreneurial scale, will only be profitable if infrastructural and logistical support conditions, capable of offering comparative and competitive advantages, are available in order to raise investors' interest. Besides these structural factors, the high humidity and uniform heat during the whole year propitiate the dissemination of pathogenic biotic agents that may create serious obstacles to economic sustainability of the production systems, due to additional costs of the intense and necessary utilization of pesticides and defensive products.

In this sense, the natural vocation of these more humid areas seems to be the exploitation of native forests through sustainable systems and the use of bio-diversity or perennial crops with a high degree of technological adaptation (as is the case of palm-oil, *açaí* or cocoa crops, among others).

In the strips at the south of the Amazon basin, more in contact with the central plateau, due to the influence of cerrados (a region that corresponds to the deforestation arch and to the penetration of the agricultural frontier) and the drier climatic conditions, the crops seem to present better performance in the face of predator biotic agent actions. In general, there are no grave climatic limitations related to availability of light, water and thermal amplitude capable of rendering infeasible systems of production for those products that already have technological innovations in their production processes.

Box 2

Rainfall zones of Legal Amazonia

Dry Amazonia – rainfall below 1,800 mm/year: this area corresponds approximately to 17 per cent of the territory of the region. It is concentrated at the south of the Amazon Basin (deforestation arch) and in isolated areas of natural fields mainly in the north of Roraima. In this region climatic conditions are relatively favourable to agriculture. The soils are generally well drained, and relief is favourable to mechanized agriculture. Vegetation is mainly cerrado, with some areas of open and semi-deciduous forests, which have low volumes of commercial wood species.

Transition Amazonia – rainfall between 1,800 mm and 2,000 mm/year: this area represents approximately 38 per cent of Amazonia and is located between the central region (humid zone) and the deforestation arch in the south of Amazonia (dry zone). This region is generally covered by dense forests with zones of open forests in Mato Grosso and south of Pará. The soils are reasonably well drained. The relief is mostly ondulated with some significant elevations in Roraima and north of Pará. The excess of rain and short dry period create agricultural and economic difficulties for the production of grains. Perennial crops have had better success. In the case of cattle-raising there is some evidence of relative success for more intensive technology of production in eastern Pará (Paragominas).

Humid Amazon – rainfall higher than 2,200mm/year: there are some areas in this zone that register rainfall up to 4,000 mm/year. In many areas soils have insufficient drainage. This zone, embracing 45 percent of the Amazon, is located mainly in the central region, occupying most parts of the states of Amazonas and Amapá, the northwest of Rondônia, the southwest and northwest of Pará, besides the Marajó island and Bragantina region (northeast of Pará). Dense forests cover the biggest part of this zone. The excess of rain and insufficient drainage tend to make agriculture (especially the cultivation of grains) economically non-competitive. The profitable activities occur only in areas with better infrastructure and market. This big area, around 84 percent, has average or high potential for timber exploitation, according to data from IMAZON[9].

3.3.3 Present use of land

3.3.3.1 The growth of agricultural activity in the Amazon

The economic growth of the northern region of Brazil, in the last four decades, has been quite intense. Throughout this period, the Amazon has shown a higher rate of economic expansion, compared to the other Brazilian regions, whether measured by total GDP or by GDP per capita. From 1960 to 1996, while the country grew at an average annual (a.a.) rate of 5.2 per cent, the north presented a more expressive performance, of 8.6 per cent a.a. (Table 3.3) with the post-1970 period showing a more accelerated growth. This caused Amazon GDP to become 7.0 per cent of the country's GDP in 1996, as against only 3.5 per cent in 1970[10].

Legal Amazonia GDP per inhabitant, in spite of the significant growth in regional population in the 1970-1996 period, expanded from US$ 1,100 (1970) to US$ 2,300 (1980) and reached US$ 2,850 in 1996. This economic expansion placed the region's GDP per capita at 58 per cent of Brazil's per capita GDP in 1996, when it was only 41 per cent in 1970.

In terms of sectoral composition of the regional GDP (see figure 3.1), it can be verified that in the Amazon, as in the rest of the country, the mark of economic growth has also been urban--industrial, that is, the services (including government) and industry (including mining) sectors have shown greater expansion of their relative positions in GDP. The urban-based services sector dominates the Amazon economy.

Table 3.3: Legal Amazonia – GDP, per capita GDP and share in Brazilian GDP

Discrimination	1970	1980	1996
Amazonian GDP (in US$ 1,000 of 1998)	8,518,772	27,041,642	53,468,347
Amazonian GDP per capita (in US$ 1.00 of 1998)	1,104	2,300	2,854
% of Amazonian GDP in Brazil's GDP	3.5	4.8	7.0
Annual GDP rate of growth – Amazonia (1960/1996) : 8.6%			
Annual GDP rate of growth – Brazil (1960/1996) : 5.2%			

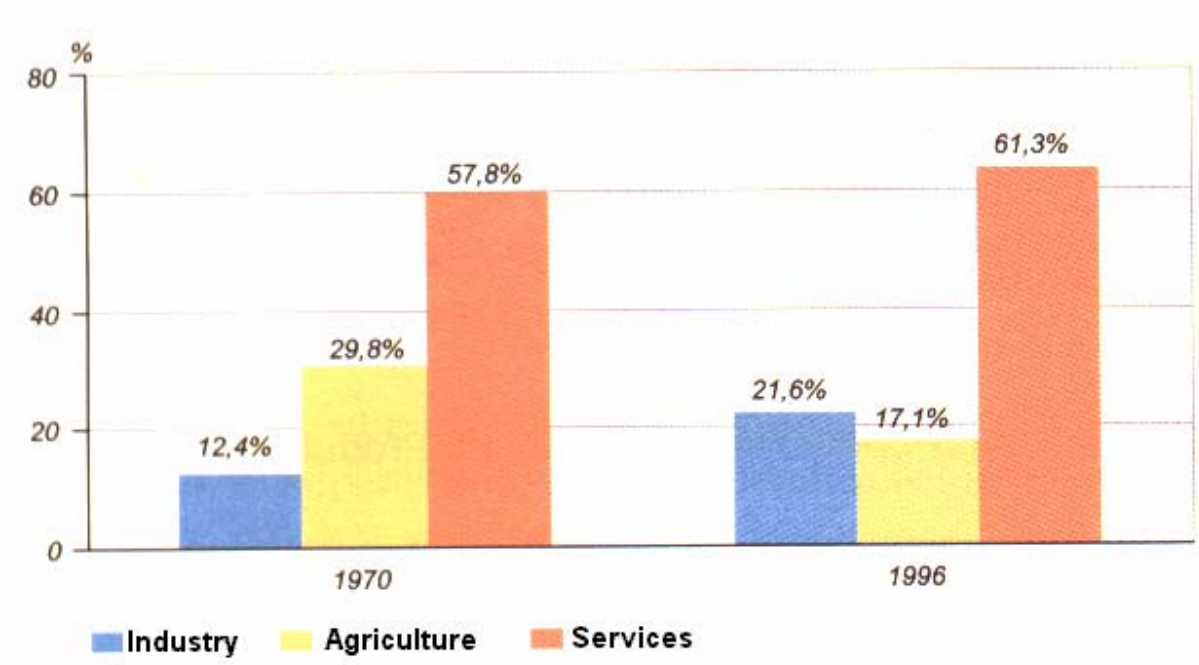
Source: Monteiro Neto, A.

In the 1970s and 1980s the mining industry has shown the highest growth in the Amazon region. Mining puts pressure on the forests either from its impact on local demand for agricultural goods, or because of its direct environmental effects. The mineral wealth of Brazilian Amazonia has been estimated to be at least US$ 3 trillion, with deposits of gold, bauxite, iron, copper, uranium, potassium, niobium, manganese, diamonds and other precious stones. New mineral deposits are discovered every year. Some mineral reserves are yet to be exploited, such as the gigantic copper reserve of Salobo (in the Carajás area, in Pará), with an estimated stock of 1.2 billion tonnes of copper.

The bigger expression of industry and services in the region's GDP, in the 1970-1996 period, indicated a reduction in the relative participation of the agricultural sector. Nevertheless, while the relative participation of agriculture and cattle-raising in GDP is reduced, its growth is stimulated in absolute terms, since wider consumer markets for agricultural products are created in the local urban areas with higher income levels. As commonly pointed out, agriculture in Amazonia seems to depend a lot on the existence and availability of local markets, given the long distances and high transportation costs for agricultural products to the other regions of the country.

As some authors single out (Schneider, R.[6], for example), the rapid growth of urban markets in Amazonia has been crucial to the feasibility of agriculture in the region. Rapid urbanization in Legal Amazonia points in the direction of a clear modification in the terms of trade between the rural and urban sectors, in favour of the agricultural producer, thus contributing to an increasing profitability of agriculture in the region.

Figure 3.1: Legal Amazonia – sectoral composition of regional product – 1970-1996



Source: Monteiro Neto, A.

So, notwithstanding the fall in the relative participation of agricultural activities in the regional total, from 29.8 per cent in 1970 to 17.1 per cent in 1996, the absolute value of agriculture GDP grew more than threefold, from US$ 2.5 billion (at 1998 prices) in 1970 to US$ 9.1 billion (at 1998 prices) in 1996.

3.3.3.2 Legal Amazonia – altered areas by the expansion of agricultural activities

An idea of what represents the expansion of agriculture and cattle-raising in Legal Amazonia, in terms of a global alteration of the natural landscape of the region, may be obtained from the data given in Table 3.4. The INPE data on gross deforestation occurring in the Amazon reveal that, up to August 1996, more than 51 million ha of forests had been converted, around 13 per cent of the region's forest cover. The four states that mostly lost forest areas, in absolute terms of area extension, have been Pará, Mato Grosso, Maranhão and Rondônia.

In relative terms of their own surfaces of original forest area, Tocantins was the one that mostly converted forests to alternative land uses (84 per cent), followed by Maranhão (68 per cent), Mato Grosso (28 per cent) and Rondônia (23 per cent).

An approximate estimate of the extension of the modification of vegetation cover of cerrados and other biomas, provoked by anthropogenic action in Legal Amazonia, may be obtained if we compare the data on total altered area in the region, as provided by the 1996 agricultural census of IBGE, with gross deforestation of INPE (the definitions of IBGE on altered areas may be found in notes to Table 3.4).

Compared to the INPE statistics, and given the adopted definitions and different methodologies of getting the information, the data on altered area of IBGE census are consistently higher than those of INPE (except in the case of Acré, where the area of *cerrados* and other biomass, relatively insignificant, would normally not have alterations usually captured by IBGE) revealing that anthropogenic action and the use of land in Amazonia also encroach, and quite intensely, into areas previously occupied by the vegetation of cerrados and other biomass.

In the Amazon as a whole, the estimates of altered areas of cerrados and other biomas, as presented in Table 3.4, show that until the end of 1996 around 26 million ha of these types of vegetation would have been converted to agricultural use. Although this represents only half of what has been deforested, in absolute terms in forest areas, in relative terms (proportion of the area of each bioma), however, the cerrados are the ecosystems mostly affected: 23 per cent of the area already converted, against 13 per cent in the case of forests, in all of Legal Amazonia. As the cerrados of Legal Amazonia are more representative in the so-called deforestation arch (see below), the expansion of the agriculture frontier to the south of the Amazon basin has significantly affected this vegetation typology.

The biggest absolute extensions of altered areas in cerrados and other biomas occur in Mato Grosso, Tocantins and Pará, in this order. In Mato Grosso and Tocantins, the two states that have the greatest surfaces originally covered by cerrados, even greater than their forest surfaces, the extensions of altered areas of their cerrados are bigger than their converted forest areas to alternative land uses. Deforestation of cerrados in Rondônia and in Pará is also significant, but more in terms of the proportions of the original area of the bioma in these two states.

3.3.3.3 Used areas x "abandoned" areas and main uses of land

According to estimates made by IMAZON[11], and by Chomitz and Thomas[8], on the basis of data and information of the IBGE agricultural census of 1996, it is possible to have a general idea, even if static, of the extension of used and non-used productive areas on the total of altered areas (that is, areas that had their vegetation cover removed/altered to give way to agriculture, silviculture or pastures) in the states of Legal Amazonia.

As per IBGE definitions, for each agricultural establishment the altered areas represent the sum of the areas of annual crops, perennial cultivations, planted pastures and planted forests, as well as other areas already altered and considered productive but non-utilized, and lands in rest. As can be seen, these areas amount to a total of 78.3 million ha in all of Legal Amazonia (Table 3.4). Still, by IBGE definition, the non-used productive areas are those altered areas that are capable of use for the establishment of crops/cultivations, pastures and plantations, but were not being used for such purposes, including lands not in use for a period greater than four years. The lands in rest are those habitually used for the establishment of temporary crops/cultivations, but were in rest for a period of less than four years, in relation to the last year of their establishment.

Table 3.4: Global extension of deforestation and of altered areas (converted to agricultural use; 000 ha) in Legal Amazonia – 1996

States	(A) Area of forests	(B) Area of cerrados and other biomas	(C) Gross deforestation INPE/96 (1)	C/A %	(D) Global altered area IBGE/96 (2)	E = D - C Altered area of *Cerrado* and other biomas	E/B %
Acré	15,239.4	75.5	1,374.2	9.0	1,329.7	-	-
Amapá	13,415.3	930.0	178.2	1.3	469.2	291.0	31.3
Amazonas	153,112.2	4,669.8	2,743.4	1.8	3,775.9	1,032.5	22.1
Maranhão	14,576.6	18,759.9	9,933.8	68.1	11,544.9	1,611.1	8.6
Mato Grosso	41,567.9	49,112.7	11,914.1	28.7	24,070.2	12,156.1	24.8
Para	118,357.1	6,959.3	17,613.8	14.9	21,792.0	4,178.2	60.0
Rondônia	21,221.4	2,629.8	4,864.8	22.9	6,266.9	1,402.1	53.3
Roraima	17,242.5	5,269.1	536.1	3.1	627.4	91.3	1.7
Tocantins	3,032.5	24,809.5	2,548.3	84.0	8,466.6	5,918.3	23.8
Total	**397,764.9**	**113,215.6**	**51,706.9**	**13.0**	**78,342.8**	**26,680.6**	**23.6**

Source: (1) INPE – Monitoring of the Brazilian Amazon Forest 1998/99; (2) IBGE agricultural census 1996, obtained from IMAZON, 2000. Obs.: (-) inconsistent.

Note: Data on altered area of IBGE/96 refer to agricultural establishments. The definition of IBGE for altered area is the sum of areas of perennial and annual crops, temporary areas in rest, non-used productive areas, planted pastures and planted forests. It excludes, therefore, the areas of natural pastures, the intact cerrados and native forests. Given this definition, it does not seem too correct to qualify the non-used areas, totally, in the sense of degraded areas, and thereby in an "abandoned areas" condition.

Although the amount of non-used areas in Legal Amazonia reaches 16.5 million ha, which is almost 21 per cent of altered areas (Table 3.5) in the region - and one recognizes that low levels of land occupation, high rates of labour turnover, itinerancy and abandonment of arable areas are characteristics always singled out in analyses of the expansion of the agriculture frontier, and associated with disappointing results of colonization projects and settlements of rural population in remote areas of the Amazon - such conditions would be sufficient to allow us to qualify as "degraded" and "abandoned" all the areas classified as non-used, only if these areas were considered as intrinsically inapt for agriculture, of nil, or very low, agricultural vocation/aptitude.

In fact, those mentioned conditions also manifest themselves for other reasons, and not only because of "low agricultural aptitude" but also due to the: scarcity/lack of adequate technical assistance offered to the rural producer; changes in financing conditions and credit available to croppers/cultivators; occurrence of irregular climatic variations; and unforeseen price changes of inputs and agricultural commodities that alter investment plans for planting.

With these reservations in mind, and considering that the non-utilization of areas is a reflex of a set of factors, among which the natural vocation of lands versus the adaptation of crops is only one, from Table 3.5 it will be seen that Mato Grosso and Rondônia show the lowest indices of non-used areas, that is, these two states are those that have the highest rate of occupation of altered areas. It may be noted that Mato Grosso and Rondônia are also the two states of Legal Amazonia that had the highest annual agricultural GDP rates of growth in the 1970-1996 period, above the Amazon agricultural GDP growth as a whole, as depicted in Figure 3.2.

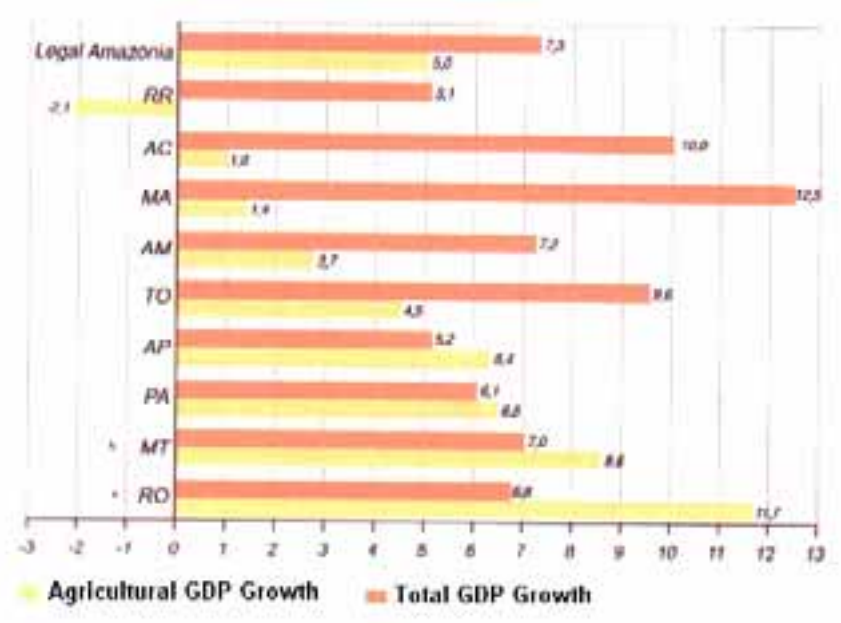
Table 3.5: Altered areas - used and non-used, or in rest, in Legal Amazonia –1996 (000 ha)

State	(A) Global altered area IBGE/96	(B) Non-used area IBGE/96	B / A %	(C) Area in use C = A – B
Acré	1,329.7	179.5	13.5	1,150.2
Amapá	469.2	105.1	22.3	364.1
Amazonas	3,775.9	1,563.2	41.4	2,212.7
Maranhão	11,544.9	4,848.8	42.0	6,696.1
Mato Grosso	24,070.2	2,310.7	9.6	21,759.5
Pará	21,792.0	4,859.6	22.2	16,932.4
Rondônia	6,266.9	570.3	9.1	5,696.6
Roraima	627.4	156.8	25.0	470.6
Tocantins	8,466.6	1,947.3	22.9	6,519.3
TOTAL	**78,342.8**	**16,541.3**	**21.1**	**61,801.5**

Source: IBGE – agricultural census-1996, obtained from IMAZON, 2000

Note: According to IBGE, non-used productive areas include those that are good for the formation of crops, pastures and forests and that were not being used for such ends, including non-used lands, for a period of more than four years, and lands in rest, which are those habitually used for the planting of temporary crops, and that were in rest for a period of less than four years, in relation to the last year of their establishment.

Figure 3.2: Annual rates of growth of total GDP and of agricultural GDP of Legal Amazonia – 1970/1996



Source: IBGE/IPEA

Figure 3.2 shows in which states of the region, for the 1970-96 period, the expansion of agriculture has been more intense and, therefore, where the activity has had a more influential role on total GDPs. The four states that had the highest annual growth rates of agricultural output were Rondônia (11.7 per cent), Mato Grosso (8 per cent), Pará (6.5 per cent) and Amapá (6.4 per cent). In terms of the whole of Legal Amazonia, the growth rate of agriculture and cattle-raising was 5 per cent average annual rate. in the period. In the states referred to, the agricultural GDPs grew faster than their total GDPs, which may have resulted in a significant deforestation impact due to the expansion of agriculture.

On the other hand, Maranhão and Amazonas are the states that have the highest percentages of non-used areas in relation to their altered areas. It may also be observed from the graph that Maranhão and Amazonas (besides Tocantins and Acré) are the states that, in the 1970-1996 period, had the highest growth rates of total GDP, with agricultural GDP growth rates relatively much lower, showing that their economies have expanded, more significantly, by stimuli from other productive activities than the agricultural ones.

Using the information of the World Bank study[6], on the basis of the work of Chomitz and Thomas[8], one can verify the variation of the use of land in the Amazon per rainfall zone. According to the data presented by the authors and included in Table 3.6, the major part of used areas of agricultural establishments (38 per cent) is found in the dry zone of the Amazon (which in greater proportion corresponds to the deforestation arch, and therefore where most of deforestation and conversion of areas to agricultural use occurs) and a small portion (3.2 per cent) in the humid zones of the region (zones that, comparatively, have a scarce population in the whole of the Amazon).

The dominant use of land in the altered areas is livestock breeding, with planted pastures representing 77 per cent of areas converted to agricultural economic use in Amazonia. Approximately 83 per cent of land in use in the dry zone is pasture, falling to 57 per cent in the humid areas (see Table 3.7).

As per Veríssimo, A., Arima, E. and Barreto, P.[11], the present cattle herd (1996) is estimated at 32 million head of bovine cattle, and the respective total occupied area must be around 45 million ha (0.7 head/ha).

Only in a few cases does cattle-raising reach an intensity greater than one head per hectare, in contrast with an average of 1.3 head per ha in the south and southeast of the country.

According to Andrade, E.[7] while cattle-raising in the south, southeast and centre-south of the country is stabilizing, and in the northeast it has been falling since the 1992-93 drought, the north and centre-west regions have shown a surprising dynamism. In the last decade, the reduction of almost 5 million head of cattle in the northeast has been compensated by an equal or greater amount in the north. As IPAM data[12] show, between 1992 and 1996 the bovine cattle stock has grown to more than 4 million head in the north.

Table 3.6: Use of land per rainfall zone in Legal Amazonia – 1996

Rainfall zone	Total area (000 ha)	Area of agricultural establishments (% of rainfall zone)	% of agricultural establishment area in agricultural use
Dry	83,657.2	55.6	38.2
Transition	181,624.0	28.7	13.0
Humid	219,488.7	7.5	3.2
TOTAL	**484,770.0**	**24.0**	**12.9**

Source: World Bank

Table 3.7: Main uses of land in Legal Amazonia, per category of productive activity and per rainfall zone – 1996

Rainfall zone	Area in use (%)	Area of pastures (%)	Area of temporary crops (%)	Area of permanent crops (%)	Abandoned areas (%)	(1) Others (%)
Dry	100.0	83.3	5.1	0.5	8.4	2.6
Transition	100.0	77.6	9.1	1.9	7.7	3.6
Humid	100.0	56.8	7.2	4.4	20.9	10.7
TOTAL	**100.0**	**77.6**	**6.8**	**1.5**	**9.5**	**4.6**

Source: World Bank; (1) includes planted forests and lands in rest.

Observation: Note that “abandoned areas” are included in ”area in use”, as per the quoted World Bank study. The authors did not define “abandoned areas”, nor why they included them in “agricultural use”. This inclusion differs, therefore, from the classification adopted in Table 4.

Cattle-raising, and its effects on Amazonian deforestation, have been thoroughly investigated in the search for explanations about progress and expansion of the agricultural frontier in the region. According to Margulis, S.[13] there still is a lack of more consistent explanations on some variables and field observations, and one of the most important perhaps refers to the persistence of cattle-raising expansion in spite of various indicators that point in the direction of its low profitability. As Margulis points out, quoting Schneider, R. *et al.*[6], until the end of the 1980s, various studies showed that cattle-raising had no satisfactory financial performance with the use of traditional technology (that is, it would only be feasible if there were fiscal incentives, subsidized credit, speculative gains on land and favourable input/cattle price relation). From the 1990s, some studies, like those of Mattos and Uhl[14], started indicating positive feasibility for small dairy cattle production and cattle-raising in reformed pastures, and more recently Muchagata *et al.*[15] confirmed low rates of return for traditional extensive cattle-breeding and better rates for small dairy cattle production close to roads in the region.

Notwithstanding these findings, according to Schneider, R. *et al.*[6], the increase of bovine cattle-herds and of extensive cattle-raising of big and small animals continues without much economic and financial justification. In the past, economic incentives and stimuli granted by government (mainly subsidized credit and regional fiscal incentives) to the activity may have been an important factor in the maintenance and expansion of cattle-raising in Amazonia. However, nowadays this is no longer the case.

There are various suggested hypotheses that argue in favour of different factors that are not captured in the models which try to estimate "theoretical" return rates for the activity. For example, some of these factors linclude the following: net capital gains that are easily tradeable; land value increase and guarantee of land tenure by the existence of cattle; low risk of the activity; low levels of human capital and the reduced opportunity costs of labour, which are required by the activity and that are characteristics of the expansion frontier regions; smaller initial investments; ease of carrying out the activity; indirect benefits like animal traction; fertilizing; political and cultural power, etc.. Some of these factor were pointed out by Faminow *et al.*[16] as advantages of cattle-raising in relation to other uses of land, and according to Schneider *et al.*[6] still need more empirical verification.

Turning back to Table 3.7, and leaving cattle-raising aside, it will be seen that temporary and permanent crops occupy only 8.3 per cent of the total area in agricultural use in Amazonia, as shown by the 1996 agricultural census data compiled by Chomitz and Thomas[8].

Although the Amazon, with its harvested area of temporary and permanent crops, participates with a still modest share (4.6 per cent in 1995) in the total harvested area of the country, this participation has increased considerably in the 1960-95 period: in 1960 it was only 1.5 per cent of the national total, the regional harvested area having jumped from 432 thousand ha in 1960 to 2.3 million ha in 1995. This is evidence of the significant increase in the participation of the Amazon harvested area in the total of the country. Until 1980 this share had only slightly evolved (it was then only 1.9 per cent of the national total). From the end of the 1980s, and especially from the mid-1990s, the share of the regional harvested area increased considerably in the Brazilian total (data from Monteiro Neto, A.[10]).

In the last 25-30 years the expansion of large-scale cultivation of grains in the Amazon – more specifically in the regions that constitute the so-called deforestation arch (the more meridional regions, drier and in contact with the cerrados of the central plateau) to the south of Maranhão, south/southeast of Pará, north of Tocantins and Mato Grosso – has attracted attention because of the surprising growth it has been showing. This expansion in grain production has also attracted international attention, not only for the environmental consequences of the extensive forms of production based on forest land conversion, but also for the perspectives of the country's greater competitive potential in the international markets of agricultural commodities. The case of soybeans is illustrative of this picture. In fact, the most evident feature of grain production is the need for big land extensions to create the necessary scale for international competitiveness. On the other hand, if such an expansion occurs, without the adequate technological conditions, and in sites/areas that are also not adequate and do not provide economic and environmental sustainability for the crops, conditions for maintaining conquered shares in international markets and avoiding environmental losses and damages cannot be guaranteed.

According to data compiled by Monteiro Neto, A.[10], considering the six main types of grains (rice, herbaceous cotton, beans, corn, soya and wheat), the Amazon evolves from a production of 204 thousand tons and a harvested area of 190 thousand ha in 1973, to almost 1.8 million tons and a harvested area of 1.27 million ha in 1997. This means that production has been multiplied by 8.8 times and harvested area by 6.7 times.

Despite the growth that occurred in these last three decades in the production and harvested area of grains, the Amazon's participation in the country's total grain production activity is still relatively small: in 1997, relative participation of regional production and harvested area in the national total were 2.4 per cent and 3.6 per cent, respectively, against 0.6 per cent and 0.7 per cent in 1973.

Although the region's participation in the country's total production is still small, data show that the importance of the Amazon for growing grains has been increasing due to the: (i) continued reduction, since 1988, of the total harvested area of grains in the rest of the country, meaning that the expansion of grains in the region has been compensating retraction in the other areas of Brazil; and (ii) as well as to the extensive expansion of the activity (that is, the increment in the relation between harvested area in the north to that of Brazil as a whole), which has been superior to the increment of the participation of the region's production

of grains in the national total, in the last three decades, revealing that growth is taking place more on account of the expansion of areas than to the productivity gains.

Finally, in the face of this expansion in grain cultivation in Amazonia, one may enquire about possible competition, or substitution, between cattle-raising and other large-scale agricultural crops in the region. As pointed out by Margulis, S.[13], "there have been indications that large-scale agricultural production in the region does not seem possible without a previous 'adaptation' of soils with cattle-breeding, particularly in the case of highly technically demanding crops like soya beans. Not for other reasons, perhaps, do soya crops only exist in the cerrado areas of Mato Grosso, Tocantins and Maranhão; there still is a lack of technological control and dominance in soya beans, before it outweighs cattle-raising in the south of Pará".

3.3.3.4 The "deforestation arch"

Brazil is one of a few developing countries that have a modern and comprehensive forest cover monitoring programme for most of its territory. Known as PRODES (Project of Brazilian Amazon Deforestation Estimates), and coordinated by the National Institute of Spatial Research (INPE), the monitoring of the Amazon forests has been systematically carried out for many years (since 1988) through the employment of satellite remote sensoring techniques, using the images of the north American Landsat satellite, in coloured compositions, in the scale 1:250,000, which provides the identification of deforestation areas bigger than 6.25 ha.

As Krug, T.[17] observes, the singularity of this programme is associated with the frequency with which deforestation sites in the Brazilian Amazon are verified, as well as with the geographical scope and extension of the area in question. In most of the countries (mainly the tropical ones), their forests are monitored every five or 10 years, and in a way that is not necessarily comprehensive. Therefore, Brazil has been generating annual estimates of the mean average rate and extension of gross deforestation since 1988 for the entire Legal Amazon region based on an annual basis of 229 images of the TM-Landsat satellite. Each year, an overlay containing all deforestation sites that were identified until last year is placed over each image of the Amazon. Polygons are then delimited if they present a "clear cut" pattern of deforestation. The fact that PRODES is carried out every year, involving alterations of forest areas that promote soil exposure, makes identification of an affected area by deforestation unequivocal, without the need of a field verification.

Additionally, this methodology allows the crossing of deforested areas with other types of data, such as the municipal limits, the vegetation map of Brazil (Radambrasil surveys, IBGE) and others. The significant progress provided by the continuous development of the technology of geographical information systems has also permitted PRODES to evolve from a simple presentation of illustrative tables and deforestation graphs to generating relevant data to public, federal or state institutions of environmental control and inspection, mainly for the purposes of carrying out prognoses, in which knowledge of the geographical location and spacing of deforestation over time is fundamental.

Deforestation, in the monitoring implemented by INPE, is understood as the conversion of areas of primary forest physiognomy by human actions for the establishment and development of agro-silvo-pastoral activities. Deforestation detected by PRODES is a "gross deforestation", that is, only altered areas by anthropogenic actions of forest cover removal known as "clear cut". So, the net result between deforested areas and regrown areas (succession or secondary regeneration) is not taken into account, i.e. one does not consider areas that are already recuperated or in process of recuperation. Forest cover alterations due to exploitation of selective timber cutting activities that do not immediately result in the total removal (clear cut) of forest cover, are also not captured. Areas affected by forest fires are not included either, though these are the object of other specific INPE reports (since 1988 Brazil has had a system of national prevention and combat of forest fires (PREVFOGO) under the coordination of IBAMA. In May 1998, a national programme for the prevention and control of burnings and forest fires in the deforestation arch (PROARCO) was created, and has since been coordinated by IBAMA, involving federal institutions like INPE and other state institutions – this programme is based on a monitoring system of daily maps of heat

foci, fire risk maps and alert systems for the municipalities of the Amazon, all stemming from daily images of the NOAA and GOES satellites.

The last report of INPE[18] (May 2000) shows the complete and final estimates of deforestation in Legal Amazonia for the period 1998/1999, and the provisional estimates for total deforestation that occurred in the region in 1999/2000. Tables 3.8, 3.9 and 3.10 present the deforestation data per state of the Amazon.

Table 3.8: Extension of gross deforestation (km^2) from January 1978 to August 1999

Amazon States	Jan/78	Apr/88	Aug/89	Aug/90	Aug/91	Aug/92	Aug/93	Aug/94	Aug/95	Aug/96	Aug/97	Aug/98
Acré	2.500	8.900	9.800	10.300	10.700	11.100	12.064	13.306	13.742	14.203	14.714	15.136
Amapá	200	800	1.000	1.300	1.700	1.736	1.736	1.782	1.782	1.846	1.962	1.963
Amazonas	1.700	19.700	21.700	22.200	23.200	23.999	24.739	26.629	27.434	28.140	28.866	29.616
Maranhão	63.900	90.800	92.300	93.400	94.100	95.235	95.979	97.761	99.338	99.789	100.590	102.326
Mato Grosso	20.000	71.500	79.600	83.600	86.500	91.174	103.614	112.150	119.141	125.023	131.808	137.610
Pará	56.400	131.500	139.300	144.200	148.000	151.787	160.355	169.007	176.138	181.225	188.372	194.619
Rondônia	4.200	30.000	31.800	33.500	34.600	36.865	42.055	46.152	48.648	50.529	53.275	55.274
Roraima	100	2.700	3.600	3.800	4.200	4.481	4.961	5.124	5.361	5.563	5.791	6.112
Tocantins	3.200	21.600	22.300	22.900	23.400	23.809	24.475	25.142	25.483	25.768	26.404	26.613
Brazilian Amazon	152.200	377.500	401.400	415.200	426.400	440.186	469.978	497.055	517.069	532.086	551.782	569.269

Source: INPE, 1999

The utilization of GIS by PRODES/INPE, with the crossing of the deforestation polygons and the vegetation map of IBGE, has made it possible, for example, to verify that around 63 per cent of identified deforestation in the last five years (average percentage from 1995 to 1999) has occurred in areas of dense and open rain forests. It has also been possible to build classes of deforestation sizes that allowed the identification of deforestation patterns for each type of affected vegetation (pioneer formations, forested *campinarana, cerradão,* contact/transition region, seasonal forest, open and dense rain forests).

According to Krug, T.[17], the continuous monitoring of the forest cover of Amazonia and the crossing of information by PRODES permit verifying that the major part of deforestation activities in the Amazon (approximately 75 per cent) has traditionally concentrated in a limited and specific portion of the Amazonian region, that has come to be known as the “deforestation arch”. The arch covers part of the states of Acré, Rondônia, Mato Grosso and Pará, and is covered by 50 TM-Landsat images, that is, 75 per cent of total deforestation is concentrated in approximately 20 per cent of the images that cover the whole region (see Map 3.8).

Table 3.9: Average rate of gross deforestation (km^2/year) from January 1978 to August 1999

Amazon States	77/88*	88/89	89/90	90/91	91/92	92/94**	94/95	95/96	96/97	97/98	98/99
Acré	620	540	550	380	400	482	1.208	433	358	536	441
Amapá	60	130	250	410	36	-	9	-	18	30	-
Amazonas	1.510	1.180	520	980	799	370	2.114	1.023	589	670	720
Maranhão	2.450	1.420	1.100	670	1.135	372	1.745	1.061	409	1.012	1.230
Mato Grosso	5.140	5.960	4.020	2.840	4.674	6.220	10.391	6.543	5.271	6.466	6.963
Pará	6.990	5.750	4.890	3.780	3.787	4.284	7.845	6.135	4.139	5.829	5.111
Rondônia	2.340	1.430	1.670	1.110	2.265	2.595	4.730	2.432	1.986	2.041	2.358
Roraima	290	630	150	420	281	240	220	214	184	223	220
Tocantins	1.650	730	580	440	409	333	797	320	273	576	216
Brazilian Amazon	21.130	17.860	13.810	11.130	13.786	14.896	29.059	18.161	13.227	17.383	17.259

Source: INPE, 1999

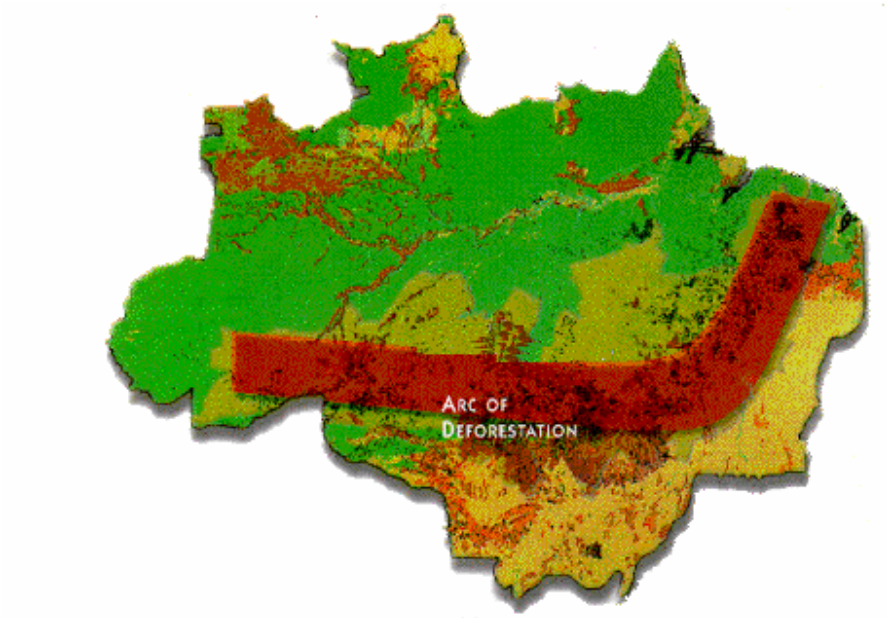
Compounding this deforestation arch, the southern areas of Legal Amazonia, drier and in contact with the central plateau cerrado regions, due to the lower cost of land, the greater availability of access roads, the greater relative proximity of bigger urban centres of the rest of the country, the cheap supply of labour, the easier clearing of forest areas with less vegetation density – areas that correspond to the regions of the south of Maranhão, south/southeast of Pará, north of Tocantins, and Mato Grosso – have in the last decades attracted the attention of corporate business groups that have shown interest in large-scale grain cultivation, as well as in the expansion of cattle-raising and timber exploitation associated with the wide availability of wood that comes from deforestation.

Table 3.10: Average rate of gross deforestation (%/year) from January 1978 to August 1999

Amazon States	77/88*	88/89	89/90	90/91	91/92	92/94**	94/95	95/96	96/97	97/98	98/99
Acré	0,42	0,39	0,39	0,28	0,29	0,35	0,86	0,31	0,26	0,40	0,33
Amapá	0,06	0,12	0,23	0,37	0,03	-	0,01	-	0,02	0,03	-
Amazonas	0,10	0,08	0,04	0,07	0,06	0,03	0,14	0,07	0,04	0,05	0,05
Maranhão	1,79	1,30	1,03	0,63	1,07	0,35	3,21	2,01	0,40	0,99	1,21
Mato Grosso	1,01	1,31	0,90	0,84	1,05	1,40	2,43	1,56	1,25	1,56	1,71
Pará	0,62	0,55	0,47	0,37	0,37	0,42	0,78	0,62	0,41	0,58	0,51
Rondônia	1,11	0,78	0,91	0,62	1,27	1,46	2,75	1,45	1,18	1,23	1,44
Roraima	0,18	0,39	0,10	0,27	0,18	0,15	0,14	0,14	0,11	0,14	0,14
Tocantins	2,97	2,00	1,61	1,61	1,17	0,95	2,29	0,94	0,81	1,73	0,66
Brazilian Amazon	0,54	0,48	0,37	0,30	0,37	0,40	0,81	0,51	0,37	0,48	0,48

Source: INPE

Map 3.8: The deforestation arch in Legal Amazonia



In this strip of land, the width of which varies between 300 and 500 kms, the public power has been intensifying its investments in infrastructure, expanding and improving the transportation routes, increasing energy generation capacity, etc. All of this region, which has shown a greater dynamism and greater supply of jobs, has also been a place of intense social mobilization, with an overloaded infrastructure of public social service, where poor supply of basic needs has been provoking an increase in social tensions.

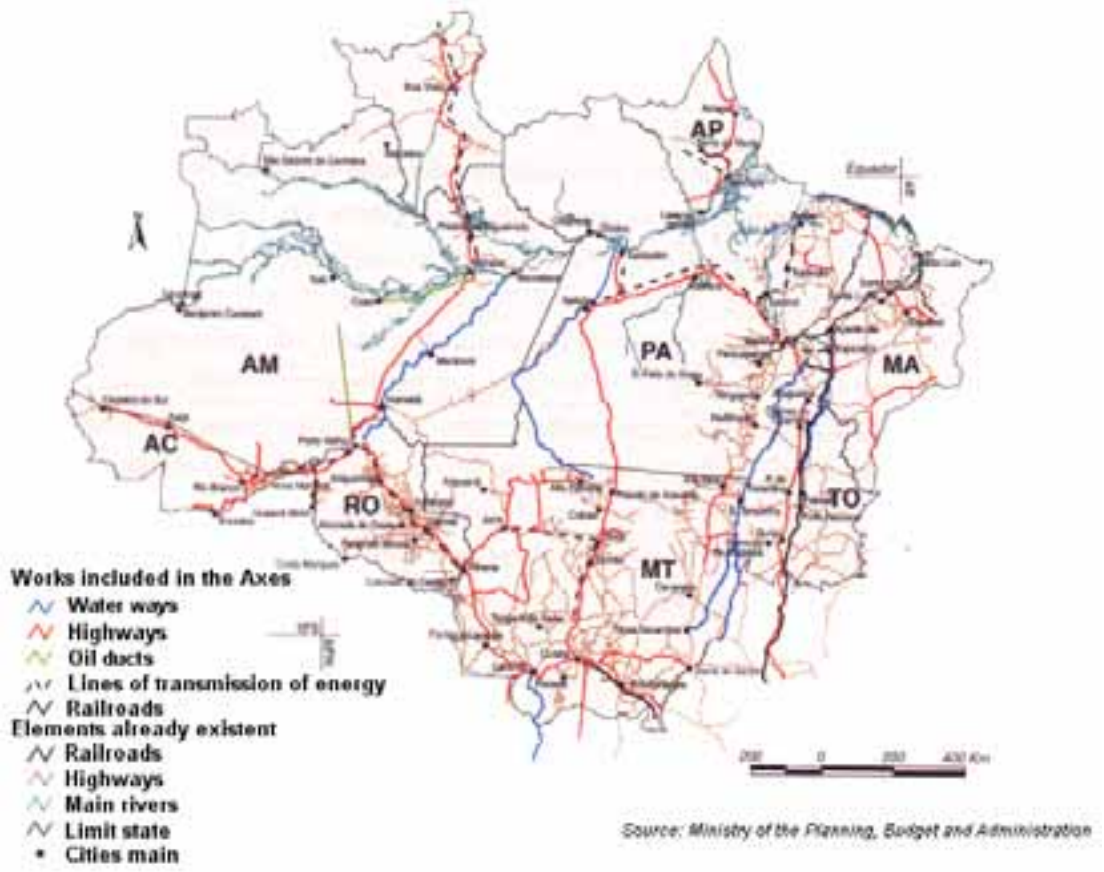
In the more oriental portion of this "arch", a wide institutional public and private "consortium" has determined a large polygon (known as the area of the "Great Carajás" programme, based on the Carajás-Iron Mining Project) where the development of strategic actions would benefit from the modern infrastructure of the Carajás/São Luís railway, federal and state roads, the Itaqui port in Maranhão, the Araguaia/Tocantins waterway and other available large physical investments aimed at ensuring the bases for modern technology agri-businesses. In the more occidental extremity of the "arch", another similar "consortium" has provided feasibility to one of the most important multi-modal routes of regional channelling of production: the waterway of the Madeira/Amazonas rivers, placing wide agricultural areas located in central Brazil in an advantageous market competitive position. Map 3.9 provides a view of the main routes of penetration and access to the regions of the "deforestation arch", and others, in the Brazilian Amazon.

The crossing of PRODES satellite images information with that of the vegetation map of Brazil (IBGE) and the employment of GIS techniques has provided a means of extracting some conclusions about the profile of deforestation in the Amazon, particularly in the "deforestation arch". Thus, for example:

- in the 1995/99 period, in which it was identified that 63 per cent of deforestation occurred in areas of dense and open rain forests, it was also found that around 20 per cent of the total number of deforestation polygons in these forest areas are smaller than 50 ha, and approximately 10 per cent are larger than 1,000 ha (average percentages for the 1995/99 period), while a major part of deforested areas in the contact/transition regions (around 21 per cent) are bigger than 1,000 ha. These differences in the pattern of deforestation serve as indications or empirical evidence for the comprehension and analysis of the possible causes or factors of the deforestation process. In the examples cited, one may speculate, for

instance, that big extensions of deforested areas in regions of transition/contact may be linked to the expansion of large-scale crops or cattle-raising, while the small deforested areas would be linked to small-scale subsistence agriculture or occupation of lands for the purpose of agrarian reform;

Map 3.9: Legal Amazonia – national integration and development axes of the "Avança Brasil" programme



- in relation to the whole period of 1978/99, a significant variation of the gross deforestation rate has been observed each year, having ranged from around 29,000 km^2 (1994/95, the largest observed rate since 1978) to 13,000 km^2 (1996/97, second smallest rate estimated since 1978), a difference that occurs in only two years (from 1994/95 to 1996/97). As pointed out by Krug, T. op. cit., much debate and speculation exists about the possible causes that may explain these variations, mainly those of an economic nature, such as the changes in the economic and monetary stabilization policy of the country with the "Real Plan" in 1994, decrease in the real value of lands in the Amazon, etc. Nevertheless, one still needs a more comprehensive explanatory model, capable of justifying the variations that occurred in the deforestation rate in the Amazon and that can provide more secure prognoses of the behaviour of deforestation;
- another type of information provided by the surveys of INPE/PRODES refers to the quantification of primary forest areas that are affected by activities of selective timber exploitation type, in sites that are not, or will not be, immediately subject or suitable for deforestation or clear-cutting, in the process of converting land to agricultural use. This has been a point of controversy in the literature and in the analyses about the "true extension" of deforestation in the Amazon (as examples of studies that criticize data/information of PRODES/INPE, and that try to show that the extension of deforestation in the region is larger than that pointed out by INPE, one may quote the work of

Nepstad, D. *et al*.[19], and as reply the work of Krug, T. *et al.*[20]). As per the specific surveys carried out by INPE, from TM-Landsat images that showed a pattern associated with the selective type of timber exploitation (in which only a few high value species per unit of area are extracted in the forests) this leaves a still significant area covered by forests. The analysis – done for each year, from 1988 to 1998, and based on visual interpretation – identified 26 scenes (among the 229 that cover the whole of Legal Amazonia) with that pattern, with different intensities of exploitation. The data obtained by the analysis provided the following conclusions: (a) the average annual increment (extension) of areas associated with selective cut were only of the order of 2,000 km^2; (b) of the delineated polygons for the 1988/98 period, 40 per cent ceased to show a spectral pattern of selective cut type, which suggests that the affected areas were in process of recuperation, i.e. the pattern of these areas began to be confused with that of primary forests; (c) 15 per cent, therefore, of the delineated polygons, in the period, began to have a pattern corresponding to clear-cut activities of effective conversion to agricultural use; (d) the remaining polygons still presented, in 1998, a pattern of selective cut; (e) the average time for an area submitted to selective cut to stop showing signs of this type of activity in the images is close to four years.

Another interesting description of the evolution and profile of deforestation in the Amazon, that has already been used for optimizing "command and control" actions of environmental monitoring, inspection and policing in the region, either by IBAMA or by OEMAs, is that which refers to the spatial location of deforestation by municipalities that mostly concentrate these forest-cover conversions to other land use. Map 3.10 is the result of joint work carried out by the Secretariat of Amazonia/Ministry of the Environment (SCA/MMA) and IBAMA, and shows that the great majority of municipalities that mostly account for deforestation in Legal Amazonia lie in the "deforestation arch".

According to data compiled by Menezes, M.[21], as per Table 3.11, 47 municipalities responsible for 50 per cent of deforestation that occurred in the states of Mato Grosso, Pará and Rondônia (the three states that contribute with 86 per cent of total deforested area in the region) cover an approximate surface of 568,000 km^2 (or 13.6 per cent of the whole surface of the region). If the 139 municipalities that account for 90 per cent of deforestation in these three states are taken into account (which amounts to 77.4 per cent of deforestation in Legal Amazonia as a whole) one comes to a total surface of 1,238,000 km^2 (which is almost 30 per cent of the region's surface).

This finding, although showing that there is a concentration of deforestation in a gigantic extension of lands, but restricted to a relatively small number of municipalities, is more important for the strategic content of its political message or implication for the control of deforestation in the sense that the responsibility for monitoring, control and public decision-taking concerning the expansion (or reduction) of deforestation should also fall on the shoulders of the local public power (municipalities) and not only on federal or state fields of action. But such implication also poses a further problem: local public decision-taking on issues like deforestation tend to be very much influenced by local vested interests (interests of people directly involved in and willing to expand conversion of forests to other uses) and by short-term financial gains that local public power see as forthcoming by the expansion of whatever production can be created in the municipality. Moreover, these large municipalities, whose territories are bigger than many countries in the world, are indeed very poor and certainly do not have the means to devote adequate efforts to controlling and combating deforestation.

Map 3.10: Legal Amazonia – distribution of municipalities that mostly concentrate deforestation – 1997

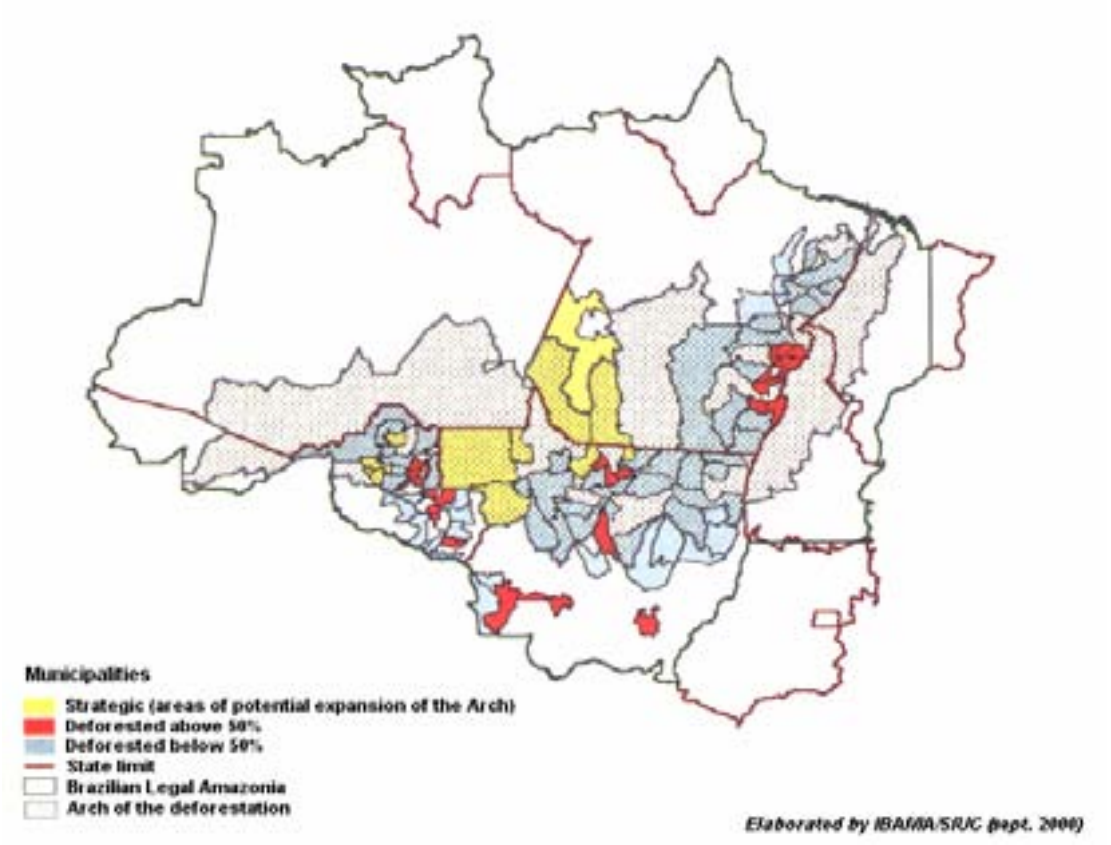


Table 3.11: Number of municipalities that contribute with progressive deforestation rates (50 to 90 per cent) in the states of Mato Grosso, Pará and Rondônia, with their respective shares in regional deforestation and percentage classification in relation to all 624 municipalities of Amazonia

Participation	Number of municipalities	Share (%) of municipalities in region's deforestation	% of Municipalities in the region's total (624)	Total area of municipalities (km^2)	% of total region's surface
50	47	43.0	7.7	568,659	13.6
60	65	51.6	10.4	720,047	17.3
70	85	60.2	13.6	907,045	21.8
80	108	68.8	17.3	983,913	23.6
90	139	77.4	22.3	1,238,285	29.7

Source: Menezes, M.

This points to the need for establishing institutional partnerships, governmental and non-governmental (such as, for example, the implementation of federative pacts among the Union, states and municipalities for the execution of environmental policies and decentralization of environmental management, etc.) with the purpose of optimizing, and making more effective, the establishment and operation of an integrated system of environmental monitoring and control that makes use of modern instruments of remote sensoring, licensing and inspection, capable of operating in such a vast region like Amazonia.

3.3.3.5 Private areas x public areas and conservation units

Private areas

According to the latest statistics from the "Registry of Rural Properties of Brazil" (1998), produced by INCRA, the structure or profile of private land tenure in Legal Amazonia can be depicted as in Table 3.12. The data from this Table reveal an extremely concentrated pattern of private land distribution in the Amazon region, a concentration much stronger than that which prevails for Brazil as a whole, according to INCRA data. As will can be seen from Table 3.12, almost 90 per cent of all rural properties in Amazonia hold less than 20 per cent of the total area occupied by these estates or, in other words, more than 80 per cent of the total area of rural properties are concentrated in a bit more than 10 per cent of these properties.

Note: The rural modules are defined in Law 4504/64 (Land Statute) as the necessary area to guarantee the economic subsistence of a cropper and his family; the dimensions of the modules of rural properties are established by municipality of the Amazon, whose maximum dimension, per module, is the following: in Acré, up to 100 ha; in Rondônia, up to 60 ha; in Amazonas, up to 100 ha; in Roraima, up to 100 ha; in Pará, up to 75 ha; in Amapá, up to 70 ha; in Tocantins, up to 80 ha; in Mato Grosso, up to 100 ha; and in Maranhão, up to 75 ha.

Table 3.12: Profile of private land tenure in Legal Amazonia – number of private properties (estates) and total area, per classes of area size of the properties – 1998

Classes of area size of properties (ha)	Total number of properties			Total area of properties		
	In units	In percentage		In 000ha	In percentage	
		Smple	Accum		Simple	Accum
Up to<25 ha	53,525	13.7	13.7	681.85	0.4	0.4
25 to<50 ha	72,305	18.5	32.2	2,614.06	1.4	1.8
50 to<100 ha	103,476	26.5	58.7	7,040.68	3.9	5.7
100 to<200 ha	70,124	18.0	76.7	8,035.19	4.4	10.1
200 to<500 ha	43,142	11.2	87.9	13,433.15	7.4	17.5
500 ha to more	47,107	12.1	100.0	149,359.90	82.5	100.0
Total	389,679	100.0	-	181,164.83	100.0	-
Up to ≤ 1 module	219,873	56.4	56.4	14,554.25	8.0	8.0
>1 to ≤ 2 modules	70,358	18.0	74.4	14,554.25	8.0	8.0

Source: Estatisticas Cadastrais – INCRA – 1998.

From the point of view of taxation on land property, and corresponding to what is established in Law 9393/96 that instituted the new ITR (and in compliance with the dispositions of art. 153, §4, of the Brazilian Constitution, that the ITR cannot be levied on small rural properties when these are exploited by the owner alone, or with his family, provided he does not own another property), small rural properties or estates are exempt from the tax and, in the case of Amazonia, are defined as properties with area equal to or smaller than 100 ha if located in a municipality of western Amazonia, or with area equal to or smaller than 50 ha if located in a municipality of eastern Amazonia.

Based on these definitions, and using the data from Table 3.12, one can estimate that at the very least there would be 219,873 small properties in Legal Amazonia (56.4 per cent of the total of registered properties in the region) that would hold around 14.5 million ha (only 8 per cent of the total area of properties) of land.

It is interesting to compare this information about the structure of private property of land in the Amazon region with some of the findings of PRODES, as per the INPE surveys. As we have remarked (under 3.3.3.4), it has been identified that from 1995 to 1999 around 20 per cent of the total number of deforested sites in areas of dense and open tropical rain forests were smaller than 50 ha, and that it had been speculated

that these small or smaller deforestation sites could be associated with small-scale or subsistence agricultural activities, or occupation of lands by settlements of agrarian reform, that is, that deforestation in the small properties of Amazonia would also have a relevant role in the composition of the global deforestation rate in the region, despite the weight of bigger deforested sites in the properties with bigger areas.

Surely, if we separate the very small properties, with less than 25 ha (see Table 3.12), and the total area that they occupy, the impact or contribution of the deforestation attributed to them on total regional deforestation should be insignificant. But, as we move up on the scale of the sizes of rural property areas in the region, and consider that, for the Amazon, small property is something that goes up to 100 ha (inclusive), then we can see that the group of small properties may indeed have a more relevant weight on the global regional rate of deforestation, without necessarily transforming them into the main deforestation agents in the region.

The implications of this finding for the purposes of control, monitoring and policing of deforestation, and for the enforcement of the legislation that regulates it, are important. One cannot underestimate the weight of these small properties, and pretend, for example, to concentrate actions only in the monitoring and control of big properties (something that would be less costly and operationally easier given the possibility of using modern technologies to identify more quickly the big deforestation sites and to arrive sooner at the places with policing and inspection teams). Much less should one concede a more favourable or acquiescent treatment to "average" size properties (up to 400 ha, for example, as has been the case of Normative Instruction 03, dated 04.03.2002, of the Ministry of the Environment, still in force, that attenuated requirements for the authorization of deforestation in properties up to such an area) on the assumption that a more rigid and systematic control would be necessary, in fact, only for bigger properties (more than 400 ha) since these would be the ones that would generate a significant impact on the global rate of deforestation. As can be seen from Table 3.12, the extension of the area occupied by properties whose individual size reaches 400 ha, in the entire Amazon region, is quite significant and has even more weight in the total. It is a concrete possibility, therefore, that deforestation in these properties has a more than negligible influence on global regional deforestation.

Another important aspect of the deforestation question, be it in small or big properties, is that related to the supply to the markets of native timbers that become available and originate from deforestation that occurs in these properties. Although the relative weight of "small", in terms of deforested area, may be less than that of "big" deforested areas, this proportionality, or contribution, may be different, or less apparent, in terms of the global supply of timber to the wood industry of the region. This is a more complex issue (with which we shall deal further below) with serious implications for the systems of enforcement of environmental norms and regulations in the control and monitoring of deforestation and of associated activities, including those of timber exploitation, particularly with regard to ensuring an authenticity/legality of the origin of native timber (derived from authorized deforested areas, small or big) that enters the country's markets.

Within the structure of private property of lands in Amazonia, one should highlight the official colonization and agrarian reform settlement projects existing in the region. Until August 2000, according to INCRA data, and as depicted in Table 3.13, there were 1,460 rural settlement projects in Amazonia, involving more than 300,000 officially settled families and a global area of more than 17 million ha (as per INCRA statistics, outside Amazonia – that is, in the rest of Brazil – 2,482 agrarian reform settlement projects had been established, involving 177,000 families and a global area of almost 4.9 million ha, which corresponds to an average estate of 27.7 ha per settled family).

As for the official colonization projects created in Legal Amazonia, up to August 2000 (in the recent past the so-called "private colonization" was an option largely used in the region, particularly in states like Mato Grosso, for instance) the data indicate that around 13.3 million ha have been involved in this modality of transference and occupation of lands in the region (while in the rest of Brazil only 138,000 ha would have been the object of colonization projects). In general, in Amazonia, the average area of rural estate per

family involved in a colonization project has been bigger than that of the agrarian reform settlement projects. Based on these data one can see that up to August 2000 at least 30 million ha of land had been utilized for and transferred to peasants and rural producers in settlement and colonization projects in Legal Amazonia.

Table 3.13: Agrarian reform settlement projects created in Legal Amazonia – total area, number of projects and settled families, per state, up to August 2000

State	Area (000ha)	No. of projects	No. of families	Area/family (in ha)
Pará	5,692.38	368	98,616	57.7
Maranhão	1,925.19	391	59,979	32.1
Mato Grosso	3,340.19	279	56,149	59.5
Acré	783.03	57	10,615	73.8
Amazonas	1,342.65	30	16,297	82.4
Rondônia	1,073.47	83	23,223	46.2
Amapá	1,378.90	26	8,912	154.7
Roraima	954.58	29	13,670	69.8
Tocantins	807.35	197	17,506	46.1
Total	**17,297.74**	**1,460**	**304,967**	**56.7**

Source: INCRA, in MMA

Note: It should be noted that the data on registered properties of the "Estatisticas Cadastrais" of INCRA (of Table 3.12 above) include the properties that are part of settlement and colonization projects. Therefore, the figures of the present Table would be included in the data of Table 3.12, except for the amount that would refer to the period after 1998.

In general, and on the basis of observations in the region, it is common to hear (cf., for example, Fearnside, P.[22] and Sawyer, D.[4]) that on average "small rural producers or family croppers can only deforest up to 2-3 ha/year, with family labour, this being a pattern that is reflected in the deforestation behaviour in areas of rural settlement". Only for comparative purposes, and without the intention of giving the impression that small rural producers could be the main deforestation agents, taking as a basis INCRA's number of officially settled families in Amazonia (at least 300,000), as well as the average of 2.5 ha/year of forests cleared per family/cropper, it may be assumed that a total of around 700,000 ha per year of deforestation could be attributed to this part of the population in Amazonia. This would be a conservative figure, since, as Sawyer[4] well observes, in a rural population of 8 million people in Amazonia, or almost 2 million families, it is reasonable to assume that there are at least 1 million family croppers/producers in the region. The number of families and people involved in spontaneous settlements (non-official) in Amazonia - in adjacent areas to colonization and settlement projects, as well as in other new areas (where families are camped and will be incorporated into new settlements) or in areas of old frontiers - must amount to a number that is at least equal to what has been officially settled.

As is notorious, the Brazilian agrarian policy has for many years given emphasis to the occupation of the Amazon. In the 1970-1984 period, 71 per cent of discriminated lands in the country were in this region, with much less accomplishment in the other regions of the country. The insufficiency of other social policies would add to this, increasing the incentives to the spontaneous migration process directed to the Amazon. The region still continues to participate in the solution of problems of the other regions of the country, despite current intra-regional predominating over inter-regional migration, as we remarked before.

According to INCRA, and based on Weiss, J.[23], the proportion of beneficiary families in settlements of Amazonia, in relation to the total of settled families in Brazil as a whole, has been undergoing a process of reduction over time. In 2001, the regional target of INCRA for settling families in Amazonia corresponded to only 27 per cent of the national total, and in 2002 this proportion was reduced to 14 per cent. Another indication of this trend can be obtained from the relation of settled family/camped family: while in 2001 around 2.5 families for each camped family had been settled in Amazonia – 20,310 settled families in 2001

to 7,982 families already camped in 2002 – the target for 2002 has been reduced to 1.05 settled family/camped family in the region (this is more in line with the determinations of Law 4504/64 – the Land Statute – whose orientation commended agrarian reform for families in their areas of origin).

With this type of change in the implementation of the agrarian reform policy by INCRA, the regional target for the Amazon is reduced from 16,348 to 8,400 families to be settled. If such a trend is maintained, one could perhaps foresee a future reduction of the environmental impact of the agrarian reform policy in the region. Nevertheless, as stressed by Weiss, J., op.cit., the performance of the regional superintendencies of INCRA continues mostly to be measured in terms of the number of settled families against the established annual targets. Only more recently have "sustainability indicators" come to be considered as parameters for the evaluation of that performance.

Another area of agrarian policy in which the actions of the government have more recently come to be implemented in a more effective way is that of land regularization. It is interesting that this be mentioned here, because seeking land tenure regularity has a direct affect on the registry of lands in Brazil, and in particular in Amazonia, and thereby the data and information of this registry.

In order to bring the occupation of lands in the Amazon to a more normal pattern, and to know the holders of large areas, whether or not occupied by private agents, INCRA has been adopting different measures to combat irregular latifundia and irregular occupation of lands (such irregularity happens, in general, through the illegal way in which lands end up in the hands of private initiative, either under good faith acquisitions or under criminal methods that forge false documents (methods known as *"grilagem"*).

From 1999 to 2001 INCRA has strongly attacked the holders of rural properties, using legal requirements to know better the reality of land structure in the Amazon, on the basis of the Land Statute, the Brazilian Civil Code, the Forest Code and the Law of Public Registries.

According to information contained in Weiss, J., op.cit., INCRA has detected more than 100 million ha of land in the whole country, of which 70.5 million ha in the Amazon, that have been identified as irregular lands (*"grilagem"*). Table 3.14 presents the figures, per state of Legal Amazonia, of private irregular

Table 3.14: Areas identified as irregular (*"griladas"*) in Legal Amazonia – 2000

Area/State	Million ha
Acré	3.6
Amazonas	13.9
Amapá	0.8
Maranhão	4.1
Mato Grosso	22.8
Pará	20.8
Rondônia	1.4
Roraima	0.2
Tocantins	2.9
Total	**70.5**

Source: Ministry of Agrarian Development, in Weiss, J.

lands. In a partnership with the Secretariat of Federal Income (SRF), and on the basis of Law 10267/01 that is the basis for the National Registry of Rural Properties, INCRA has rescinded the records of individual properties larger than 10,000 ha (around 3,000) and of individual properties with areas between 5,000 and 10,000 ha (around 600). This, undoubtedly, reveals the fragility and deficiency of the registry statistics of INCRA for 1998 (and other years), last published data of the institute, and that have been used here to describe the agrarian structure of the Amazon. The data do not reflect a very trustworthy reality of the profile of private land distribution in the region. The elimination of records of properties taken as irregular

before INCRA and SRF creates a loss of identity for these estates, which results in a series of obstacles and restrictions that prevent these properties (and their alleged owners) from undertaking any sort of businesses, firming contracts, etc.

An important aspect of Law 10267/01 is that it foresees the national registry of rural properties linked to other registries of federal institutions, like SRF for example, and includes requirements such as the geo-referencing of the vertices of the properties' perimeters, particularly for the transference of properties. The effective implementation of the Law will solve a good part of the existing conflicts in relation to rural properties in the Amazon. Their holders, for instance, will be liable to be held responsible, in a more effective way, for environmental damages committed on their properties, damages that will come to be captured through satellite images. Undoubtedly, this is a particularly important point for the conception and building of a control and monitoring system for public environmental agencies (at federal or state levels), the attributes and competence of which are concerned with the enforcement of environmental legislation relative to the adequate use of land in the country (we shall comment more on some of these control systems that are already being used, at state level, in the Amazon region).

Public areas

Although a good part of the land in Amazonia is already in private hands – as per the 1998 statistics of INCRA, the total would be 181.16 million ha according to Table 3.12, or 110.66 million ha if we deduct the 70.5 million ha considered irregular by INCRA, cf. Table 3.14 – the major part is still in the public domain. Table 3.15 summarizes the general picture of land property in Legal Amazonia, highlighting the total of private areas and the areas in the hands of public power, the latter divided into public areas already legally defined (indigenous reserves, conservation units of strict protection and conservation units of sustainable use) and public areas still without legal discrimination or determination of destination or use.

As will be seen from Table 3.15, there are in Amazonia around 103 million ha legally defined as indigenous reserves (in the last 5-6 years, federal government demarcated more than 22 million ha of indigenous reserves in the region), 13.9 million ha determined as strict protection conservation units (national and state parks, biological reserves, ecological stations, etc. whose target established by federal government is to increase the area of this category of conservation unit to 10 per cent of the total area of the region, that is, to create more than 37 million ha of strict protection units in Amazonia) and 34.2 million ha defined as conservation units of sustainable use (national forests, extractivist reserves, reserves of sustainable use, and others). The states of the region with the largest surface areas legally defined as public areas are: Roraima (62.7 per cent) and Rondônia (43.3 per cent). Mato Grosso (16 per cent) and Tocantins (16 per cent) are areas that have the smallest proportions of identified public areas in relation to their territories.

There is at least 38 per cent (193 million ha) of land in Legal Amazonia in the hands of the public power, federal and state, that would not yet have a defined destination (areas in the power of INCRA, but still not destined for settlements, are part of this total). Although this represents an enormous quantity of land in the entire region, the situation is not so uniform at the state level. Some states, like Tocantins, Roraima and Rondônia, have smaller portions of undefined public areas than the average for the whole of the region (Mato Grosso would be the state with the smallest share, but given the extensive area of private land registries considered irregular by INCRA – 22.8 million ha – a good quantity of these lands could be reverted to public domain).

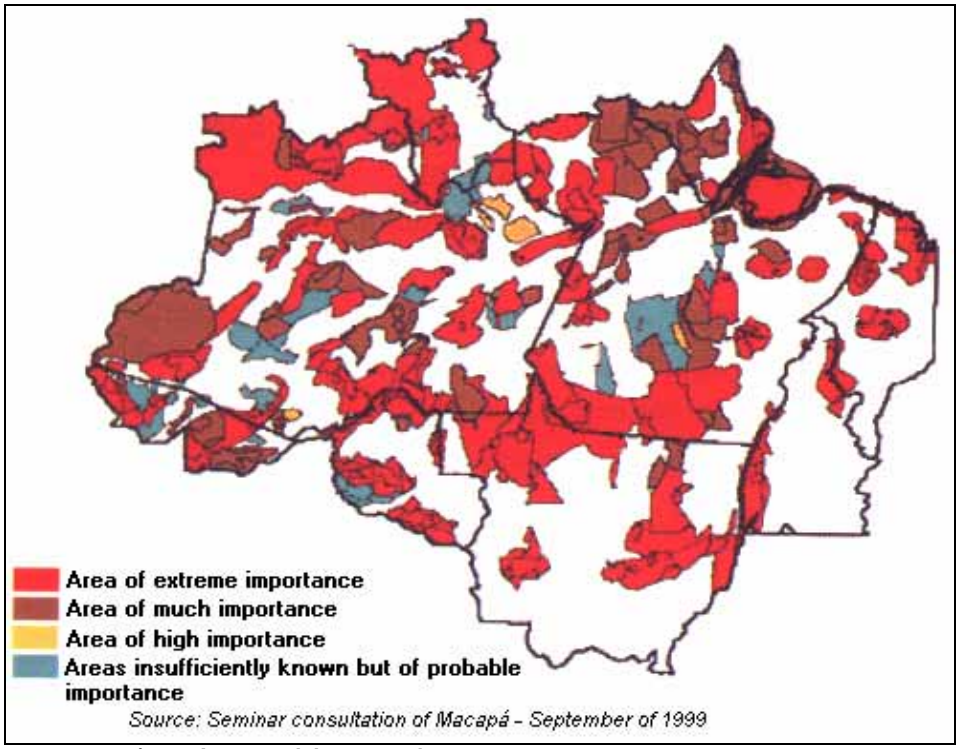
As for the quantity of area still in the hands of the public power (at least 193 million ha) there should be no lack of land for accomplishing the 10 per cent target of strict protection areas in Amazonia, as well as the target of the Brazilian national forest programme of creating a network of national forests in the same region with at least 50 million ha (there are already around 17 million ha of national forests in the Amazon).

The conflicts between land privatization policies in Amazonia and those of creation and destination of public lands for conservation units (be it for strict protection or for sustainable use) are a registered mark of the national geo-politics for the region and of its process of occupation. The creation by federal government of a federal conservation unit in a state of Amazonia often displeases the state government (even if lands

did not belong to the state government but to federal government) who would prefer, for example, to see those lands occupied by agricultural activities. Most of the time, the process of choice itself, and of definition and creation of a conservation unit, whether for strict protection or for sustainable use, has been marked by extreme positions of environmentalists who only accept strict protection for environmental conservation areas in Amazonia, and thus try to create difficulties when it is a case of creating areas for sustainable use in the region.

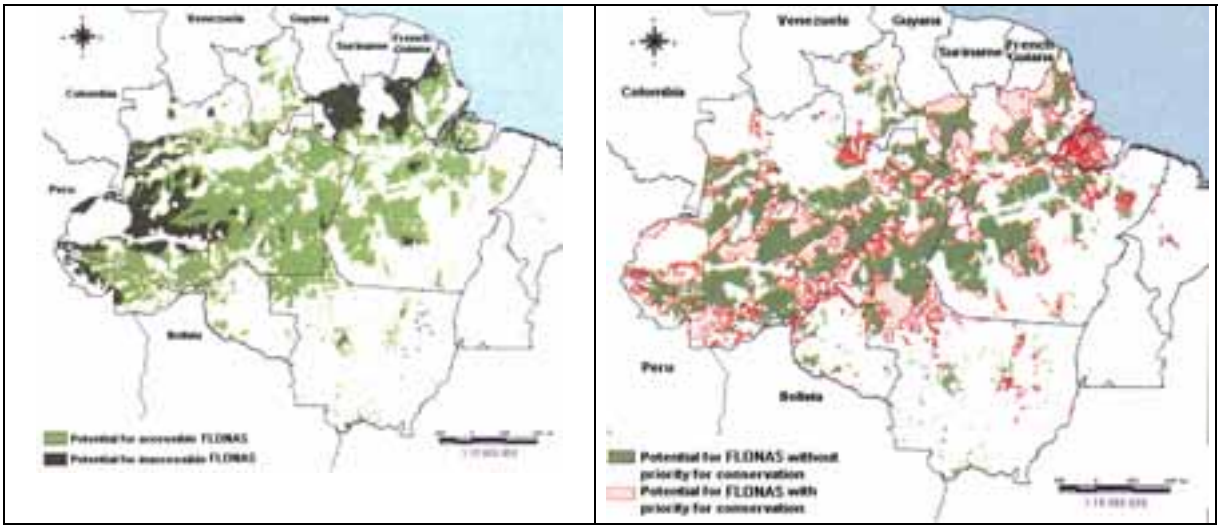
Nevertheless, in the last decade, there has been progress in the creation and establishment of conservation units in the region. INCRA, itself, by determination of the government and of the Ministry of Agrarian Development, is defining and transferring to IBAMA a total of 20 million ha of lands in the Amazon (resulting from areas regained by the policy of land regularization and rescinding records of properties considered irregular) for the creation of conservation units, out of which 14 million ha will be destined for the creation of national forests. The creation of conservation units in the Amazon relies today on a strong apparatus of technical and zoning studies that serve as a basis for the selection process and choice of the areas. In this respect, the studies promoted by the Ministry of the Environment should be mentioned: (i) the project of studies for the definition of priority areas for conservation of bio-diversity of the Amazon bioma, which was summed up in the Macapá Consultation Workshop in September 1999; and (ii) the study for the identification of areas with potential for the creation of national forests in Legal Amazonia. Maps 3.11 and 3.12 show the potential and priorities for the creation of these conservation units.

Map 3.11: Priority areas for the conservation of bio-diversity in Amazonia



Source: Macapá Consultation Workshop, September 1999

Map 3.12: Potential and priority areas for national forests in Legal Amazonia



There are various criticisms of the national system of conservation units of Brazil (Law 9985/00 established and defined this national system), among which those that allege that the government has been incapable of satisfactorily implementing this system, or that these units have only been created "on paper" and are not in fact protected (especially the units created in Amazonia), due to a lack of adequate infrastructure, personnel under-staffing and insufficient action by IBAMA to keep them. No doubt, the Brazilian Government and IBAMA are in need of means to better implement the system of conservation units in Amazonia.

But the simple organization or zoning of the territorial space in the region through the mere transformation of lands in areas of public domain by the creation of protected areas, such as indigenous reserves and conservation units – not to mention their benefits for the protection of bio-diversity and protection and guarantee of indigenous populations – has an extremely positive effect in safeguarding these spaces from the expansion of deforestation and privatization of lands through deforestation. And this has been a fact, as rightly demonstrated by Arima, E.[24], of superimposing the conservation units and indigenous reserves map on the map of heat foci in Amazonia identified by NOAA satellite. As will be seen from Maps 3.13 and 3.14, it becomes clear why there is no fire in enormous areas of the region. The occupation, deforestation and burnings are inhibited in these vast areas, even without the presence of IBAMA's inspection and policing, because these are public power lands and this helps to make invasion, occupation and resource depletion more difficult or infeasible.

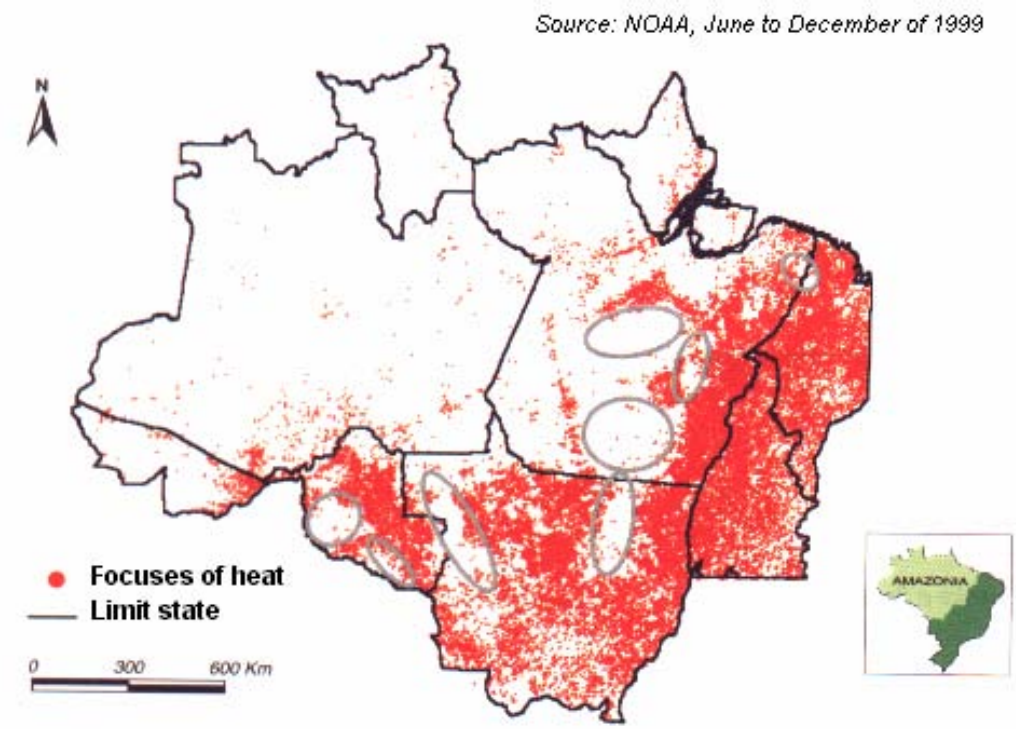
To conclude this section, a few points that serve as evidence of how the irregularity and insecurity of land tenure in the Amazon are associated with deforestation in the region should still be noted. An irregular and unclear land tenure framework is a characteristic feature of many regions in Brazil, particularly in areas with vast forest cover, as in Amazonia, but even in some areas still covered by the Atlantic forest.

According to agrarian and civil legislation in Brazil, people can claim land in the Amazon (as in other regions of the country) provided they have occupied a certain area for a certain period of time (a person who does not own lands can acquire up to 50 ha of rural land, making it productive, after an uncontested possession of five years) and that they have "improved" the area or "made it productive". Historically, to fell trees and to "clean" the land for crops and pastures have been considered, by INCRA, as an "improvement" or a "benefit". Deforestation has therefore been a rational decision for those that seek to obtain the possession and property of rural land. In the process of occupation of lands, deforestation ends

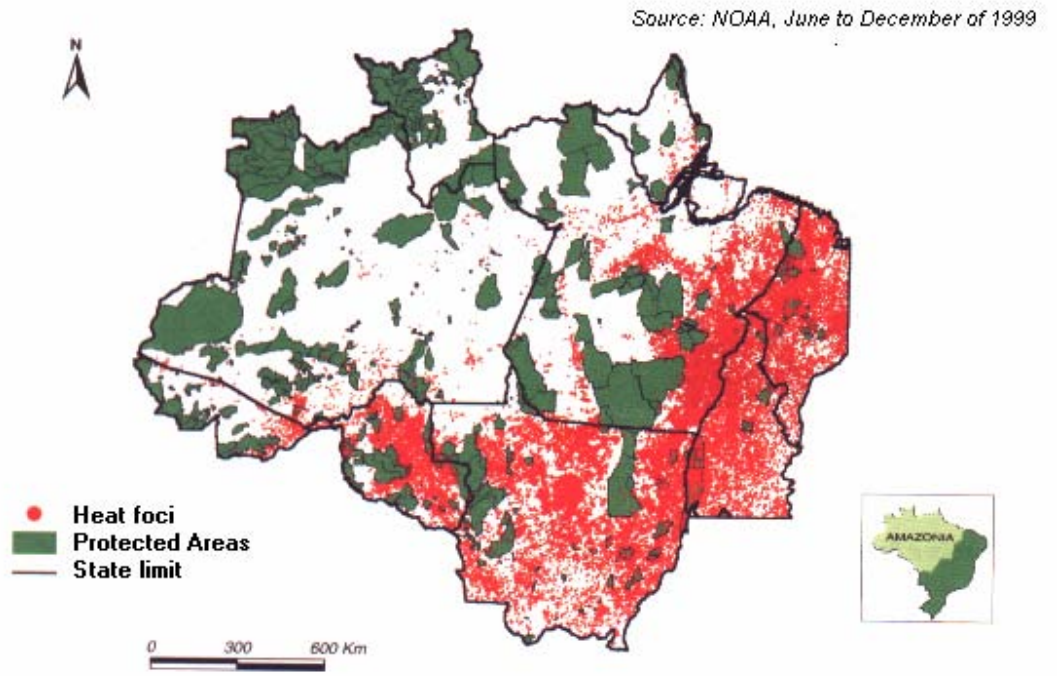
up being a means for the establishment of private ownership of lands, a pre-condition for the legalization of the property.

Land is incorporated into the private sector through various legal (leasings, public biddings, concessions, agrarian reform settlements in accordance with the Land Statute/Law 4504, usage based on occupation and possession, etc.) or illegal mechanisms ("*grilagem*", false registrations in notaries public, etc.). The possession of land, in general, is proved by lasting occupation and by deforestation. The irregular or illegal forms of getting possession or acquisition of land in Amazonia have been constant in the occupation process of the region, which contributes to increasing the inequality of access to land and use of natural resources, besides provoking serious conflicts and violence in the struggle for the possession of land.

Map 3.13: Heat foci – NOAA – June to December 1999



Map 3.14: Federal conservation units, indigenous reserves and heat foci in Amazonia



In Amazonia, the irregular and insecure regimes of land tenure have been indicated as one of the main factors that favour deforestation and serve as dis-incentives to SFM. Various authors, such as Weiss, J.[23], Margulis, S.[13], Viana, V.[25], Prado, A.C.[26] and others, single out the fact that the irregularity and insecurity of land ownership are an incentive to degradation of forest resources, favouring an attitude of converting gains from the exploitation of these and other natural resources, with quicker liquidation and loss of natural capital. When possession/property rights are not well defined, or are insecure, the planning horizon of involved agents reduces enormously, so that losses with the liquidation of natural capital do not get incorporated into their short-run decisions. The irregular and insecure tenure of land, therefore, favours deforestation and dis-favours environmental conservation and economy in the use, or sustainable use, of the natural forest resource. In this sense, therefore, such a framework of land tenure is something that militates against SFM.

Far from being a consensus, this issue is much disputed in the literature. So, for instance, while the team of Brazilians that participated in the elaboration of a World Bank sponsored study, "Forests in the Balance: Challenges of Conservation with Development – An evaluation of Brazil's Forest Development and World Bank Assistance"[27], is categorical in stating that clear and secure land possession and property rights are a prerequisite/condition for the conservation of forests in the Amazon through SFM (without which the chances for forest management to compete with the alternative activities that remove forests remain poor), the other authors of the document consider that there is no certainty, or consensus, that a framework of more security and regularity of land tenure contributes to reducing deforestation.

According to the cited document, and to the arguments of the authors referred to, on the contrary, "to accelerate the formal processes of ensuring clearer and more formal land tenure will probably increase the deforestation rate in small properties, since these will have easier access to credit", or that, "because greater security in land tenure leads to more investment in land, this could equally well apply to investments in

forest management or reforestation as to investments in deforestation/removal of forests for the establishment of agriculture or cattle-raising".

Authors like Weiss, J.[23], for example, are even more categorical in stating that a situation of secure and regular possession and ownership of lands in Amazonia is a *sine qua non* for better control of deforestation and for reducing the dis-incentives to SFM for which the current unclear pattern of land tenure is responsible. As the referred author says, "more important than the illegality of forest exploitation ("illegal logging") in the control of deforestation and in providing dis-incentives to forest management is the illegality of possession/property of lands in the Amazon".

Table 3.15: Use of land in Legal Amazonia – private areas x public areas and conservation units

State	(A) Surface (000 ha)	(B) Area of private properties INCRA/98 (000 ha)	B/A %	Public Areas (F) = C + D + E						(F) (000 ha)	F/A %	(A – B – F) / A
				(C) Indígenous reserves (000 ha)	C/A %	(D) CUs Integral protection (000 ha)	D/A %	(E) CUs sust. use (000 ha)	E/A %			
Acré	15,314.9	5,244.6	34.2	2,123.1	13.9	918.8	6.0	1,683.8	11.0	4,725.7	30.9	34.9
Amapá	14,345.3	1,881.8	13.1	1,084.4	7.6	894.3	6.2	1,855.5	12.9	3,834.2	26.7	60.2
Amazonas	157,782.0	17,190.5	10.9	39,705.6	25.1	6,337.4	4.0	7,872.7	5.0	53,915.7	34.1	55.0
Maranhão	33,336.5	15,336.8	46.0	1,886.5	5.6	698.2	2.1	4,022.9	12.0	6,607.6	19.7	34.3
Mato Grosso	90,680.6	72,814.4	80.3	12,747.3	14.0	806.7	0.9	1,041.7	1.1	14,595.7	16.0	3.7
Pará	125,316.4	38,019.7	30.3	27,952.3	22.3	1,529.7	1.2	9,096.3	7.2	38,578.3	30.7	39.0
Rondônia	23,851.2	6,557.9	27.5	4,937.5	20.7	1,427.8	6.0	3,971.4	16.6	10,336.7	43.3	29.2
Roraima	22,511.6	5,188.1	23.0	10,236.7	45.5	1,071.3	4.7	2,824.7	12.5	14,132.7	62.7	14.3
Tocantins	27,842.0	18,931.2	68.0	2,366.3	8.5	278.1	1.0	1,823.9	6.5	4,468.3	16.0	16.0
TOTAL	**510,980.5**	**181,165.0**	**35.4**	**103,039.7**	**20.2**	**13,962.3**	**2.7**	**34,192.9**	**6.7**	**151,194.9**	**26.6**	**35.0**

Sources: MMA, "Causas e dinâmica do desmatamento na Amazônia"

3.4 Dynamics of timber exploitation and timber industry in Legal Amazonia

3.4.1 The numbers in the timber industry of Amazonia

Perhaps the best and clearest way of presenting an overview of the profile and dynamics of timber exploitation activity (industrial timber exploitation and processing) in Amazonia is to use the evidence provided by some recent research work such as that of Schneider *et al.*[6], IMAZON[9], Veríssimo, A. *et al.*[28], Veríssimo *et al.*[29], Uhl, C. *et al.*[30], Nepstad, D. *et al.*[19] and Scholz, I[31]. These authors, after some years of research and assessment of the deforestation process under way in Legal Amazonia, have produced excellent syntheses of "the production mode" of timber exploitation and timber industry activity in the region. According to them, Legal Amazonia would nowadays produce approximately 90 per cent of the industrial native timber of Brazil. The timber industry is the main economic sector of industrial manufacturing in the Amazon (the first industrial sector still is mining), representing some 15 per cent of the GDP of Pará, Mato Grosso and Rondônia states. In 1998, the gross income of the sector was estimated at US$ 2.5 billion. The timber industry generates approximately 500,000 direct and indirect jobs in the region.

These are significant indicators: compared to the past three to four decades, industrial logging in the Amazon was a relatively small, unimportant activity. As Scholz, I., op.cit., remarks, in the 1960s timber had no economic expression in the economy of Amazonia. The value of timber production was much smaller than the value of production of extractivism (natural rubber, Brazil nuts, etc.). Extractivism and family agriculture, complemented by hunting and fishing, were at that time the main activities that constituted the bulk of the region's economy.

From the mid-1960s the Amazonian economy began to change profoundly as a result of governmental policies directed towards the economic integration of the region with the rest of the country. It is in this context of policies, of the high rates of economic growth of the region, of the accelerated urbanization of the population, and of the expansion of the agriculture frontier (see items 3.2, 3.3.3.1 and 3.3.3.3 above) that the development of the timber industry and timber exploitation in Amazonia occurs[1].

According to IBGE and FAO estimates, the volume of timber (industrial logs) produced in the region has risen from a mere 1 million m^3 in the 1950s and 1960s to 2.3 million in the 1970s, and to 11.4 million m^3 in 1980. From then on the annual volume of production, as per IBGE and FAO statistics, shows a considerable and steady growth. Other sources of data (regional research and surveys carried out, particularly those by IMAZON op.cit.) also reveal this continuous increasing trend, and place the present (1997-98) annual volume of production in the order of 28-30 million m^3 of industrial logs.

In the last decades, the growth in production of native industrial timber in the Amazon not only (i) responded to the increase in demand for this type of raw material due to the rapid expansion of the region's economy, but also (ii) responded to a greater extent to the demand for native industrial timber from the rest of the country (the "centre-south") – structural timber, sawnwood, veneers, plywood – a demand that expanded considerably. Note that, in the past (in the 1960s and 1970s), this demand from the centre-south

[1] Most authors tend to single out, as the most important factor for the dynamism and expansion of industrial timber exploitation in the region, the public investments in the opening and building of roads, which made migration and deforestation possible in vast areas of Amazonia. Scholz, I., op.cit., also singles out the policy that from 1974 prohibited the exports of native timber in the form of logs from the region to foreign markets. The fiscal incentives of SUDAM for industrialization in Amazonia are not singled out as a very significant influence on the expansion of the timber industry itself, according to Scholz, op.cit. In fact, as she puts it, until the end of the 1980s SUDAM gave priority to the big investment projects. Out of the free trade zone of SUFRAMA, industrial projects of that scale only existed in mining and in cattle-raising, which absorbed the major part of fiscal incentives. The establishment of big cattle-ranching farms has always started with the purchase of vast areas of forested land with deforestation occurring in a part of the land, to prove/document possession and to obtain the fiscal benefits linked to the "improvements". As these areas were often in remote places, there was no market for the felled trees/timber, which ended up being burnt. Small and medium investment projects that had no access to SUDAM incentives depended more on the sale of timber to finance the clear-cutting. This makes sense with the verification that, in the past, very high deforestation rates in Amazonia were not associated with a strong and dynamic presence and activity of the timber industry in the region.

used to have alternative important sources of supply that were earlier constituted by native timber proceeding from the Brazilian Atlantic forest (a source of timber that, from the 1980s, practically ceased to exist due to the shrinking of these forests).

Another source of growth in the timber industry in the Amazon has been international trade (resulting from the increase in foreign demand for tropical hardwoods, combined with a relative decline in traditional sources of supply from countries like Indonesia, Malaysia and others – a decline that had been anticipated in various forecast studies of the international market for tropical timber). Although Brazil, and the Brazilian Amazon, currently still supplies only 4 to 5 per cent of the global market for tropical hardwood (20 years ago this share was 2 to 3 per cent at most), exports increased significantly since the mid-1980s, having grown from US$ 100 million in 1985 to about US$ 400 million in 1997.

As put forward by IMAZON[11] "out of those 90 per cent of native tropical timber produced in the country, that is exploited and primarily processed in the Amazon, 85 to 86 per cent go to domestic markets, and the rest, 4 to 5 per cent, go abroad. In the south and southeast of Brazil there is concentrated the biggest and most intensive trade in tropical timber in the world, more than double that imported by the whole of the European Union". Indeed, this information that Brazil has an enormous consumer market of tropical timber should not be lost sight of.

It is important to underscore this continuing and strong demand stimulus on the expansion of the timber industry in the Amazon. First, because it means that it does and will continue to exert a very significant influence on the expansion of the region's industry, and, thereby, on deforestation. Second, it must be recalled that in some quite important international documents on forest policy this influence of demand has been played down or underestimated, with implications for Brazil and the Brazilian Amazon. The most outstanding one is the 1991 World Bank Policy Paper – *The Forest Sector*[32] (still in force, it must be recorded) in which, as Lele, U *et al.*[27] remark, "small cultivators and rural producers had been identified as the most important source of deforestation in the Amazon, based on the assumption that much of the urban industrial demand for wood products would be met by imports from temperate countries".

As the cited authors state, "unlike the Bank's 1978 Forest Policy, this assumption underestimated the power of domestic urban and manufacturing demand for wood products and its implications for forest policy. Most of Brazil's domestic needs for wood products have been met from its own forests". This is really astonishing! Empirically speaking, that assumption is, in the entire economic history of Brazil, just the opposite of what has always happened. Brazil has never been an "importer of wood". On the contrary, the country has always met its demand with domestic production of wood, and it has always been an "exporter of wood". Indeed, the exhaustion of the Atlantic forest has a lot to do with that!

Having said that, and for the purpose of providing further figures on the situation or profile of timber exploitation and timber industrial activities in Amazonia, Table 3.16, extracted from the works of Veríssimo, A. *et al.*[28], and Nepstad, *et al.*[19], gives an idea of the distribution of the industrial timber units (sawmills) and their corresponding timber exploitation volumes per state of Legal Amazonia. As will be seen from Table 3.16, in 1997 there were around 2,500 units responsible for demanding or processing a volume of industrial roundwood (logs) of around 28 million m^3. Regional processing capacity is very much concentrated in Pará, Mato Grosso and Rondônia.

These 2,500 sawmills are distributed in approximately 75 "poles or regions of timber exploitation" or "logging centres". According to these authors' research, these timber poles are responsible for more than 90 per cent of the total production of timber in the Amazon. Each of these logging centres produces at least 100,000 m^3 of roundwood (logs) per year. These poles have been circumscribed taking into account the average economic extraction distances of logging that predominate in Amazon areas/regions, on the basis of the interviews carried out by the authors on 1,393 sawmills located in these centres. Mahogany mills have been excluded from the study because their immediate effect on the forests is small compared to other logging, and the volume of mahogany extraction is much less than 5 per cent of total Amazonian production.

The harvest rates (m^3 of roundwood timber per hectare of forest) were obtained from the mills' harvest records, and from there the authors estimated the forest area required to supply each centre's production. The estimated average rates of logging lie within the interval of 19 m^3/ha (low-intensity), 28 m^3/ha (medium intensity) and 40 m^3/ha (high intensity). Maximum total forest area required to supply the centres was estimated at 1,509,000 ha per year. This would be the area necessary for the production of 28 million m^3 of logs in 1997. The authors say that this area of "undisturbed forest" has been logged in 1996/97 and leave the impression that the total "affected"/"logged" area of forests in the Amazon would have been that area plus the year's total deforested area.

We have seen above (item 3.3.3.4) that INPE's researchers have rejected this idea: as Krug, T. *et al.*[20] have shown, beyond the area effectively deforested in a year, only 10 per cent at most of this deforested area, on average from 1989 to 1998, would have been affected by selective timber logging. Therefore, in terms of the industry's demand for timber, the area needed for that purpose would, at most, be made up of the deforested area plus 10 per cent related to selective cutting (the latter being an area that partly regenerates, and partly may be subsequently clear-cut, but not immediately).

Table 3.16: Production of industrial roundwood, per state, logging centres, logging intensity and "forest area affected by logging" – 1996/1997

State	No. of poles	No. of sawmills	Production of logs in million m^3	Logging intensity (% of production)			Necessary area to support production (km^2/year)
				L	M	H	
Acré	1	25	0.3	100	0	0	120-210
Amapá	2	89	0.2	100	0	0	80-140
Amazonas	3	20	0.7	100	0	0	290-500
Maranhão	2	52	0.7	0	0	100	160-200
M.Grosso	22	708	9.8	100	0	0	4080-7000
Pará	24	1324	11.9	11	61	28	3560-4910
Rondônia	19	272	3.9	25	75	0	1320-1920
Roraima	1	25	0.2	100	0	0	80-140
Tocantins	1	18	0.1	100	0	0	40-70
Total	**75**	**2533**	**27.8**	**49**	**41**	**10**	**9730-15090**

Source: Nepstad, D. *et al.;* L=low; M=Medium; H=High

The more than 2,500 sawmills in operation in Legal Amazonia, which extract about 28 million m^3 of logs, place the region as one of the greatest tropical timber producers in the world (alongside Malaysia and Indonesia). Most of this timber is transformed into sawnwood and the rest in veneers, plywood and other industrialized timber.

An approximate idea of the size of the participation of Amazonia's industrial timber (sawnwood, veneer and plywood) relative to the national total (including native forests and planted forests) can also be gathered from Table 3.17, in terms of the consumption of timber by the different forest-based sectors of the Brazilian economy. Assuming that 90 per cent of all sawnwood, plywood and veneer produced from native forests in the country originate from Amazonian forests, this would mean that the region's share would amount to 60 per cent of the overall national production of these goods (obtained both from native and planted forests).

Table 3.17: Consumption of industrial roundwood (logs) in Brazil, per sector – 2000 (000 m^3)

Sector/product	Native forests	Planted forests	Total	% of native forests
Pulp and paper	0	32,000	32,000	0
Charcoal	11,800	33,400	45,200	26.1
Indust. fuelwood	16,000	13,000	29,000	55.2
Sawnwood	34,000	15,100	49,100	69.2
Veneer and plywood	2,050	3,960	6,010	34.1
Reconst. panels*	0	5,000	5,000	0
Total	**63,850**	**102,460**	**166,310**	**38.4**

Source: STCP; *Reconstituted panels include particle-board, fibre-board, and MDF.

3.4.2 Deforestation and industrial timber exploitation

Strictly speaking, logging, as practised in Amazonia, cannot be considered as a forest activity on its own. It is, in fact, either a land-clearing operation of forest conversion (clear-cutting) to give way to other alternative competing land use activities (such as crops, pastures) or a partial harvesting of timber (exploitation/felling of the best individuals of valuable commercial timber stocks) that will ultimately also lead, at a later stage, to agriculture or cattle-breeding activities replacing forests. Even "low-impact" highly selective logging, as still practised in some flooded forest areas (*varzea* forests) in Amazonia, is a predatory and empirical type of exploitation, that may lead to impoverishment of the forest, and even threaten the survival/reproduction of species in some limited areas. With population pressure and the increasing occupation of some remote areas in the Amazon, traditional selective logging tends to be more intensive, and thus becomes as damaging as logging directly associated with deforestation.

"Deforestation" logging in Amazonia ensures conversion of forests to other alternative uses. Actually, logging is but a mere complementary activity, an accessory, to agriculture and cattle-breeding, an operational stage in the process of converting land to subsequent establishment of pastures and crops. As such, logging activity can be a means of financing the conversion of forests to other land uses, and indeed there is ample evidence that this has become so in many areas in Amazonia. Since the end of the 1980s, when timber industry production in Amazonia started to grow considerably, and fiscal incentives to agriculture and cattle-raising and other government-sponsored investments in the region began to decline, this capacity of logging to finance deforestation, as put forward by various of the authors quoted at the beginning of this section, has become more intense in areas of bigger influence of the timber industry, such as for instance in the municipalities of Paragominas-Pará, Sinop-Mato Grosso, and Ji-Paraná/Ariquemes-Rondônia, examples of regions known as timber-industry poles. As pointed out by Reis, E. and Margulis, S.[33], until then, the timber industry in the Amazon had a weak influence on deforestation.

As part of the process of deforestation under way in the Amazon region, logging interests are very much the same as those of farmers, shifting-cultivators, rural producers and ranchers. In this sense, loggers' interests reinforce deforestation interests, and vice-versa. They seem to go hand in hand, bound together by an identity of association as if they were al partners in a business: deforestation. As very well put forward by Carvalho, J.C.[34] in his description of the political configuration of the problems of the Amazon rainforest: "When conservation activities and sustainable use of forest resources are ranked as secondary or subsidiary factors in the development process, the vision and focus of the community regarding forest issues are subordinated to its higher ranked day-to-day activities. These are of more immediate interest to the social groups that participate in the productive process and dominate political decisions. In many countries and regions, particularly where ample land is still available, rural development is based largely on the expansion of the farming and ranching frontier, converting forests into farmland, in parallel to the empirical and predatory exploitation of forest resources of greater economic value. In these cases, rural communities do not view forestlands as sheltering resources that can be managed, but rather as strategic reserves of land

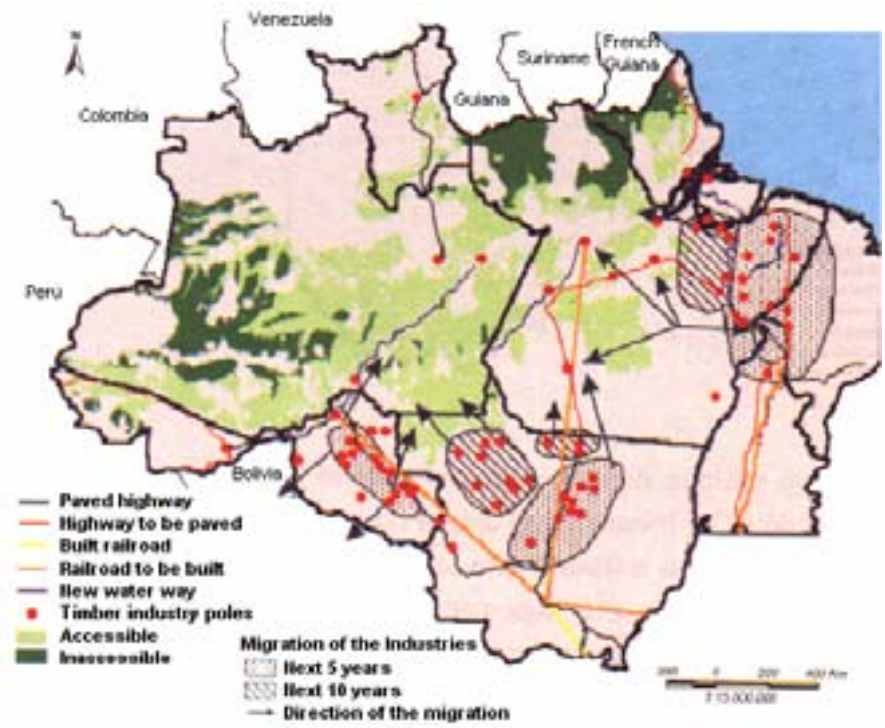
available for take-over by the farming and ranching process, making merely residual use of timber left over from cleared areas."

As Schneider *et al.*[6] underscore in their descriptive analyses, the major part of timber industry logging in the Amazon is done as a complement to agriculture and cattle-raising. As a result, the exploitation or logging frontier of the industry has followed the expansion of the agriculture frontier in the whole of the region. The overwhelming pattern of the mode of exploitation is predatory logging for industrial or commercial timber, characterized by excessive damage to the forests, excessive pressure over high valued timber species and greater risk of fires in exploited areas.

This pattern of predatory or "deforestation" logging closely associated to the expansion of deforestation has been exhausting forest resources in all old "timber-pole" regions of the Amazon. By the end of the 1990s, timber industry logging in old frontier areas, such as Paragominas (Pará), Sinop (Mato Grosso), Vilhena-Ji Parana-Ariquemes (Rondônia) was already in decadence and, according to estimates, the scarcity of wood in these regions will be forcing timber companies to migrate or to shut down in the next five years. In frontier areas not so old (intermediate age), as in the north of Mato Grosso state and in Pará (Tailandia-Maraba), the authors estimate that the natural forest timber stocks will be sufficient for an additional 10-20 year period of exploitation under present conditions. In the regions of more recent agriculture frontier expansion (the new frontiers) as, for example, Novo Progresso (Pará), Novo Aripuana-Apui (Amazonas) and Senador Jose Porfirio-Portel (Pará), the estimates are that stocks could last up to 30-40 years.

As per the analyses of Schneider *et al.,* op. cit., and as illustrated by the map on the mobility of the timber industry in the Amazon, elaborated by the authors (see Map 3.15), industrial timber companies and loggers of Rondônia are moving into Bolivia and to Amazonas state, while the timber industry of the old frontiers of Pará and Mato Grosso are migrating to the newer frontiers of western Pará and southeastern Amazonas. As the cited authors state, "the current logging model has a strong impact on the economies of communities in the Amazon. Following the expansion period, the consequent exhaustion of resources results in an inevitable economic recession in the local economy. The gravity of this recession depends on the local agricultural potential, that is, on the extent to which the emerging agricultural economy can replace the loss of the timber economy. For example, Paragominas, the oldest logging frontier in Amazonia, established at the end of the 1970s, is confronting a grave shortage of primary material due to the exhaustion of its forests. In the past five years, approximately 50 sawmills closed or migrated, and the volume of wood processed fell approximately 30 per cent. A similar phenomenon can be witnessed in the county of Sinop (Mato Grosso), one of the largest logging centres in the 1980s, and in Redençao (south of Pará). However, due to the fact that Sinop and Redençao are located in areas of open forest (characterized by low density of marketable timber) situated in the dry zone, the decline in timber harvesting has been more rapid than in Paragominas. In Sinop, the number of sawmills fell from approximately 400 at the end of the 1980s to fewer than 100 at the end of the 1990s. However, in this county, the decline in the timber sector has been largely compensated by the rapid growth of agriculture, principally ranching and soybean cultivation"..... "If market forces are not restrained, communities constructed in the latter (newer frontiers) areas during the logging "boom" will become increasingly depressed during the subsequent "bust" to an ever weaker agricultural base."

Map 3.15: Timber industry poles and migration of industrial logging in Legal Amazonia



Source: Schneider *et al.* (2000)

It is this "boom & bust" model of timber resource exploitation, associated with deforestation, that conditions the nature and workings of the timber industry in the region, as well as its future prospects. This is confirmed by the work of Scholz, I. op.cit, and on a recent survey of STCP[35] on the problems and constraints of the Amazonian timber industry, whose key limitations on the development of this industry may be summarized as follows:

- sawmills operate with used machinery that in general is not renewed. Profits are not reinvested in the mills, but rather in the purchase of lands, or are accumulated to prepare the "opting out", i.e., to leave the sector in order to invest in cattle-ranching, agriculture and urban activities, mainly in services;
- low productivity, increasing costs of raw material and scarcity of noble species lead to a constant decline in the returns and profits of mills;
- although recovery rates of raw material may have shown some improvement over time, they still fall short of the potential offered by the quality of the raw material (this suggests that the shortage of raw material may not be strong enough, and the cost high enough, to enable the industry to optimize its recovery rates, and/or the industry may not have the skills to do this);
- most timber companies are supplied exclusively from third-party forests. Few invest in the formation of a forest-base of their own;
- since most mills produce for the domestic market only, and this market does not require specific quality norms, the mills expand and survive on this indifference of the market towards quality;

- the introduction of new species has not changed the pattern of behaviour at the mill level: the increase in the number of commercial species has allowed more intensive cutting in areas already exploited (cutting of so-called secondary species, that were not exploited in a first cutting cycle);
- mills are not willing or interested in facing costs, risks and necessary efforts to introduce new species in foreign markets;
- the longevity of milling activity is based on the perpetuity of the predatory model associated with deforestation, changing/moving the site of the mill in accordance with the abundance of forest resources;
- the vision of the timber industry, by the entrepreneurs themselves, as a transitory and itinerant activity becomes a barrier to its development: there is no long-term growth strategy for the companies, of either opening new markets or production diversification.

The statistics for sustainably managed timber production are still deficient and controversial. Item 3.4.3, below, provides a discussion of PMFS under control of IBAMA and of SISPROF. Since the whole of SISPROF is not yet fully operational (particularly the "data bank" module of automated registration of all exploitation authorizations, and the corresponding issuance of the conceded licences for transportation of the authorized exploited timber ("ATPFs" or "Stamps of Origin" – see Sections 4 and 5 below) there still remains a difficulty in establishing more accurately the annual volumes of timber effectively produced from PMFS in Amazonia. For 2001, the potential volume of production from "apt" PMFS could have reached the total of 9 million m^3, as shown below. For 1997, the data on annual potential production would be controversial, given the start of an extensive scrutiny carried out by IBAMA of all PMFS in Amazonia in 1996/97.

There are various and different estimates concerning production from forest managed areas. Hummel, A.[36] estimates that the timber production under management was around 7.11 per cent of the total production of 28 million m³ in 1996/97. Veríssimo, A.[37] reports that SFM covers 5 per cent of the total timber production, and Angelo, H.[38] estimates that sustainable timber production was 5.6 per cent of the total timber industry production in 2000. Angelo, H. and Prado, A.C.[39] estimated an Amazonian tropical timber supply function for the period 1977-2000, so that the production is a function of the price of timber, managed areas and Amazonian deforestation. The results for the equation are shown below:

$$Q_t = 8{,}765 + 0{,}014P_t + 0{,}114X_{1t} - 0{,}020X_{2t} \qquad R^2 = 0{,}92$$
$$(21{,}11)\ (4{,}09) \qquad (3{,}11) \qquad (-1{,}24)$$

"Q" represents the logarithm of the total tropical timber production in the year t; P is the logarithm of the price index, the aggregate wholesale price index, as a proxy for the timber price; X_1 measures the deforestation area in the year t, it is a variable that captures the non-sustainable tropical timber production; X_2 is the logarithm of the managed area in the year t.

The adjusted equation explains 92 per cent of the theoretical specification. The variable "managed forest area" does not have the expected sign, and it is not statistically significant at a 10 per cent probability.

Based on these results, the authors concluded that Amazonian tropical timber production is highly dependent on deforestation timber. The expansion of production under forest management must be stimulated by the implementation of mechanisms that differentiate prices of timber (timber from deforestation x timber from managed areas), overcharging deforestation timber and making sustainably forest managed timber more competitive.

3.4.3 Forest management plans in Amazonia

Forest management still is a relatively incipient activity in the Brazilian Amazon. Due to the deforestation process under way in the region and to the continuous expansion of the agricultural frontier, the exploitation of native timber resources is carried out in close association with the frontier's expansion. The vast majority of the timber industry of the region is supplied by timber from deforestation areas (present and future), i.e. from areas destined for soil conversion to agricultural and cattle-raising activities.

As Scholz, I.[31] observes, the Amazonian timber industry was "moulded" to the deforestation process occurring in the region, and to the easy and cheap supply of "deforestation" timber. So, as the quoted author states, and as all research in the 1990s indicates, the timber sector firms are characterized by great instability, having an average life span of seven to 10 years. Such instability is due to the typical cycle of the sawmills, which work until the timber reserves in their neighbourhood have been exhausted, as agriculture and cattle-raising move forward. The existence of timber extraction activity is based on the perpetuation of the predatory exploitation model, moving the sites/locations of the companies according to the abundance of forest reserves.

As per Scholz's research, the main demands and requests of the timber industry of Pará prove the diagnosis that its main objective is that external control requirements and impositions (mainly from the public sector) on the sector get reduced, so that it can continue in its traditional path of exploitation and timber fellings, together with minimum levels of timber processing, and without having to assume responsibility for the sustainable use of the native forest resource. In fact, the set of incentives that give shape and body to this predominant pattern of predatory exploitation of timber associated with deforestation, and that condition the profile and behaviour of the timber industry in the region, make it extremely difficult for forest management activity to become feasible and diffused in Amazonia.

Even with a greater control of the activity and an improvement in the enforcement of legal regulations and norms (see sections 3.5.1 and 3.5.2 ahead), which require industry to exploit resources through forest management (with the employment of PMFS), which facilitates the verification of exploitation conditions, maintenance and renewability of the resources, effective harvesting of timber from these plans and/or areas is not only marginal in terms of total regional production, but also some of them may be fictitious or irrelevant. As a result of this, several PMFS may be used as a "façade" for legalizing timber that has been irregularly obtained from other areas (see section 3.5.2, in particular).

Several measures have been adopted on behalf of PMFS in the Amazon and are described in Section 5. Although insufficient to compensate or to remove existing disincentives to forest management in the region, some of the measures have adopted the more systematic monitoring and technical auditing assessments of PMFS implemented by IBAMA in Amazonia since 1996/97; these have contributed to "moralizing" the PMFS instrument. In that year, after the first, more intensive and far-reaching technical auditing undertaken by IBAMA on all registered PMFS, out of a total of 1,592 management plans that were audited, only 484 were considered "apt", 992 were suspended and 116 were legally cancelled (see Tables 5.6, 5.7 and 5.8, in Section 5). Since then, and as described in Section 5, IBAMA has been implementing a set of actions of control and technical support to PMFS in Amazonia. In 2001, as pointed out in IBAMA's "Report of monitoring and technical auditing on PMFS"[40], and as a result of the field and office assessments, out of a total of 1,059 audited timber PMFS (21 plans were non-timber, viz.,"heart of palms"), 549 were considered "apt", 459 were suspended (of which 48 were soon legally cancelled) and 51 were "in recomposition".

Table 3.18 shows the situation, in terms of the number of registered PMFS, area of management under annual production (according to POA), and corresponding potential volume of production.

Table 3.18: Timber PMFS – Total number of audited plans, annual harvesting area and potential volume of production – per state of Legal Amazonia – 2001

State	Number of plans	Harvesting area (in ha)	Production volume (in m^3)	Average volume Per ha
Acré	17	13,361.00	126,875.94	9.49
Amazonas	44	23,980.93	716,935.00	29.89
Amapá	52	9,893.00	323,662.00	32.71
Maranhão	132	77,052.74	369,336.50	4.79
Mato Grosso	224	171,680.78	4,312,440.14	25.11
Pará	301	176,405.30	6,281,769.36	35.60
Rondônia	273	126,615.48	3,239,678.72	25.58
Tocantins	16	6,616.00	25,594.00	3.87
Total	**1,059**	**605,605.23**	**15,393,291.66**	**25.41**

Source: IBAMA

As will be seen from Table 3.19, taking into account "apt" PMFS, in 2001 there was an annual potential volume for extraction, capable of being authorized, of 9.3 million $m^{3.}$ This represents approximately 30 per cent of the total regional industrial roundwood (logs) timber production which is 30 million m^3 (the extraction volume is the requested volume in the POAs, and may end up either not being fully authorized or not being fully practised by the producers).

In terms of potential annual area and corresponding production under forest management in the region, according to audited and "apt" PMFS and their POAs, there would be approximately 340,000 ha corresponding to 549 forest management units (forest estates). Considering that 411 PMFS were suspended, and that out of these a good part could solve the pending problems identified by the audit visits, and that 51 were in "recomposition", there could be a total of some 1,000 plans operating in a regular situation in Amazonia in 2001. Using this basis for comparison, therefore, one may say that the maximum area of forests under regular forest management production in Amazonia would hardly have reached those 600,000 ha.

As for the quality of forest management at unit level, IBAMA is already capable of reporting on this too, thanks to SISPROF. The next chapters are dedicated to describing and explaining the whole of SISPROF. Here a brief account is given of how PMFS performed, based on the 2001 technical auditing carried out by IBAMA.

Table 3.19: "Apt" timber PMFS – number of plans, annual harvesting area and potential volume of production – per state of Legal Amazonia – 2001

State	No. of plans	Harvesting area (ha)	Production volume (000 m^3)	Average volume/ha m^3	Other plans suspended	Other plans recomposition
Acré	15	7,053.00	126.36	17.91	2	-
Amazonas	39	21,973.93	662.64	30.15	5	1
Amapá	29	7,135.00	269.97	37.83	21	2
Maranhão	47	23,547.96	130.48	5.54	73	11
M. Grosso	105	98,553.03	2,180.47	22.12	98	21
Pará	205	132,752.00	4,665.38	35.14	86	10
Rondônia	109	49,360.07	1,337.88	27.10	158	6
Tocantins	-	-	-	-	16	-
Total	**549**	**340,374.99**	**9,373.18**	**27.53**	**459**	**51**

Source: IBAMA

Details of the system of "indicators and verifiers" of PMFS, defined in SISPROF, may be found in Section 5 of this document. Just as an example, Table 3.20 shows the "quality" results of "apt" timber PMFS in highlands of the Amazon (this category corresponds to the majority of PMFS in Amazonia – only in the state of Amazonas is there a bigger proportion of lowland (*varzea* forests) timber PMFS, and management in *varzea* forests is relatively inexpressive in the other states of Legal Amazonia).

As Table 3.20 shows, only the states of Pará and Amapá, with more significance, have shown general averages above a level considered as regular. Mato Grosso has shown the smallest average quality index among all apt PMFS in the region. In relation to activities considered in isolation, those related to the "general aspects" have had the least attention, although the averages of the other groups of activities have not shown much difference between them. The group that had the best average was that of pre-exploitation activities. This could, perhaps, be expected since these activities are more easily transmitted in forest management than the further activities (exploitation and post-exploitation) that need better infrastructure in order to be more adequately passed on and absorbed. It must be remarked that these assessments, now made possible by SISPROF, are in their initial stages of use in IBAMA, and therefore will need further refinement. But, in particular, the verification system will need more time to be systematically applied, in order to allow better and more relevant comparisons.

Table 3.20: Quality of "apt" timber PMFS in Amazonia (high land, individual, industrial scale and regime of area control) - 2001

Phase	General			Pre-exploitation						Exploitation			Post-exploitation				Média Geral
ACTIVITIES	Labour security	Camping infrastructure	Monitoring of activities	Delimitation of AMF/UPA	Orientation tracks	FI 100%	Micro-zoning	Vine-cutting	Infrastructure	Tree-felling	Logging	Patio operations	Silvicultural treatment	Forest protection	Infrastructure maintenance	Monitoring of forest development	
UF	**1**	**2**	**12**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**13**	**14**	**15**	**16**	
AC	2,42	2,42	2,79	3,21	3,13	3,00	3,25	3,63	3,25	3,17	3,08	2,17	3,25	3,00	3,08	2,71	2,97
AM	1,71	2,40	2,00	2,44	2,56	2,24	1,85	2,34	2,40	2,53	2,50	2,27	2,00	2,24	2,50	2,33	2,27
AP	3,30	3,09	3,44	4,00	4,43	4,00	3,50	3,69	3,76	3,63	3,92	3,44	2,81	2,63	3,19	2,38	3,45
MA	1,13	1,14	2,80	3,04	2,68	2,95	2,36	1,11	2,40	2,37	2,77	2,29	2,45	1,89	3,10	2,45	2,31
MT	2,04	1,78	1,47	2,71	2,45	2,82	1,61	1,45	2,29	2,27	2,14	1,85	2,13	1,45	2,70	1,60	2,05
PA	2,63	2,78	2,87	3,82	3,58	3,51	2,94	3,16	3,45	2,97	3,07	2,81	3,02	3,15	3,62	3,15	3,16
RO	2,42	2,35	2,67	3,39	3,76	3,63	3,51	2,82	3,07	3,04	2,90	2,51	3,04	2,94	3,78	1,88	2,98
Média	2,23	2,28	2,58	3,23	3,23	3,16	2,72	2,60	2,95	2,86	2,91	2,48	2,67	2,47	3,14	2,36	
	2,36			**2,98**						**2,75**			**2,66**				**2,74**

In terms of the general pattern of different land uses in the region, as we have attempted to describe in the previous sections, the above figures on forest management as a permanent land use activity carried out in Amazonia clearly reveal that the activity is no more than a "grain of sand" in the whole regional landscape: in a universe of at least 390,000 rural properties with a corresponding area of 180 million ha (according to INCRA's 1998 data), there would be only around 1,000 properties (0.33 per cent) at most, dedicating themselves to forest management. Or, if we take the figures from the IBGE 1996 agricultural census, out of a total area of 116 million ha of more than 500,000 "agricultural establishments" reported in Amazonia, whose area under some form of use (agricultural, pastoral and other uses) would be nearly 62 million ha (see Tables 3.5 and 3.7, under item 3.3.3.3, and where the latter table shows that 77 per cent, 6.8 per cent, 1.5 per cent and 9.5 per cent account for cattle-raising, temporary crops, permanent crops and "abandoned areas", respectively), the participation of the area under forest management production would be, at most, 1 per cent of that total area under use by all agricultural establishments in the region.

Note that Table 3.7 also shows that "other types of land use in agricultural establishments, which refer to lands in rest, planted forests, extractivism, etc." amount to 4.6 per cent of the total area in some form of agricultural use. Therefore, since the agricultural census does not have specific data on forest management area under production, or in PMFS, what one can do is to guess that the real participation of areas under forest management must be included in those 4.6 per cent, and that the participation would, at most, amount to the 1 per cent order of magnitude that we have here estimated for comparative results only.

Another interesting indication of the present smallness of "private permanent productive forestry" in Amazonia may be gathered from data provided by WWF/Brazil[41], which states that some private companies committed to the sustainable use of their forests, and with an increased valuation of their products, have been seeking to obtain certification for their managed forest areas. According to WWF/Brazil the total

certified area in the Amazon is currently 353,313 ha. Just for information, and as anyone would easily guess, PMFS are also concentrated in the region of the "deforestation arch" of Amazonia.

Thus, in terms of the above numbers, one can see quite well why a private permanent productive forest management activity in the Brazilian Amazon does not yet have any reasonable significance in all the interests and aspirations of the rural population of the region, be it from communities (in the total of audited PMFS in 2001, only 11 belong to the communal category), be it from small settlers or family croppers, or be it from bigger rural producers, agriculturalists or cattle-ranchers. This profile on the tiny size of the activity shows the gravity of the political challenge that will have to be faced in trying to convince the rural landholders of the Amazon that their properties (i.e. particularly a substantial part of them, viz. their legal forest reserves) must be maintained and destined for an economic activity which, until now, is practically unknown or non-existent in their properties, namely, SFM.

Although some farmers and communities may be starting to manage their forests, instead of contracting tree-felling to outsiders, or selling timber-cutting rights (both linked to a present, or future, subsequent conversion of their areas to agriculture), in fact very few farmers in the Amazon perceive the opportunity of their legal forest reserves (much less of their possible increase). Very few perceive this opportunity and, moreover, very few possess the necessary capacities. As a consequence, the legal forest reserves are poorly observed and owners see them as a constraint rather than an opportunity. If SFM is not widely diffused, decisively supported and motivated, in order to demonstrate that it could be an *economically* attractive and competitive land use activity, it will hardly succeed in Amazonia. Moreover, this also shows how unrealistic it may be to propose and expect that all of these properties maintain and keep their legal forest reserves untouched, for purposes such as that of *"an integral protection of bio-diversity"* (as environmentalists usually propose, even if the proposal is genuinely accompanied by some, though still really non-existent, broad mechanism of financial or economic compensation).

On the other hand, what all rural landholders (small, medium and big) of Legal Amazonia know quite well is the activity of deforestation and its corresponding income generated from timber sales, that allow them to finance the conversion of their forests to other agricultural or cattle--raising uses. It is this activity, indeed, whose immediate product/output (deforestation timber) is not adequately captured in the production statistics of the agricultural census (even though, in fact, it does not really mean "use" or "output of a resource use" but "disuse"/elimination of a resource, something that is naturally and generally not reported by informants to the agricultural census enquiries) that is familiar to and interests all rural owners.

It is expected that with the full and permanent functioning of SISPROF, forest management activity will become more transparent and PMFS will be less vulnerable to being used as a "fictitious" instrument. One could expect as well that the hard-data on deforestation – *viz*. the exploitation and recovery of timber from deforested sites – per unit of landholdings in the Amazon, together with other information on the landholdings, such as the corresponding registry and maintenance of legal forest reserves, will become more readily available and more effectively controlled.

3.5 "Command and control" of deforestation and of forest resource use and access: progress of regulation and enforcement

3.5.1 The evolution of legislation

The Brazilian forestry sector is extensively regulated along all its production and commercialization chain. Basically, the regulations that guide deforestation and the exploitation of natural forests fall within the following areas: (i) environmental impact assessments; (ii) deforestation and burning authorizations; (iii) cutting restrictions specific to rural properties; (iv) cutting restrictions specific to species, regions and ecosystems; (v) technical obligations and requirements of SFM; (vi) conditions/obligations of forest replacement and recomposition; (vii) conduct restrictions and requirements of licences for transportation and commercialization of forest products; (viii) restrictions on maintaining legal forest reserves and permanent preservation areas in private rural properties; (ix) rules concerning public conservation units of sustainable use. The basic laws that are the basis of these regulations are the:

Forest Code (Law 4771 of 1965 and subsequent alterations)
National Environment Policy (Law 6938 of 1981 and subsequent alterations)
Law of Environmental Crimes (Law 9605 of 1998)
Law of the National System of Conservation Units (Law 9985 of 2000)

The principles of environmental protection have been consolidated in chapter V, article 225 of the Federal Constitution (1988). The above federal laws are complemented by specific state-level legislation. A series of lower-rank legislation such as federal decrees, national environment council resolutions, normative instructions of the Ministry of the Environment and resolutions of IBAMA converts the principles and commands established in the federal laws into regulations and rules to be enforced in practice. At state level a similar process is followed.

The main dispositions and rules of the above-mentioned legislation that are more directly concerned with the regulation of deforestation and of access to forest resources in Brazil, and in the Amazon, are highlighted with the purpose of providing grounds for understanding how this legislation conditions the design and workings of enforcement mechanisms such as monitoring and control systems like SISPROF.

National Environment Policy Law

The National Environment Policy Law, and CONAMA Resolutions 001/86, 011/87, 006/88, 009/90, 010/90 and 237/97, establish the principles, rules and obligations for the environmental licensing of activities that are potentially pollutant or degrading to the environment. Agriculture, animal husbandry and agrarian reform settlement projects are land use activities listed in Resolution 237/97, leaving to the states of the federation the competence to adequate licensing norms to their peculiarities. In relation to these land use activities, the objectives of licensing are, among others, to protect and monitor permanent preservation areas in rural properties that request deforestation permits, reduce the processes of soil erosion, the pollution of waters with agrotoxic substances and avoid forest fires. States like Mato Grosso have built modern monitoring systems of rural licensing on the basis of specific legislation enacted for this purpose (see Box 3).

Forest Code

The 1965 Forest Code has been revised a few times. In 1989, just after promulgation of the 1988 Constitution, under the aegis of the first more comprehensive programme of the Federal Government for the environment – "Our Nature Programme" – some important changes were introduced in the Forest Code by Law 7803/89. Among them the following may be noted:

(i) rural properties have been compelled to register their obligatory legal forest reserves in land registries at notary publics;
(ii) clear-cutting was explicitly prohibited in legal forest reserves of rural properties;
(iii) legal forest reserves could not have their destination altered in cases of "*inter-vivos*" or "*causa mortis*" transmissions/transfers, or in cases of dismemberment of areas.
(iv) the obligation to recompose legal forest reserves in rural properties was imposed by the new agricultural law passed in 1989;
(v) although article 15 of the Forest Code had since 1965 prohibited the exploitation of primitive forests of the Amazon basin under empirical form, and that these forests could only be used by observing technical plans of conduct and management to be established by act of the public power within a year - and until 1989 such regulation had not been issued - a new article was included in the Forest Code by Law 7803/89 establishing that "the exploitation of forests (in any region of the country), public or private, would depend on the previous approval of IBAMA, as well as on the adoption of techniques of conduct, exploitation, forest replacement and management compatible with the varied ecosystems formed by the forest cover";

(vi) some limits on the strips of permanent preservation areas, either public or private, were modified, such as banks/margins along water courses and around water sources.

The other main dispositions of the Forest Code concerning deforestation and use of forest resources and products were maintained. These were:

(i) permanent preservation forests in rural properties must be observed on riverbanks, steep slopes, hilltops and around lakes, ponds and water sources. The Forest Code has put indigenous reserves at the same level as permanent preservation forests;

(ii) forests (and other wooded vegetation) that were not subject to any limited regime of utilization, and except those of permanent preservation areas, could be clear cut, in rural properties, provided the owner/holder of the land maintained at least 20 per cent of the area of the property with forest cover as legal forest reserve (in all regions of the country except in the Amazon) or at least 50 per cent of the area of the property with forest cover as legal forest reserve, in the case of the Amazon region;

(iii) obligatory forest replacement for industrial consumption of native forest raw material (timber, charcoal, fuelwood and other forest raw materials) that exceeds the consumption from rationally managed and exploited forests of the consumer and/or from forests owned by others but with whom the owner had supply contracts;

(iv) among the penal contraventions established in the Forest Code the following could be noted: the destruction or damage to permanent preservation forests; the cutting of trees in permanent preservation forests without permission of the competent authority; to set fire to forests; to transport or keep timber, fuelwood, charcoal and other forest products without a valid licence, issued by the competent authority, for the trip or storage; to receive timber, fuelwood, charcoal and other forest products without requiring a valid licence of the seller, and without keeping the copy of the licence that must follow the product until final manufacturing processing.

Note that unauthorized or illegal deforestation or clear-cutting of forests, other than permanent preservation forests, was not considered as penal contraventions.

(v) extraction of fuelwood and other forest products, or the production of charcoal, are free in planted forests not considered as permanent preservation forests;

In 1996, together with the disclosure of INPE's 1994/95 data on deforestation of the Amazon, the government decided to send to national congress a specific "provisional measure" (which until today is under discussion in congress) that alters some dispositions of the Forest Code (the modifications thereby introduced have been in force since then, despite not yet being ratified by Congress), and provoked the opening of a wide and substantial debate among Brazilian society about the need to proceed to more significant changes in the norms and rules that regulate the use and access to lands and forest resources in the Amazon (and in the rest of the country). The following changes, worthy of mention here, have been promoted by the measure:

(i) a strong legal limitation on the alternative use of land in rural properties that are covered by forests in Legal Amazonia. Legal forest reserves in rural properties in Amazonia increase from 50 to 80 per cent minimum of the total area of the property in the case of forest cover, and from 20 to 35 per cent minimum in the case of cerrado vegetation cover (no change is introduced in the percentages for the other regions of the country, thus remaining at 20 per cent);

(ii) the prohibition of conceding deforestation permits/licences if the property already has a deforested land which is underused, degraded or abandoned;

(iii) the possibility of compensating deficits of minimum legal forest reserve in a property in exchange for another area in a reserve-surplus property (but only in the same water-basin and in the same state);
(iv) the possibility that these compensations be made with "bonds/equities representing legal reserves", and not only through unilateral or bilateral transactions of physical areas;
(v) the possibility of constituting "non-obligatory forest reserves" such as "forest serfdoms" and others, that will be able to be negotiated in a "market for compensations" for forest protection.

Since 1996 this provisional measure has been extended by government 67 times, and the bill is still awaiting final decision in Congress, but no agreement has so far been reached. The measure has provoked tension and reaction from rural agricultural producers (small family producers, small agrarian reform settled croppers, medium-size farmers and big rural producers) in the whole of the Amazon who, because of an absence of other mechanisms or incentives that reinforce the conservation and sustainable use of forests, still do not perceive that they may gain with the new proposals (small croppers and rural producers in the Amazon, whose properties are smaller than 150 ha have managed, through lobbying in Congress, to introduce an exception to the 80 per cent legal reserve rule: they succeeded in getting a modification that maintained, for their property size, the former percentage of 50 per cent). Indeed, very few farmers and communities perceive this opportunity, and even possess the necessary capacities to make best use of their legal forest reserves. As a consequence, these legal reserves are poorly observed, and owners see them as a constraint rather than an opportunity. As has been mentioned above, only a few farmers and communities are managing their forests instead of contracting harvesting to outsiders or selling harvesting rights in forest-land conversions.

Law of Environmental Crimes

In February 1998 an important step forward was achieved in terms of enforcement of environmental policy in general: the passing of Law 9605 (the Law of Environmental Crimes), which established and clearly defined the crimes (and respective penalties and fines) against the environment. The Law established the crimes against fauna and flora, those related to pollution and other environmental crimes, to urban space and cultural patrimony and crimes against environmental administration.

The dispositions of Law 9605 relating to the crimes against flora (Section II of the Law) are underscored here. As disposed in the Law, the following actions are now crimes punishable by specific penalties and fines:

(i) destroying or damaging permanent preservation forests;
(ii) cutting trees in permanent preservation forests without the authorization of the competent authority;
(iii) causing damage to conservation units;
(iv) provoking fires in forests or woods;
(v) extracting minerals, sand, stones from forests of public dominion or from permanent preservation forests;
(vi) cutting or transforming commercially valuable timber into charcoal for industrial, energetic purposes or for any other economic exploitation, in disagreement with legal determinations;
(vii) receiving or purchasing, for commercial or industrial purposes, timber, fuelwood, charcoal and other products of forest origin, without requiring the licence of the seller issued by the competent authority, and without the document/copy that must accompany the product until final processing;

(viii) whoever sells, exposes for sale, keeps in deposits/stores, transports or keeps timber, fuelwood, charcoal and other products of forest origin, without a valid licence for the duration of the trip or storage will incur the same penalties as those in (vii).

Note that what once was penal contravention of the Forest Code has now become a crime under the Law of Environmental Crimes. Criminal offences are punishable by detention or imprisonment and/or fines.

Note also that unauthorized or illegal deforestation or clear-cutting of forests, other than permanent preservation forests and/or in conservation units, are still not considered as criminal offences. So, a small cropper, or a big rural producer, that clear-cuts an area (not of permanent preservation forest) of his estate, for the establishment of agriculture or cattle-raising, without a licence or authorization, will not legally be a criminal, provided he is not caught selling timber from his deforestation. If he sells the wood without a deforestation licence (which allows him to legalize his timber for sale) and gets caught, then he could be criminally prosecuted for that sale, and not for the deforestation itself. That, of course, does not exempt any such infractor from other penalties such as embargo on his activities, seizure/confiscation of machinery, equipment and merchandise and other administrative prosecution. But, provided he does not commercialize, transform or process that timber into any sort of economic exploitation, he could not be prosecuted as a criminal.

Note, also, that any buyer (or further buyer along the production and commercialization chain) who buys and/or transports timber, fuelwood, charcoal or any other forest product from an illegal/unauthorized deforestation site will always be subject to prosecution as a criminal.

These features/dispositions of the Law of Environmental Crimes, and also of the Forest Code, seem to put a heavier demand on the need for control instruments to have a series of documents/proofs that unfold or accompany the various steps/links of the production and commercialization chain of forest-based products. Indeed such various “step-wise” documents are indispensable proof for any legal court case or discussion. These requirements of the two Laws also serve to show why the exploiters that buy timber-harvesting rights, transporters, merchants and manufacturers of timber and forest-based products are those that somehow have to be “more fully documented” in terms of their activities. The fines foreseen in Law 9605 have been stipulated in Decree 3179 of September 1999. The Law allows for much higher fines than in the past.

National System of Conservation Units

The issuing of Law 9985/00 has been a significant achievement of environmental policy in Brazil. Besides having clearly defined and established the roles, categories and grouping of conservation units in the country, thereby improving considerably what had been foreseen in this respect in previous legislation, particularly in the Forest Code, the Law (i) fixed the discipline for the charging of different fees/duties related to access and various uses of these units, and defined how funds and other receipts should be used to consolidate them, (ii) set basic rules for the indemnity or compensation of private lands involved in the transformation of these estates into a public conservation unit, (iii) specified the actions and limits to which encroachment near and around the units could be accepted and controlled, (iv) defined penalties and fines for damages against the units, and (iv) established other compensation forms for environmentally damaging actions, in general, whose debts could be legally paid or offset through contributions to or investments in the unit. The Law also established the basic distinction of two groups of conservation unit, namely, the group of strict protection units (national, state and municipal parks, biological reserves, ecological stations, etc.) and the group of sustainable use units (national, state and municipal forests, extractivist reserves, reserves of sustainable use, etc.).

Other regulations on deforestation and forest-based activities

The dispositions of the Forest Code, as well as the extensive complementary array of their regulations, are generally in direct conflict with the economic incentives that drive the private sector (either rural producers as well as timber industry and deforestation logging activities in the Amazon), which makes enforcing these apparatuses, a difficult task. Regulations, also, are rarely targeted at specific externalities.

In 1994, the Federal Government issued Decree 1282/94 and thereby established for the first time, after 29 years, the first regulations of Article 15 of the Forest Code, stipulating the basic norms and principles for the sustainable management of Amazon forests. Decree 1282 would be further amended by Decree 2788/98. These decrees set the guidelines for formulating and presenting PMFS to IBAMA, as well as the ways in which legal forest reserves could be used through SFM. They also reaffirmed, in the case of conversion of forests for alternative uses of land in the Amazon, that deforestation through clear-cutting could only be done if legal forest reserves were maintained, and that it would only be allowed with a deforestation authorization that had to be issued following a previous technical visit to the site by the competent authority.

Norms for the accomplishment of obligatory forest replacement were likewise re-addressed and made less complicated, but considering the increasing demand for forest products and the lack of incentives for replanting, those prescriptions also could not be easily complied with given the continuous and further moving of the agricultural frontier. Requirements for obligatory forest replacement have been particularly difficult to comply with or enforce.

IBAMA or state environmental agencies (provided federative pacts were firmed) would have to approve forest land conversions involving clear cuttings/deforestation. They would also have to approve PMFS (so far, in the Amazon, only IBAMA has been approving such plans).

Transportation authorizations of forest products (ATPFs) are required and are issued on the basis of approved deforestation requests/projects or on the basis of approved POAs of PMFS. Requirements for the authorization of deforestation have been much easier and simpler to fulfil than the requirements for the approval of PMFS or of their annual POAs (though, as is described in Section 5 below, a lot of improvement, streamlining and simplification concerning requirements for the approval of PMFS has been achieved).

Although the Forest Code, and all of its pertinent regulatory legislation, establishes a series of restrictions on the suppression and use of forest resources in a rural property (that permanent preservation forests cannot be exploited and that legal forest reserves must be maintained in each property are major commandments), the basic right to deforest a part of the estate is ensured to each owner or holder, and therefore the right to exploit/cut the forests and trees of that area, without much further restriction, except that the owner and the buyers of his harvesting rights, as well as transporters, get the required licences/permits.

To be more precise, the norms of IBAMA, or of the Ministry of the Environment, related to deforestation authorizations have generally established, to a lesser extent, a maximum volume of commercial timber per hectare that may be authorized/conceded to the owner/holder of the property without a forest inventory, and in an upper extreme a maximum volume (that may be higher than that established for the lower extreme) that could only be determined by a forest inventory. As a rule, in general, IBAMA has tried to maintain authorized volumes per ha at lower levels for deforestation authorizations, comparative to authorized per ha volumes of PMFS. But there have been exceptions to this pattern .

Insufficiency of existing legislation towards SFM

Despite considerable progress reached in the last decade in enacting new legislation that certainly improved the country's possibilities of better protecting and conserving its forests, there still is a crucial need for

specific and more efficient legislation capable of promoting the sustainable management and use of the country's natural forests, particularly those of the Amazon.

It should be noted that, in the case of deforestation authorizations and control, so far a principle, norm or rule has not yet been established – that either (i) charged for the "scarcity rent" of the forest resource, or (ii) imposed a quantitative limitation on the share of each agent in the supply of the market – that could constrain an owner's ability or capacity to effect, via deforestation, the reduction of the total availability or stock of the forest resource in the region, because of the negative externality that he inflicts on the other agents for eliminating part of the resource. Note that this type of externality seems indeed to be the case in Amazonia.

As Seroa, R. and Ferraz, C.[42] point out, the way in which land property or possession rights get established in Amazonia characterizes a free-access regime to forest resources of the region. In the process of occupation and agricultural frontier expansion in Amazonia, the traditional form of occupying lands through deforestation, with the consequent suppression of forest resources, as the authors put it, shapes a typical model of free access in which the scarcity of the forest resources is not perceived, and after a time leads to their exhaustion.

Property/possession rights are defined "ex-post", that is, economic agents move to the frontier, convert forests, sell (or burn) timber, initiate an agricultural or cattle-breeding activity, and then wait for the land-title. This, as we have pointed out previously (see item 3.3.3.5 above) is very much conditioned by the rules of Brazilian agrarian legislation for getting property rights on deforested land.

As Seroa and Ferraz, op. cit., remark, in a free-access regime like this, each agent acts on the presumption that it is not worth foregoing an extraction of the resource today in exchange for a bigger stock in the future, because the resource would be captured by another agent, given free access. This is aggravated in Amazonia, because the way of ensuring the possession of land (reducing the risks of losing it or of being invaded) is to deforest it as soon as possible. In the land occupation process a land-holder knows that his neighbour will adopt such behaviour, which means that the action of one agent forces the exhaustion of the resources to the other, thus typifying the mentioned externality.

In this traditional process of occupation and privatization of lands and of forest exploitation in the Amazon, access to forest resources is also free for others that exploit them (loggers, timber industry) without these agents necessarily being the owners of the resources.

So far there has been no limitation on entry, or on access to forest resources that can originate from deforestation, either in terms of the number of extraction agents or timber companies that would exploit or consume the resources in their production processes, or in terms of their having to pay a "cost of use" for using the resource (except for the obligation to register with IBAMA, get the necessary licences and, in the case of the consuming industry, also the obligation of forest replacement. Note that, in the past, the "forest replacement fee" that was optionally paid by consuming industries of timber originating from deforestation was such that its value only included the unit costs of replanting the wood/tree. The "fee" has never foreseen a value relative to the "stumpage value of the resource". On the other hand, the obligation to physically replant the suppressed timber has been particularly difficult to enforce and to comply with, which indicates that "full resource cost" recovery through this modality has hardly been achieved either).

What must be underscored from these remarks is that the institutional norms and rules so far enacted/available in Brazilian legislation for controlling deforestation and associated forest exploitation are incapable, or insufficient, of restricting access and promoting the exploitation and use of forest resources in a more efficient way. In other words, insufficient in providing ways/instruments for really economizing on the use of the resources.

In addition, this is particularly perverse for SFM activity in the Amazon: since present norms and rules cannot limit deforestation and associated timber exploitation more efficiently, and thereby the free entry of

this wood into the market, this reduces market shares and competitiveness of sustainably managed timber in the total market of timber originating from the natural forests of Amazonia.

3.5.2 The evolution of enforcement

Various important policy measures have been taken by the Brazilian Government since the end of the 1980s – a period that immediately preceded the United Nations Conference on the Environment and Development (UNCED/1992) and consolidated in the so-called "Our Nature Programme" (1988/89), considered as a key change in the position of the country in dealing with environmental issues related to the development of the Brazilian Amazon. Among the main measures that were adopted then, the following can be recalled: the suspension of the fiscal incentives of the investment fund for the Amazon (FINAM/SUDAM) for agriculture and cattle-breeding projects in areas of primary tropical forests; the elimination of subsidies to rural agricultural credit; the extinction of big public investment and infrastructure programmes in Amazonia, such as the POLAMAZONIA, PIN/PROTERRA and others; the end of the unified minimum support prices for agriculture; the creation of IBAMA; the creation of various "extractivist reserves" and national forests in Amazonia; and the modifications introduced in the Forest Code, as have already been highlighted.

In the case of control and enforcement, the creation of the "Operação Amazonia"/Operation Amazonia programme constituted the first and more comprehensive set of actions concerned with monitoring, control and inspection of environmental impact activities in the Amazon, such as deforestation, mining, placer-mining, timber exploitation and others (vigilance of frontiers, etc.). The PRODES programme, implemented by INPE since 1988, for example, was created under the auspices of "Our Nature Programme". From 1989 to 1994/95 much emphasis has been given to the "command and control" instruments with the purpose of seeking to "hold" the progress of deforestation and the somewhat "unruled" wasteful exploitation of forest resources in Amazonia. From 1996, the government has proceeded with still more impetus in the enforcement of regulation and control measures, thanks to new legislation that was enacted but also thanks to further and specific programmes formulated for that end. Programmes such as the "PPG-7 Pilot Programme for the Protection of Brazilian Tropical Forests" have had more latitude of implementation.

Other programmes like, for example, PREVFOGO (Programme for the prevention and combat of forest fires and burnings) and PROARCO (Programme for the inspection and policing in the region of the deforestation arch in Legal Amazonia), besides a series of "annual operations of inspection and control", involving IBAMA and OEMAs, destined to reinforce the control and monitoring of deforestation and timber exploitation, have been allocated substantial human and financial resources for structure and capacity building, training and purchase of modern equipment, in order to improve the effectiveness of control and inspection actions and the integration among federal and state institutions.

The system of monitoring and control built by FEMA/MT (see Box 3) is a concrete example of these efforts. FEMA has received resources from PPG-7 and from the PRODEAGRO/MT ecological-economic zoning programme to build its licensing and monitoring capacities. Such programmes in other states of Amazonia have also been reinforced under the aegis of PPG-7.

Since "Our Nature Programme", and particularly from 1995/96, the areas of monitoring, control and inspection of deforestation, forest exploitation and environmental licensing of agricultural activities have been receiving the biggest sums of federal budget resources and of international funds destined both for the Federal Agency-IBAMA and to OEMAs. More recently (2000), the government sanctioned Law 10165/00 that created the "fee for environmental control and inspection", a specific levy to be paid by all activities of potential environmental impact and users of natural resources, and whose funds will revert to IBAMA and will reinforce the institution's capability of exercising its policing and inspection competence. The involvement and participation of NGOs (national and international) have grown considerably and have been fundamental in contributing to all of these government initiatives and efforts towards a more decisive action in controlling activities in the Amazon. In 1996, various reports from NGOs on illegal activities in

the Amazon involving timber exploitation were published, nationally and worldwide. At that time, the government, as a result of an intergovernmental working group coordinated by the then Secretariat of Strategic Affairs of the Presidency of the Republic, estimated that approximately 80 per cent of all wood that was traded in Amazonia would have been obtained either illegally and/or without the required licences and documentation. Until the mid-1990s the costs of the "illegality" involved in activities of forest conversion and associated deforestation, as well as of timber thefts from indigenous reserves and some conservation units in Amazonia, were still very low.

It is only since the second half of the last decade that this situation began to change more decisively. The enacting of a new legal apparatus (especially Law 9605/98) and the strengthening and increase of inspection and control operations in Amazonia have resulted in quite relevant infringement findings, the issuing of substantial fines and numerous apprehensions of illegal timber. In the state of Pará, for example, the total value of fines imposed by IBAMA in 1999 reached at least US$1 million. In the following years, with the intensification of inspection and policing operations in the region, the total value of fines increased further, and in 2001 may have reached the sum of US$ 15 million for the whole region. By 2001, the total volume of timber confiscated by IBAMA in Amazonia is said to have been 295,000 m^3 (cf. Simula, M.[43]).

These renewed and strengthened inspection and control actions by environmental agencies in the Amazon seem to have led to a considerable increase in the costs of engaging into and maintaining illegal/fraudulent activities in exploiting and trading timber in the region. Even if fines imposed end up not being fully paid, the infringement evidence and indictment represents an additional cost to the infractors due to the need to seek legal advice, the possibility of having assets frozen, loss of part of the raw material, etc. Even though these more effective controls and inspections cause an increase in management costs, the general tendency for agents is to choose the legal path of action.

In general, people tend to continue committing illegal acts as long as illegality costs remain lower than the costs of getting legal timber. One result of the various control and inspection operations of IBAMA and OEMAs in Amazonia was that the costs of remaining illegal were significantly increased. According to estimates of Friends of the Earth/Brazil (FoE)[44], because of these stronger and more systematic control and inspection actions, the costs of illegality increased to a level around US$ 4-6 per m^3 of logs, something very close to the unit cost/m^3 paid to landowners/settlers for standing timber/harvesting rights.

The modality of timber exploitation through PMFS has been, perhaps, the one to suffer more control and inspections. Prior to the beginning of the renewed actions of control and inspections by IBAMA, it was known that PMFS had been widely used to cover up illegal/fraudulent extraction of timber. The streamlining of the rules for SFM and the systematic operations of auditing visits, control and inspection of the PMFS served to "clean" or "moralize" the instrument to a good extent. In 1996/97 IBAMA started a wide and complete auditing review of PMFS in Amazonia. Out of around 2,800 PMFS that were registered, and whose monitoring/control visits started in that year, 1592 plans were audited in the field (the rest were suspended or cancelled through mere documentation or legal review) and only 484 were considered "apt" to operate.

Box 3

System of inspection, licensing and monitoring of rural properties of Mato Grosso State

Since 1998 the state of Mato Grosso has instituted an LAU (single environmental licence) for rural properties to facilitate the licensing of agricultural activities, authorizing at once the location, establishment and operation of land use activities.

The state, through a Federative Pact signed with IBAMA, has the right to authorize deforestation in rural properties bigger than 1,000 ha (which amount to 85 per cent of the area of rural land holdings in the state, but which represent a small proportion of their number). The deforestation authorizations that are processed/operated by FEMA are issued on the back of the image-chart of the rural property that applies for the LAU. The system adopted by FEMA for the control of deforestation and of technical visits to the sites uses information technology systems, remote sensoring, geographical information systems and global positioning systems. FEMA promotes the production of information as much as it can. The map of annual deforestation for the state is done by private companies of the geo-processing sector. FEMA also uses private professionals of the environmental licensing area. FEMA only monitors, audits and inspects alterations in the use of land at the level of rural properties. The monitoring, control and inspection of timber exploitation is the responsibility of IBAMA, that is, the authorization/concession of timber exploitation volumes and consequent ATPFs are issued and conceded by IBAMA. deforestation authorizations of smaller areas in the state also continue to be IBAMA's responsibility.

On the basis of updated image charts (1:50,000) FEMA identifies in the deforested areas bigger than 1,000 ha the deforestation that occurred in APPs (permanent preservation areas). On these images, the inspection teams move to the field for the inspections, using also image charts of the previous year, to check whether or not landholders have deforestation authorizations. Each team is formed by one graduate technician and a driver. At least two teams have been mobilized to audit each property (the presence of two vehicles is important given the risk of break-downs and "atolamentos" – that is, getting stuck in the mud).

The work of FEMA has had the financial support of PPG-7 .
Rural landholders have to provide a digital map of their properties, including the limits of the legal forest reserves of these properties.

By 1998 the technical team of the Directorate of Forests – DIREF of IBAMA - had also begun to design and take the first steps in establishing SISPROF. Another proposal, though much less comprehensive, for an integrated control and monitoring system for forest exploitation and transportation of forest products in Amazonia would later (2001) be made by IMAZON (see Box 4).

The results of the auditing actions in PMFS, together with the other control and inspection operations launched by IBAMA in Amazonia since 1997, must have contributed to a reduction in the relative freedom to which timber industry operation and timber exploitation associated with deforestation in the Amazon were accustomed.

By 1999, the context of the considerable progress achieved by the government in agrarian reform policy, in terms of the numbers of settled families in the region (a boastful result of the government's achievement in social rural policy) started to impose pressure on other spheres of government, particularly pressures for relaxing or softening of some of the rules for controlling and authorizing deforestation.

The first normative instruction on the control of deforestation issued by the new administration that assumed the Ministry of the Environment in 1999 (IN 002/99) greatly simplified the rules for the authorization of deforestation in the Amazon: for deforested areas up to 3 ha per year, in the case of family agriculture practised in small rural holdings (smaller than 150 ha), deforestation authorizations were practically made automatic, without the need of a previous technical visit to the area. This decision also responded to complaints of timber merchants and timber-industry of the region, who denounced "the extensive and increased extortion by government inspection and auditing agents in the region". The new

normative instruction had the support of the associations of agriculture producers and rural labourers of the region, as well as of the Timber Trade Federation and timber industry associations of Amazonia. The normative instruction was also widely supported and endorsed by all environmental NGOs, regional and national, which started to have a more participatory role and involvement in the newly-inaugurated administration of the Ministry of the Environment.

Box 4

IMAZON's proposal for a control system of deforestation and forest exploitation in Amazonia

IMAZON has designed and proposed a system for the control of deforestation and forest exploitation in the Brazilian Amazon. One component of the system is technically based on FEMA's system already in use. It includes, nevertheless, two additional elements:

(i) integration of environmental management of the state and of federal governments, with the proposition that the control functions be specifically divided between the institutions involved, on the basis that each rural property is controlled in all respects (i.e. deforestation/forest conversion and forest management) by only one institution.

(ii) "tracing back" of transported and exploited timber, based on the "OMNISAT" system. Authorized deforestation and authorized PMFS allow the concession of certain volumes of timber to be exploited and transported. But the timber could only be transported in vehicles that were equipped with a mobile communication terminal, constantly providing information on the location of the vehicle to the controlling institution (central). The driver would have to declare the origin, quantity and destination of the transported timber. In a central data bank the authorized volume (from management or from deforestation) would be automatically decreased/diminished by the quantity of transported timber.

The OMNISAT system is being used worldwide by 350,000 vehicles. In Brazil the system is operated by AutoTrac in more than 30,000 vehicles (private and public). The monthly cost is estimated at around US$ 110 for the leasing of the mobile equipment and US$ 50 for the data communication. Per year this means US$ 2000 per truck, or US$ 10-15 million for the whole timber transporting fleet of the Amazon. This means a cost of US$ 0.30 or US$ 0.50 per m^3 of logs produced in the region (assuming a total of 30 million m^3 of logs per year). These figures should be compared with the costs of SISPROF presented in Section 6 of this paper (especially with the costs/fees proposed/planned to be charged by IBAMA for the Stamps of Origin).

Other aspects to be considered are that (i) the OMNISAT system has been developed for business administration and management, not for enforcement and control to be exercised by the public sector; (ii) the system will have major implications for individual exploiters and companies, which are frequently small in size and scale of production, and which work/hire labour that have limited skills; (iii) the control of transportation, as proposed, does not seem to allow for an effective tracing back of processed/manufactured timber to its origin; (iv) finally, it must not be forgotten that, according to the Forest Code and the Law of Environmental Crimes (and to its regulatory Decree), timber and other forest products must be accompanied by documents (licences/permits) in all of their routes/trips.

As FoE/Brazil[44] puts it, "the recognition that timber is the first short-term financial capital of an agrarian reform rural settler in Amazonia, and given the finding of a concrete impossibility of licensing and effectively following up his practices, has led the government to take an option for regulating in a simplified manner the raw material (timber) made available by deforestation and its injection into the commercial cycle".

From this moment, the sawmills of Amazonia were suddenly presented with a cheap and simple alternative compared to what had certainly been made more expensive and complex given the progress and increase in the apparent inspection actions and control of timber exploitation and trade in the region, already referred to.

The sense and direction of these new rules would be further strengthened by another normative instruction (Normative Instruction no. 003/2002, quoted under 3.3.3.5), later to be issued by the Ministry of the Environment, in which the treatment and prerogatives given to small rural producers and settlers would be extended to landholdings or properties of up to 400 ha. DIREF of IBAMA, through a "Technical Note" to the Presidency of the Institute, warned about the consequences and risks of that new normative instruction.

Note the numbers involved with such a "regular" flow of timber in terms of the Amazonian timber production magnitudes: as we mentioned before, given a total official number of at least 300,000 settled families in the region, one could easily expect a "regular", "simplified" potential injection of at least 14 million m^3 (300,000 x 2.5ha/year x $20m^3$/ha) of logs into the timber market of Amazonia (a volume of $20m^3$/ha was fixed as the quantity of timber to be promptly conceded in a simplified deforestation authorization). This represents around 50 per cent of the regional annual production of 28-30 million m^3 of timber (logs). It should be noted that this could also now represent the percentage of "legal", "regularly authorized" timber in circulation in Amazonia, at least (there would still be the percentage of regular timber from apt or authorized PMFS).

In the face of the new rules, the new easily licensed supply of timber from agrarian reform settlements and other small rural properties in the Amazon would increase considerably and would end up promoting or leading to:

(a) The emergence of "intermediary agents" or middlemen (an extension of traditional loggers that operated in the region) that "channel" timber from settlements' deforestation to sawmills, which contributes to reinforcing the reduction of vertical integration in the region's timber industry, or to reinforcing the dependence of the industry on out-sourcing of timber or on the purchase of timber from third parties (a marked characteristic of this industry in Amazonia, as pointed out by authors such as Scholz, I.[31]).

> As has been seen, one of the features of the "boom & bust" character of the timber industry in the region is precisely this unwillingness or aversion to invest in the formation of its own forest base. The resulting consequence has thus served to deepen/reinforce the industry's dependence on deforestation timber and its associated logging practices.

(b) The need for that "intermediation" of channelling timber from settlements to sawmills to be further qualified. The simple and easy way of getting licensed volumes of timber from deforestation in these rural properties does not necessarily mean that these authorized volumes of timber will really and effectively be extracted from their corresponding deforestation sites and taken to the sawmills and processing units.

In fact, it is quite possible and likely that these easily obtained licences will serve (i) simply and only to cover up illegal/unauthorized (and not caught by inspection) extractions from any other sites, summing up the total authorized volume (in which case a "fee" would have to be paid to the settlers for the really non-existent, or non-extracted, timber from their properties), or (ii) to cover up, partially, illegal extractions from other sites, given that the extracted volume from the corresponding licensed sites would not have exhausted the total authorized volumes, in which case, also, a "fee"/price (implicitly or not, perhaps included in the price of the timber) might somehow have been negotiated between the "intermediary" and the settlers or small rural producers;

(c) The additional supply of easily authorized timber from deforested sites may have contributed to a possible reduction of "corruption fees/bribery costs" charged by corrupt officials in the region involved in fraudulent timber operations. It may also have contributed to reducing the covering-up of illegally obtaining timber through the use of "paper" or "ghost" PMFS, an alternative that, as we saw, used to be employed in the region but whose existence had been strongly combated through the extensive auditing and inspection operations undertaken by IBAMA.

(d) The new regime must have lowered transaction costs of getting timber for exploiters as well as for the timber industry;

(e) These new licensed volumes of timber thereby "injected" in the market of Amazonia will have been more than enough to keep the prices of timber sufficiently low (or to depress prices even further) and, therefore:

(i) will have surely contributed to worsening the competitiveness conditions of sustainably managed timber in the region, thereby making life more difficult for those that have engaged (or wanted to engage) in any sort of more environmentally sound activity, and in need of more economic profitability.

Prado, A.C.[26] and Angelo, H. and Prado, A.C.[39] have called attention to the fact that the two distinct sources of timber supply in Amazonia (deforestation x forest management) compete with each other, and that within present market conditions, timber coming from managed forests cannot compete with much cheaper timber coming from deforestation. The authors, therefore, suggest that to increase participation of forest management and of timber sustainably managed in the total supply of tropical timbers in the Amazon there is a need for measures that promote price differentiation between the two sources/types of timber, in favour of sustainably managed timber, of course, and not in favour of deforestation timber;

(ii) may not have represented, after all, a real advantage or gain to small rural producers or settlers (except, perhaps, in the very short term), given the outcome of lower market prices for timber;

(iii) served to deepen the ties and incentives that exist between timber exploitation and deforestation in the Amazon, reinforcing the significant propelling effect that the "boom & bust" timber industry exerts in the expansion of deforestation in the region; and

(iv) although the new regime might have eliminated or reduced the perverse action of "corrupt officials", it did not eliminate, perhaps not even reduce, the unfair/fraudulent businesses or deals involved with timber exploitation and trade associated with deforestation in the Amazon.

In what could be seen as a pathetic attempt at public recognition and warning that these have been the likely results of the new rules imposed on authorizing deforestation in small rural properties and settlement areas in the Amazon, FoE/Brazil[44] calls this new reality a "predatory legality". Nice name for an old, widely known problem. Combating illegality is indisputably essential and necessary, and there is ample evidence that much progress has been achieved in this direction. Nevertheless, it is insufficient to revert the predatory and transient character of timber exploitation and the workings of the timber industry in the Amazon, whose incentives make them so deeply associated with deforestation[2]. On the other hand, to resort to measures, even if well-intentioned, in the name of simplification, for an alleged short-term alleviation of the harsh living conditions of the rural poor, may end up "turning the sorcery against the sorcerer".

Be that as it may, there still are some complaints from parts of the timber industry, in terms of "operational difficulties" related to getting the licences, specifically from agrarian reform settlements in some areas of the Amazon, where the local INCRA offices have not been capable or willing to carry out the simple licensing due to difficulties in providing the necessary information on the allocated settlement lots or parcels.

These sectors of the industry have been using this type of argument to "justify" that they keep using PMFS in a fraudulent way, as a mere façade to cover up illegally obtained wood from deforestation (or from anywhere else), because of those operational obstructions. As if the difficulty (or facility) in obtaining licences for deforestation timber were the real determining factor in their using (or not) PMFS falsely or as a façade instrument. The ease in obtaining these licenses is certainly not what would make forest management an attractive or more competitive activity in the Amazon.

[2] No comments are provided here on other policies/measures already taken (or still to be taken) that, being more oriented to incentives instead of control, have resulted (or could result) in more efficient and effective achievement of the goals of forest conservation and sustainable forest management, as well as of reduction of deforestation in the Amazon. A detailed review and analysis of these other policies/measures may be found in Angelo, H. and Prado, A.C.[39], op. cit.

4. SISPROF – GENERAL DESCRIPTION

SISPROF has as one of its objectives the establishment of a roster of rural properties, authorized by IBAMA, to carry out forest resource use activities. This registry will be associated with Landsat satellite images with the purpose of facilitating and improving the command and control actions related to the activities developed in these properties. SISPROF also aims to provide greater effectiveness to the monitoring and control of sustainable PMFS, of deforestation authorizations or permits for conversion of forest lands to alternative agricultural use, of forest replacement or reforestation projects in fulfilment of the obligatory forest replacement rule, in sum, to monitor the different forms of access to forest resources as established by Brazilian legislation. SISPROF will also provide the control of all flows of forest products related to the incoming and outgoing movements of raw material and manufactures, to and from forest-producing areas, manufacturing industries and commercial establishments, identifying, mapping and following up, in a more effective way, the whole chain of custody involved in the exploitation, production and commercialization of forest resources and products.

As a means of enforcing forest policy and legislation, and as an instrument of administrative and technical support to IBAMA in consolidating innovative and modern mechanisms and tools of the regulatory processes of environmental and territorial management, SISPROF represents the incorporation of the most modern and available technology information instruments in terms of the monitoring of forest cover changes, providing the identification of biomas and predominant forest typologies in rural private property areas, the extension of the areas under use, the location of permanent preservation areas and legal forest reserve areas, as well as monitoring the maintenance and dynamics of the alteration of these areas in rural private properties.

The treatment of this information, through the use of geo-processing techniques, under the scope of GIS, provides information that is even more refined, indispensable for the planning and management of the inspection, policing and control actions of IBAMA. Demystifying the ineffectiveness of control and monitoring systems in the Brazilian Amazon is, perhaps, the biggest challenge for SISPROF.

The establishment of a modern, trustworthy and effective control and monitoring system, capable of contributing decisively to the zoning and to the putting in order the use of forest resources, will allow IBAMA to know better how and where to prioritize activities. As such, society will have at its disposal an important data bank with precise information about rural properties that, for instance, adopt sustainable management practices in the use of forest resources, such as PMFS, or that still practise unauthorized or illegal deforestation, in addition to an excellent basis of geo-referenced information on the municipalities and states where these properties are located.

In spite of being a system for application and use at national level, SISPROF is being established and put into operation, initially, in the nine states of the Legal Amazon, including Acré, Amapá, Amazonas, Maranhão, Mato Grosso, Pará, Rondônia, Roraima and Tocantins, with a mandate to control and monitor an area of approximately 398 million hectares of tropical rain forests in the Amazon region.

Taking into account the great territorial extension, the lack of adequate structure of state environmental agencies, and the operational difficulties in the region, the establishment of SISPROF was initiated in 23 IBAMA bases (offices), chosen in a strategic way to provide coverage to and feasibility of attending the main towns and timber-processing centres or poles of the region. So, as a priority, each base will be covering an area within a radius of 200 km, involving some 500 municipalities, where citizens and users of forest resources will be attended to in a more rapid manner and closer to their properties.

Map 4.1, below, shows the location of the 23 bases and their respective areas of scope, corresponding directly to around 80 per cent of the municipalities of the “deforestation arch” of Amazonia.

SISPROF is based on three pillars (Figure 4.1):

On the techniques of geo-processing for the control of rural property areas, made up by the RSS, Global Information Systems (GIS) and the Global Positioning System (GPS).

On the data bank with Oracle Technology and Delphi 5.0 Language, which carries out registration of properties, "forest projects" (PMFS, forest exploitation projects for conversion of forests to alternative agricultural use of land - linked to deforestation authorizations or permits - reforestation projects and forest replacement projects), licences and authorizations, the control of the flow of forest products (commercialization and transportation of wood and non-wood forest products) and the issuing of ATPFs or "forest origin" stamps.

On the validation of field data. Field work that is carried out through PMFS, in areas that require deforestation permits, and in reforestation projects linked to obligatory forest replacement, produces a quantity of information that systematically provides the validation and updating of data that is fed into the system. In this context, the actions of IBAMA devoted to capacity building and training of its own technicians, e.g. of OEMAs, of the productive sector, of communities and professionals, as well as to the development of technical manuals, and the planning and setting of criteria and standards for field work, are also included.

Map 4.1: SISPROF bases in Legal Amazonia – IBAMA/DIREF/CGREF

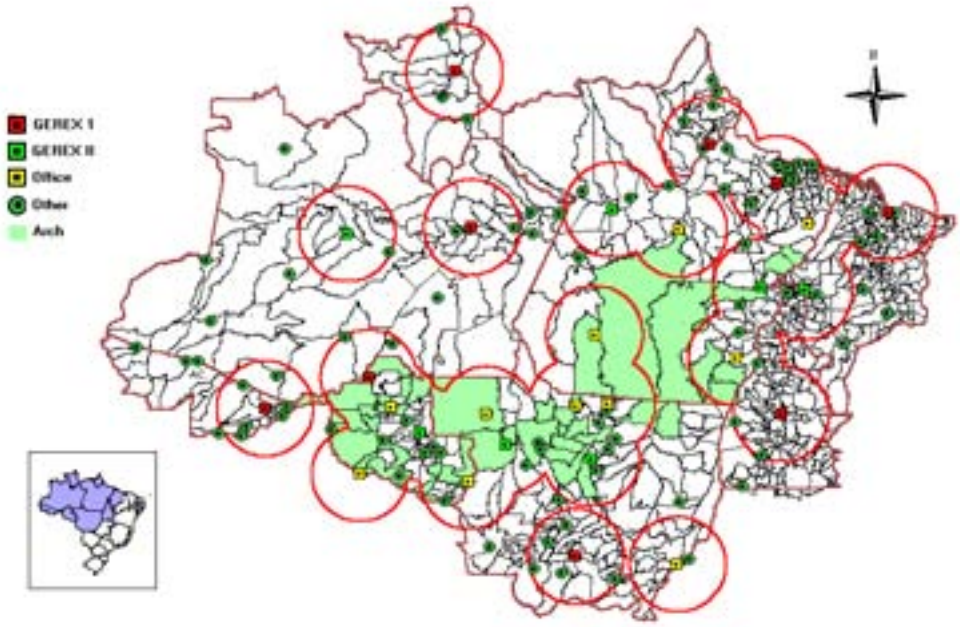
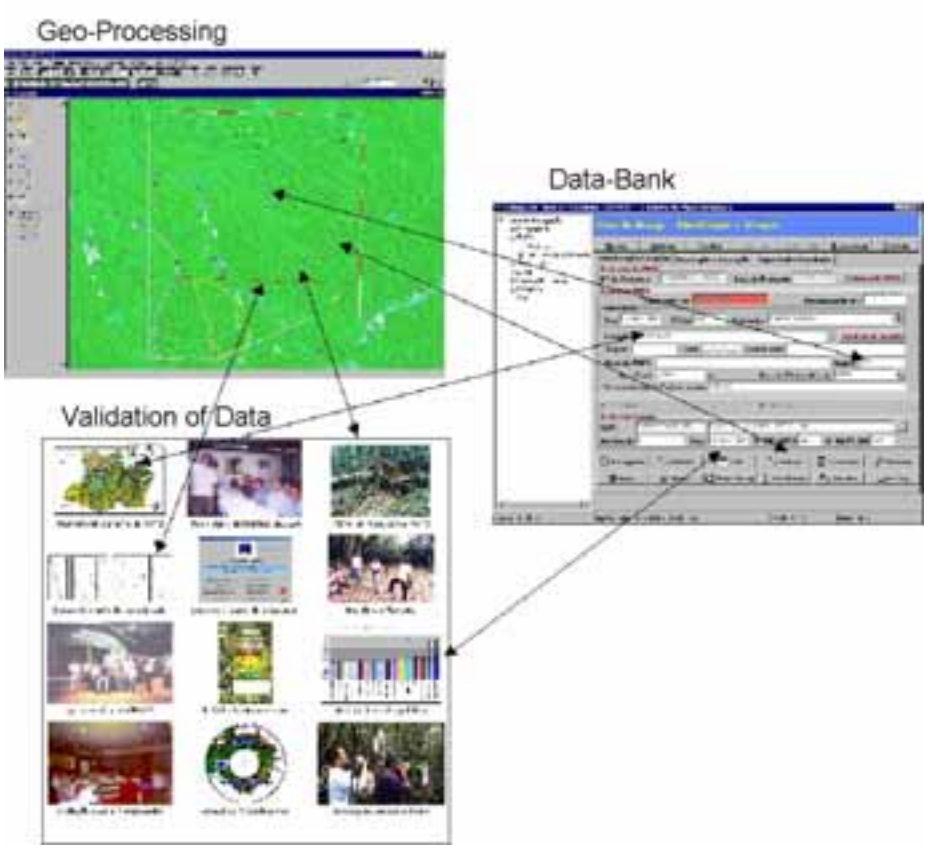


Figure 4.1: The three pillars of SISPROF



4.1 Geo-processing in SISPROF

The control and monitoring of forest activities in rural properties requires agility in managing a significant volume of information and the use of appropriate technologies for collecting and handling these data and information, e.g. to assess if the areas of permanent preservation (APP) and of legal forest reserves (ARL) are being respected by the property owner, identify non-authorized deforestation in areas of the property, enforce the accomplishment of forest exploitation authorizations, monitor and evaluate areas of PMFS and follow up recuperation plans for degraded areas.

For these purposes, SISPROF uses technologies of geo-processing, as well as its data bank, where all rural land-properties, with some type of authorization given by IBAMA, are registered. The main technologies used by SISPROF in the area of geo-processing are RSS, GIS and GPS.

4.1.1 Remote sensoring system (RSS)

The use of satellite images is essential for getting information on forest cover and its alterations. In SISPROF, multi-spectral images of satellite TM-LANDSAT 7 are used. Topographic maps of IBGE (Brazilian Institute of Geography and Statistics) in the scale 1:100,000 and 1:50,000 (when available for the object area of the study) are also used for the geo-referencing of projects and plans submitted to IBAMA and for guiding the work of interpreting images and geo-referencing data. The vegetation and land use thematic maps of the areas of interest for the projects and plans are also used for the consolidation of the database.

With the purpose of obtaining the present use of land and forest typologies of areas in use, the Remote Sensoring Centre (CSR) of IBAMA carries out the work of interpreting satellite images, preparing and

updating the operational base of the system, having as inputs the most recent images now purchased on a permanent basis from INPE (and, in the future, from SIVAM - Vigilance System of Amazonia), the information derived from field visits (updated and geo-referenced by field data validation) and the refinement achieved from the vegetation maps of land use and topography.

4.1.2 Geographical information systems

The systems that are used for treating and providing the geo-processing of data are the ArcView and the ArcInfo, which produce archives in interchangeable formats to the Oracle data bank of SISPROF, making access to and use of information already registered in the referred data bank more feasible and easy. GIS allow a quick analysis and integration of geographical data (maps, geo-referenced images and field collected data) with other information (the system's data bank) involving the registry of properties, property owners, areas in use and projects and plans in operation.

The utilization of GISs integrated with remote sensoring (geo-referenced images) and with the SISPROF data bank allows the issuing of licences and authorizations by the system, with a precise location of the authorized activities in a rural property and its monitoring at any time. Systems of digital image treatment are also used to allow a better definition of images, the elaboration of image cuttings in the areas of interest and the compounding of digital mosaics.

The SISPROF data bank can be integrated with other banks and operational systems of IBAMA, through the GIS's ArcView and ArcInfo, supplying information on maps, graphs and tables, such as on illegal deforestation. In this case, the IBAMA system that monitors areas with deforestation can consult the SISPROF data bank and may generate information quantifying and locating deforestation, as well as identifying whether or not this deforestation has been authorized by the Institute. This type of information, if made available to the area of inspection and surveillance/policing of IBAMA, will lead the Institute to more effectively and efficiently management of the environmental resources. So, an integrated SISPROF with other systems of IBAMA, such as those of deforestation monitoring, heat foci control, the federal technical registry of potentially pollutant activities, and of income and receipts of IBAMA, can and should develop detailed maps and reports for the monitoring and inspection/policing actions of IBAMA in Amazonia.

4.1.3 Global positioning system

Current technology allows the geographical location of any object in the globe with a precision that varies from 1 to 15 meters. The system that made this possible is called "global positioning system" and was conceived by the US Defence Department at the beginning of the 1960s under the name of "project NAVSTAR". The system was declared fully operational only in 1995. It consists of 24 satellites that orbit the earth at 20,200 kms twice daily, and issue coded radio signals simultaneously. The system was originally projected for military use, but in 1980 it was opened for general use, while reserving better precision for the military.

This system allows, through eletronic means, that calls from GPS receivers can convert satellite signals into positioning and geographical location. There are different receivers available on the market made by different manufacturers, from the portable ones – that cost just over US$100 - to the more sophisticated computers on board aircraft and navy vessels, as well as those that come as appliances of modern cars. Besides receiving and decoding satellite signals, the receivers are real computers that permit different options: references, measure systems, coordinate systems, data storage, data exchange with another receiver or computer, etc. Some models have detailed maps in their memories. A small liquid crystal screen and some keys permit the interaction receiver/user.

IBAMA uses in its field work a portable-type receiver that works with four AA batteries; its memory has a storage capacity of up to 500 points, 20 different routes, and registers its movements automatically. It allows the entrance/exit of data to other equipment and costs approximately US$ 300. These appliances permit the measurement and calculation of areas as well as the GPS-computer connection when specific

software is used for this end. Besides portable GPS, IBAMA also counts on a sophisticated system of mobile communication of data and monitoring and tracking of vehicles called OmniSat System, which uses communication resources of the BrasilSat satellite and of GPS positioning. The OmniSat system uses technology for remote transmission of data and tracking of vehicles in transport operations in any part of South America, providing the instantaneous exchange of messages and data among the vehicles and their operation bases.

The system is basically composed of: hardware, on board the vehicle, called MCT-Mobile Communication Terminal, and software, installed in the operation bases of IBAMA, called QTRACS-BR. In this way, it is possible to send and receive an enormous quantity of data and information on time, from any part of the country. To guarantee the full functioning of this operation, the AutoTrac Company, supplier of the services, has an exclusive channel of communication in the BrasilSat satellite, where all messages of the system are transmitted.

IBAMA has today a fleet of 130 vehicles equipped with the OmniSat system/AutoTrac for the Institute's inspection and policing actions, and this fleet can also be oriented to move to areas of PMFS, deforestation areas, agricultural burnings and other forms of environmental degradation, where technicians and inspectors will be capable of making consultations with the SISPROF data bank, through that system. The software and programme facilities for this type of communication are being developed by IBAMA and AutoTrac.

In the case of SISPROF, technicians use portable GPS appliances in field work for moving from one place to another, for location, for measuring areas and for collecting geographical coordinates of areas and properties that have been visited. The collected information can be transmitted by the OmniSat/AutoTrac installed in the vehicles and, automatically, registered in the geo-processing module of SISPROF. For that purpose, the necessary equipment is:

GPS portable receiver type Garmin 12XL, Garmin III Plus or Magellan 2000 XL;
AutoTrac unit installed in the vehicle with hardware MCT and software QTRACS/ BR;
Pick-up type of vehicle, with 4x4 traction;
Operational Base with computer type: Pentium Processor IV, 1.3 Ghz or superior, HD of 20GB, RAM of 256 MB, CD-ROM and Multi-use printer;
Software with the facilities to integrate SISPROF with AutoTrac (in development).

4.1.4 Computational apparatus of IBAMA's bases

In the execution of office works in all 23 bases of IBAMA, computers with sufficient capacity to undertake both imagery processing and geographical information processing are used. The installed computer capacity to allow the operation of the ArcInfo and ArcView software has the following basic configuration:

Micro-computer (two units per base)

Pentium III processor, with minimum clock of 700 MHz

Memory RAM minimum of 512 MB

Windows 2000 Professional operational system

Video plate of 32 MB

Hard Disc minimum of 20 GB

17" Monitor

IDE Internal CD recorder, with minimum speed of 32x8x4

Internal DVD-Rom unit, with minimum speed of 8x

Standard Network plate Ethernet 10T-100TX

02 serial doors

Fax Modem plate 56k and multi-media kit

Ink-Jet Printer (one unit per base)

Impression in size A3

Minimum resolution of 1,200 dpi

Standard network plate ICP and LPD

Parallel interface Centronics and USB

Printing speed of 11,000 ppm

Color Table Scanner

Size A4

Minimum Resolution of 1,200x600 dpi

ArcView software license with Image Analysis extensions

4.1.5 Roster of geo-referenced information in SISPROF

The roster of geo-referenced data and information of a rural property, and thus of a PMFS, of a deforestation authorization for alternative land use, or of an obligatory forest-replacement project, in the geo-processing module of SISPROF follows a basic routine with technical specifications for the elaboration of projects, in analogical and digital formats, to be presented to IBAMA by the owners or holders of such projects. The rural property documentation, the identification of owners/holders and of the professional technically responsible for the activities to be implemented, as well as the analogical project with the environmental features of the areas that constitute the property, will be registered in the "property", "PMFS" and "authorizations" modules of SISPROF. The geo-processing module registers the digital project handed in by the interested agent, with the digital map and image archives of the property, in accordance with the following technical specifications:

- the geo-referencing of raster and vector archives must be based in a digital grade of geodesic coordinates, referenced to Datum SAD-69, to guarantee a homogeneous cartographic base;
- the vector maps, with geographical coordinates and Datum SAD-69, must be delivered in formats CAD (DGN, DWG and DXF), Shapefile (SHP), ArcInfo Coverage or export archives type E00. The digital archives must reproduce all the thematic features related to the property, so that one may identify the use and occupation of land (property limits, legal forest reserve areas, permanent preservation areas, altered areas, with or without agricultural projects, pasture areas, etc.) in open polygons and with due measurements of each type of area in hectares;
- all polygons (areas) must be geometrically closed, and perfectly connected, with the aim of allowing vegetation typology identifications, avoiding flaws or overlaps that jeopardize the continuity of linear elements and their respective knots;
- the archives with raster data (geo-referenced images) must be presented with GEOTIFF extension, and will be used for the process of complementing cartographic data, with the obligation of showing the satellite passage date in the stamp of the image-chart;
- the digital archives must be submitted in CD-ROM, non-compacted (ex: pkzip or arj), and, in the case of archives in format CAD (DXF, DWG and DGN), the project must contain the levels (layers) presented in Table 4.1, and for the archives in formats Shapefile (SHP), Coverage (ArcInfo) or E00, each project theme must be one archive, as Table 4.1 also shows;
- the scales of printed maps and image-charts must be: (i) for areas up to 2,500 hectares, maps in the 1:25,000 scale; (ii) for areas from 2,501 to 20,000 hectares, maps in the 1:50,000 scale; (iii) for areas over 20,000 hectares, maps in the 1:100,000 scale
- the analogical maps must be submitted in glossy-paper or similar (of the same quality)
- the legend, stamp and nomenclature of maps must follow the pattern established by IBAMA.

Table 4.1: Specification of themes related to the property

Level/Layer	Description
ATP AUA ARD AEXP AUAG AMF ARL ARLD APP APPD APPRL APPAUA AR	Total area of the property Area of alternative use Area required for deforestation Area to be exploited Area of agricultural use Area of forest management Area of total legal forest reserve Area of legal forest reserve (degraded) Area of total permanent preservation Area of permanent preservation (degraded) Area of permanent preservation in legal forest reserve Area of permanent preservation in alternative use area Remaining or free area in the property
	Water-basin ; altitude level curves; roads (federal, state, municipal, secondary, private)
	Limits (state, municipal); special areas (conservation units)

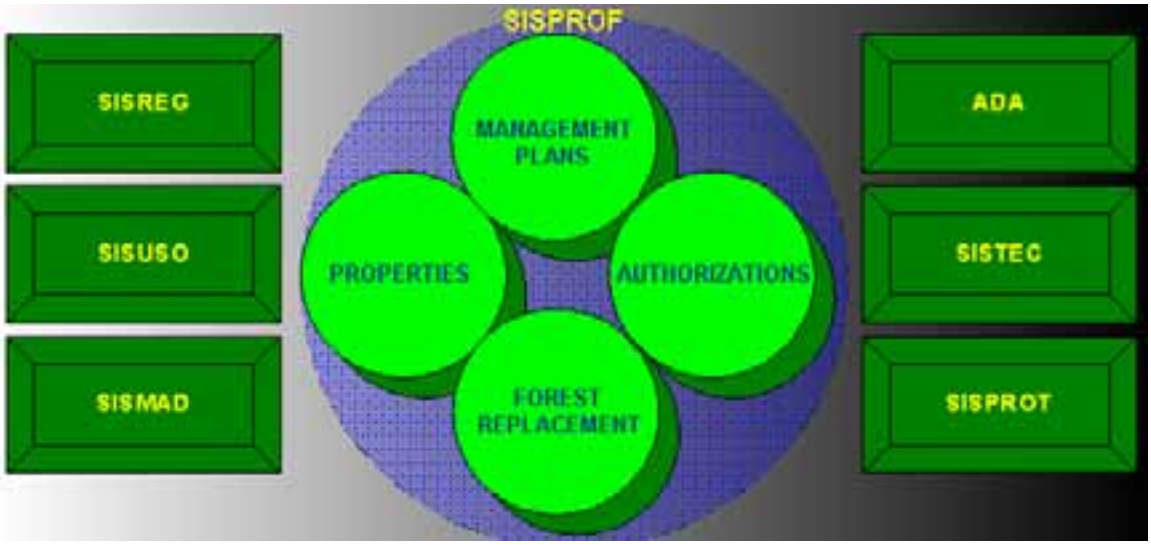
The proprietor (either an individual or a firm/company), besides submitting to IBAMA all projects in analogical and digital formats, also has to present all documents of the property to be registered in SISPROF. The cross-checking of information on forest cover, water-basin and limits of the property allows a greater precision to technical analyses of enquiries and requests for licences and authorizations for that property. The enquirer or licensee is legally responsible for the geo-referenced information that he provides, accompanied by the technical project (in analogical or digital formats) signed by an accredited professional. Figure 4.2, below, presents an illustration of geo-processing and geo-referencing of projects submitted to IBAMA.

Figure 4.2: Illustration of geo-referencing and geo-processing of projects submitted to IBAMA

4.2 The SISPROF data bank

The SISPROF data bank was conceived to facilitate interaction with the user and also with other systems of IBAMA: the system of registry (SISREG), the system of users with passwords (SISUSO), the system of control of flows and trade of sawnwood (SISMAD), the system of environmental declaration act (ADA), which is linked to the rural land tax (ITR), the system of technical/scientific names (SISTEC), the protocol system (SISPROT). Thus, SISPROF works with modules to make the handling of information easier for the rosters of properties and projects of PMFS, of deforestation authorizations, of reforestation, of in-flow and out-flow of wood and wood-products balance sheets of firms/companies, of the issuing of authorizations for the transportation of forest products (ATPFs) and, afterwards, the stamp of forest origin.

Figure 4.3 - Interactions of SISPROF with other systems

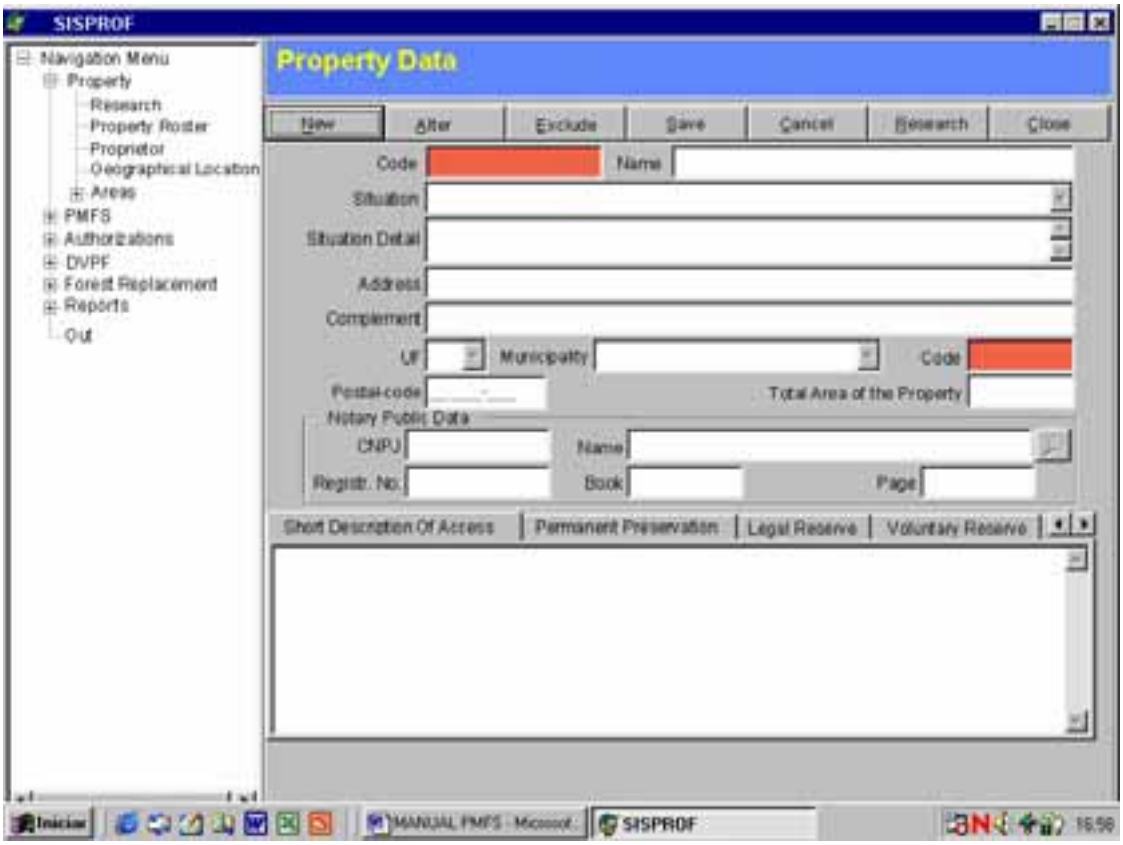


4.2.1 The module of properties in SISPROF

This module registers the following data and information of every rural property that has requested, or is requesting, any sort of authorization or concession from IBAMA: geographical coordinates of the estate, proprietors, land documentation, type of ownership, data related to legal forest reserves, permanent preservation areas, areas of ecological interest and of private natural patrimony reserves. The registration number of the property will be linked to its number in the national roster of rural properties of INCRA (National Institute of Colonization and Agrarian Reform), to its number in the roster of the rural land property tax (ITR) and the corresponding environmental declaration act of the secretariat of federal receipts (SRF).

This module carries out the control of the use of land in a property according to the precepts of prevailing legislation, with automatic updating of information whenever new plans/projects are approved and authorizations/permits are issued. A description of the module is given below:

Figure 4.4 – Property data



PROPERTY DATA

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
NAME OF PROPERTY	Full name of property	Ex: Santa Terezinha Farm
SITUATION DETAIL	For “others” the filling in of situation detail is obligatory.	When the property is rented or shared, fill in this space, giving date and time-term of contract.
ADDRESS	Give location and address.	
MUNICIPALITY	Choose the municipality of the location.	If municipality cannot be located, send request for inclusion to Brasilia headquarters.
TOTAL AREA OF PROPERTY	State the total area of the property.	
TYPE OF DOCUMENT	State the type of document according to relation below “Documents that typify possession”.	In the case of “possession”, if document presented does not figure in the list, choose “others” and fill name of document in space “Which?”
NUMBER OF DOCUMENT	State the number of the document of possession.	
DATE OF DOCUMENT	Give the date on which the document of possession was issued.	

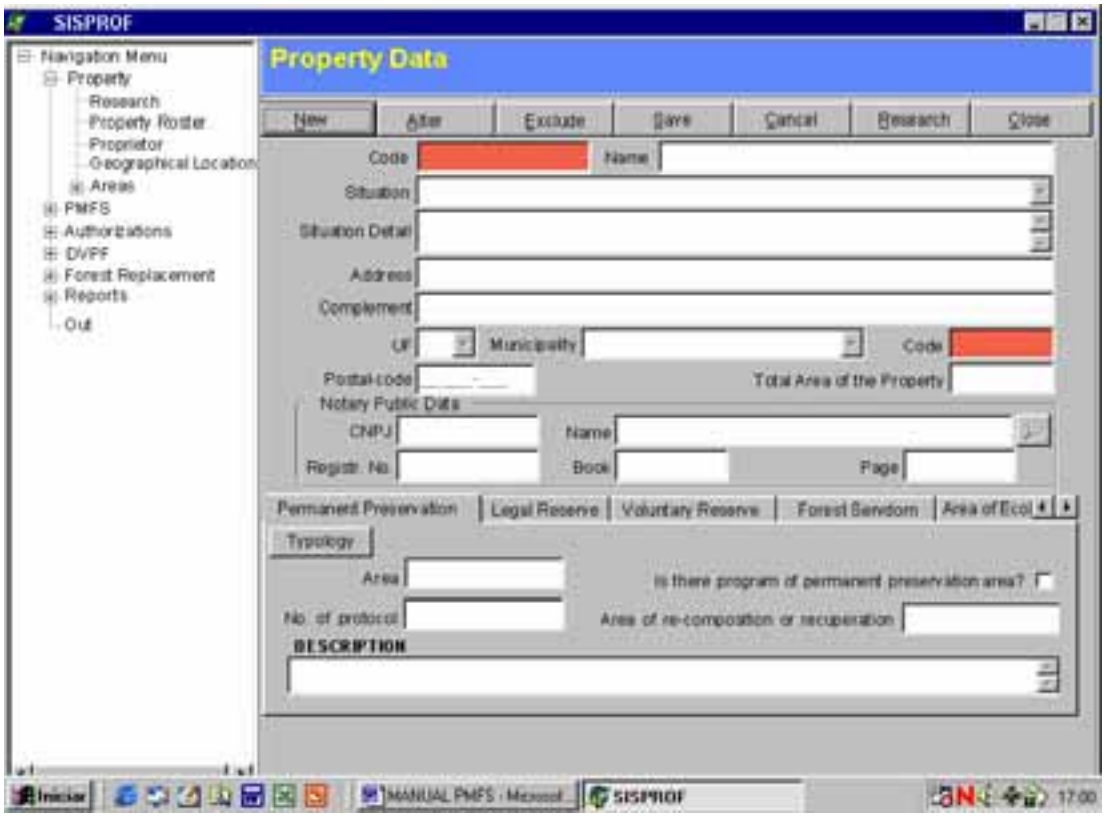
CNPJ/NAME OF NOTARY PUBLIC	Choose the notary public where property is registered. In case of non-existence, include the notary.	When the notary public has no CNPJ number, look for the 99999999999999 number (notary to be registered). Give the name in a separate sheet and hand it to the DITEC chief. Then register the notary and replace notary in property and PMFS.
REGISTRATION NUMBER	Registration number and/or property matriculation.	
BOOK	Book's number where estate is registered.	
PAGE	Book's page number where estate is registered.	
SHORT DESCRIPTION OF ACCESS TO ESTATE	State the access to property, indicating reference points and respective distances.	

According to Brazilian forest and environment legislation the f areas within a rural property should, as appropriate, be discriminated:

APP- Area of permanent preservation
SERFLO- Area of forest serfdom
RESLEG- Area of legal forest reserve (obligatory)
RPPN- Area of private natural patrimony reserve
RESLEV- Area of legal reserve (voluntary)
AIE- Area of ecological interest
REMAINING or FREE AREA- Total area of the property that can be used for any purpose.
SISPROF has specific sub-modules for each of the above categories, as given below.

4.2.1.1 Permanent preservation area –(APP)

Figure 4.5 – Permanent preservation area

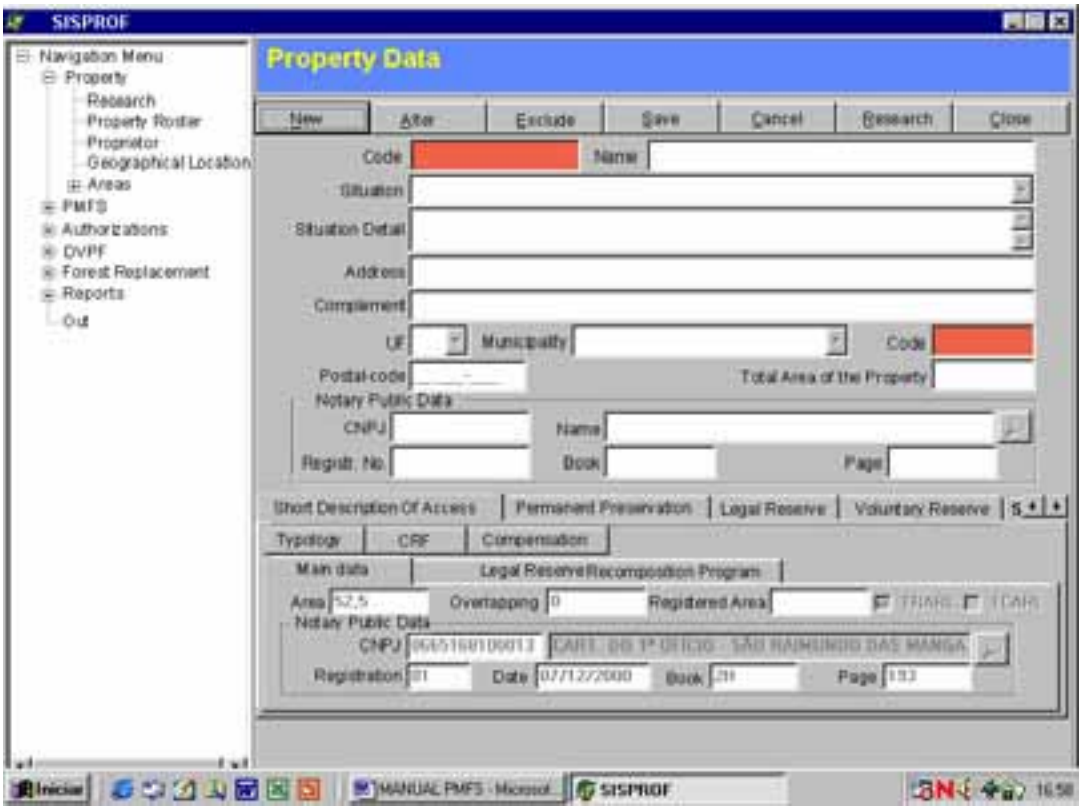


PERMANENT PRESERVATION AREA

IDENTIFICATION	DISCRIMINATION	OBSERVATION
AREA	State the permanent preservation area existing in the property.	
IS THERE A PROGRAMME OF RECUPERATION OF PERMANENT PRESERVATION AREA?	State if a programme of recuperation of permanent preservation area exists.	Register the commitment term if presented.
PROTOCOL NUMBER	Give the protocol number of the recuperation programme.	Register the commitment term with the same protocol of the authorization request.
RECUPERATION OR RE-COMPOSITION AREA	State the area to be recuperated.	State the area of the commitment term, if that is the case.
DESCRIPTION	Description of the recuperation programme.	State the form and time-periods of the term, if that is the case.

4.2.1.2 Area of legal forest reserve (RESLEG)

Figure 4.6 – Legal forest reserve



AREA OF LEGAL FOREST RESERVE

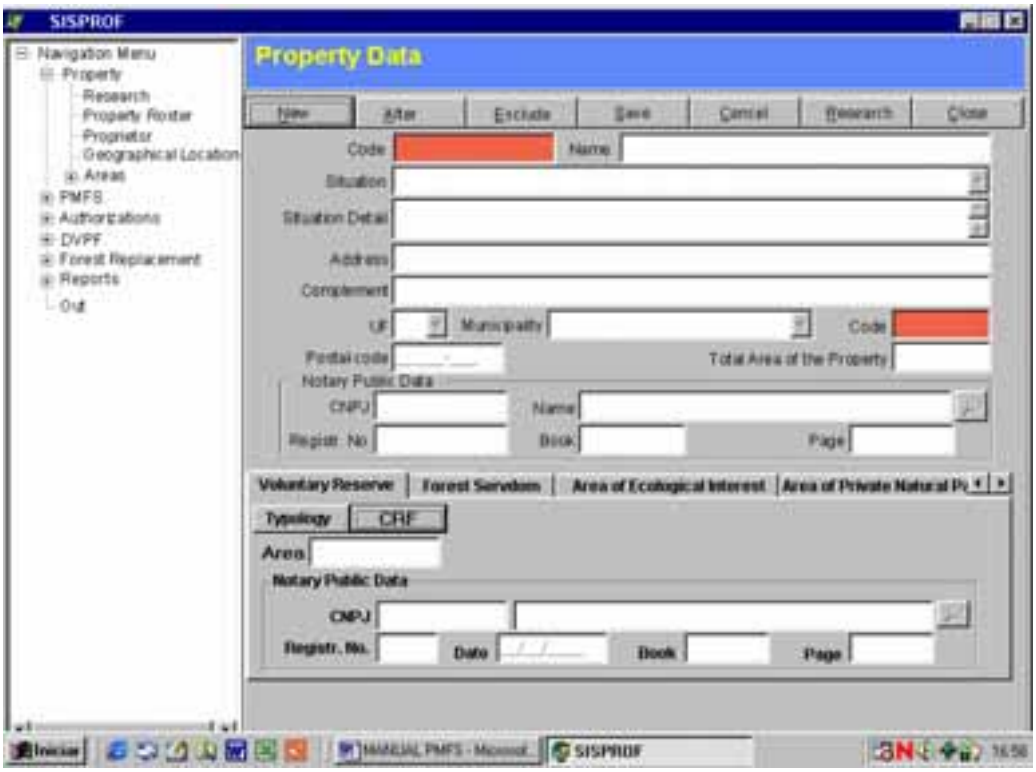
IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
AREA	Give the area of legal reserve.	Fill in with the required percentage as per present legislation, independently of the registered area percentage. Calculation of the RESLEG area: total area of the property minus permanent preservation area, with 80% of result for RESLEG in forest area, and 35% of result for RESLEG in cerrado area.
OVERLAPPING	State the area overlapping permanent preservation area.	
REGISTERED AREA	State the registered area from the document of registration in the notary public.	The registration of RESLEG in the notary public from May 2000 is 80% of total area less permanent preservation.
TRARL/TCARL	State if registration (TRARL-Term	

	of registration lf legal reserve area) or term of commitment of registration of legal reserve area (TCARL) exists.	
CNPJ	Choose or register the notary public where registration of RESLEG has been done or TCARL has been registered.	When the notary public has no CNPJ number, look for the number 99999999…, idem, idem, idem, idem ……. Idem.
REGISTRATION	Number of registration.	
DATE	Date of registration	In the case of TCARL, put the date of signature of the term or date of registration.
IS THERE A PROGRAMME OF RECUPERATION OF LEGAL FOREST RESERVE?	State if there is any programme in the property for this purpose.	

CRF=bonds/shares of legal forest reserves (new compensation modality of legal forest reserves introduced in recent modification of the Forest Code, not yet regulated).

4.2.1.3 Area of voluntary legal reserve (RESLEV)

Figure 4.7 – Voluntary legal reserve

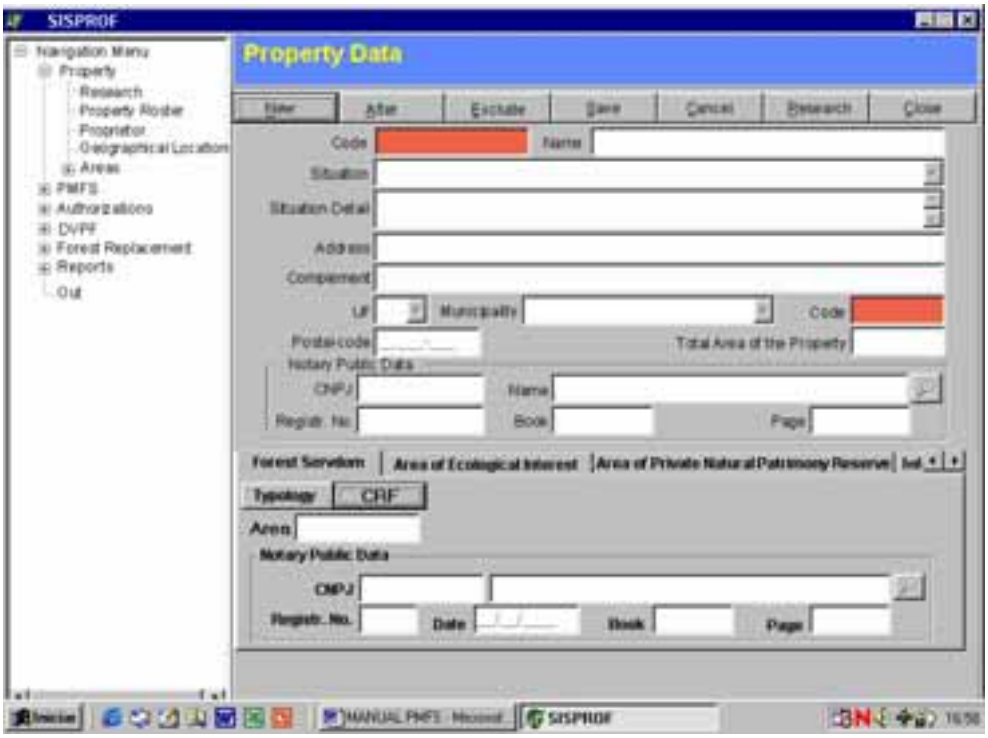


AREA OF VOLUNTARY LEGAL RESERVE

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
AREA	State the area of RESLEV, i.e. the excess to the minimum obligatory legal forest reserve that was registered in notary public.	
CNPJ	Choose or register the notary public were registration was done.	When the notary public ….. idem, idem, idem, idem, idem, idem.
REGISTRATION	Number of registration.	
DATE	Date of registration.	
BOOK	Book where registration was done.	
PAGE	Page of the book where registration was done	

4.2.1.4 Area of forest serfdom (SERFLO)

Figure 4.8 – Forest serfdom

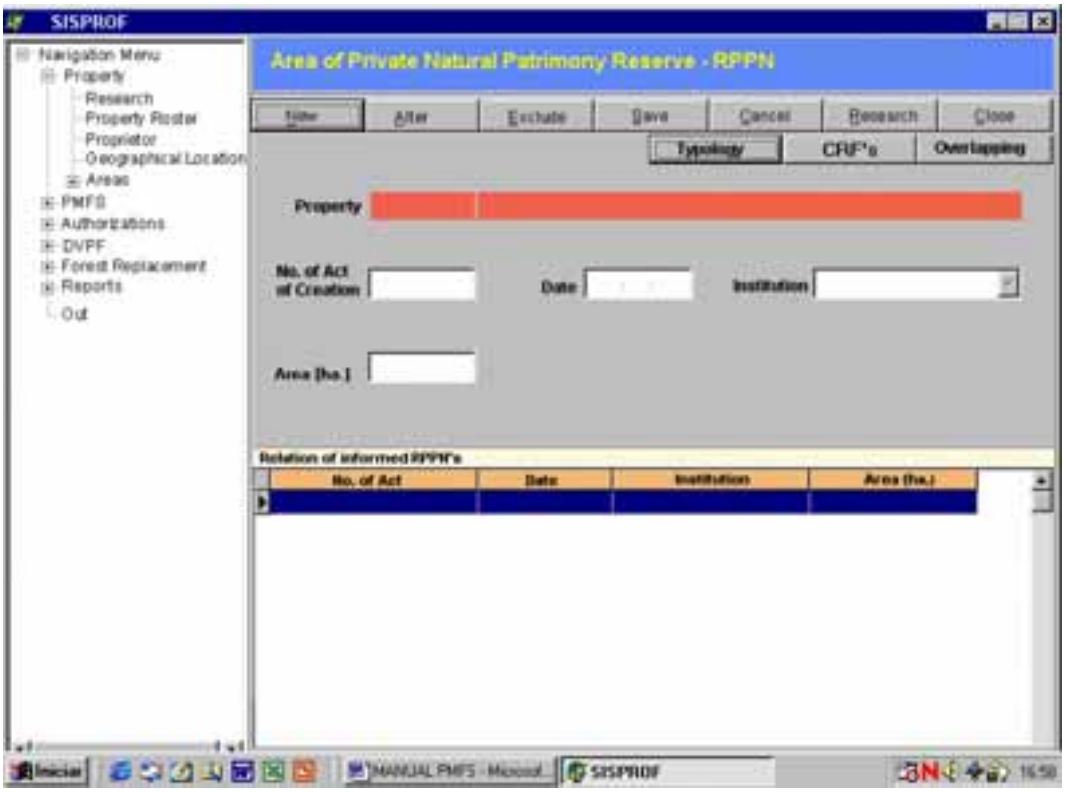


AREA OF FOREST SERFDOM

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
AREA	State the area of forest serfdom, i.e. the excess to the minimum obligatory legal forest reserve that was registered in notary public.	
CNPJ	Choose or register the notary public where registration was done.	When the notary ….. idem, idem, idem, idem.
REGISTRATION	Number of registration.	
DATE	Date of registration.	
BOOK	Book where registration was done.	
PAGE	Page of the book where registration was done.	

4.2.1.5 Area of private natural patrimony reserve (RPPN)

Figure 4.9 – RPPN

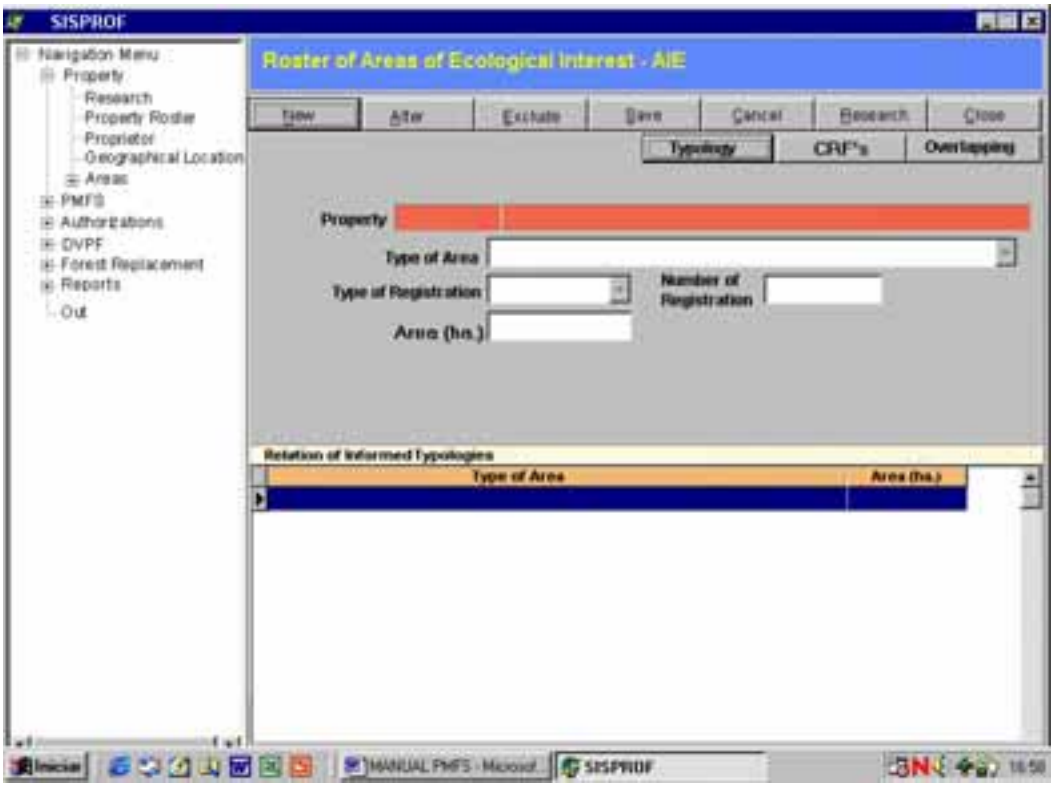


AREA OF PRIVATE NATURAL PATRIMONY RESERVE

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
NUMBER OF ACT	Fill in the number of the Act that approved the RPPN.	
DATE	Date of the Act that approved the RPPN.	
INSTITUTION	State whether the institution is federal or state.	
AREA	Give the area of the RPPN.	

4.2.1.6 Area of ecological interest (AIE)

Figure 4.10 – AIE

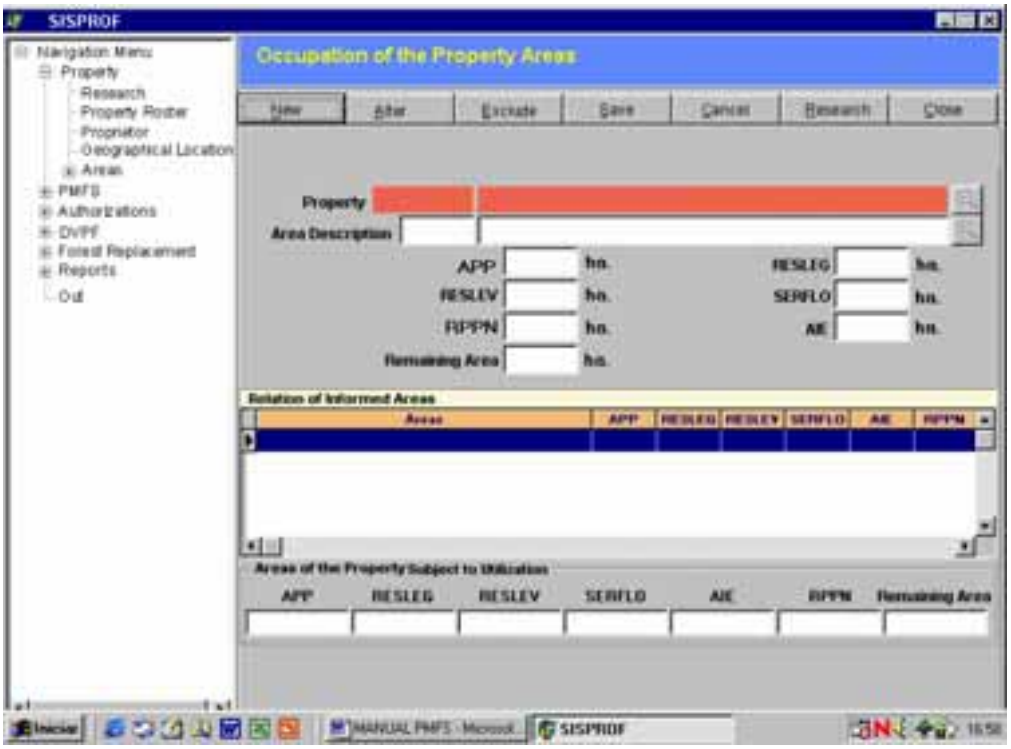


AREA OF ECOLOGICAL INTEREST

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
TYPE OF AREA	State among the existing areas only if approved by an official act of public power.	
TYPE OF REGISTRATION	State decree, law or other minor act.	
NO. OF DECREE	State the number of the decree, law or other act.	
AREA	Give the area of the AIE.	

4.2.1.7 Occupation of the property areas

Figure 4.11 – Occupation of property areas



OCCUPATION OF PROPERTY AREAS

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
ZOOM IN THE NAME OF THE PROPERTY	Show the list of occupied areas per end-use.	
DESCRIPTION OF AREAS	Choose in the table the existing occupation/use of land of the property.	
LOCATION OF THE USE OF LAND	State the area of the activity in the corresponding location	Ex: 1000 ha of PMFS area in the legal forest reserve area

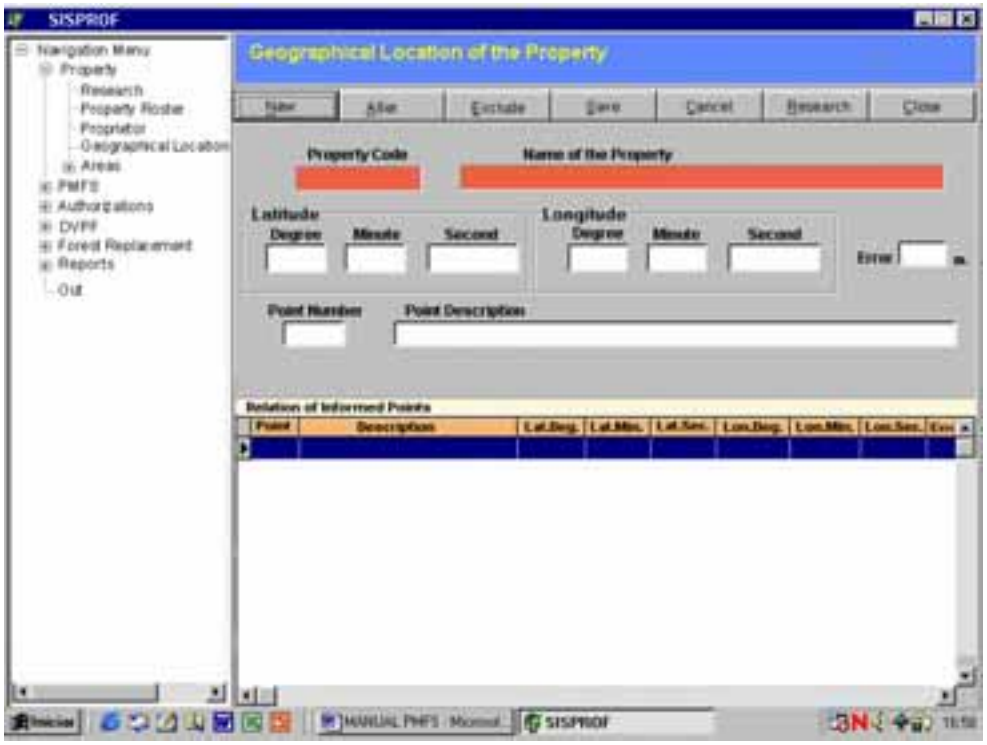
NOTE: The system will control the areas subject to utilization, informing the type of available area, according to the types given below.

DESCRIPTION OF OCCUPATION OF THE PROPERTY AREAS

01. COLONIZATION PROJECT
02. AGRO-PASTURAL PROJECT
03. AGRO-FORESTRY PROJECT
04. AGRO-SILVI-PASTURAL PROJECT
05. AGRO-INDUSTRIAL PROJECT
06. PROJECT OF RELEVANT PUBLIC INTEREST
07. REFORESTATION PROJECT
08. AGRICULTURAL PROJECT
09. CATTLE-RAISING PROJECT
10. INDUSTRIAL PROJECT
11. FLORICULTURE PROJECT
12. MINING PROJECT
13. FOREST MANAGEMENT PROJECT
14. URBAN PLOTTING
15. FRUIT TREE PLANTATION PROJECT
16. UNDER-USED AREAS
17. POULTRY PROJECT
18. INFRASTRUCTURE
19. FISHERY PROJECT
20. SAND MINING
21. SELECTIVE TREE HARVESTING

4.2.1.8 Roster of geographical coordinates of the property

Figure 4.12 – Geographical coordinates

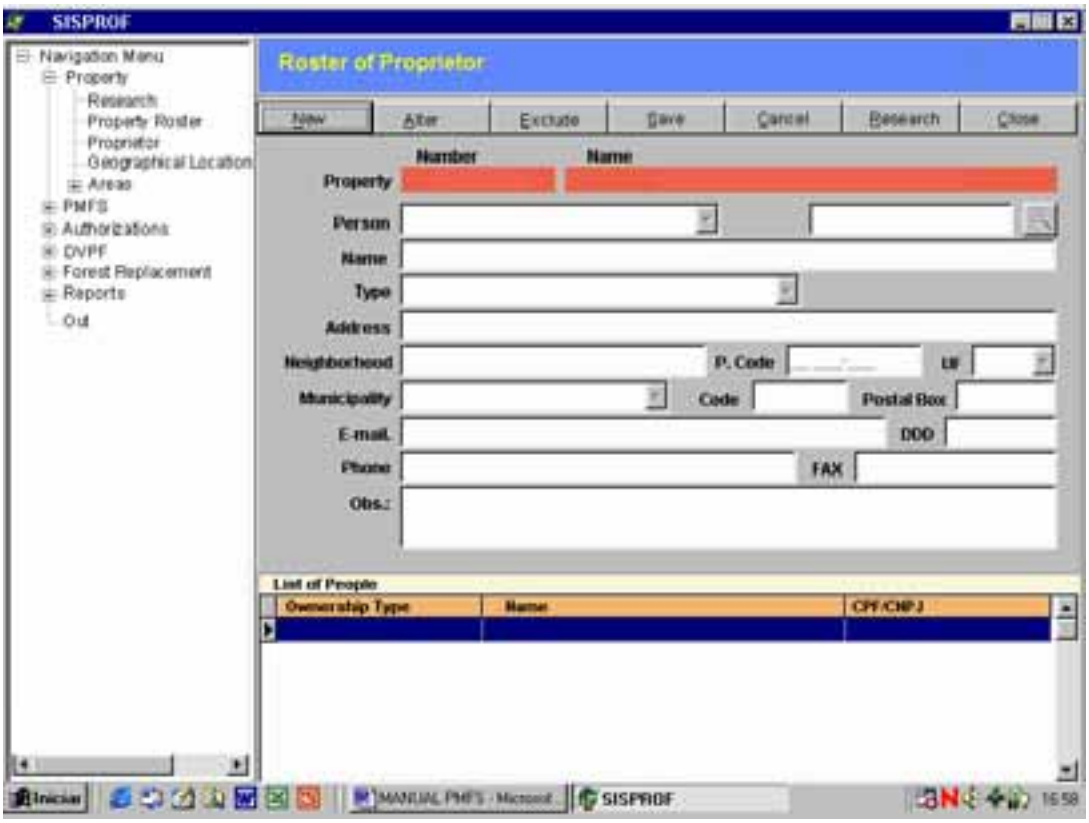


GEOGRAPHICAL COORDINATES OF THE PROPERTY

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
POINT NUMBER	Sequential number of the point. Locate the number of the point in the topographical plant of property.	
POINT DESCRIPTION	Describe briefly the point location.	
LATITUDE/LONGITUDE	Fill in degree, minute and second for latitude and longitude. In case seconds are not available leave the respective space blank.	Use one decimal after comma. Place negative sign in latitude for properties located below the Equator line.

4.2.1.9 Roster of proprietors/renters/lease-holders/possessors

Figure 4.13 – Landholders



PROPRIETORS/RENTERS/LEASE-HOLDERS/POSSESSORS

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
PERSON	Choose “physical” or “juridical” person.	
NAME	Register all proprietors/possessors/renters/lease-holders/others linked to the property, one by one, independently of how many they are. The category others” must only be marked if detailed or marked in the identification screen of the property.	When there is a legal representative of the owner/renter/possessor/lease-holder, fill in his name in the “observations” space.
TYPE	Choose proprietor, renter, lease-holder, possessor, and others, according to the situation of the person to be included.	
LIST OF PEOPLE	Show all of the categories and people registered in the property.	

4.2.2 The module of forest management plans (PMFS) in SISPROF

Brazilian forest legislation defines a PMFS as a plan for the administration and management of the forest with the purpose of generating economic and social benefits and respecting the conditions and mechanisms of sustaining the ecosystem-object of management. A PMFS may be located on one or more properties, as more than one PMFS may exist in each property. A PMFS may have one or more holders, physical or juridical persons, consumers or non-consumers of forest raw material. Nevertheless, it is mandatory that the holders of PMFS have some link with the property (they must be either a proprietor, a lease-holder, a renter or a possessor). The PMFS is prepared by capable professionals, and during the whole of its implementation there should be a technical person responsible for it. The PMFS must be registered at the margin of the matriculation of the property at the Notary Public Registration of Properties, independently of the registration of the legal forest reserve.

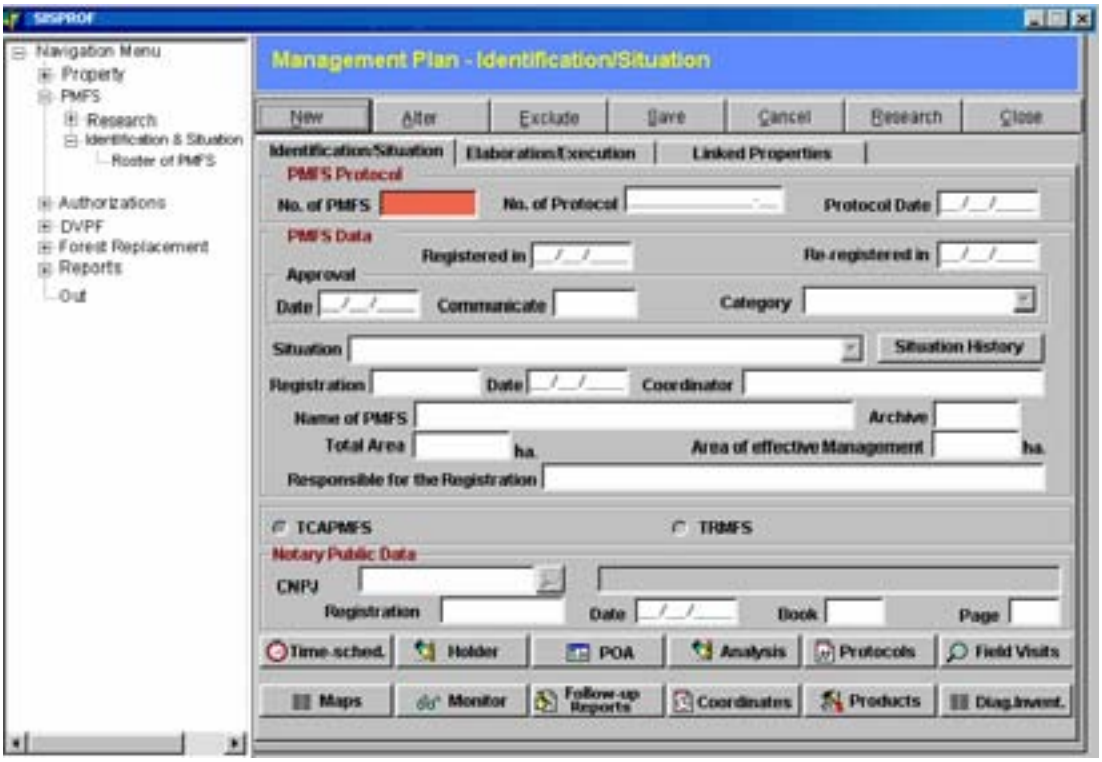
The basis of the PMFS is the forest inventory, that is, a sampling survey or a census (100 per cent forest inventory), as appropriate, of the forest species and their respective stocks and volumes in the area. In general, the area of the PMFS is divided into sub-areas called units of work (UTs). One or more UTs may be exploited annually, in accordance with the execution time-table of the PMFS, and with the POA of the annual production unit (UPA). After the exploitation phase, the maintenance phase of the PMFS is started, and no more authorizations of exploitation are issued. In the execution/exploitation time-table of the PMFS the number of years, and the years in which the forest will be exploited, are defined, as well as the UTs of the plan.

In order for IBAMA to approve a PMFS, it must be assessed from a technical point of view, including a previous technical field visit, an analysis of the stock volume estimate, the exploitation time-table and a legal analysis of the land/property documentation.

This module registers the more relevant information on a PMFS identifying its holders, its link to one or more properties who have been its elaborators, who is its executor and responsible technician. It also identifies what is the category of the plan (entrepreneurial, communal or individual) and its present situation (new, in analysis, denied/disapproved, approved, apt, suspended, in maintenance or cancelled). Forest inventories carried out in the plan’s area are also registered, as well as the commercial species and volumes, the POAs, the technical analyses and visits performed, the follow-up reports with field indicators and technical evaluation, geo-referenced information and maps, the proposed system for the monitoring of the management plan, and the types of raw material and resulting products. All the history of the plan and procedures undertaken are registered, becoming a basis for the monitoring of the plan.

4.2.2.1 Roster of PMFS – identification/situation

Figure 4.14 – PMFS identification



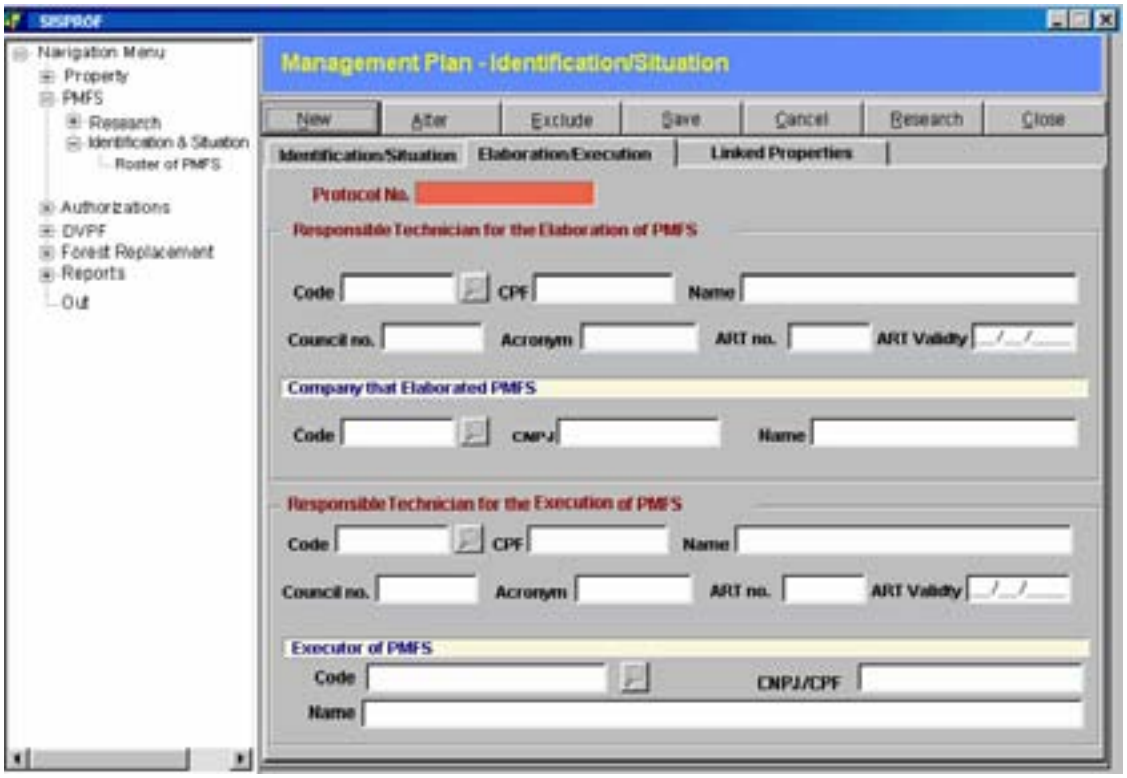
IDENTIFICATION/SITUATION

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
PROTOCOL NUMBER	Complete protocol number of PMFS in IBAMA.	0201800059598 – no need to include dash or slash.
PROTOCOL DATE	Date of protocol of PMFS in IBAMA.	04/05/1999
APPROVAL DATE	Date of approval communicate of PMFS by IBAMA.	In case communicate does not exist, fill in with approval date of the authorization; if that does not exist, fill in with the first permit issuing date.
NO. OF APPROVAL COMMUNICATE	NO. of the PMFS approval communicate.	
CATEGORY	Choose the category of PMFS.	Entrepreneurial, small scale, community small scale, community entrepreneurial, palm trees, in process of certification.
PRESENT SITUATION OF THE PLAN	Choose according to the present situation of the plan.	Apt, suspended, in analysis, in analysis with pending points, and cancelled.

SITUATION HISTORY	Show the diverse situations of PMFS indicating the date of alteration, type of situation and condition for issuing authorizations. The name of the person who makes the change is recorded in the system.	Only when PMFS is in the “Apt” situation n can an authorization for exploitation be issued. When filling in the registration form of a PMFS, if there are any pending points, fill in with “pending analysis”.
REGISTRATION	Registration No. of the association or cooperative in the Commercial Registry, in the case of community PMFS.	
DATE	Date of registration in the Commercial Registry in the case of community PMFS.	
COORDINATOR	Name of the physical or juridical person responsible for the community PMFS.	
NAME OF PMFS	Name given to PMFS.	Ex: Alvorada I.
ARCHIVE	Name of the box or folder where PMFS is found. 1/99.	The use of sequential/year number is suggested. Ex: Box 1/98, folder.
TOTAL AREA	Total area of PMFS including infrastructure + APP of PMFS	
AREA OF EFFECTIVE MANAGEMENT	Area to be managed. State the area of PMFS minus the area of infrastructure and APP of PMFS.	In case the holder asks for the inclusion of areas of roads in the exploitation area of PMFS, the area of effective management may be equal to the total area of PMFS.
TCAPMFS/TRMFM	Mark TCAPMFS (Term of commitment to register PMFS) in the case of possession; mark TRMFM (Term of responsibility to maintain managed forest) in the case of definitive matriculation of property.	When registration of PMFS is in the notary public document there is no need to firm TRMFM.
NOTARY PUBLIC	Look for or register the name of the notary public and municipality where TRMFM or TCAPMFS have been registered.	When the notary public ….. idem, idem, idem, idem, idem … idem.
BOOK	Number of book where TCAPMFS or TRMFM have been registered.	
PAGE	Number of page where TCAPMFS or TRMFM have been registered.	

4.2.2.2 Roster of PMFS – executor/author

Figure 4.15 – Executor of PMFS



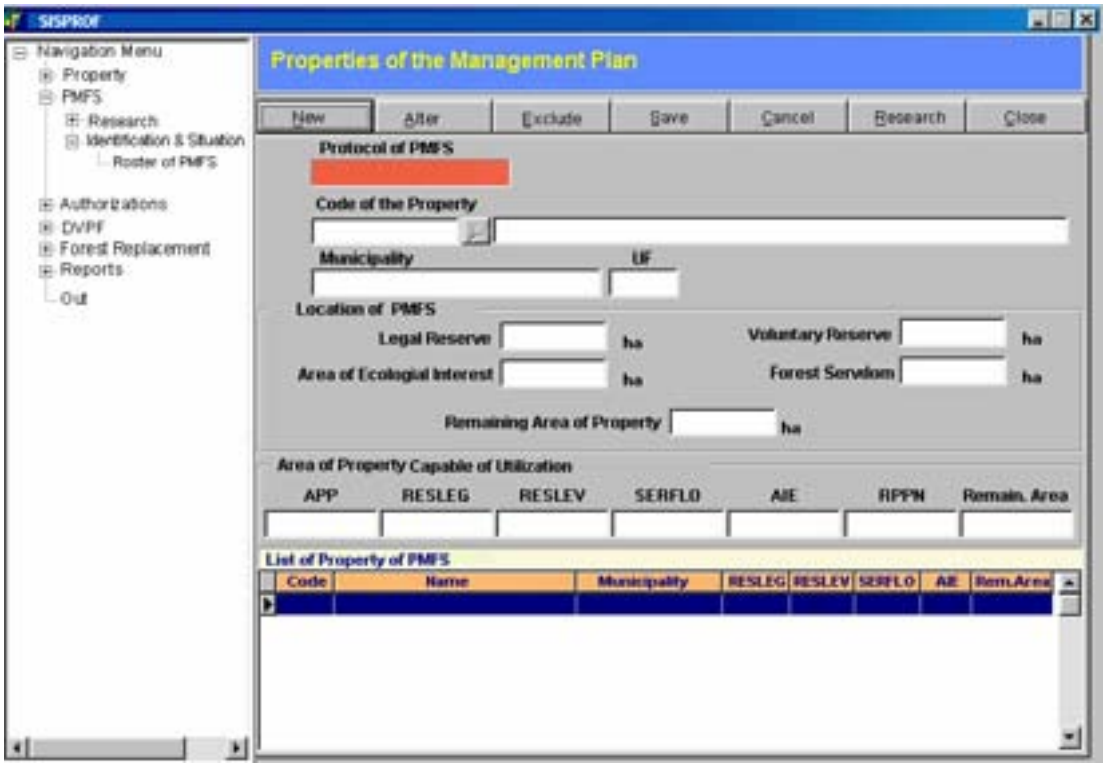
EXECUTOR/AUTHOR

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
RESPONSIBLE TECHNICIAN-ELABORATOR	Research or roster the responsible technician for the elaboration of PMFS (physical person/autonomous).	When filling in the acronym of the Council place the state where technician is registered.
COUNCIL NO.	Return from the table of the roster of responsible technician.	
COUNCIL SIGLA?	Return from the table of the roster of responsible technician.	Ex: CREAMT, OABMT
ART NO.	Number of ART of the author of PMFS.	
ART VALIDITY	Date of validity of ART of author of PMFS.	If there is no date of validity, leave space blank.
COMPANY THAT ELABORATED PMFS	Select or roster the company (juridical person).	In the case of a company, the responsible technician hired by company must also be registered.
RESPONSIBLE TECHNICIAN-EXECUTION	Research or roster the responsible technician for the execution of PMFS (physical person/autonomous).	Register the present responsible technician.
COUNCIL NO.	Return from table of the roster of	

	responsible technician.	
COUNCIL SIGLA??	Return from table of the roster of responsible technician.	Ex: CREABA, OABBA
ART NO.	ART No. of executor of PMFS.	Ask for renewed ART every five years.
ART VALIDITY	Date of validity of ART of executor of PMFS	If there is no date of validity, fill in validity for five years from date of emission.
EXECUTOR	Research or roster the physical or juridical person responsible for the execution of PMFS, the holder himself capable of being responsible.	

4.2.2.3 Roster of PMFS – properties linked to PMFS

Figure 4.16 – Properties linked to PMFS

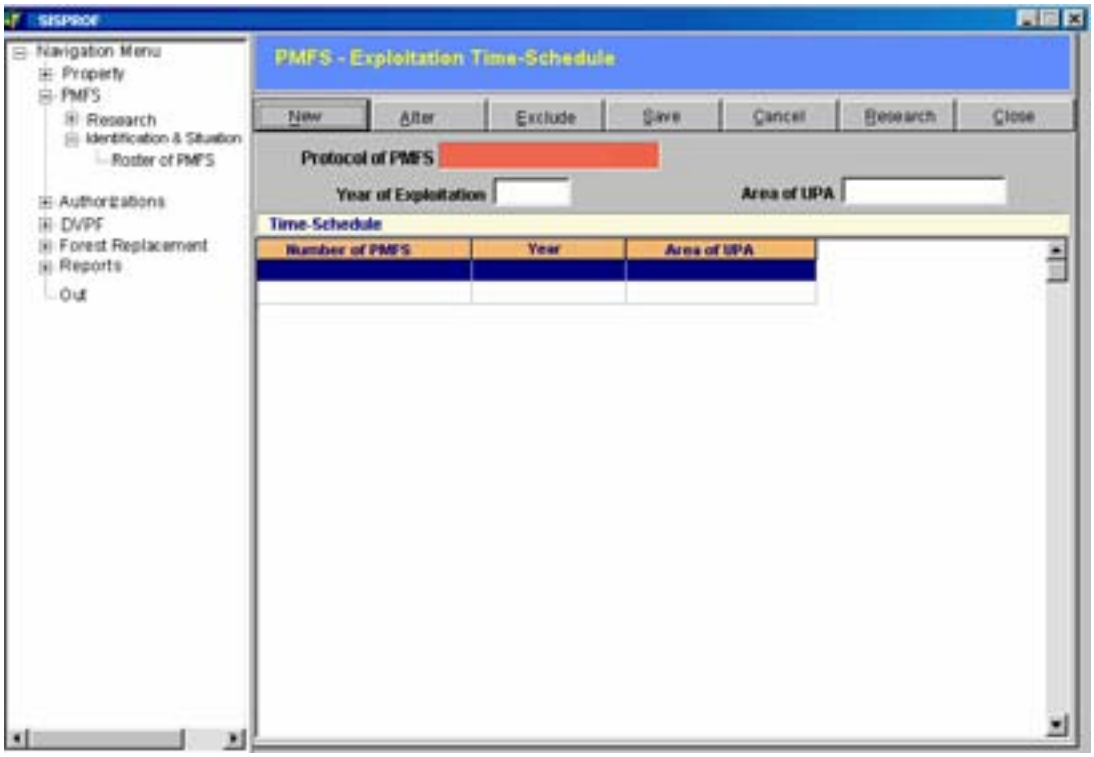


PROPERTIES LINKED TO PMFS

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
PROPERTY	Choose the property where PMFS is located. If non-existent, register the property and then link.	PMFS may be located in various properties. If so, proceed to link them all.
PMFS LOCATION	State the area of location of PMFS according to the areas of utilization. When location of areas under forest management does not show up in the property fill in the PMFS area first in the legal reserve area and the rest in the remaining area.	When in the total area of PMFS there is APP, the location areas must be filled in with the area of effective management of PMFS.

4.2.2.4 Roster of PMFS – exploitation time-schedule of PMFS

Figure 4.17 – Exploitation time-schedule of PMFS

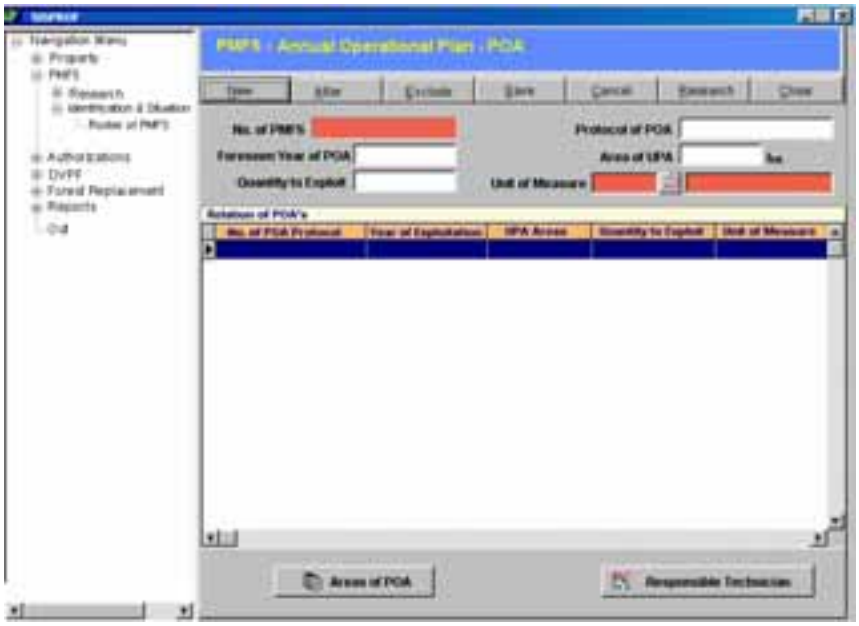


EXPLOITATION TIME-SCHEDULE

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
YEAR OF EXPLOITATION	Foreseen years of exploitation of PMFS.	Fill in with all years of exploitation.
FORESEEN AREA OF UPA	Total area in ha corresponding to each year of exploitation. Summation of UT areas for a similar year.	In the case of PMFS in process of certification, the area of each UPA may correspond to the total area of PMFS. For older PMFS the area of UPA will be the sum of the areas of plots of the same year.

4.2.2.5 Roster of PMFS – annual operational plan –(POA)

Figure 4.18 – POA

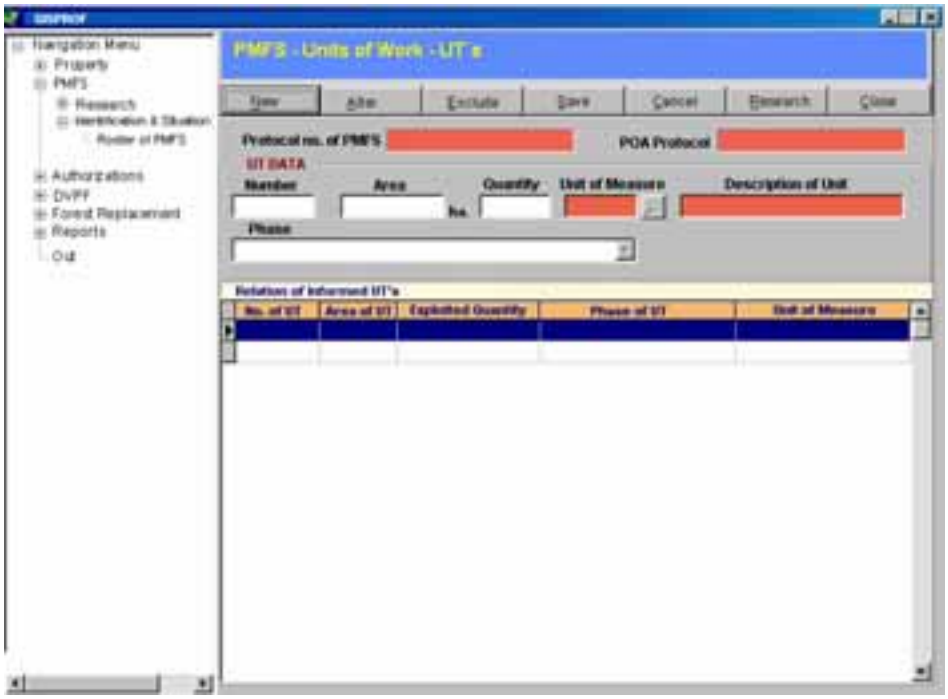


ANNUAL OPERATIONAL PLAN (POA)

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
PROTOCOL NO. OF POA	Give the protocol number of POA. Register all POAs that have been presented with a 100% inventory.	When PMFS has no exploitation plan or POA, put PMFS protocol number as the POA number, the number of authorizations already issued, and fill in the exploitation year according to the authorization issuing year, the UPA area in accordance with the authorized area; save the POA areas, and fill the corresponding UTs.
FORESEEN YEAR OF POA	State the exploitation year of POA.	It corresponds to the year in which the POA will be exploited. For older PMFS, consider as exploitation year as corresponding to the year of the authorization/beginning.
UPA AREA	Corresponds to the summation of UT areas related in POA.	In the case of PMFS in process of certification, the UPA area may be equal to the PMFS area.
QUANTITY TO EXPLOIT	Fill in with the quantity to be exploited or quantity of cutting as per the inventory, except residues.	When the information is taken from the authorization, the quantity must correspond to the volume to be authorized.
UNIT OF MEASURE	State the unit of measure, converting if necessary to the same unit.	

4.2.2.6 Roster of PMFS – unit of work of POA/inventory

Figure 4.19 – Unit of work of POA

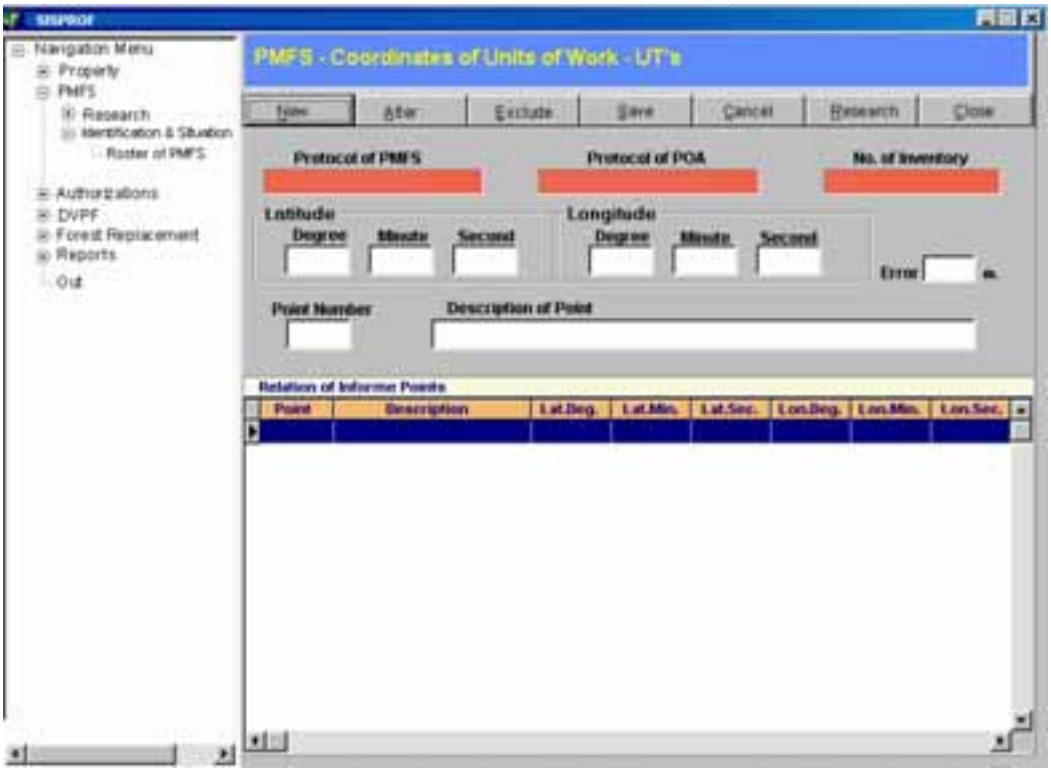


UNITS OF WORK OF POA/INVENTORY

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
NUMBER	Fill in with the UT number of POA/inventory.	Several UTs may exist for the same POA/inventory. When one inventory refers to more than one UT, fill in one by one.
QUANTITY	State the quantity to be exploited or cut as in the inventory, in relation to the summation of the species quantities, except residues.	In the case of older PMFS, without inventory of POA, fill in the quantity to be exploited for that year on the basis of the authorization. When there is one inventory for several UTs, leave this space blank.
UNIT OF MEASURE	Give the corresponding unit of measure. If necessary, convert to the same unit.	
PHASE	State the phase in which the UT is found.	Pre-exploitation: period that comes before exploitation. Exploitation: period of the validity of the authorization. Post-exploitation: period up to one year after the end of the authorization. Maintenance: period after post-exploitation.

4.2.2.7 Roster of PMFS – Coordinates of POA/inventory

Figure 4.20 – Coordinates of POA

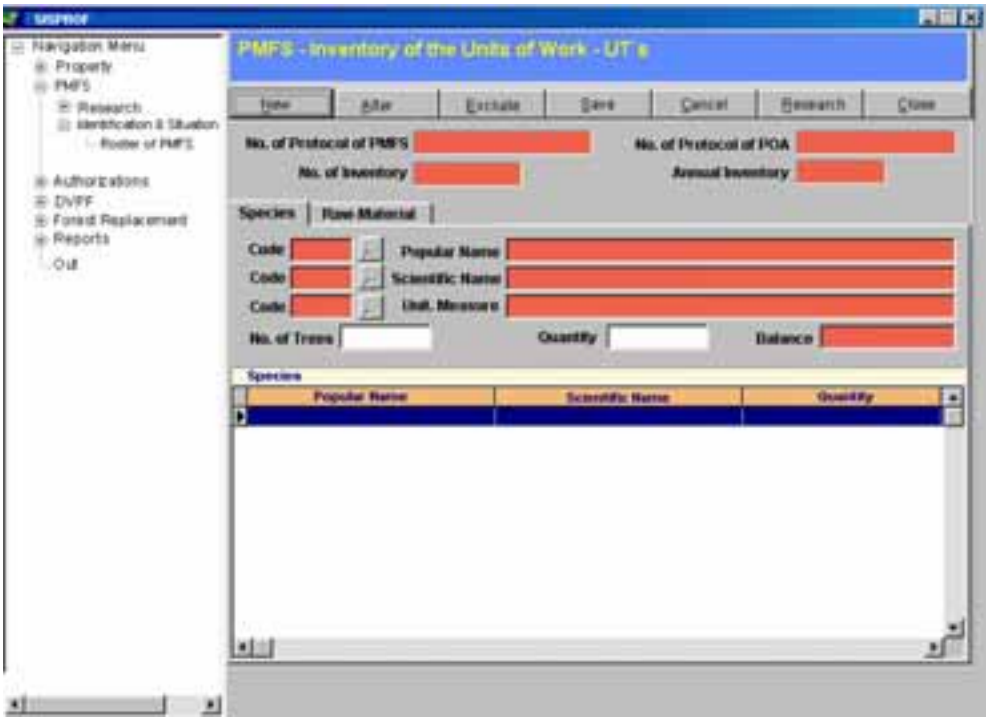


COORDINATES OF POA/INVENTORY

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
LATITUDE/LONGITUDE	Fill in degree, minute and second of latitude and of longitude. In case there is no information on seconds, leave space blank.	In the space for seconds use only one decimal space after the comma. Place the negative sign for latitude for properties located below the Equator line. When there is only one inventory for several UTs, the coordinates will refer to the UT areas.
ERROR	State the error in meters.	
POINT NUMBER	State the number that corresponds to each coordinate. Place point number in the map.	
POINT DESCRIPTION	Describe briefly the point location.	Example: stockpile patio, frontier of UT 1 with UT 2, main house.

4.2.2.8 Roster of PMFS – species of inventory

Figure 4.21 – Species of inventory (UTs)



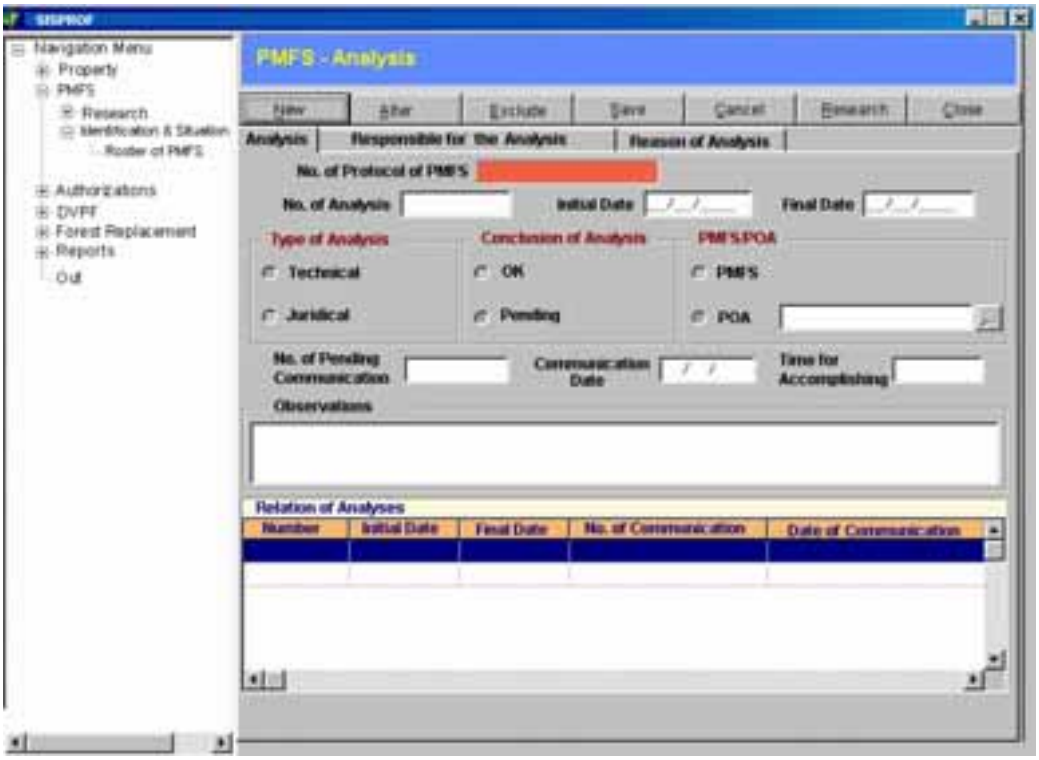
SPECIES OF INVENTORY

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
SPECIES	Fill in with all species registered in the inventory.	Where there is diagnostic inventory per UT/plot, fill in the species in POA of the corresponding year. When there is diagnostic inventory for the whole area of the plan, fill in the species only in the diagnostic inventory.
POPULAR NAME/SCIENTIFIC NAME	Search in the system list for the popular name of the species and select the scientific name corresponding to the inventory. When we have the scientific name and the popular name has not been mentioned in the inventory, search in the field “Popular name” with the code “To identify”. If there is more than one species in this situation, fill in as “diverse”, summing the quantities. When neither the popular nor the scientific name of the species is found in SISPROF, fill in as “diverse”. If more than one species is not found, fill in as “diverse” adding the quantities.	If there is any POA whose species have not been related or raw material is fuelwood, research with the popular name “diverse” and fill in the total quantity to exploit with this code. If only the popular name is in SISPROF, search for popular name and fill in the scientific name with the code “to classify”.

UNIT OF MEASURE	Unit of measure referring to the quantity.
NUMBER OF TREES	Give the number of trees of each species existing in the inventory.
QUANTITY	Existing quantity of each species in the inventory.

4.2.2.9 Roster of PMFS – analysis of PMFS/POA

Figure 4.22 – Analysis of POA



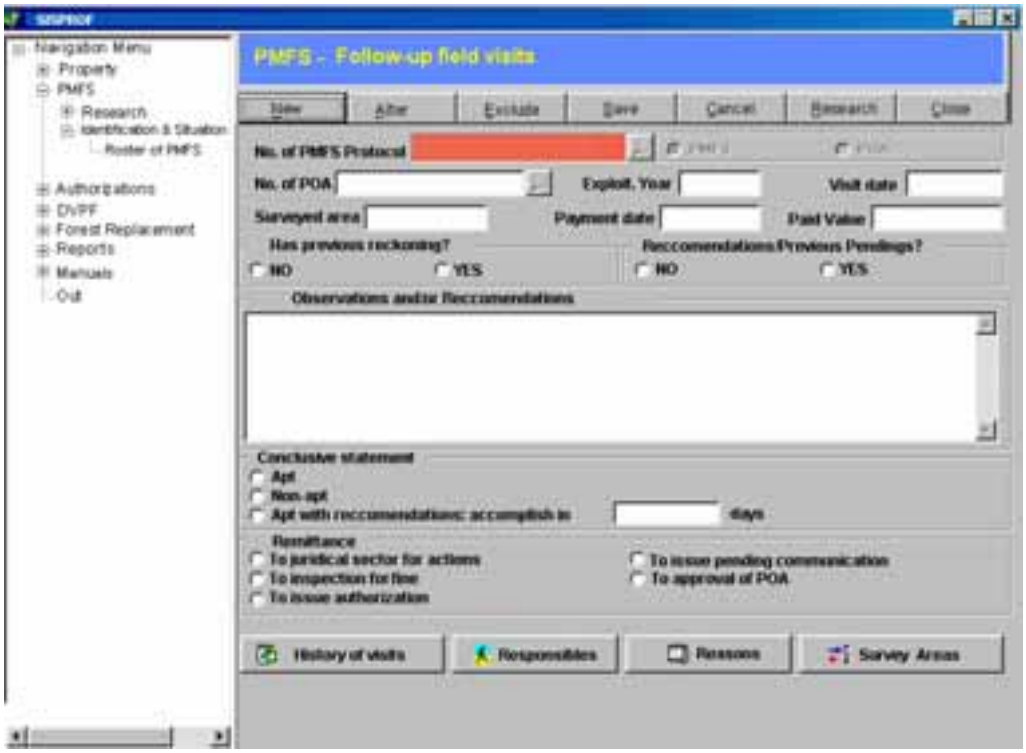
ANALYSIS OF PMFS/POA

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
TYPE OF ANALYSIS	Mark the type of analysis under current registration.	One analysis to be given at each time. In the case of PMFS already approved, register the last legal analysis and register the technical analysis of the sorting. When pending, state all reasons and issue communication pending points with accomplishing time, and leave the PMFS situation as “pending”. The responsible technician must be the engineer who is filling the PMFS registration form.
INITIAL DATE	Initial date of technical or legal analysis.	Obligatory space.
FINAL DATE	Final date of technical or legal analysis.	Obligatory space.
PMFS	Mark when analysis refers to PMFS.	
POA	Choose in registered POAs the one to which the analysis refers.	

NO. OF PENDING COMMUNICATION	No. of pending communication. In case of technical or legal analysis, indicate any pending.	When issuing a pending communication, the situation of PMFS must be “pending analysis”. There are cases where communication is issued with technical recommendations that do not impede liberation. In this case, the situation will be “apt” until the given accomplishment, time, date, which the system utilized, and which will automatically classify the PMFS as “suspended”.
COMMUNICATION DATE	Date of pending communication.	
TIME FOR ACCOMPLISHMENT	Time for accomplishing pending points given by IBAMA.	
OBSERVATIONS	Information judged necessary referring to the conclusion of the analysis.	

4.2.2.10 Roster of PMFS – follow-up field visits of POA and PMFS

Figure 4.23 – Follow-up field visits



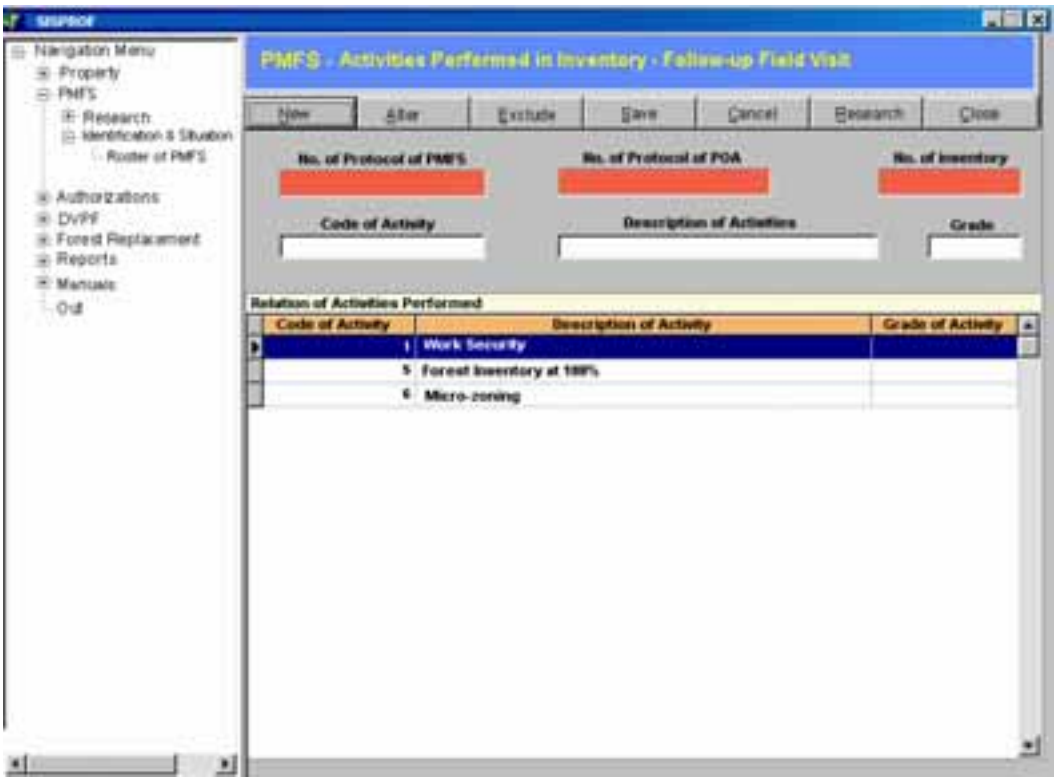
FOLLOW-UP FIELD VISITS OF POA/PMFS

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
PMFS/POA	State whether visit to POA or PMFS. In the case of POA choose the corresponding one.	When visit is t PMFS the system does not habilitate the UTs, since they are registered only in POAs.
NUMBER OF POA	Choose the number of the protocol of POA to which visit refers.	
EXPLOITATION YEAR	State the year of exploitation of POA.	In the case of visit/survey of PMFS, state the year of the last exploitation.
VISIT DATE	Date of last follow-up visit.	For approved PMFS with more than one visit, fill in only last visit.
VISIT AREA	State the total area visited.	
PAYMENT DATE	Date of payment of visit fee, if the visit is made by IBAMA's technicians.	
HAS PREVIOUS RECKONINGS	State if previous reckoning relating to the same POA exists.	
RECOMMENDATIONS/PREVIOUS PENDING POINTS?	State if there are recommendations/pendings in previous reckoning.	

OBSERVATIONS/ RECOMMENDATIONS	Space of obligatory filling.	State if previous recommendations have been accomplished and fill in with recommendations of present reckoning.
CONCLUSIVE STATEMENT	Choose one of the alternatives.	The statement must be relative to the continuity or not of the accomplishment of pending points. The statement “apt with recommendations” must be used for plans with pending points that can be accomplished in the short term, without the need for a new visit, so that it does not jeopardize the continuity of PMFS.
REMITTANCE	Choose one of the alternatives.	

4.2.2.10.1 Roster of PMFS – activities verified in the field

Figure 4.24 – Activities verified in the field

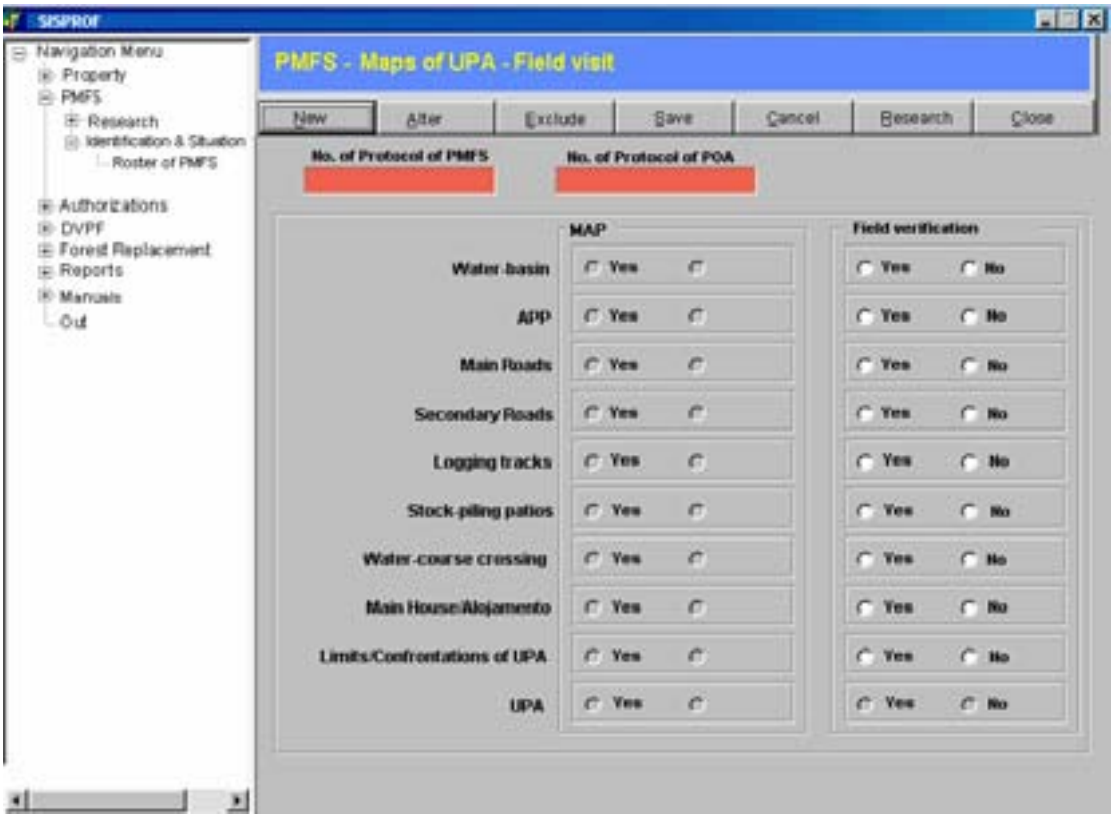


ACTIVITIES VERIFIED IN THE FIELD

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
ACTIVITIES	The system returns the listed activities in the POA/inventory; other non-programmed activities in the POA/inventory may be included, by choosing the option “others”.	If in the case of PMFS field visit it does not return the activities, then choose the option “others” and include the activities verified in field.
DESCRIPTION OF ACTIVITIES	Choose the activities performed.	This field must be used when there is a non-programmed activity in the POA/inventory, or when it is a field visit of PMFS.
GRADE/PUNCTUATION	Grade attributed by technician to each activity. This note varies from 0 to 5.	A “zero” grade must be used for programmed operations that have not been performed.

4.2.2.10.2 Roster of PMFS – maps in follow-up field visits

Figure 4.25 – Maps in field visits

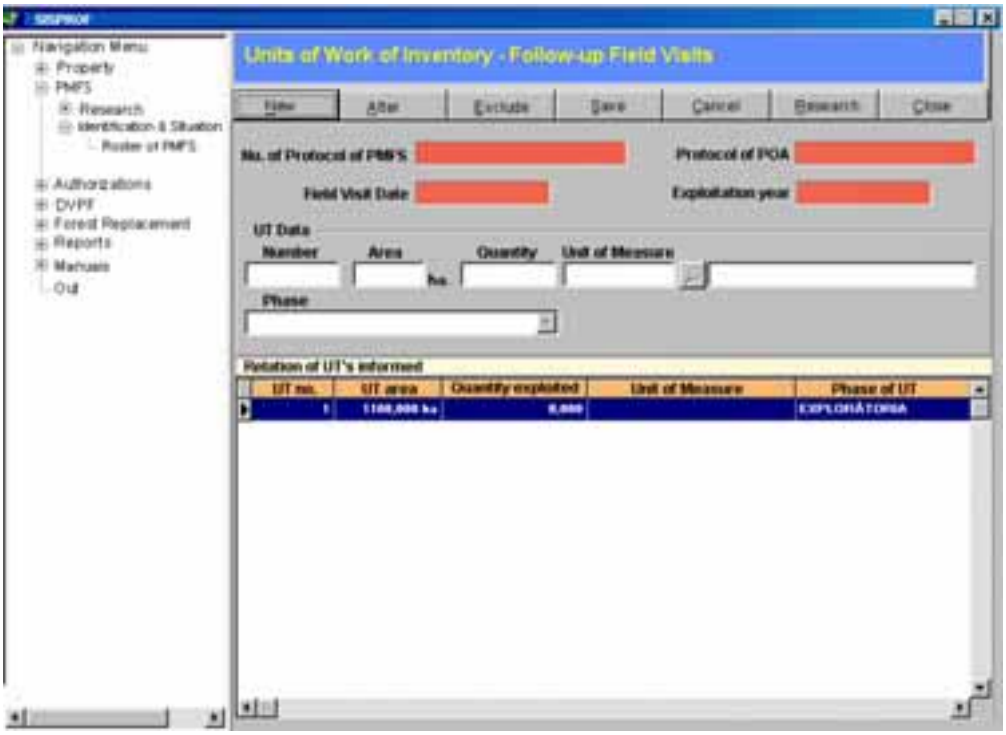


MAPS IN FOLLOW-UP FIELD VISITS

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
FIELD VERIFICATION	Mark the items checked in the field.	

4.2.2.10.3 Roster of PMFS – units of work in follow-up field visits

Figure 4.26 – Units of work of inventory in field visits

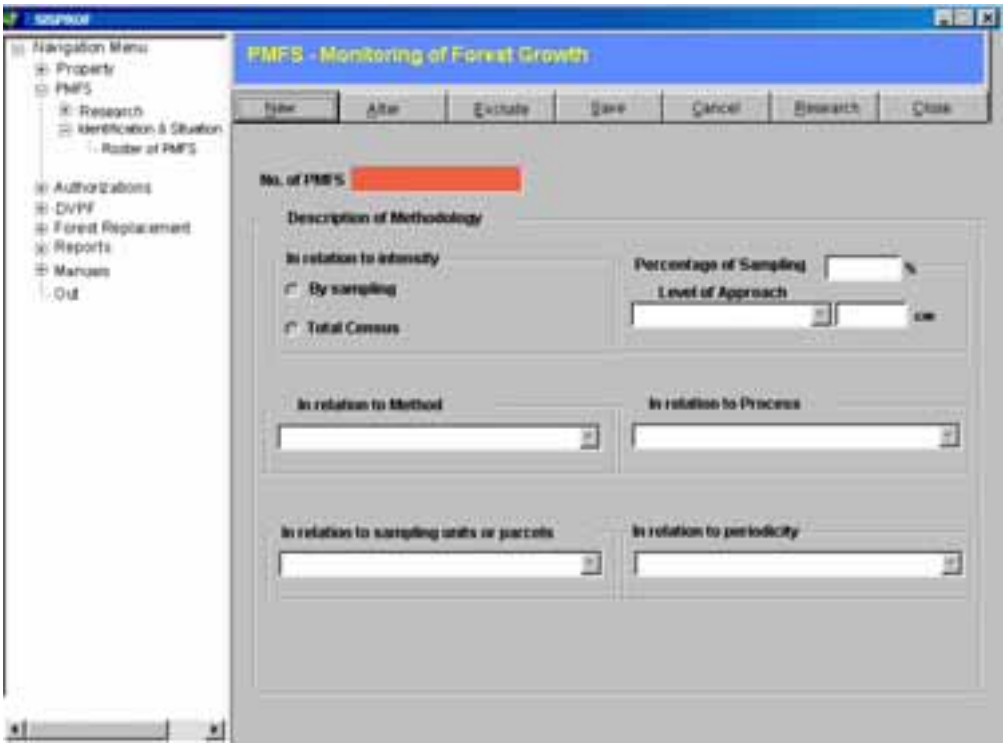


UNITS OF WORK IN FOLLOW-UP FIELD VISITS

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
UT NUMBER	Give the number of visited UTs	In the case of older plans, place the number of the plots.
AREA	State the area of each UT or plot visited.	
QUANTITY	State the quantity exploited.	Compare the exploited quantity with authorized quantity.
UNIT OF MEASURE	Give the corresponding unit of measure.	
PHASE	Select the phase in which the visited UT or plot is found.	Pre-exploitation – idem, idem Exploitation – idem, idem Post-exploitation – idem, idem Maintenance – idem, idem

4.2.2.11 Roster of PMFS – monitoring of PMFS

Figure 4.27 – Monitoring of forest growth in PMFS



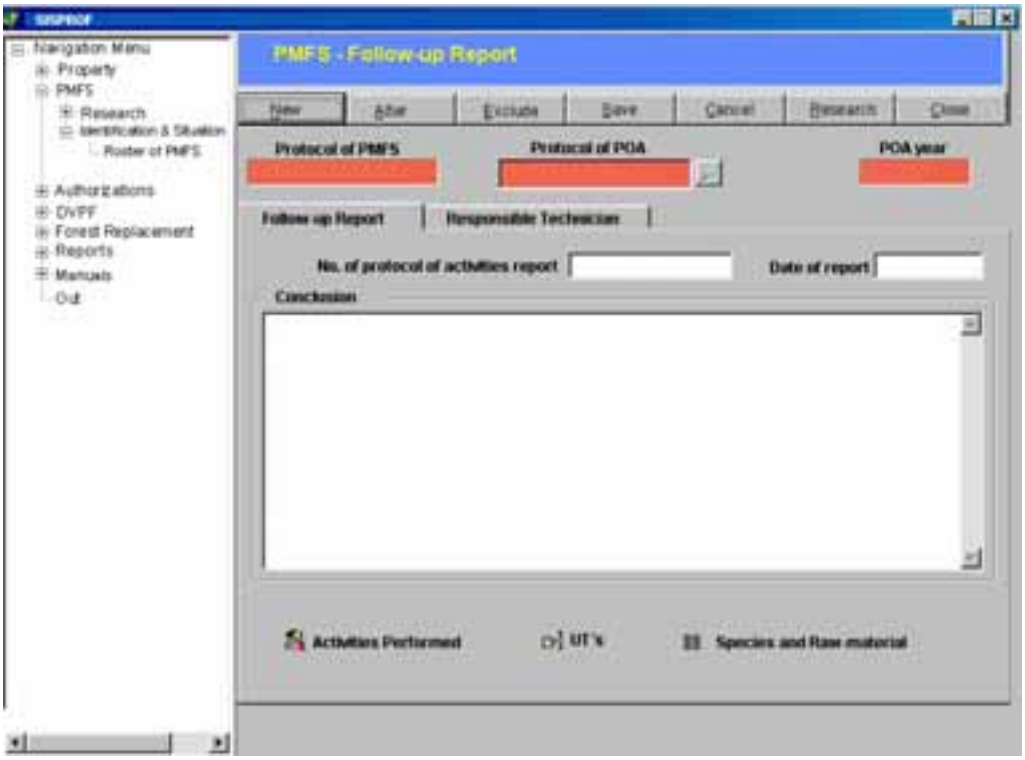
MONITORING OF PMFS

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
IN RELATION TO INTENSITY	Choose sampling or total census.	State if the monitoring of forest growth is done through sampling or total census.
SAMPLING INTENSITY	Give the sampling percentage.	This percentage is obtained by dividing the total sampled area (sum of the areas of sample units) by the total inventoried area.
LEVEL OF APPROACH	Choose between approach and sub-approach.	State the minimum diameter (or height) measured in the parcels or sub-parcels. One level of approach: when there is no sub-division of sampling units, necessary when measuring sticks or plantules. With sub-approach: when besides parcels for measuring adult trees, sub-parcels are also established for measuring individuals of smaller size.
IN RELATION TO METHOD	Choose between the methods of fixed area or the next tree harvest.	There are various methods of sampling. The programme has the options of fixed area, in the case of sampling units with a pre-defined

		dimension, of tree of next harvest as sampling unit, and another one in case the monitoring foresees a different method from the other two.
IN RELATION TO SAMPLING UNITS OR PARCELS	Choose between permanent, temporary and partial substitution.	State if the inventory is done with permanent or temporary parcels, or with partial substitution, that is, when sampling is done with permanent parcels and also with other temporary samples for a single evaluation in the event of each measurement.
IN RELATION TO PROCESS	Choose between random, systematic and mixed.	State if the process used is random, systematic or random/systematic.
IN RELATION TO PERIODICITY	Choose between the presented alternatives.	State the periodicity (in years) of measurements.

4.2.2.12 Roster of PMFS – follow-up report

Figure 4.28 – Follow-up report

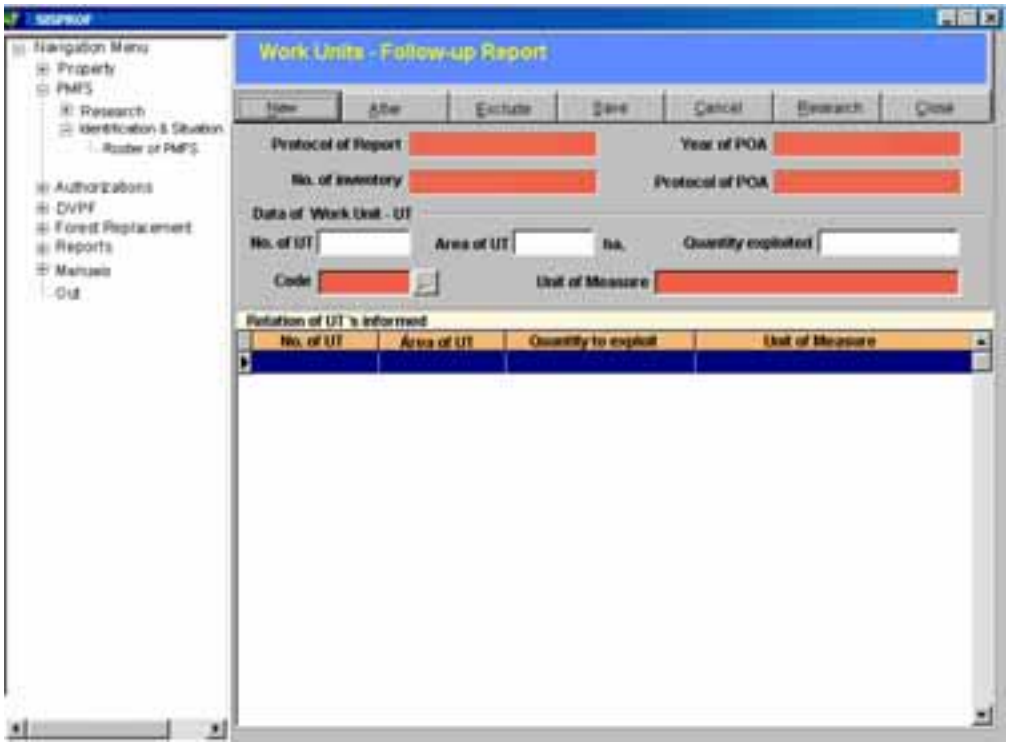


FOLLOW-UP REPORT

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
PROTOCOL NO.	No. of IBAMA's protocol of the follow-up report.	Register the last report presented. If there is no report from previous year to registration, ask for it through sorting.
REPORT DATE	Date of last report.	When there is no date in the report, put the protocol date.
PROTOCOL OF POA	Choose the POA/inventory to which the report refers.	When it is report of PMFS, choose the exploitation year of POA to which the report refers, and put in the conclusion space that it is a PMFS report.
CONCLUSION	General observations about the performed activities.	

4.2.2.12.1 Roster of PMFS – follow-up report/work units

Figure 4.29 – Work unit follow-up



FOLLOW-UP REPORT/WORK UNITS

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
NUMBER, AREA, QUANTITY AND UNIT OF MEASURE	Fill in with number, area, quantity and unit of measure of each work unit/plots.	All units of work/plots referred to in the report must be filled in.
ACTIVITIES PERFORMED	In relation to all activities foreseen in PMFS/POA, state period and percentage of execution and quality.	In case of unforeseen activities that have been executed, include them.
EXPLOITED SPECIES	State scientific name of popular or exploited species with respective quantities, units of measure and number of trees per ha.	For PMFS in exploitation and post-exploitation phases.
RAW MATERIAL	State the name of raw materials exploited with respective quantity and units of measure.	For PMFS/POA in exploitation and post-exploitation phases.

4.2.3 The module of authorizations in SISPROF

Every raw material extracted from or exploited/produced in forests and that has a commercial utilization must have an identified origin as well as a corresponding authorization. Brazilian forestry legislation establishes that access to forest resources must be done through (i) a PMFS, and in this case with a consequent forest exploitation authorization (APE), or (ii) through an authorization for alternative use of land, known as deforestation authorization (AD). The other authorizations that are granted, in general, are variations of these two, that is, they are revalidation authorizations, authorizations for the utilization of raw material not previously used, authorizations for non-wood products, authorizations for the cleaning of pastures, etc.

These authorizations give the necessary subsidies for the liberation of authorizations for the transportation of forest products (ATPFs), and in the near future for the stamp of forest origin –(SOF). Therefore, the authorizations issued by SISPROF need to be permanently and specifically controlled and the system itself monitored, with checking and validation of their data and information as standard procedures.

Thus, the data and information compiled in the referred authorizations are, in their majority, already registered in the system and validated by it. The SISPROF module of authorizations is the place where the operator of the system formats the authorizations with data and information on: type of the authorization (new or old), identification of the holder, the PMFS/POA, or area authorized for deforestation, geographical location, period of validity, type of product or raw material, species and volumes authorized. After it has been formatted, the authorization goes for final technical analysis and, if approved, is sent to the Executive Manager of IBAMA to confirm and issue it.

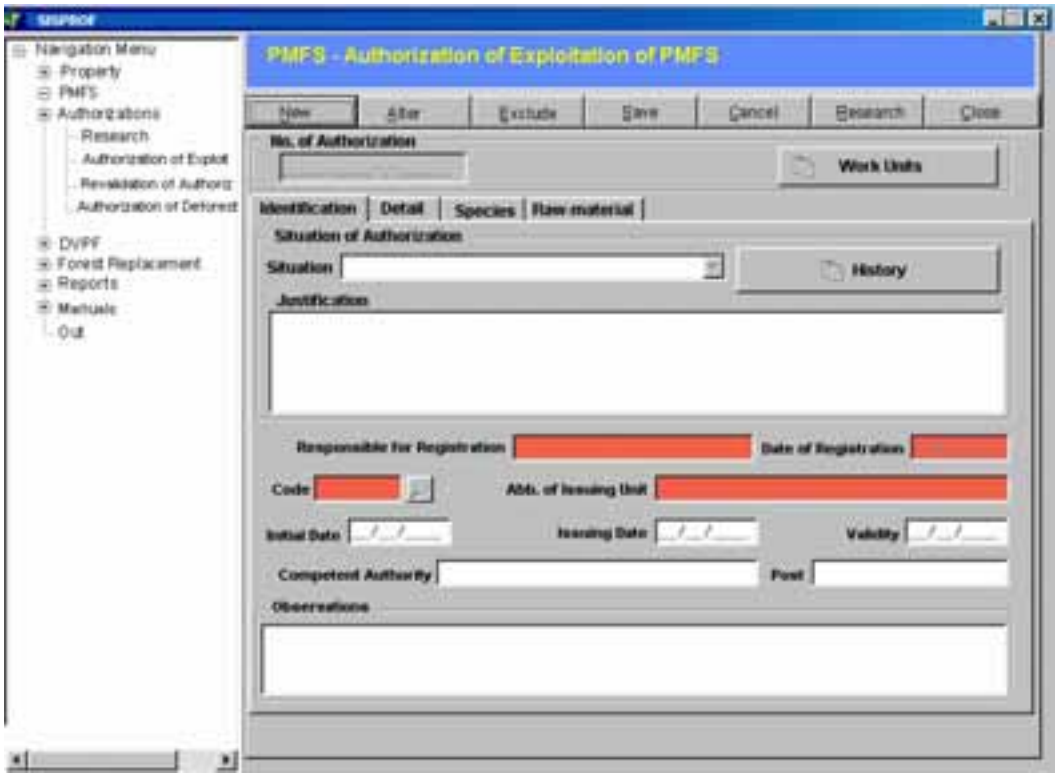
The authorizations may be revalidated for one year, within the limits of the existing balance (surplus) and based on new technical visits. The new authorizations issued by the system, and those that were issued previously (old ones), but still valid, have a differentiated treatment. The old ones are subject to a critical review and warning/alert signs, with reminders. The new ones, in case they do not fulfil the pre-determined conditions, will simply not be issued.

4.2.3.1 Authorizations of PMFS exploitation

The authorizations for exploitation of PMFS (APE) are issued by SISPROF after a rigorous process of verification and validation of the information that is already registered in the system. The system operator works with five screens to format an APE of PMFS. The screens are: identification, detail of authorization, unit of work of PMFS, species of the authorization and raw material authorized. Three examples of these screens are given below.

4.2.3.1.1 Identification of PMFS

Figure 4.30 – Authorization of exploitation of PMFS – identification



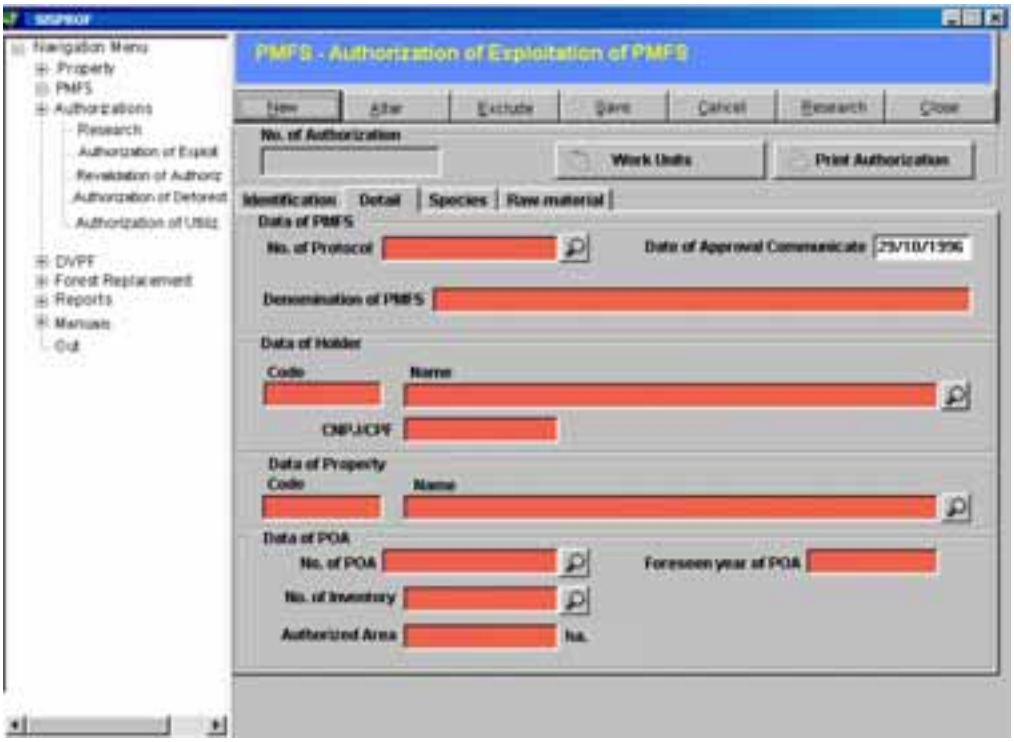
IDENTIFICATION

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
ISSUED AUTHORIZATIONS	Roster of authorizations of PMFS that have not been issued by the system.	The authorizations must only be registered after the registration of PMFS.
NUMBER OF AUTHORIZATION	Place the year and number of the authorization already issued. The system fills in the number of the issuing unit and the number of the type of authorization. In the case of old PMFS, where one authorization was issued for several years of exploitation, use the following form: Ex: No. of authorization – 550 for years 87, 88, 89. 1987/550A – Data referring to volume authorized for 1987. 1987/550B – Data referring to volume authorized for 1988. 1987/550C – Data referring to volume authorized for 1989.	Ex: 2000/85. In case described patterns cannot be followed, contact DEREF for solution. When number of authorization is: 20/98-1[a], 20/98-2[a], 20/98-3[a], put number like this: 199u8/20 A for the first, 1998/20 B for the second, and 199/20C for the third.

SITUATION	When registration is registered it passes automatically to the situation “Initial Roster”. From this situation check the situation table.	For authorizations already issued, fill in with “old” situation.
HISTORY	Show the situation, periods and the permission or not for the concession of ATPF/DVPF.	
JUSTIFICATION	For any alteration of authorized situation it is obligatory to give the reason for the alteration.	When the situation of the PMFS is altered there is alteration in the situation of the authorization. Ex: accomplishment of the pending communication of PMFS.
ISSUING DATE	Date of issuance of the exploitation authorization of PMFS.	
INITIAL DATE	Initial date of the validity of PMFS authorization, which must be the same as that of issue.	
VALIDITY	Expiry date of PMFS authorization.	Maximum validity of one year after issuance.

4.2.3.1.2 Details of the authorization of PMFS

Figure 4.31 – Details of PMFS authorization

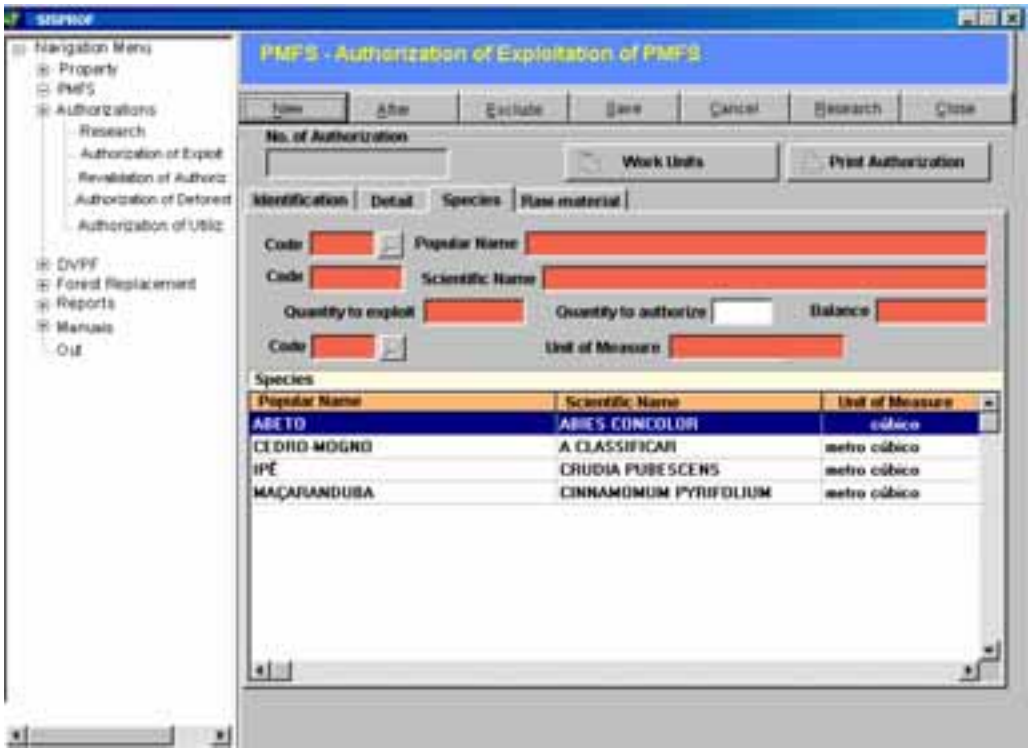


DETAILS OF THE AUTHORIZATION

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
NO. OF PLAN PROTOCOL	State the number of plan protocol linked to the authorization.	
DENOMINATION OF PMFS	Digit the name of PMFS.	
DATE OF APPROVAL	Give the date of approval of PMFS.	
HOLDER'S CODE	Give the number of holder's code that is registered in the system.	This number is communicated by the system when searching the name is done and confirmed. The same occurs with the CNPJ/CPF.
PROPERTY CODE	Give the number of property code that is registered in the system.	Idem to previous topic.
NO. OF POA	State the number of POA registration.	
NO. OF INVENTORY	Give the inventory number linked to the area authorized for exploitation.	
AUTHORIZED AREA	Authorized area related to POA and inventory already identified.	

4.2.3.1.3 Details of the species in the authorization

Figure 4.32 – Details of authorized species



SPECES IN THE AUTHORIZATION

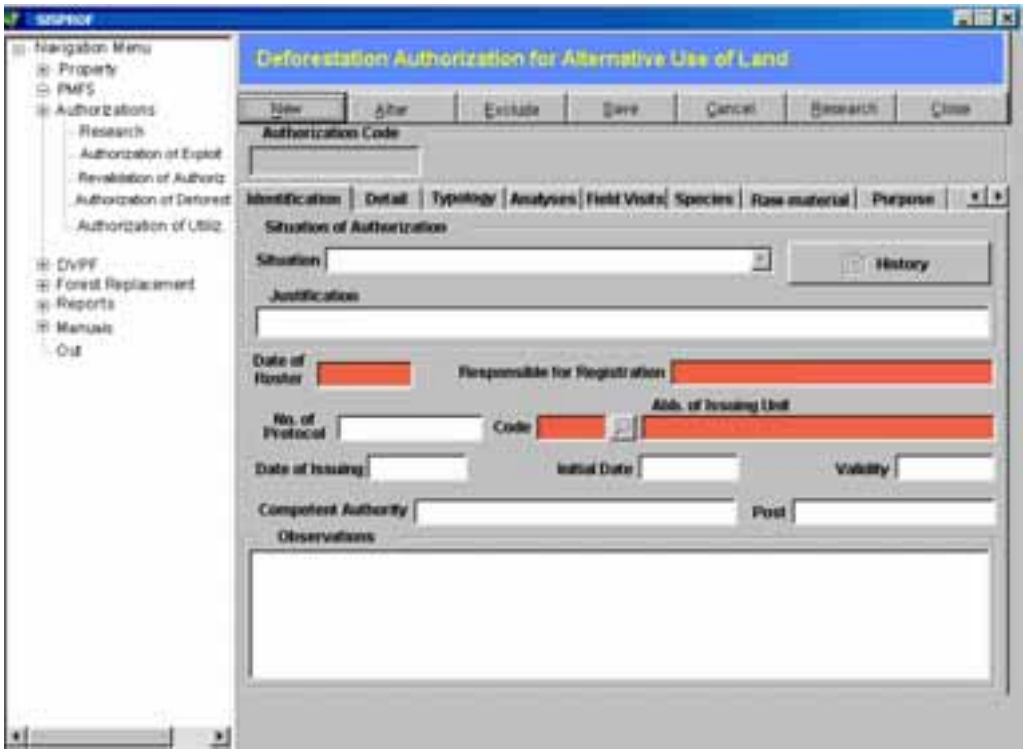
IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
SPECIES	Choose the diagnosis inventory for annual and respective year.	
POPULAR/SCIENTIFIC NAME	Choose among the species of PMFS/POA those with available surplus.	In the choice of species, only those registered in PMFS/POA, in accordance with forest inventory, will be available.
QUANTITY TO EXPLOIT	Quantity corresponding to sum of quantity per species of the selected units of work of PMFS. Returned by the system.	
SURPLUS IN INVENTORY	Quantity to exploit less quantities previously authorized. Returned by the system.	
QUANTITY TO AUTHORIZE	State the quantity to be authorized per species in the present authorization.	When there are species in the authorization that do not appear in the referred inventory, put the species in the inventory, one by one, with zero quantity, and then put them in the authorization.
MEASURE UNITS	Unit of measurement corresponding to quantity of species in the authorized area.	

4.2.3.2 Authorizations of deforestation

The authorizations for alternative use of land (deforestation authorizations) are like those for PMFS, issued by SISPROF after a rigorous process of verification and validation of the information already registered in the system. Nevertheless, the number of screens for the system operator to work with is quite bigger. There are 15 available screens to format a deforestation authorization. Among them the current four types are exemplified and presented: : identification, detail of authorization, technical and legal analyses and visits.

4.2.3.2.1 Authorization of deforestation – identification

Figure 4.33 – Identification of deforestation authorization



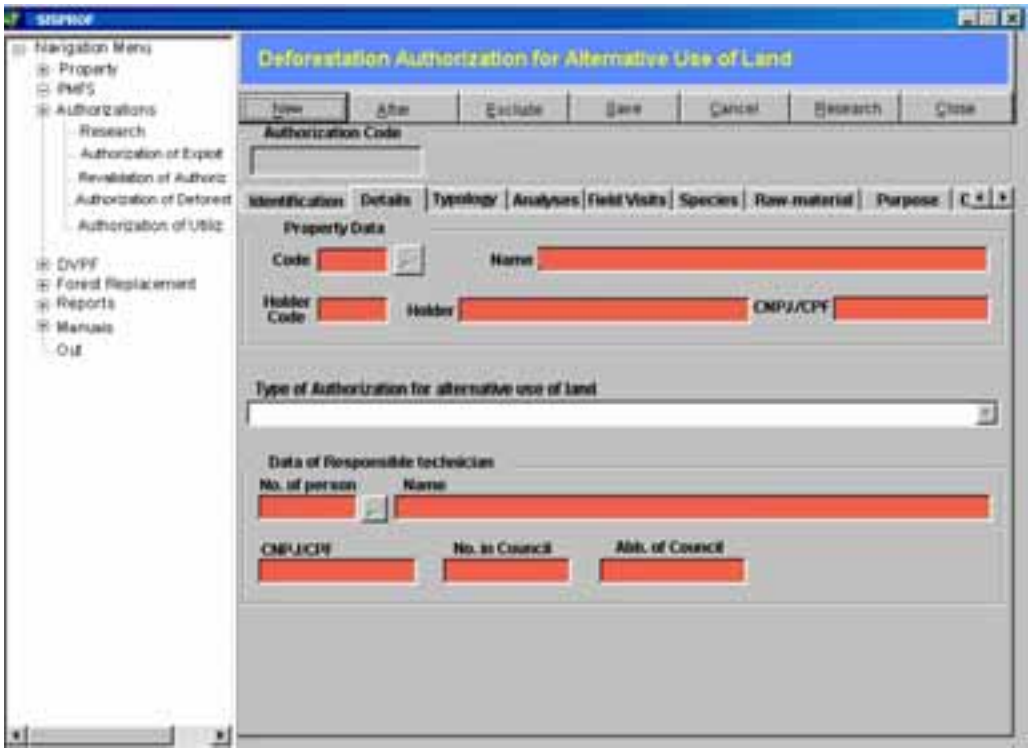
IDENTIFICATION

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
ISSUED AUTHORIZATIONS/NEW	Choose between authorizations previously issued and those that will be issued by the system.	Register first the authorizations issued in 2001 and then those issued in 2000 still valid. In the case of revalidated authorizations, put these with the new period of validity.
NUMBER OF AUTHORIZATION	Place the year and number of the issued authorization. The system fills in the number of the issuing unit and the number of the type of authorization.	Ex: 2000/85 If there is a repeated number in a same year do as follows: 2000/20 for the first and 2000/20A for the second.
SITUATION	When the authorization is registered, it passes automatically to the situation “Initial roster”. From this situation verify Table of Situation.	For the issued authorizations fill in with “old situation”.
JUSTIFICATION	For any alteration of the authorization situation it is obligatory to state the reason for the alteration.	Ex: Accomplishment of pending communication number 20/99.
PROTOCOL NUMBER	Number of protocol of	

	authorization request.	
ISSUING UNIT	Look for the abb. of the issuing unit of IBAMA.	
ISSUING DATE	Date of authorization issuance.	
INITIAL DATE	Initial date of the validity of the authorization.	
VALIDITY	Expiry date of authorization.	Maximum one year of validity after issuing.
COMPETENT AUTHORITY	Name of whoever is responsible for the authorization.	
GENERAL OBSERVATIONS	Information judged necessary.	Name of species whose cut is prohibited, etc.

4.2.3.2.2 Authorization of deforestation – details of authorization

Figure 4.34 – Details of authorization

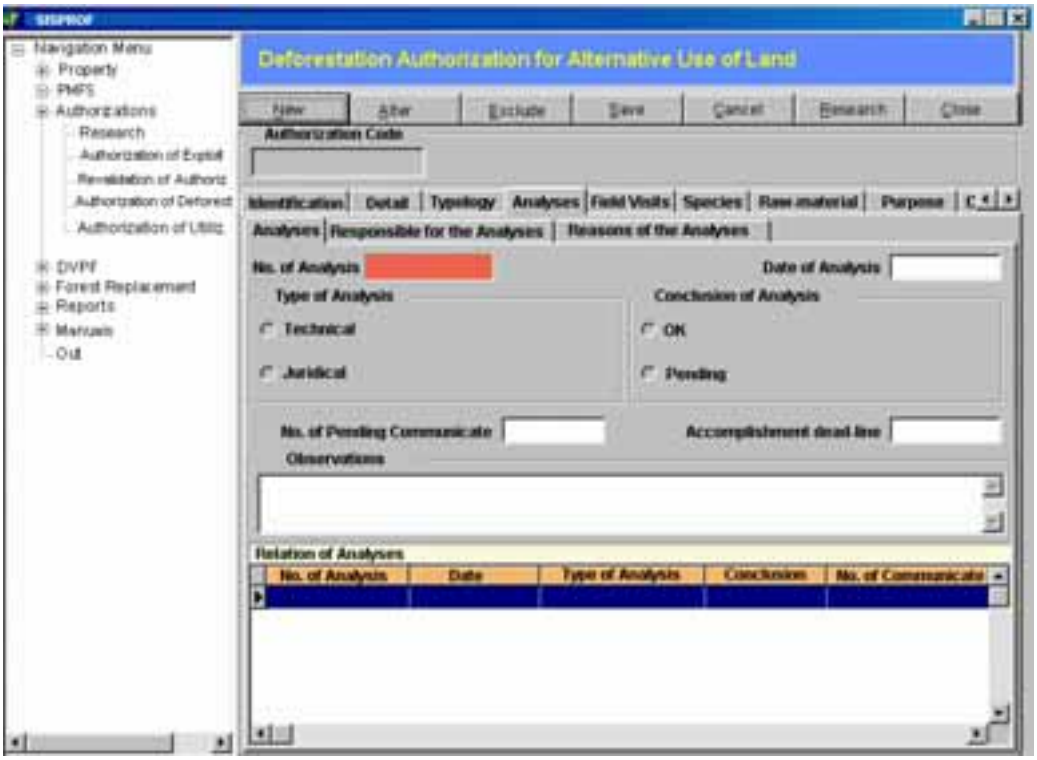


DETAILS OF AUTHORIZATION

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
PROPERTY NUMBER	Search for the property for which authorization is being requested.	
TYPE OF AUTHORIZATION	Choose the type of authorization to be issued.	
CODE OF HOLDER	Search for the name of one of the owners/renters/leasers/possessors of the property.	
AREA PREVIOUSLY AUTHORIZED	State in case the area had already received any sort of authorization.	

4.2.3.2.3 Authorization of deforestation – technical and legal analyses

Figure 4.35 – Technical and legal analysis of deforestation

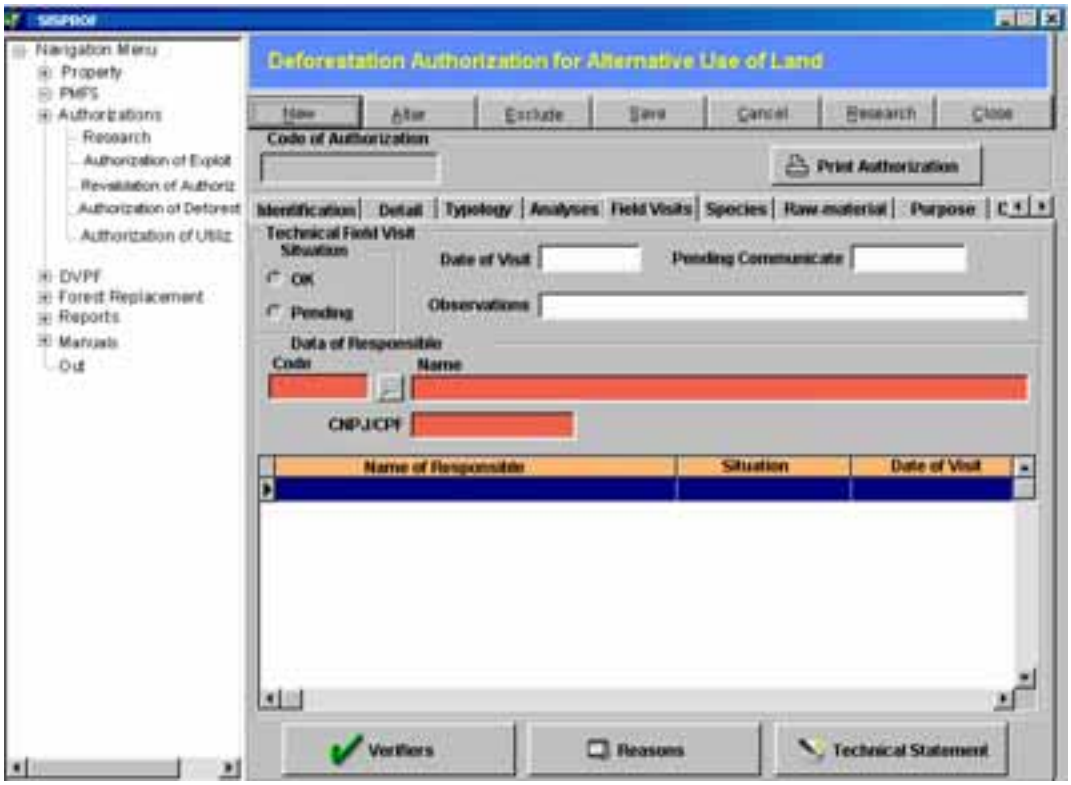


TECHNICAL AND LEGAL ANALYSIS

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
TYPE OF ANALYSIS	If technical or legal.	
CONCLUSION	Indicate conclusion of analysis.	
ANALYSIS DATE	Date when analysis was done.	
PENDING COMMUNICATION	No. of pending communication in case situation of analysis is pending.	Ex: 45/99.
TIME FOR ACCOMPLISHMENT	Time given for accomplishing pending points.	
OBSERVATIONS	Observations as necessary.	

4.2.3.2.4 Authorization of deforestation – field visits

Figure 4.36 – Deforestation field visits



FIELD VISITS

IDENTIFICATION	DISCRIMINATION	EXAMPLE/OBSERVATION
SITUATION	Indicate the situation of the field visit.	
DATE OF FIELD VISIT	Date on which technical visit took place.	
PENDING COMMUNICATION	Pending communication number in case the visit encounters problems.	Ex: 45/99.
OBSERVATION	Information judged necessary.	
RESPONSIBLE	Search for or register the responsible technicians for the field visit.	

4.2.4 The module of companies' reporting on balance sheets of in-flow and out-flow of wood and wood-products in SISPROF

In relation to the control of the movement and transportation of forest products, the old functions of the system known as SISMAD (System for the control of commercialization flows of wood and wood products) have been incorporated in SISPROF, and thereby the control and monitoring of flows of transportation and commercialization of wood and wood-products is carried out through a system of monthly reporting by companies/firms based on three distinct modules whose basic functions are:

Module where the company reports on the initial balances and monthly movements of in-flows and out-flows of raw materials and products.

Module where IBAMA receives and records the archives that contain the company's monthly reports.

Module where the data of these monthly reports are processed, by making an accounting statement of the monthly movement, and cross-checking these data with those that exist in the SISPROF data bank, as well as verifying the consistency or inconsistency of the operations performed by the company and generating managerial reports.

4.2.4.1 Module of the company's monthly reporting

This module is made available (either by diskette or through the internet) by IBAMA to companies (juridical/corporate personality) and individuals that are forced by legislation to submit monthly reporting. The package must be installed in a personal computer of the company or of its legal representative before IBAMA. The main functions of this module are described in the following sub-sections.

4.2.4.1.1 Roster of individual personality or of corporate company (in the module of the company)

Each unit of this module may be shared by one or more individuals or companies. The initial registration of each one of them must be made and all their identification data put in file. These data will serve to update the roster of the individual/company in SISREG, when they are processed by IBAMA.

4.2.4.1.2 Roster of patios and balances (by the company)

The address of the patio is not always the same as that of the office or headquarters of the company; therefore it is necessary that the registration of the patio be done with its respective address.

The system allows for the registration of more than one patio by company, with different addresses. In this case the reporting by the company will be the same, but the accounting statement of each patio will be independent.

All initial balances of each patio must also be registered, by product and sub-product, species, raw material and existing volumes in the last day of the month previous to the first monthly reporting.

From then on, all movements of in-flows and out-flows of products (ATPFs) and sub-products (RET-2/Stamp) must be registered, in order that the system calculate the stock balances of each wood species at the end of the period.

Based on the relation between stocks of products and sub-products of each species, the system will calculate the degree or rate of recovery of the raw material (index of transformation of logs into manufactured timber – sawnwood or veneer), cross-checking it with the normative rate adopted by IBAMA, for the generation of debts/deficits of obligatory forest replacement and other legal consequences.

4.2.4.1.3 Roster of authorizations/DVPFs and balances (in the company)

The system/module in the company must maintain a roster of all its authorizations and DVPFs (declaration of sales of forest products) through which IBAMA must have authorized the exploitation/utilization of forest resources of a known origin. This roster must contain the balances of authorized species, raw

materials and volumes, which will be automatically taken out along with the respective accounting of ATPF balances into the system, until balances are brought to zero. Before the movements of the first reporting by the company are registered in the system, old authorizations must have been registered with their remaining balances.

4.2.4.1.4 Accounting of ATPFs (logs) in the module of the company

The accounting of ATPFs must be done in accordance with the extent of their use and their inclusion in the accounts means that the corresponding raw material is already in the patio, with a consequent and respective drawing out in the balance of the authorization and a corresponding credit to the patio. Each debit in the authorization of origin (a used ATPF) generates a credit for the destination patio, which will be matched and zeroed in the future by the exit of a sub-product (ATPF of processed or industrialized wood or timber/stamp) or, in specific cases, an exit of raw material in its raw state (ATPF of later/posterior phase/stage).

During the establishment phase of SISPROF the system will have to admit the accounting of old ATPFs (not issued by the computerized system). The ATPFs of later phases/stages may either be of entry or exit, since they refer to movements from one patio to another, and not from the place of extraction of the product to the patio of the company. In the accounting of exit ATPFs of a later phase there must be a corresponding balance of the species, raw material and volume that was previously transported with the use of the ATPF from an authorized origin to the respective exit patio, from where it will be correspondingly cancelled/debited. In the accounting of entry ATPFs of a later phase the corresponding credit will be issued for the destination patio through the reporting of the destination company of the transported product.

The system, nevertheless, must do the cross-checking or balancing of the two accounting statements, acknowledging the conformity or divergence between both, at the time that the latter is processed. The registration of the inclusion of new species, not included in the authorizations/DVPFs that a company may hold, in the company's patio may be accepted only for raw material bought in a raw state or condition and that has entered the company's patio with ATPF of a later phase.

The inclusion of new species in the patio, originating from new authorizations issued by SISPROF, will be automatically processed by the system, with zero balance, as soon as the authorization is registered.

4.2.4.1.5 Recording of ATPFs (processed/industrialized wood in the module of the company)

Every movement of exit and entry of a product or sub-product must be recorded in the system, in order that the final balance may be calculated, from the initial balance recorded at the patio of the company. For the movements of entry of a sub-product (ATPF – industrialized wood/stamp of entry), relative to purchases of sub-products already industrialized or processed, the system allows for the recording of new species that have not appeared in the initial roster of the authorized species. For that purpose, the system should open a window from the screen of registration of RET-2 or stamp of entry, when the then non-existent species is recorded.

4.2.4.1.6 Roster of credits and debits of obligatory forest replacement

The module of the company, through the registration of the produced/generated debits and of the entered credits, must contain the control of its forest replacement record..

4.2.4.1.7 Diskette disposal

The operation of diskette recording must be realized after the recording of all documents corresponding to the movements of entry and exit of products and sub-products occurring during the base-month. Before recording the files, checking or cross-examination reports must be produced. The system has been conceived with a concern to avoid errors that jeopardize the data reception and processing in IBAMA. In this sense, as soon as the file recording module is started, a warning and/or error communication is displayed (which may be printed). In the event of the existence of errors, the diskette will not be

produced/recorded, and the company will have to try to correct them before a new trial. The menu of warnings and errors may be put into action, by the user, during the data inclusion phase. It will also check/verify whether or not there is a pending point relative to the company's reporting of the previous period. Open periods will not be accepted (if there has been no movement, this must be communicated).

The receipt of the report will be printed at the company. For this purpose the reception module has been conceived with a protection system capable of detecting eventual manipulation of data that might be done after the recording of the diskette.

4.2.4.1.8 Confirmation of delivery

After the company's reporting is delivered to IBAMA, it must be confirmed by the system, for the purpose of consolidating the accounting statements/entries and preparation for the next period.

4.2.4.1.9 Adjustment of database

The company's database must always mirror its base in IBAMA, so any necessary adjustments must be first carried out in the data bank of IBAMA. In sequence, the files containing the adjustments will be made available to the company, which will then make the corresponding corrections in its database through the activation of this module. To preserve the conformity between the two databases the activation of this module must contain a "security key", specific for each adjustment file generated by IBAMA, and only from it (key) will the module be activated.

4.2.4.1.10 Complementary reporting

In case the company, after having delivered the monthly reporting to IBAMA, realizes that some, merchandise movements might have been left out of the reporting, it may prepare a complementary one containing the necessary inclusion.

4.2.4.1.11 Rectification reporting

Similarly, a rectification reporting may be done to correct possible errors that could be detected after delivery of the monthly reporting to IBAMA. If necessary, a single reporting could be complementary and rectifying.

4.2.4.2 Module of reception in IBAMA

4.2.4.2.1 Reception and recording of files

This module is independent and can be installed in any machine without having to be connected to the data bank at the moment of the reception. The files will be recorded and kept for further processing through the sharing of the net with the operating station of the system (that which contains the processing module connected to the corporation systems). At the moment of receiving the files containing the company's data, the verification of the security codes will be done to test the consistency of the data. If all is well, the receipt of the reception/delivery of the reporting will be registered. If not, the user will be informed of the data inconsistency and a new diskette will have to be recorded. In the initial stages of SISPROF the reception of the documentation in an annex to the reporting will be maintained, which will serve for possible checking and verification of the data consistency. Nevertheless, this practice will be abolished along with the consolidation of the system.

4.2.4.3 Module of accounting processing in the system

4.2.4.3.1 Search of available files

The operators of the system will search the files in the computers, on a daily basis, where the reports will be received for processing.

4.2.4.3.2 Accounting records in the authorization

Once processing of a report is activated the pertinent data of used ATPFs will be recorded in their respective authorizations/DVPFs, to be duly debited in their corresponding balances. Considering that in the initial reporting only old ATPFs will be recorded the system should be prepared to process them, taking into account that they will not contain all the information and characteristics of the new model. The ATPFs of a later phase will not be registered in this operation, since they no longer refer to the withdrawal of a product from the point of origin, but to simple transfer between patios.

4.2.4.3.3 Accounting recording in the patio

From the recording of patio stocks in the initial report, every movement of entry and exit will be recorded in the accounts through the recording of ATPFs and STAMPs (fiscal bills), respectively. For accounting effects, the recorded ATPF generates a debit in the authorization/DVPF of origin, and a respective credit in the destination patio; the recording of the stamp, in its turn, may generate a debit or a credit, depending on whether the sub-product is leaving or entering the patio in question (taking into account that transference or commercialization between different patios and companies may occur).

Likewise the STAMP, the ATPF of a later phase, may also generate a debit or credit in the patio in the case of a raw material that is still in gross and good conditions and that may have been transferred or commercialized. In those cases where a transference or commercialization of a forest product or sub-product may occur, involving movements that will contain distinct recordings for debit and credit (to be processed in different moments, from commands stemming from the reportings of two companies), the system has been conceived with a function for checking and comparing these two recordings, communicating significant divergences eventually detected.

4.2.4.3.4 Verification of consistency with the authorization

At the end of the processing the system will make a communication on the consistency of recorded data, relative to the incurred debits in the authorization/DVPF (SISPROF) of all ATPFs used in the period. In this verification, the parameters of tolerance of the system for volumes of each species and transported raw material will be observed.

4.2.4.3.5 Verification of consistency with the patio control

At the end of processing the system will also issue a communication on the consistency of recorded data on the control of patios, relative to the stocks of initial balances, the entry and exit movements and the final balances of registered species, raw materials and sub-products.

4.2.4.3.6 Verification of consistency with forest replacement

Information relative to the control of obligatory forest replacement will also be processed with the issuing of reports and warning messages.

4.2.4.3.7 Issuing of reports

In case the tolerance limits established for the controls of authorizations and/or patios are outstripped, detailed reports will be issued for a preliminary verification on the origin of the divergences. If irregularities are confirmed the appropriate administrative actions should be taken in accordance with the prevailing norms and legislation (such as forest replacement, fines, suspension of ATPF issuing, etc.). In relation to this, the system has been conceived to operate in a corporate form, where, from a communication of irregularity that might generate a penalty decision or suspension of rights, the measure will be recorded in the system in a compatible level of access which will have repercussions in all interlinked systems. After the conclusion of the preliminary verification process, and eventually the necessary adjustments have been made, managerial reports will be issued to support the inspection actions and/or technical visits.

4.2.4.3.8 Recording the complementary or rectifying reporting

These will be received and recorded as in normal reportings, where the system will do the necessary and possible adjustments, observing the time sequence of information and the time limits to be accomplished, as well as compatibility with other processed data that have not been the object of alteration.

4.2.4.3.9 Initial reporting

Before the first computerized ATPFs are issued, the companies will have to make an "initial reporting" so that there may be an adjustment of the whole accounting system already recorded by IBAMA, and by the companies, on the balances of authorizations/DVPFs in use, and on the patio stocks. This operation is of extreme importance, considering that from that moment all movements of entry and exit from the patios, and all balances of authorizations/DVPFs will be accounted for through the recording of the same documents, either in the module of the company or in the data bank of IBAMA, thereby eliminating any possibility of divergence between the two controls. Data referring to control of forest replacement will also be recorded at that occasion.

Considering that the companies would already have recorded in their modules all balances and stocks, and that this information would be in the initial reporting, the IBAMA technicians must do a thorough cross-checking and evaluation so that, in the event of divergences, including those of forest replacement, they may make the necessary adjustments.

In the assessments, it is important to observe the acceptable rates and margins of tolerance, in accordance with the legislation and practices of the sector, so that a double accounting adjustment can be done (module of the company and data bank of IBAMA), which will result in one being a mirror of the other.

As a consequence, considering that the system will do the mechanical control of the flows and balances, the focus of attention and acting of IBAMA technicians and inspectors will be centred on the verification of conformity between the accounting statements (issued reports) and the physical reality of the company, either in relation to the extraction of authorized raw materials or in relation to their transportation and final destination, or to the patio stocks.

4.2.4.3.10 Adjustment of the database

The company's database must always mirror its base in IBAMA, and so any needed adjustment will be done first in the IBAMA data bank. Afterwards, the files that contain the alterations performed by IBAMA will be made available to the company, which will then make the corresponding corrections in its module. To preserve conformity between the two databases the recording of each adjustment file by IBAMA must generate a security code that will be the only key capable of activating the menu of "adjustment of database" of the company's module. In the event there are adjustments due to divergences that were verified in the processing of the initial reporting, the system will generate a correction file to be used in time by the company, so that it can make the due adjustments in its module before the next reporting is processed. The company's module must contain warning messages on these details.

4.2.5 The module of ATPF issuing and its functions

4.2.5.1 Request file

ATPFs will be provided through a protocol of standard requirement to the holders of authorizations issued or registered in SISPROF, or to the buyer of DVPFs registered in SISPROF, as per the current legislation. When registering the requirements in the system, the situation of the person making the request will be verified in all corporate systems, and in the presence of any irregularity, including any related to reporting and forest replacement, a pending report will be issued, with a clear description of the irregularity, to check its reason or origin, and to forward a solution. All pending points will be observed and listed at once and at the same moment. The requirement will contain an estimate of the species, raw materials and volumes to be transported with the necessary ATPFs.

4.2.5.2 File of the stamp of origin

For the old authorizations or DVPFs, whether issued by SISPROF or not but registered in it and where raw material has been withdrawn, the current balance will need to be registered, which will be that resulting from the controls done by IBAMA (according to proceedings described in the initial reporting). For the purposes of confrontation and possible adjustments, the company, when initially reporting, must provide the balances of all its authorizations/DVPFs resulting from its own accounting. There is a module of entry for these initial balances in the file request screen, through which they must be recorded, after possible necessary adjustments have been done. For the new authorizations issued by SISPROF, and that still have not had ATPFs issued manually, there is no need for this operation. The approval of the request will be done from the balances of the authorization or DVPF registered in SISPROF.

4.2.5.3 Analysis of the request

Within pre-established parameters, the system will verify the request considering the: person making it, situation of the authorization/DVPF and of the species, raw materials and required volumes, performance of the confrontations with the SISPROF authorized balances and required quantities of ATPFs. After verifications and analysis of the merits of the request, including in relation to forest replacement, and in accordance with the limits of the established parameters, the system itself will automatically defer the required ATPFs.

4.2.5.4 Delivery to DITEC (Technical Division of IBAMA's office)

In the event that the request outstrips the parameters of the system, it will be forwarded for analysis and manifestation to DITEC, which will decide whether to approve the request totally or partially, or even deny it. After any one of these conclusions the registration of the request in the system must be done in order to allow sequence in the process of issuing ATPFs, or communication of denial, as the case may be.

4.2.5.5 Roster of ATPFs

Once the requirement has been approved, the ATPFs conceded will be registered in the system. This operation consists of recording the data that pertain to each ATPF (such as the colour of the edging, the name of the holder, the information of the authorization/DVPF, the place of origin, the number of copies, etc.). Also, at this moment, the ATPF receives a sequential number provided by the system (which will become the number of the document and which differs from the number of the forms where it will be printed).

4.2.5.6 Printing of ATPFs

After performing the recording, the ATPF will be ready to be printed by the system. ATPFs will be printed on security paper size A4 containing some pre-printings, a security button, the Arms of the Republic and a sequential numbering that will serve for controlling stocks. Laser printers will be used to print in the appropriate forms, the spaces, their names, as well as the content of each space in accordance with the characteristics of the previously recorded ATPF. This flexibility allows for the utilization of only one type of form for the printing of all types of ATPF, which will simplify the process of formatting and logistics of their distribution.

Considering that, with present legislation, the holder of an ATPF is almost always its destination/addressee, which eliminates the need for a second copy of the document, the system foresees the printing of ATPFs in a single copy. The forms in A4 size will come with dented dots in the middle, making possible the issuing of two ATPFs on a single copy, or one or two copies in each sheet. Before the issuing is confirmed, and given the possibility of damages or faults in printing, the system allows that each ATPF be printed more than once until its issuing is confirmed.

4.2.5.7 Confirmation of issuing

This operation confirms the issuing of the document, and appropriates the number of the ATPF given by the system to the number of the form where it has been printed. Once the operation is confirmed, it will no longer be possible to print the respective series, and the numbers of the used forms will be automatically cancelled in the control of stocks.

4.2.5.8 Roster of forms

The logistics of the distribution of forms will be coordinated by Central Administration, which will do the monitoring and control of stocks, through the specific system module, by recording the respective numerical series linked to each one of the issuing units of the system. When the issuing of an ATPF is confirmed, its respective number in the form that was used will be automatically eliminated, making control of stocks easier. The roster of forms will be implemented exclusively by Central Administration, and an issuing unit will only be able to print a document if there is an available form recorded for such a purpose.

4.2.5.9 Cancellation of forms

The damaged forms up to the moment of printing, and before confirmation that the document has been issued, must be cleared from the stock through its cancellation. After the confirmation of issuing, there will be no further cancelling of the form but cancellation of the document that was printed on it, if necessary.

4.2.5.10 Issuing of ATPFs of later/posterior phase (natural/industrialized)

In case new transportation of gross raw material in good conditions is needed to a new destination, a new ATPF of the type "Later phase" may be issued for authorizing this transportation. This type of ATPF is being introduced (and still depends on a legal norm) to allow for the mentioned possibility, and especially to the commercialization of gross raw material. In the case of traders/merchants, transport from the site of origin to the company's patio will be done with a normal ATPF, issued by IBAMA, with data (authorization/DVPF) relating to origin and destination. The system will only issue an ATPF for a further phase if there are balances in the trader's patio, relative to the species and volumes required, that have been previously transported from the site of origin, with the utilization of another ATPF.

4.2.6 Stamp of forest origin

Objective

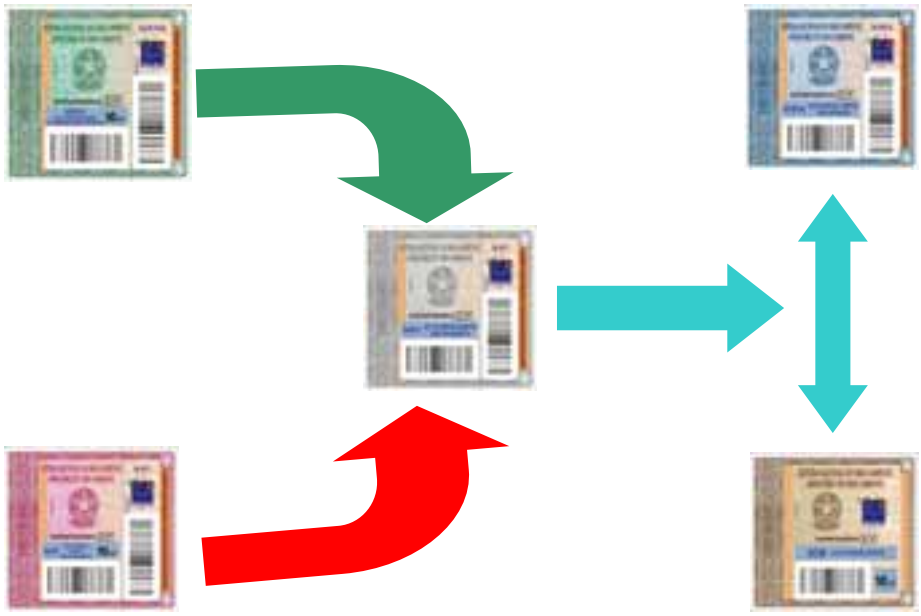
The stamp of forest origin is currently being instituted at national level in Brazil as a new instrument of control for the transportation of native forest resources and products, replacing the extinct "Special transport regime (RET)" and the "authorization for transportation of forest products (ATPF)" still in force. Its creation is part of the modernization imposed on IBAMA's control systems. The processes of manufacturing and remittance of the stamps will be totally supported by integrated and automated information technology procedures, with guarantees of a high security standard and integrity of the documents issued.

The stamp

The stamps of forest origin will be produced in the following types: Deforestation; Forest Management Plan; Transportation; Final Consumer; and Exports. Each model will have the equivalent volume, for the following quantities of $1m^3$, $2m^3$, $5m^3$ and $10\ m^3$, in accordance with the table below:

Type of Stamp	**Volume in m^3**				**Tag**
Deforestation	1	2	5	10	Yes
Management plan	1	2	5	10	Yes
Transportation	1	2	5	10	Yes
Exports	1	2	5	10	Yes
Final consumer	1	2	5	10	No

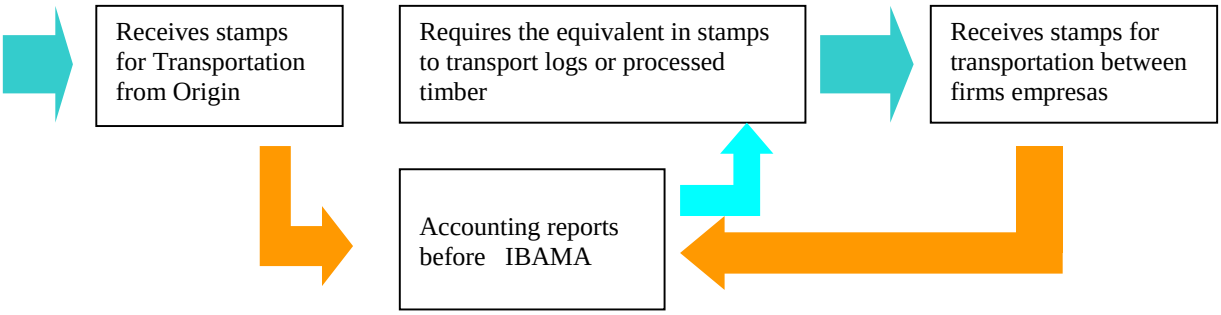
The stamps referring to deforestation and to management plans will be used in the first transportation of the forest raw material from the site of its extraction to the buyer's patio or processing industry. For further transportation, be it still a raw material, or already processed product, other types of stamps will be used, with the inscription "Deforestation" or "Forest management plan", to refer to the segment of the chain of custody that gave origin to the product. For the movement among patios the "Transportation" stamp will be used, preserving the characteristic of transferring credits to the final destination patio of the transported material, thus allowing for the request of new stamps.



The stamps of "Final Consumer" and "Export" types do not have that characteristic, once IBAMA's control ends at the transportation from the last patio, from where the material will be shipped to final consumption or export. At this point, the corresponding stamps will be used, with the aim of certifying the legal origin of the merchandise that is being sent either to the final consumer in the domestic market or to the foreign importer.

The "Deforestation" and/or "Forest management plan" types of stamp are provided by IBAMA upon an specific requirement signed by the holder of the exploitation licence (AUTEX), in which the name and address of the user of the merchandise, to whom the required stamp will be handed, will be indicated to IBAMA. The requirement to be registered will be verified or checked through the SISPROF database.

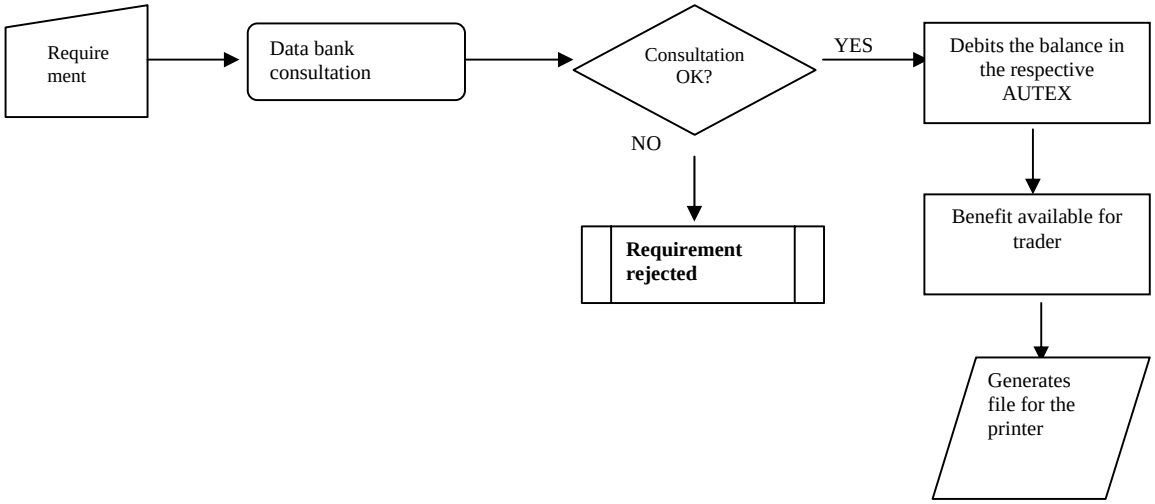
Once approved by IBAMA, the requirement will be computed in SISPROF, which will proceed to the cancellation of the required volumes in the AUTEX. At the monthly accounting reporting, done through SISPROF the user of stamps declares that the material has been taken and transported from its origin. The corresponding credits are then issued/accounted to the destination patio.



In the subsequent stages, the requirement and the utilization of stamps will always be done by the user that holds the patio credits. As we said, from patio to patio the transport stamps will be required, as well as those for the final domestic consumer and for exports. Through SISPROF, and using the connection on-line, the printers will be requested to carry out the printing of the stamps and their remittance, in accordance with the requirements that have been approved. The names and addresses of the destinations will then be passed to the printers, together with the types and quantities of required stamps and respective volumes per fraction. Once the printers receive the data referring to the final addressee through their computerized system, as well as the other caracteristics of the stamps, they must then carry out the manufacturing of the stamps, in the required quantities, pack them in water-proof packages with an iviolable security seal, and post them at the specific Post Office agency through the postal modality to be indicated by IBAMA.The flow of demands for the manufacturing of stamps from IBAMA to the printers will be continuous, with the closing of daily quantity bundles at 20:00 hours. The maximum time limit for the production of each bundle is three working days, counting from the respective closing time and reception by the printing company. The information to which the printers will access in IBAMA's sytem will be limited to the names of final addressees, quantities and types of stamps to be produced. No additional information will be necessary for the production of the stamps.

The accounting process

The stamp of forest origin is an instrument of control for all transactions involving forest products, timber at first. Its purpose is to provide feedback of information on requests made by the timber industry to the control and inspection agencies. The process of control of balances is based on the accounting balances that have been generated from a request for exploitation authorization. This document allows its holder to trade the timber that comes from an inventory. With this document, duly signed and electronically issued by SISPROF, the holder or his legal representative will indicate to IBAMA the final receivers of the timber and its respective volumes, through a requirement filled in at the closest IBAMA unit, or through Internet. When the requirement is filled in, the balance transferred by the holder will be automatically cancelled from his exploitation authorization (AUTEX) and made available to the transporter or trader of the timber. The latter shall be duly registered in IBAMA to be eligible to receive this benefit. Once the information is duly validated at the data bank service, through a specific routine for that purpose, the system will pass the corresponding information to the printers of the data files. The printer can have access to this information directly in the data bank via Internet, through a specific procedure created for this purpose. The procedures are the following:



After the transporter or trader has received the stamps, it is necessary to register the stamps at their local system, a facility provided by IBAMA. Thus the system will update the balances of the origin of the cargo that is being reported. If this registration is done through the Internet, the user will only report the numbers of the series of the received stamps. When transporting the timber, the user must affix on the reverse side of the transportation bill the stamps of the respective cargo. If he is stopped at a road inspection, his documentation will be easily identified via an Intranet (IBAMA's net), Internet or AutoTrac consultation. When he reaches the company's patio, and the cargo is unloaded, the user must report, through the system, the transported volumes and further data of the fiscal bill that refers to the transported merchandise. The company's module in SISPROF will update the patio and origin balances, and will prepare a file to be sent to IBAMA. This file will contain the information to carry out updatings of the company's balances in IBAMA's controls.

In the plan of tests to be developed, four or five units of IBAMA and four or five companies will be selected in order to monitor and follow up the establishment of the stamp of forest origin.

Types of stamps:

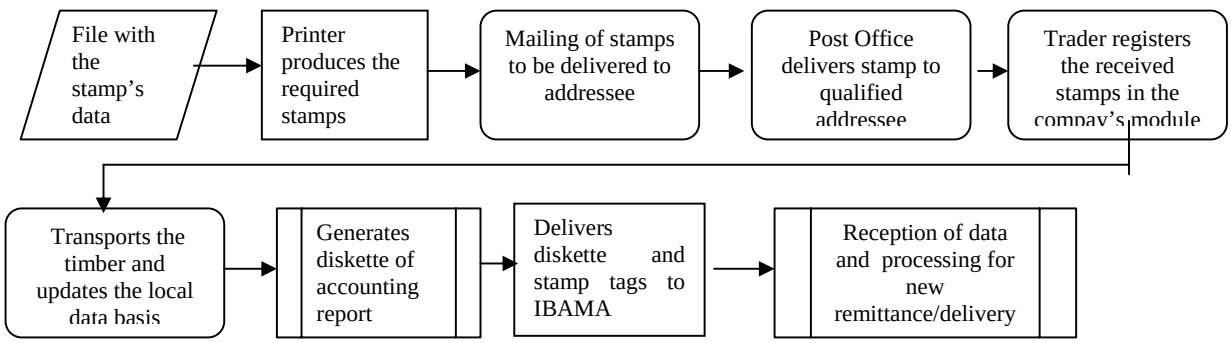
Export Stamp

Stamp of Transference of forest

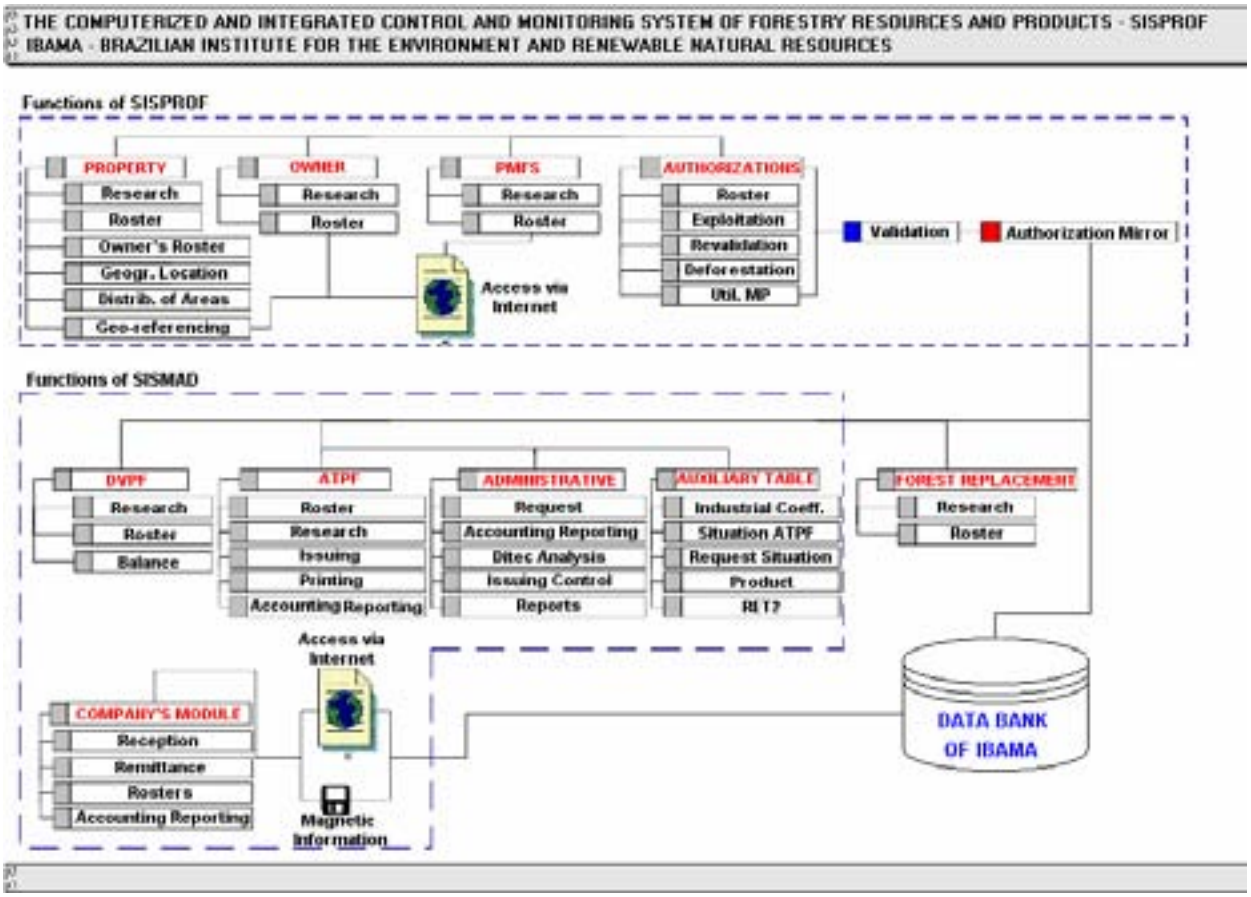
Stamp of Final Consumer product

Stamp of Origin – PMFS

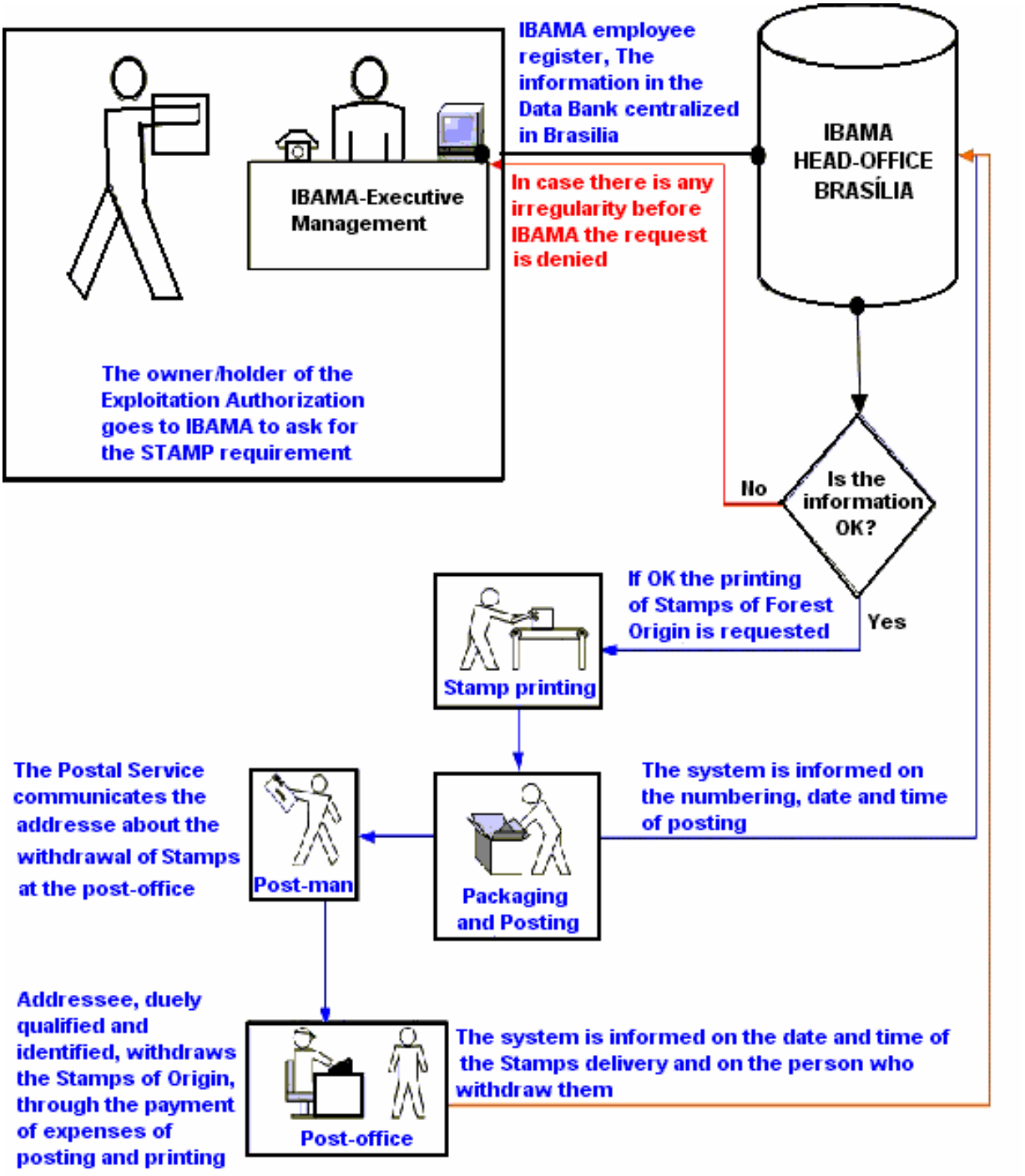
Stamp of Origin – Deforestation



4.3 - Diagram of the work-flow of SISPROF (including SISMAD)



4.4 - Diagram of the flow of the stamp of origin

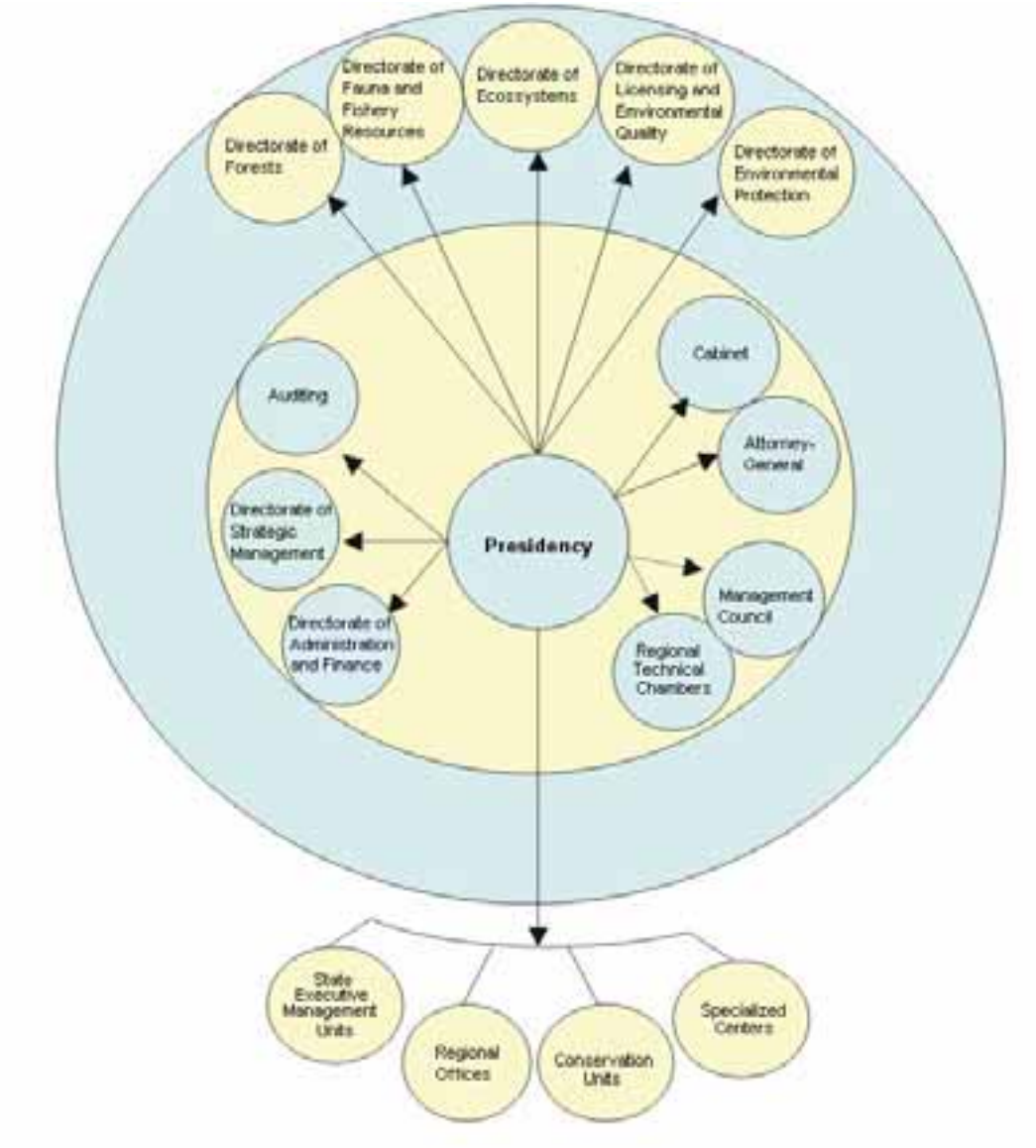


5. CONTROL AND MONITORING OF FOREST MANAGEMENT IN SISPROF

5.1 The direction and management from Brasilia headquarters and the advanced bases: their functions and articulation in the planning of activities

Figure 5.1 presents the organizational structure of IBAMA, in which the monitoring and control of SISPROF's activities are inserted in the Directorate of Forests and in the Executive Management Units corresponding to each state of the Federation.

Figure 5.1 - Organizational structure of IBAMA – Decree 3833 of June 2001



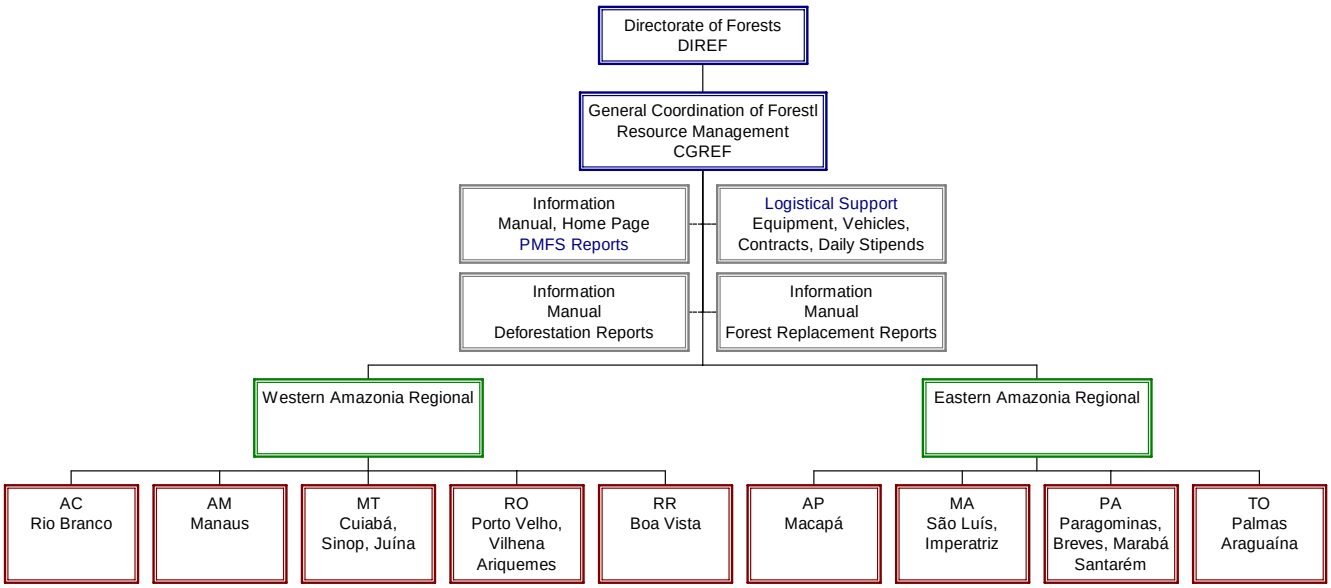
The reception and treatment of demands from the public and clients of the forestry sector are taken care of by the State Executive Management Units (GEREXs) of IBAMA in the states of the Federation, as well as by the respective local offices. In these offices, the processes of PMFS, deforestation authorizations and registry of obligatory forest replacement pass through technical and legal analysis and evaluation. It is the responsibility of headquarters in Brasilia, at the Directorate of Forests, to supervise and monitor the

performance and work of GEREXs and local offices, to establish targets and methodologies, to elaborate proposals for altering norms and rules and to provide support for solving problems at state level, when their solution seems difficult.

Every year, the Directorate of Forests, through its general coordination of forest resource management (CGREF), promotes the execution of technical field visits to forest activities related to forest management, deforestation activities and reforestation linked to obligatory forest replacement. In order to carry out the annual technical field visits, besides the above-mentioned structure, the Directorate of Forests also establishes temporary support bases. These bases count on IBAMA's infrastructure in the states, and are commanded by a civil servant of the Institute with a mandate to act as chief for a period equal to that of the operation. The organization in regional areas and bases is due to the large number of field visits and to the limited time available for carrying out such visits because of local climatic conditions. The number and location of the bases are established taking into account the concentration of the activities and the availability of physical infrastructure.

Due to the large geographical distances and communication difficulties, regional coordinators are established (eastern and western Amazonia), whose respective responsible coordinators have the function to widen contact between headquarters in Brasilia and the bases. Without any infrastructure of their own, the regional coordinators circulate among the two areas with the purpose of evaluating their performances and of speeding up the adoption of corrective measures related to the methodology of action, redistribution of personnel, vehicles and equipment. The diagram in Figure 5.2 illustrates the structure that is periodically built for the development and implementation of technical field visits to forest activities, in which the PMFS are inserted.

Figure 5.2 - Organizational structure of IBAMA for the control of forest activities



5.1.1 Functions of Brasilia headquarters (DIREF/CGREF/project coordination)

5.1.1.1 Evaluation of activities developed each year and planning for the following year

The planning of actions related to technical control and monitoring of forest activities every year - in which those directed towards SFM are included - begins at the evaluation meeting of the preceding year, organized by CGREF in Brasilia. At the annual meeting, on the basis of the accomplishments and fragilities identified in the development of the work during the year under evaluation, the general lines for the following year are defined. The elaboration of the budget is the responsibility of Brasilia headquarters and is carried out with the employment of three interlinked Excel sheets/schedules that deal, respectively, with forest management plans, deforestation authorizations and forest replacement. Thanks to these Excel sheets, the budget is quickly prepared, and for that the following information is enough:

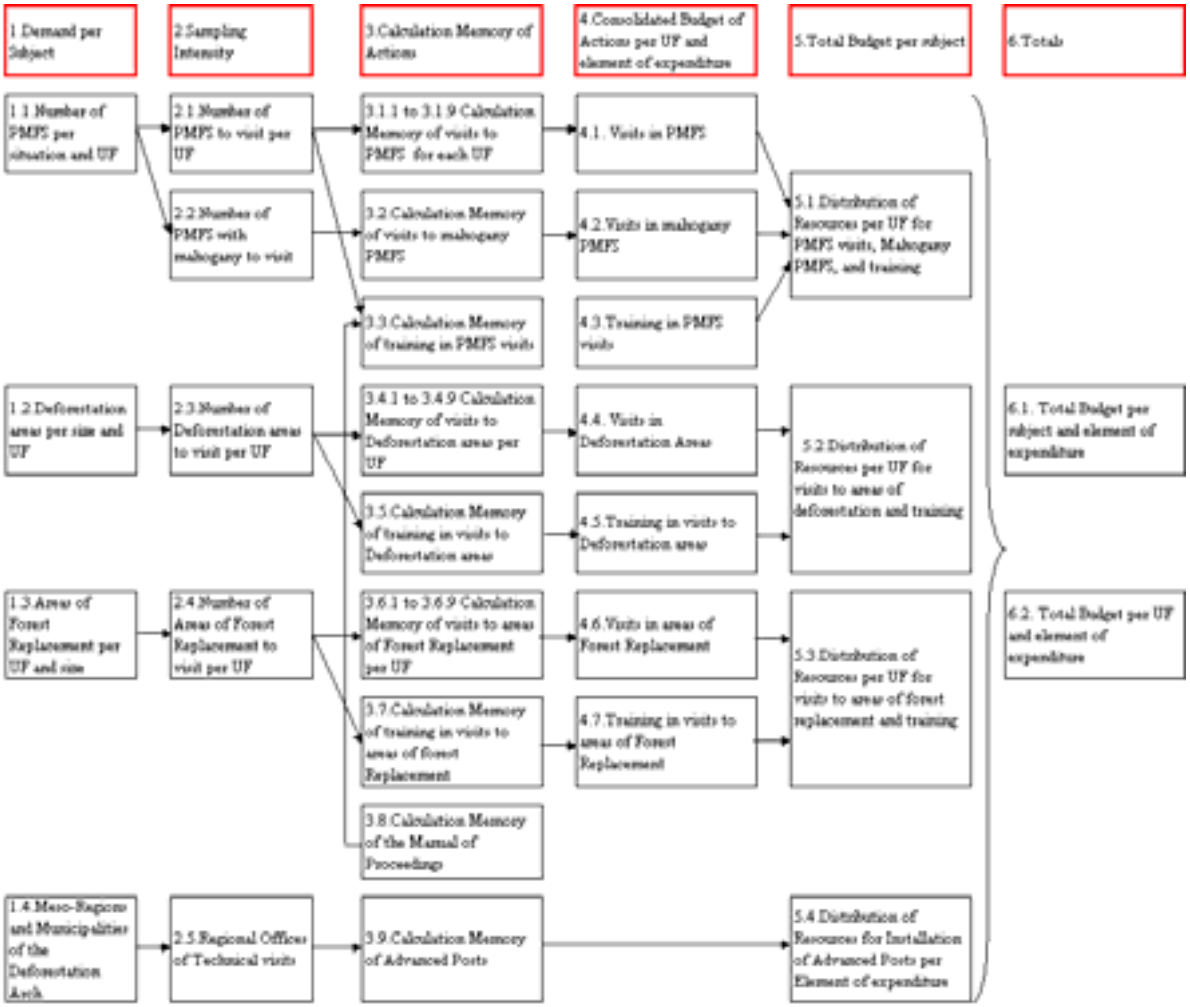
- definition of the number of processes/projects to be visited in each of the three activities. The number is provided by the local offices in the states, or by DITECs (Technical Divisions of the state GEREXs), with an estimate of new processes to be incorporated during the execution of the actions;
- definition of the sampling intensity of the field visits in each activity given the available resources;
- definition of the training courses to be ministered to IBAMA technicians, on the basis of proposed methodological progress, such as: ArcView, GPS operation, low-impact forest management, and others;
- number and location of temporary support bases to be established.

The number of teams and the consequent number of external technicians to be hired are also indicated automatically with the electronic sheet, on the basis of the following parameters:

- a minimum of approximately 120 days per year for the field actions, wherever the site in the Amazon region;
- a maximum of 15 consecutive days per mission, per team;
- a minimum interval of 10 days between missions of 15 days;
- a recommendable maximum of 60 field days, per team, per year;
- an average of two days for a field visit to each PMFS.

The picture in Figure 5.3 shows the diagram of flows of the electronic sheets responsible for the calculation of the budget of actions as described above. The sheets that refer to the actions of field visits and training related to forest management plans are on row 1.1, which deals with the number of PMFS per situation (apt, suspended, etc.) per unit of the Federation (UF).

Figure 5.3 - Sheets of the automated budget



As a result of the sheet illustrated above, Table 5.1 with the estimates of PMFS to be visited (row 2.1 in the diagram) is presented as an example, noting that the planning has foreseen a 100 per cent visit to existing PMFS, and includes a percentage relative to other new ones that normally are submitted to IBAMA before the operations begin.

Table 5.1: Example of calculating the number of PMFS to be visited

UF	Existing		To visit				
	Apt	Suspended	Apt	Suspended	Total DIREF	Unforeseen	Global total
AC	7	1	7	1	8	2	10
AM	45	9	45	9	54	11	65
AP	21	34	21	34	55	11	66
MA	63	14	63	14	77	16	93
MT	107	81	107	81	188	38	226
PA	82	175	82	175	257	52	309
RO	60	34	60	34	94	19	113
RR	0	0	0	0	0	0	0
TO	4	13	4	13	17	4	21
Total	**389**	**361**	**389**	**361**	**750**	**153**	**903**

After the calculation of the budget for the actions related to forest activities (management, deforestation and replacement) the two final sheets present the total budget per activity and per UF, and per element of expenditure and UF. This latter is shown in Table 5.2 with the costs of control, monitoring and training actions of PMFS included in it.

Table 5.2: Example of final budget sheet

UF	Daily stipends (3490.14)	Tickets (3490.33)	Consumption material (3490.30)	O.S.T.P. corporate (3490.39)	O.S.T.P. person (3490.36)	Permanent equip. & mater. (4590.52)	TOTAL
Acré	15.031,2	9.035,50	5.887,43	12.550,00	6.213,33	129.349,70	**178.067,21**
Amazonas	91.440,3	19.850,00	23.401,43	52.750,00	34.733,33	138.307,30	**360.482,38**
Amapá	39.327,5	1.951,20	10.667,88	15.214,29	17.973,33	131.327,40	**216.461,68**
Maranhão	61.460,2	3.017,00	15.791,19	36.071,44	14.933,33	256.238,40	**387.511,62**
Mato Grosso	153.282,7	2.350,00	38.151,80	64.485,71	35.840,00	573.322,15	**867.432,38**
Pará	199.994,0	20.750,00	48.312.69	91.550,00	55.666,67	699.923,35	**1.116.196,79**
Rondônia	114.472,4	8.116,26	28.855,31	56.185,71	30.293,33	321.281,25	**559.206,33**
Roraima	12.336,0	2.916,12	3.783,68	4.071,43	5.760,00	2.461,00	**31.328,23**
Tocantins	44.298,9	4.114,88	12.824,17	15.785,71	15.360,00	135.798,70	**228.182,42**
CGREF	272.777,4	131.669,57	84.531,64	102.862,11	74.694,07	55.082,0	**721.616,83**
TOTAL	**1.004.421,0**	**203.772,53**	**272.207,22**	**451.526,40**	**291.467,40**	**2.443.091,25**	**4.666.485,87**

5.1.1.2 Establishment of regional coordinators and bases

The regional coordinators do not have a structure of their own. Their structure is constituted from that of the bases, which have a chief, a secretary and their field teams. To facilitate the work of the coordinators, a room in the state GEREX or in the regional offices is normally reserved during the period of the field visits, which may take up to eight months. In the regional base, tables, chairs and one or two computers are arranged together with the PMFS, deforestation requests and forest replacement projects that are to be visited.

5.1.1.3 Definition of the regional coordinators and of the base chiefs

The base chiefs are chosen from among IBAMA technicians who have already participated in the field visits and have shown a good performance in previous years. The regional coordinators in their turn are chosen from the technical personnel in Brasilia headquarters. To the extent possible, technicians do not command the same bases in consecutive years. Under their command, the teams carry out visits independently of the type of forest activity, that is, once having departed in a certain direction, they will visit areas of forest management, deforestation and forest replacement that are located along their route, following the established methodology for each of the activities.

5.1.1.4 Selection and hiring of temporary personnel

Every year IBAMA announces, through its home page, the beginning of a selection process for candidates for the temporary service of technical field visits. The applications and submissions of candidatures are carried out via Internet, through filling out a specific form. Through the same page the criteria and results of the selection are announced. The evaluation criteria for the selection of candidates for the technical visits are described in Table 5.3. Once selected, the candidates present themselves at the bases for which they have been selected, and firm their respective contracts through Internet itself.

Table 5.3: Criteria for the scoring of candidates for temporary hiring for field visits in forest management plans, deforestation areas and forest replacement projects

Criteria	Punctuation margin	Observation
Preference of UF	1 to 3	Prioritizing candidates who indicated as first option the state for which they have been selected
Knowledge of low-impact forest exploitation	1 to 3	Depending on the training institution and on the length of the course
Carrying out of visits	1 to 3	Depending on the number of visits and on the year and team in which he participated.
Experience with forest	1 to 3	Full experience: 1 point, in order to differentiate candidate from the rest. Intermediate: 2 points.
Experience with silviculture	1 to 2	Distinction between those with full knowledge from the rest.
References	1 to 2	One point to candidates with reference from people linked to forest management in the region. And two points when the person making the reference has notorious expression.
Knowledge of GPS	1	For those who have worked with the equipment.
Knowledge of information technology	1	Criterion taken into account due to software that will be used in the reports.

5.1.1.5 Distribution of financial resources for daily stipends, hiring and repair of vehicles

Financial resources for the execution of visits are distributed in different forms – always from Brasilia headquarters – in accordance with the nature and destination of the resources. Originating from national Treasury, they may be distributed to the bases through a cooperation project with UNDP, or directly through IBAMA's financial disbursement means. A UNDP cooperation project with IBAMA allows for the hiring of temporary personnel, and on some occasions it can be quicker in making payments.

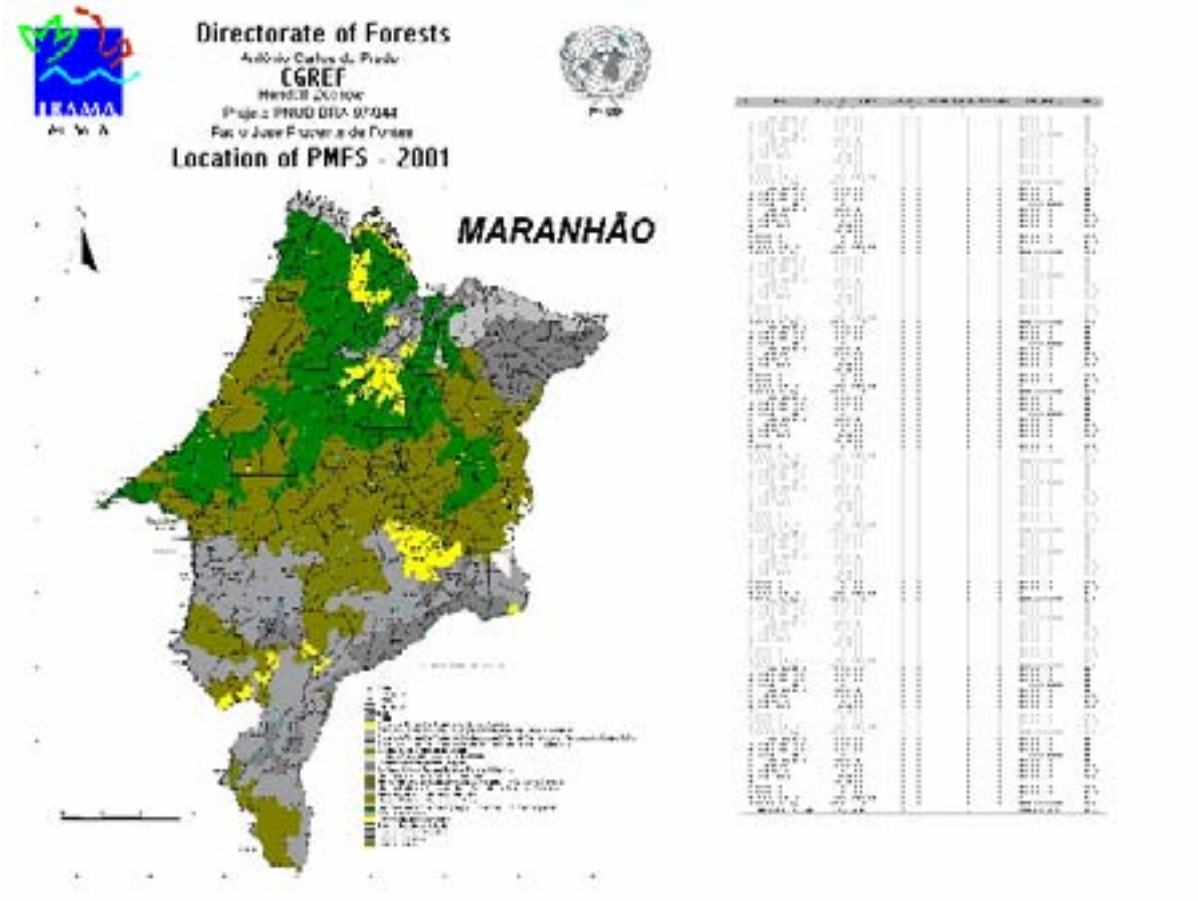
The payment of wages and daily stipends for the temporary labour force is done by Brasilia headquarters directly into bank accounts. The payment of daily stipends for permanent personnel is done through the state GEREXs.

For eventual expenditures, the base chiefs and the permanent personnel of the teams receive an advance payment, which is later reimbursed with a statement of incurred expenses. Recently, the payment of two consecutive advances had to be made, due to the length of time that teams had to wait before the statement of expenses was approved and a subsequent payment made.

5.1.1.6 Elaboration of maps

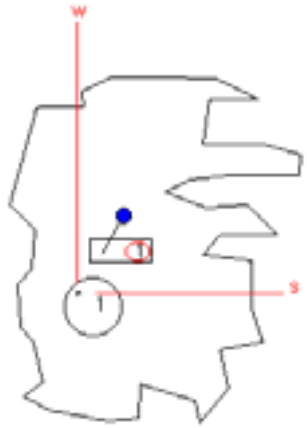
In order that bases may plan the distribution of projects among teams in a rational manner – considering their geographical distribution – Brasilia headquarters elaborates maps with the location and characteristics of the projects. Figure 5.4 presents an example of a map with the location of PMFS in the state of Maranhão.

Figure 5.4: Location map of PMFS in Maranhão



In the case of technical visits to PMFS, their implementation and execution are registered in the map in accordance with the methodology described in Figure 5.5.

Figure 5.5: Registration of execution of visits to PMFS

	Before the visit: preliminary marking • tag 0.5x1.5 with number of PMFS; • pin with colour of the team responsible for the PMFS; • pin fixed within the limits of the municipality where PMFS is located.
	After the visit: definitive marking • a point is marked in the map with the geographical • coordinates of PMFS found in the visit; • a circle is drawn holding the point and number of PMFS; another circle in the tag of the pin shows that PMFS has been visited and the location is real; • the pin is fixed on the geo-referenced point in the map.

5.1.1.7 Promotion of training

Once the methodology of proceedings to be adopted in the year, which begins in the evaluation meeting of the previous year's process, has been defined, DIREF/CGREF schedules the visits for the training. The annual training is programmed for 40 hours, with 32 hours in forest management and eight hours in deforestation and forest replacement. In the beginning they were carried out by Regional offices (eastern Amazonia and western Amazonia), with all permanent and temporary technicians. Later, in order to diminish the classes/groups and allow for a more specific approach, the training came under the supervision of each base chief. In these cases the base chiefs were trained in Brasilia. Nevertheless, this option has not shown good results due to very different interpretations of the manual by the base chiefs when they promoted the courses to their respective classes.

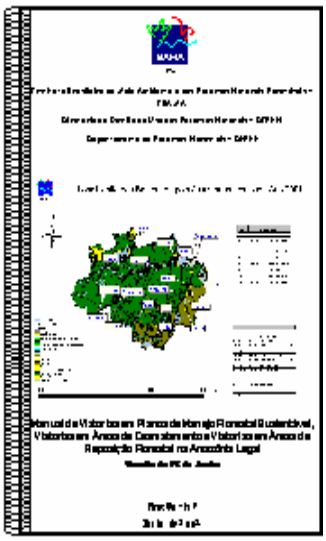


Figure 5.6 - Manual's front cover

5.1.1.8 Definition of the methodology and of the sampling percentage, elaboration and distribution of the Manual

From the version of the previous year and on the basis of suggestions and criticisms of the evaluation meeting, DIREF/CGREF elaborates the Manual of Proceedings. The manual may be altered during the training meeting if any flaw or gap is observed. Other changes may still occur during the period of activities, provided they do not compromise the coherence of proceedings or the final analysis of the results.

The content of the manual is quite wide. Besides the proceedings to be adopted in the planning and execution of the visits to PMFS, deforestation areas and forest replacement, the manual includes all forestry legislation, statistical and unit conversion formulas, support software elaborated by DIREF/CGREF, speeches on related issues and other help items.

Figure 5.7 - Front cover of the manual in the CD

Due to the increasing volume of information in the manual, initially it was prepared and distributed through a CD. Thus, it is possible to transport it easily, consult its sections with the use of any machine and print only the parts that one judges necessary. Figures 5.6 and 5.7 show the images of the printed manual and the CD. Table 5.4 presents its contents.

Table 5.4: Contents of digital manual in which forest management sections are found

Technical visits 2001		
Courses Role of coordinators In order of date In order of UF and town Transparencies Communal Transparencies Entrepreneurial	**Texts** Cover Introduction Forest management Deforestation Forest replacement Useful information Camping Legislation	**Forms** Entrepreneurial PMFS Simple PMFS Other PMFS Heart of palms PMFS *Varzea* PMFS Deforestation report Forest replacement report Forms for forest inventory 100%
Programmes PMFS 2001 Forest inventory 100% Trackmaker	**Others** Manual GPS Manual forest inventory 100% Trackmaker manual Trackmaker files Speeches kit	**Administrative** Activities routine Budget lines UNDP GEREX speeches

5.1.1.9 Elaboration of specific software for support

DIREF/CGREF have the duty to develop and distribute the software for support of technical visits. They are destined for the planning of expeditions and control of the execution of visits, to be used by the teams of technical inspections, as well as for the processing of forest inventory data, distributed freely to communities and free lance professionals that deal with forest management.

5.1.1.10 Promotion of the year's evaluation meeting and planning for the next

The evaluation meeting of each year's activities, which marks the end of a year, is also the first of the following year. In the meeting all deficiencies and difficulties are discussed in a debate that is always concluded with suggestions for improvement of the process as a whole. Besides the products described, the

meetings increase technicians' knowledge who then carry out their duties in remote areas, giving adequate space for their opinions on the process of technical visits and allowing them to discuss and put forward their views on forestry policy as a whole.

5.1.2 Functions of field offices (regionals and bases in the states)

5.1.2.1 Analysis and approval of PMFS documents/plans, requests for deforestation authorizations and forest replacement projects

An analysis of process is carried out previously at the legal and technical divisions of each state GEREX. The analysis covers the evaluation of technical coherence, adjustments to prevailing legislation, land and agrarian documentation and other aspects. When problems are identified, and in order to solve them, the administrative running of a process is interrupted and the interested parties are duly informed. It is only when the documental part has been considered satisfactory that a PMFS, that a deforestation request or a forest replacement project may be forwarded to technical field visits, which will be part of the annual operation for which the provisional bases will be established.

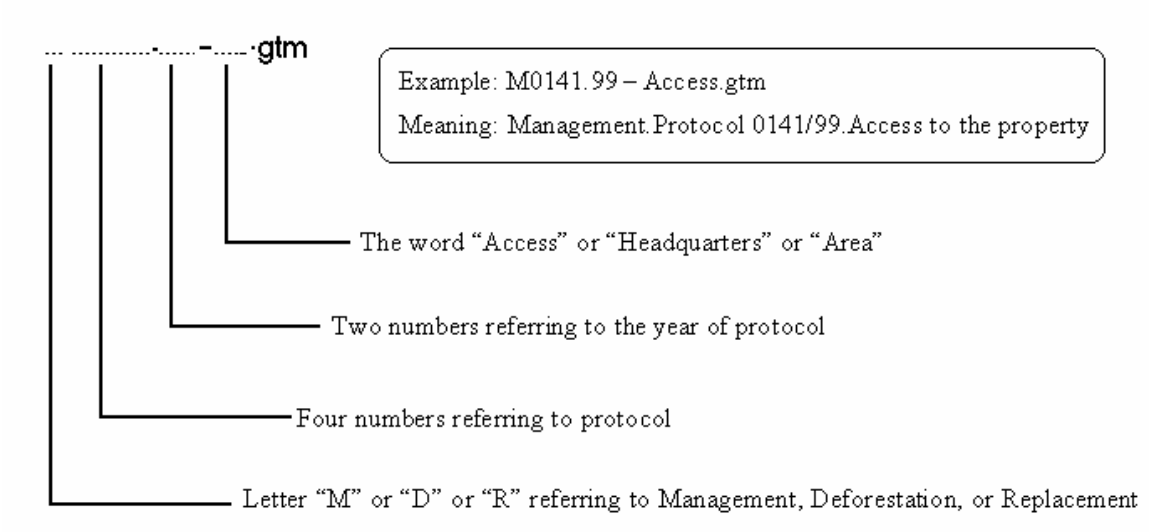
5.1.2.2 Constitution of teams

The basic composition of each team of technical inspection/visit in PMFS, as we have said, is pre-defined. In the team there must be a forest engineer from IBAMA, a temporarily hired forest engineer, exclusively recruited for that purpose, and a third forest engineer from an OEMA. It is not always possible to compose teams as planned, mainly because of the deficiency of personnel in OEMAs. It remains for each base chief to constitute teams in the best possible way, in accordance with the personal affinity and experience of each individual.

5.1.2.3 Production of information for the elaboration of maps

As mentioned, the maps are prepared by DIREF/CGREF on the basis of geographical coordinates of PMFS, authorized areas for deforestation and areas of forest replacement. In each visit the teams proceed to geo-reference the areas with the use of GPS and provide the coordinates to headquarters by using a nomenclature standard. Besides providing the plotting of the area on the map, the archive/file is kept to allow future access to the area. Figure 5.8 presents the standard that must be followed in the denomination of geo-referencing of files about the inspected areas.

Figure 5.8: Nomenclature rule for digital files of geo-referenced inspected areas of PMFS, deforestation and forest replacement



5.1.2.4 Definition of routes

After assembling the processes to be inspected/visited, they are grouped in accordance with their geographical proximity and their accessibility. As such, PMFS, together with deforestation and forest replacement processes, are organized in groups, or routes, that allow the optimization of time for the expeditions. At the end of each journey, the team gives an account of its expenditure, its production and its reports, and proceeds to accomplish another route.

5.1.2.5 Carrying out inspections/visits

The visits, including those of PMFS, are the responsibility of the bases in most of the cases, except when there is need for a "re-verification" visit. In this case, independent teams defined by headquarters carry out inspections in processes of a determined base, already visited by itself, with the purpose of comparison for further checking the coherence and correctness of such process.

5.1.2.6 Contact with OEMAs

Although the publicizing of the process as a whole is carried out by DIREF/CGREF, in direct contact with the higher Direction of OEMAs, it remains for the bases to establish a day-to-day contact with OEMAs aiming at greater participation of the state government in the process.

5.1.2.7 Roster/registry in specific software for PMFS

DIREF/CGREF has developed specific software for following up the implementation of the process of inspections/visits in PMFS. In the software, the information on technical reports is filed and then transferred automatically, via Internet, to DIREF/CGREF. Figures 5.9, 5.10, 5.11 and 5.12 present some of the software screens.

Figure 5.9: Initial screen of the follow-up programme of technical visits to PMFS

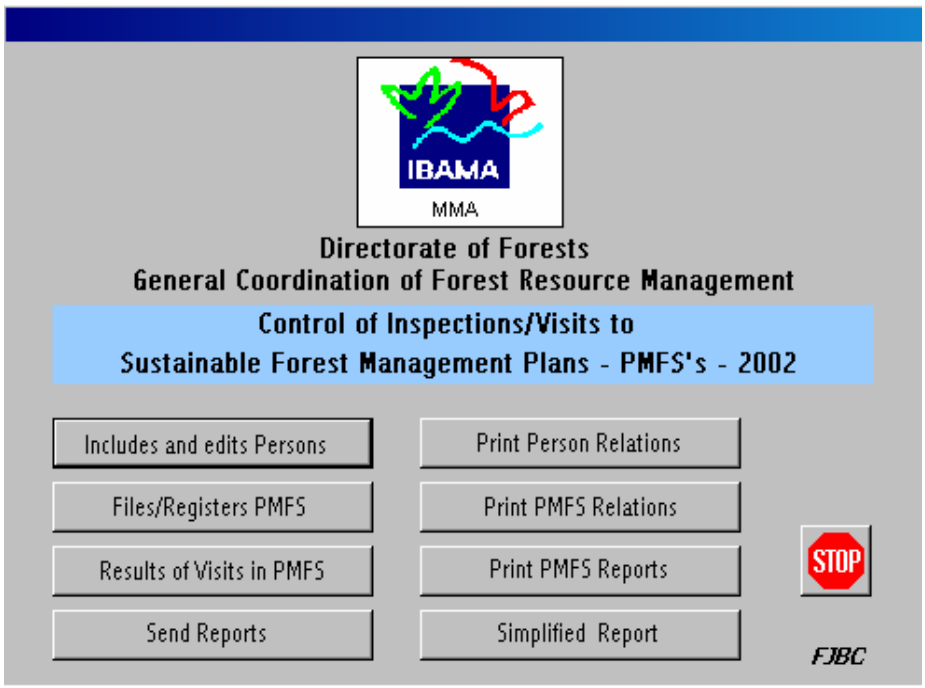


Figure 5.10: File of PMFS

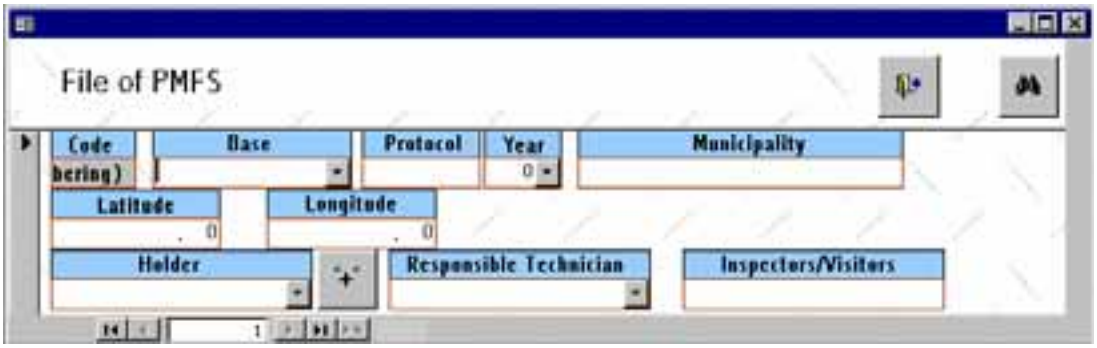


Figure 5.11: File of technicians, holders and inspectors

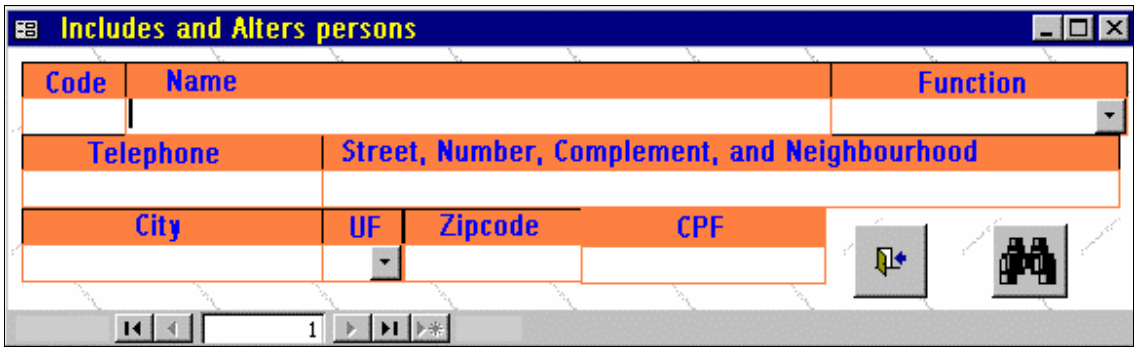
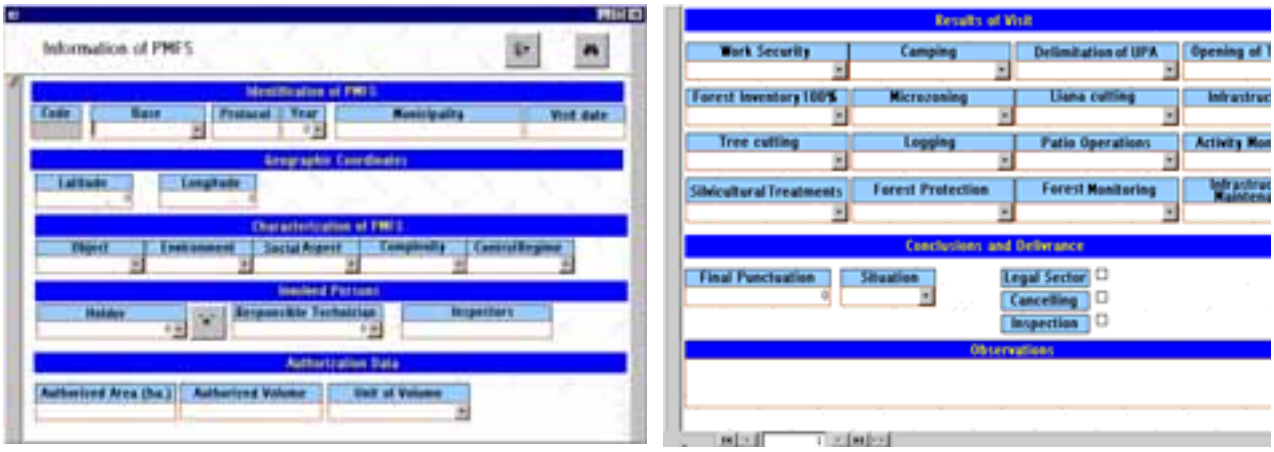


Figure 5.12: Inclusion of inspection/visit results



The software programme, directed to utilization by the bases, allows the printing of lists of involved persons, of filed PMFS and results of visits to them. It also allows for the automatic transmission of information to Brasilia headquarters.

5.1.2.8 Evaluation of temporarily hired personnel

During implementation of technical visits, it is the base chief's responsibility to evaluate technicians under temporary contracts. Such an evaluation may define the permanence or not of the contracted party during present and future periods.

5.1.2.9 Concession of exploitation authorizations (APEs) and authorizations for transportation of forest products (ATPFs)

APEs and subsequent ATPFs are issued by state GEREXs, after the PMFS has been considered "apt" by the technical field visit. The ATPF is issued in a computerized controlled form through SISPROF, as described in section 4.

5.1.2.10 Feeding the data bank of SISPROF/SISMAD

Independently of the information on the implementation and results of technical field visits – provided by the bases through the mentioned software – the GEREXs are responsible for feeding the SISPROF data bank, which processes and correlates the information on time.

5.1.3 Other shared actions

5.1.3.1 Evaluation of the year's procedures

Annual evaluations are carried out jointly. On one side it is the duty of DIREF/CGREF to promote and organize the event – which has a five-day duration – in an isolated and independent place. On another, the dynamics and success of the event depend on the base chiefs and on the chiefs of GEREX technical divisions (DITECs) that actively participated in the process closer to the field. Temporary technicians who have shown outstanding performance also participate in the meeting, as well as other parties invited by DIREF/CGREF.

5.1.3.2 Flow of information and means of communication

Once the process of technical field visits is initiated, there are different forms of contact between DIREF/CGREF and the bases, and the employment of the "AutoTrac" system is the one that allows the most remote type of contact. The "AutoTrac" is a piece of equipment that has a global positioning system and is installed in the vehicles used in field visits. Through the satellite contact, it facilitates the transmission and reception of short messages, with the use of a keyboard that is coupled to it. Through the equipment it is possible for DIREF/CGREF, in Brasilia, to follow up the movement of teams in real time, to change their routes or to ask for an unforeseen service. On the part of the team, it is possible to ask for information on documents, individuals and transportation loads of forest products.

From DITECs and the remote bases, e-mail is the means that is mostly used for sending information referring to the results of activities. The information is transmitted already digitalized in software, which is specific for each subject (forest management, deforestation and forest replacement). DIREF/CGREF uses mainly the Internet to ask for clarifications, sending new versions of software and receipt of explanations, etc. IBAMA's internal postal mail is used for sending various documents such as signed copies of reports of visits, photographs, maps and others. Its sole disadvantage is that it circulates only once a week. The telephone and fax are alternative means of communication, used mainly to clarify doubts and ask for urgent services or information.

5.2 Participation of private industry in SISPROF, with emphasis on PMFS: commitments and advantages

5.2.1 Technological level, past and present interest of private companies

A process intended to improve the control and monitoring of PMFS was initiated in 1996 when for the first time IBAMA carried out a full scrutiny of all documents pertaining to PMFS of Amazonia. For that

purpose, a concentrated institutional effort was needed, involving the participation of more than 60 forest engineers of IBAMA from all different states of the country. Up to that time, the process of standardization of technical field visits to PMFS had not been initiated; the evaluation of that year was limited to documents. With it, for the first time, it became possible to know how many PMFS there were in the region, in which state they were located, the area involved and the volume of wood/timber that they comprised. Plans were classified according to minimum criteria, in order to allow them to be considered "apt" and ready for implementation. Table 5.5 shows the criteria used for the scrutiny of PMFS, and Tables 5.6, 5.7 and 5.8 present the final situation after the scrutiny.

In terms of the three parameters – number, area and volume of timber – the situation after the scrutiny has been similar, that is, only about 30 per cent of existing PMFS had been considered "apt". At the time, when the scrutiny was carried out, the normative regulation in force on PMFS was IBAMA's normative instruction no. 048 of 1994, based on Decree 1282/94. The fundamental characteristic of that instrument was that it required basically one single and definitive document for liberation of all of the cutting cycle. This situation changed at the end of 1998, when IBAMA began to require POAs for the PMFS, of which the 100 per cent forest inventory for commercial-size trees was an integral part.

Table 5.5: Groups of reasons for the suspension or cancellation of PMFS in the operation of document evaluation

Reasons	Group
1. Without responsible technician	2
2. Without presentation of pre- and post-exploitation report or technical reason	2
3. Holder with consolidated debt.	3
4. Area with land regularity problems due to invasion	1
5. Continuous forest inventory with insufficient number of permanent parcels or not presented	2
6. Without notary registration of area under management	3
7. With unaccomplished pending pointed in technical appraisal of visit	2
8. Approved in disagreement with the legislation	3
9. PMFS of a bankrupt company without transfer of the plan	4
10. Paralysed PMFS for more than five years without technical justification	4
11. Cancelled before the scrutiny for being inside the RESEX Chico Mendes	1
12. To adapt to the legislation	3
13. Unaccomplishment of pointed pendings necessary to legislation adequacy	3
14. Legal pending issue	3
15. Land problem (lacking the creation of a state forest)	1
16. Proprietor/holder has asked for cancellation	4
17. Without visit/inspection	2
18. Without measurement of permanent parcels	2
19. Undue utilization of ATPF	4
20. Fire	4
21. PMFS inside indigenous area	1

Groups: 1-Agrarian; 2-Technician; 3-Legal; 4-Others

From a situation where frequently the forest engineer hardly knew the area under management, performing a much more bureaucratic than technical role, one has reached a point where each tree must be plated and geo-referenced before its exploitation is authorized. At the same time, the POA demands a detailed planning of the infrastructure, and finally the exploitation, of the effective presence of the technician in the field. This requirement may be attributed to the development of a technological package for the management of Brazilian Amazonian forests. The package, described below, marks the agreement between the academic milieu and private initiative on what is feasible from an ecological and economic point of view. Before the development of the technological package, the discussion on forest management in Amazonia was restricted to research institutions and forest engineering post-graduation schools of Brazil. For technicians that were responsible for the practice of forest management at commercial and

entrepreneurial levels, the discussion was restricted solely to the requirements put forward by regulating bodies of forest authorities.

Table 5.6: Number of PMFS per situation and per state, after the 1996/97 scrutiny

UF	Apt	%	Suspended	%	Cancelled	%	Total
AC	6	19,35	20	64,52	5	16,13	31
AM	5	8,20	56	91,80	-	0,00	61
AP	7	36,84	12	63,16	-	0,00	19
MA	34	51,52	28	42,42	4	6,06	66
MT	232	39,26	352	59,56	7	1,18	591
PA	183	24,73	479	64,73	78	10,54	740
RO	16	21,92	35	47,95	22	30,14	73
TO	1	9,09	10	90,91	-	0,00	11
Total	**484**	**30,40**	**992**	**62,31**	**116**	**7,29**	**1.592**

Table 5.7: Area of PMFS per situation and per state, after the 1996/97 scrutiny - ha

UF	Apt	%	Suspended	%	Cancelled	%	Total
AC	50.685	26,25	134.250	69,54	8.114	4,20	193.049,00
AM	64.194	14,07	392.161	85,93	-	0,00	456.355,00
AP	3.086	60,94	1.978	39,06	-	0,00	5.064,00
MA	48.662	47,22	51.566	50,04	2.828	2,74	103.056,00
MT	281.823	35,35	503.972	63,22	11.335	1,42	797.130,00
PA	468.896	30,63	949.317	62,01	112.687	7,36	1.530.900,00
RO	39.460	37,17	29.822	28,09	36.879	34,74	106.161,00
TO	40	1,18	3.351	98,82	-	0,00	3.391,00
Total	**956.846**	**29,95**	**2.066.417**	**64,67**	**171.843**	**5,38**	**3.195.106,00**

This dichotomy existed due to a lack of consensus between the perfectionism of academia and the immediate pragmatism of private enterprise. With the development of the technological package the convergence of positions began to occur. If, from one side, the 100 per cent FI allows the public sector to control the exploitation of the resource, it also helps the private producer to control its assets or capital. The easy finding of a tree and its wood volume are also associated with the possibility of detailed planning and consequent reduction of expenditures with equipment and labour for exploitation.

Table 5.8: Commercial timber production volume of PMFS per situation and per state, after 1996/97 scrutiny – m^3

UF	Apt	%	Suspended	%	Cancelled	%	Total
AC	2.314.233	47,34	2.473.017	50,59	100.939	2,06	4.888.189
AM	4.565.273	16,16	23.686.409	83,84	-	0,00	28.251.682
AP	296.623	77,22	87.484	22,78	-	0,00	384.107
MA	4.055.451	53,34	3.371.508	44,34	176.577	2,32	7.603.536
MT	10.905.429	36,59	18.480.728	62,01	418.148	1,40	29.804.305
PA	25.604.580	28,60	57.386.114	64,09	6.544.475	7,31	89.535.169
RO	1.188.462	33,45	801.614	22,56	1.563.118	43,99	3.553.194
TO	919	1,50	60.507	98,50	-	0,00	61.426
Total	**48.930.970**	**29,82**	**106.347.381**	**64,81**	**8.803.257**	**5,37**	**164.081.608**

IBAMA has been making efforts to clarify the package to producers and technical professionals of the sector. In 2000, 28 training courses were held, reaching about 1,400 people, among freelance professionals of intermediate and superior levels of education, businessmen and others. Also, in 2000, IBAMA created a

nucleus of support to forest management (NAMF) with the purpose of guaranteeing regularity in the supply of courses and other forest promotion publicity material.

5.2.2 Advantages of SISPROF from the point of view of the client

5.2.2.1 A philosophical change

Before turning to the advantages of the present system, it is important to emphasize that it has a fundamental philosophical difference compared to the previous one. Traditionally, forest management activity had been regulated by an apparatus of rules and actions that mostly aimed at impeding fraud or making it difficult. Such philosophy has proved totally ineffective. Due to corruption practices and violatations of rules and regulations or to the technically incapable personnel, the result was that the same rules and regulation ended up causing an increase the price of bribes. Others that might even been capable of following the rules would refuse to do so given the disloyal competition of impostors in addition to the scarce practicality of the rules. For those who would follow the rules at any cost, which happens to be the minority, the system would penalize them through an increase in bureaucracy and other transaction costs. The fundamental change came when, instead of trying to make the activity more difficult for those who could fraud the system, it moved in the direction of stimulating the performance of those who took the system seriously and were being penalized by it.

Starting from a strict system, bureaucratic and inefficient, and moving into another (system) with better rules, from an entrepreneurial point of view, and which tend to reduce bureaucracy, honest managers started to experience advantages. At the same time, investment in information technology and computer automatization of the system not only increased control but also made dishonest activity more difficult without imposing a burden on private commercial/entrepeneurial activity.

5.2.2.2 Advantages

From the point of view of private activity there are numerous practical and economical advantages of the new system compared to the old one, such as:

- **Digital PMFS**: much cheaper and more practical to transport, mainly after the requirement of a 100 per cent FI, whose tables, depending on the area, consumed hundreds of pages.
- **Pre-inspection/visit by crossing the satellite images with geo-referenced information**: from geo-referenced maps, and in view of recent satellite images and an updated data bank, the system has allowed the execution of visits solely by cross-checking information. The objective of the pre-inspection/visit is thus reached more quickly and cheaply, without the need of going to the field.
- **Follow-up inspection/visit of POA carried out during the implementation of the plan itself**: besides enabling a more realistic evaluation of the activity, once it is carried out during execution and not before, the client is definitively freed from the traditional wait for the visit in order to be able to initiate his activities. Such problem always occurred given the limited number of personnel and the seasonality of field operations.
- **Distribution of up-to-date satellite images**: the fact that to operate the system the controlling institution needs to purchase the images, putting them at the disposal of the interested parties, lowers the cost of elaborating PMFS.
- **Non-obligation to carry out the diagnostic forest inventory by sampling**: due to their high cost, diagnostic forest inventories used to make management plans more costly, many times unnecessarily. Nowadays, the decision to estimate the available average commercial volume is an option of the technician responsible for the PMFS. The technician may make use of information from other forest inventories that have been carried out in nearby areas with similar forest physiognomy. In the case of low-intensity of exploitation and small areas – as in a simplified management category – with physiognomies of good timber potential, the technician may employ alternative estimation methods.
- **Making software available to clients and technicians**: three programmes have been produced and made available, free of cost, to technicians and holders of PMFS. One was destined for the planning

and budgeting of campings and expeditions, and two for data processing of the 100 per cent FI (one for the modality of PMFS at entrepreneurial level and the other for the simplified level).

- **Control of exploited timber**: among other advantages, the census of trees to be exploited allows the producer to have better control over his production. In the past, since it was easier to smuggle/rob logs of higher value species, the producer was forced to develop a system of control of his own, frequently with various hierarchical levels (inspectors and inspectors of inspectors) in order to avoid the robbery.
- **Control of team productivity**: all the stages of the technological package offered/proposed for the practice of forest management are based on a sequential planning. To this end, all stages, from the opening of orientation tracks for the 100 per cent FI (first activity) until patio operations (last activity), make use of spreadsheets where the team's components, production and time are registered. This information allows the evaluation of the performance of a determined team, as well as the comparison of different teams in performing a similar activity. The comparison of productivities of different activities among them allows the identification of limiting factors and priorities for training.
- **Differentiated treatment**: another characteristic of the present system for entrepreneurs and technicians that implement PMFS is the distinction between those that do what is technically recommendable and those that do not, thereby providing advantages for the first or punishments for the latter.
- **Training and courses**: through the nucleus of support to forest management (NAMF), free courses of short duration on modern techniques of management are administered. Such courses also work as motivation for the practical and theoretical courses of medium duration supported by the "Pro-Manejo"/PPG7/IBAMA. In these courses entrepreneurs can be trained and will in turn be able to train their teams.
- **Technical orientation during visits**: independently of courses and trainings, in each field visit the entrepreneur or forest engineer responsible for the PMFS may receive technical orientation when verifiers of quality of each activity are being applied. The copy of the field visit reckoning/judgement, that is sent to the PMFS holder, also works as an orientation for the improvement of his activities.

5.2.3 The role of verifiers and indicators

5.2.3.1 Evaluation of the quality of forest management and standardization of proceedings

The main function of verifiers and indicators is to give a critical evaluation of the technical quality of the practice of forest management in general, as well as of each one of the activities that compose it. Before verifiers were used, the evaluation depended on the personal experience of each technician. Such procedure hardly allowed for a complete assessment, given the wide extension of subjects that compose forest management. Partial evaluations, in their turn, have never permitted a good comparison, either at local, municipal or state levels. Consequently, they also did not allow for a uniform institutional response to similar situations.

The result of this type of procedure that has accompanied the history of technical inspections/visits of IBAMA depended, therefore, on the technician. On the one hand, the sectors that were accustomed to frauding the rules would do their utmost to influence the technician who would visit/inspect their projects. On the other hand, on the part of the technicians, it was easy to choose which aspects should be treated in the analysis and which should be omitted. The final result, besides the precarious control, was the impossibility of the institution establishing regional priorities and planning specific actions of information, or of capacity formation, for each reality.

5.2.3.2 Technical orientation, self-knowledge and quality improvement

The out-dating between the knowledge currently available about SFM and practices verified in the field, demonstrates that the country's forest engineering schools may not be preparing professionals in such a way as to be able to act with native forests in the Amazon. At the same time, as in many cases, the professional may have been formed quite some time ago, when the available knowledge was even scarcer, and since then has never undertaken a course of professional updating. With the purpose of solving this problem, different strategies have been adopted. For long-term effects DIREF has been trying to widen the contact with universities, aiming at establishing the forest residence in the country, as is done with professionals in the medical field. For medium-term effects, DIREF has created the nucleus of support to forest management (NAMF), which will have the task of promoting professional updating courses in the Amazon region, as well as of distributing instruction material.

In the discussions between the team and the technician responsible for the execution of the PMFS/POA, various aspects are taken into consideration. Thus, the technician responsible becomes informed of the techniques that he so far did not know, and commits himself to undertaking certain improvements. Such commitments are registered in a specific place in the technical visit forms, and are then included in the data bank for future questioning and checking, independently of the next team that will visit the PMFS. When training IBAMA technicians about what should be seen in an analysis of a PMFS (verifiers), and having established standards for what would be adequate or not (indicators), the method allows the transference of updated information to the professional responsible for the execution of the plan

5.2.3.3 Scoring of verifiers for evaluation of PMFS/POA

The evaluation of a PMFS is carried out in accordance with the classification of the plan, as per the following characteristics:

- Object of management: wood/timber, heart of palms, or others.
- Environment: highlands or lowlands (*várzeas*).
- Social organization: individual or community.
- Intensity of exploitation: high ($\geq 10 m^3$/ha) or low ($<10 m^3$/ha)
- Control regime: area (through units of annual production, one exploited in each year until completion of the cutting cycle) or volume ($1 m^3$/ha/year in the whole AMF).

Once classified, the PMFS is evaluated in accordance with the verifiers presented in Table 5.11 and, as soon as the items to be selected in the evaluation of PMFS have been defined, the activities related to them are scored from one to five, considering the suggested verifiers in line with the concepts described in Table 5.9. The number referring to the score of each activity is multiplied by its weight or importance. The weight of each activity, varying from 1 to 5, in an increasing degree of importance, has been previously established in a technical meeting.

Table 5.9: Parameters for the scoring of forest management activities assessed on the basis of verifiers

Concept	Scoring
Good	5
Regular tending to good	4
Regular	3
Bad tending to regular	2
Bad	1
Not executed	0
Not applicable	blank

Table 5.10 presents the list of weights for each activity, and the final grade or concept of the assessed PMFS is given by the weighted average of the scores received by the plan.

Table 5.10: Weight or importance attributed to each activity developed in a PMFS

Verified item	Weight
01. Labour/work safety	3
02. Camping infrastructure	3
03. Delimitation of the annual production unit	3
04. Opening of orientation tracks	5
05. 100% forest inventory	5
06. Micro-zoning	4
07. Vine cutting	5
08. Infrastructure	4
09. Cutting/felling of trees	5
10. Logging	5
11. Patio operations	3
12. Monitoring of activities	3
13. Silvicultural treatments	1
14. Forest protection	5
15. Monitoring of forest development	3
16. Maintenance of infrastructure	2

Table 5.11: Items to evaluate in accordance with the classification of a PMFS

N	Object	Environment	Social organization	Exploitation intensity	Control regime	1- Labour safety	2- Camping infrastructure	3- Delimitation of UPAs	4- Opening of orientation tracks	5- 100% forest inventory	6- Micro-zoning	7- Vine cutting	8- Infrastructure	9- Cutting/felling	10- Logging	11- Patio operations	12- Monitoring of activities	13- Silvicultural treatments	14- Forest protection	15- Monitoring of forest development	16- Maintenance of infrastructure
1	Timber	High Land	Individual	Low	Area	x		x	x*	x	x*	x	x*	x	x	x*	x*	x*	x*	x*	x*
2	Timber	High Land	Individual	Low	Volume	x			x*	x	x*	x	x*	x	x	x*	x*	x*	x*	x*	x*
3	Timber	High Land	Individual	High	Area	x	x	x	x	x	x	x	x	x	x	x	x	x*	x	x	x
4	Timber	High Land	Individual	High	Volume	x	x		x	x	x	x	x	x	x	x	x	x*	x	x	x
5	Timber	High Land	Communal	Low	Area	x		x	x*	x	x*	x	x*	x	x	x*	x*	x*	x*	x*	x*
6	Timber	High Land	Communal	Low	Volume	x			x*	x	x*	x	x*	x	x	x*	x*	x*	x*	x*	x*
7	Timber	High Land	Communal	High	Area	x	x	x	x	x	x	x	x	x	x	x	x	x*	x	x	x
8	Timber	High Land	Communal	High	Volume	x	x		x	x	x	x	x	x	x	x	x	x*	x	x	x
9	Timber	Low Land	Individual	Low	Area	x		x	x*	x	x*	x	x*	x	x*		x*	x*	x*	x*	x*
10	Timber	Low Land	Individual	Low	Volume	x			x*	x	x*	x	x*	x	x*		x*	x*	x*	x*	x*
11	Timber	Low Land	Individual	High	Area	x	x	x	x	x	x	x	x*	x	x*		x	x*	x	x	x
12	Timber	Low Land	Individual	High	Volume	x	x		x	x	x	x	x*	x	x*		x	x*	x	x	x
13	Timber	Low Land	Communal	Low	Area	x		x	x*	x	x*	x	x*	x	x*		x*	x*	x*	x*	x*
14	Timber	Low Land	Communal	Low	Volume	x			x*	x	x*	x	x*	x	x*		x*	x*	x*	x*	x*
15	Timber	Low Land	Communal	High	Area	x	x	x	x	x	x	x	x*	x	x*		x	x*	x	x	x
16	Timber	Low Land	Communal	High	Volume	x	x		x	x	x	x	x*	x	x*		x	x*	x	x	x
17	P. H.	High Land	Individual	Low	Area	x		x	x*	x	x*		x*	x*			x*	x*	x*	x*	x*
18	P. H.	High Land	Individual	Low	Volume	x			x*	x	x*		x*	x*			x*	x*	x*	x*	x*
19	P. H.	High Land	Individual	High	Area	x	x	x	x*	x	x		x*	x*			x	x*	x	x	x
20	P. H.	High Land	Individual	High	Volume	x	x		x*	x	x		x*	x*			x	x*	x	x	x
21	P. H.	High Land	Communal	Low	Area	x		x	x*	x	x*		x*	x*			x*	x*	x*	x*	x*
22	P. H.	High Land	Communal	Low	Volume	x			x*	x	x*		x*	x*			x*	x*	x*	x*	x*
23	P. H.	High Land	Communal	High	Area	x	x	x	x*	x	x*		x*	x*			x	x*	x	x	x
24	P. H.	High Land	Communal	High	Volume	x	x		x*	x	x*		x*	x*			x	x*	x	x	x
25	P. H.	Low Land	Individual	Low	Area	x		x	x*	x	x*		x*	x*			x*	x*	x*	x*	x*
26	P. H.	Low Land	Individual	Low	Volume	x			x*	x	x*		x*	x*			x*	x*	x*	x*	x*
27	P. H.	Low Land	Individual	High	Area	x	x	x	x*	x	x*		x*	x*			x	x*	x	x	x
28	P. H.	Low Land	Individual	High	Volume	x	x		x*	x	x*		x*	x*			x	x*	x	x	x
29	P. H.	Low Land	Communal	Low	Area	x		x	x*	x	x*		x*	x*			x*	x*	x*	x*	x*
30	P. H.	Low Land	Communal	Low	Volume	x			x*	x	x*		x*	x*			x*	x*	x*	x*	x*
31	P. H.	Low Land	Communal	High	Area	x	x	x	x*	x	x*		x*	x*			x	x*	x	x	x
32	P. H.	Low Land	Communal	High	Volume	x	x		x*	x	x*		x*	x*			x	x*	x	x	x
33	Others	High Land	Individual	Low	Area	x		x	x*	x	x*	x*	x*	x*			x*	x*	x*	x*	x*
34	Others	High Land	Individual	Low	Volume	x			x*	x	x*	x*	x*	x*			x*	x*	x*	x*	x*
35	Others	High Land	Individual	High	Area	x	x	x	x*	x	x*	x*	x*	x*			x	x*	x	x	x
36	Others	High Land	Individual	High	Volume	x	x		x*	x	x*	x*	x*	x*			x	x*	x	x	x
37	Others	High Land	Communal	Low	Area	x		x	x*	x	x*	x*	x*	x*			x*	x*	x*	x*	x*
38	Others	High Land	Communal	Low	Volume	x			x*	x	x*	x*	x*	x*			x*	x*	x*	x*	x*
39	Others	High Land	Communal	High	Area	x	x	x	x*	x	x*	x*	x*	x*			x	x*	x	x	x
40	Others	High Land	Communal	High	Volume	x	x		x*	x	x*	x*	x*	x*			x	x*	x	x	x
41	Others	Low Land	Individual	Low	Area	x		x	x*	x	x*	x*	x*	x*			x*	x*	x*	x*	x*
42	Others	Low Land	Individual	Low	Volume	x			x*	x	x*	x*	x*	x*			x*	x*	x*	x*	x*
43	Others	Low Land	Individual	High	Area	x	x	x	x*	x	x*	x*	x*	x*			x	x*	x	x	x
44	Others	Low Land	Individual	High	Volume	x	x		x*	x	x*	x*	x*	x*			x	x*	x	x	x
45	Others	Low Land	Communal	Low	Area	x		x	x*	x	x*	x*	x*	x*			x*	x*	X*	x*	x*
46	Others	Low Land	Communal	Low	Volume	x			x*	x	x*	x*	x*	x*			x*	x*	X*	x*	x*
47	Others	Low Land	Communal	High	Area	x	x	x	x*	x	x*	x*	x*	x*			x	x*	x	x	x
48	Others	Low Land	Communal	High	Volume	x	x		x*	x	x*	x*	x*	x*			x	x*	x	x	x

P. H.= Palm heart * Quando for o caso;

5.2.4 The criteria and indicators of the Tarapoto Process and the assessment of PMFS from the monitoring and control procedures established in SISPROF

Principles, criteria, indicators and verifiers of the sustainability of forest management are on the discussion agenda of various international fora. Brazil is a member of the agreement that started the Tarapoto Process for the implementation of criteria and indicators for sustainability of the Amazon forest, coordinated by the Secretariat of the Treaty for Amazon Cooperation (TCA) In Tarapoto (Peru) 37 indicators of the quality of SFM, corresponding to 11 criteria, have been discussed after a local evaluation in member countries. According to the Tarapoto Process[45], criteria and indicators for sustainability are defined as:

Criterion – a category of conditions and processes through which SFM can be assessed. A criterion is characterized by a set of related indicators that can be monitored periodically with the purpose of determining eventual changes.

Indicator – a measure (measurement) of one aspect of the criterion. A quantitative or qualitative variable that can be measured or described, and when periodically observed can demonstrate trends.

Of the 37 indicators selected by the member countries of the TCA, 15 have been considered possible of immediate application in the respective countries. Eighteen other indicators have been considered applicable in a second stage, and the remaining four have not been consensual, thus kept for discussion on future occasions. The criteria and indicators have been distributed in accordance with the following classification:

5.2.4.1 Criteria at national level

1. Socio-economic benefits: Eight indicators about production and consumption; three on investment and economic growth in the forestry sector and four on cultural, social and spiritual values.

2. Policy and institutional and juridical framework for sustainable development of forests: Four indicators.

3. Sustainable forest production: Five indicators.

4. Conservation of forest cover and biological diversity: Eight indicators.

5. Conservation and integral management of water and soil resources: Four indicators.

6. Science and technology for the sustainable development of forests: Six indicators.

7. Institutional capacity to support Amazonian sustainable development: Four indicators.

5.2.4.2 Criteria at management unit level

8. Juridical and institutional basis: Three indicators.

9. Sustainable forest production: Five indicators.

10. Conservation of forest ecosystems: Six indicators.

11. Local socio-economic benefits: Nine indicators.

5.2.4.3 Services at global level

12. Economic, social and environmental services of the Amazon forests: Seven indicators.

The indicators identified by the eight countries of TCA as having more conditions of applicability at the level of the forest management unit are described below, together with the treatment given to them by the SISPROF/PMFS module. The further, or remaining, indicators that have not been consensual, or that are not directly considered by SISPROF, are merely mentioned or indicated below.

Criterion 8: Juridical and institutional basis

Indicator: Sustainable forest management plan (PMFS) approved by the competent authority.
Forest exploitation based on a PMFS is ruled by the Forest Code (Law 4771/65) and by Decree 1282/94, with modifications introduced by Decree 2788/98. When submitted to IBAMA, the PMFS is inserted in SISPROF, and from then on all its implementation will also be registered. The PMFS is composed of a basic document, similar to a letter of intentions – in which one of the items is the issue of the legal documentation of the property – and of successive annual operational plans. The PMFS is constituted of the following items:

1. Information that must be part of the PMFS
   - 1.1. Objectives.
   - 1.2. Relation of species to be managed, average volume per hectare and total volume to be exploited annually.
   - 1.3. Cutting cycle.
   - 1.4. Property maps, in appropriate scale, with involved parallels and meridians, legend and conventions, showing location, access, confrontations, roads and rivers, forest types, areas of legal forest reserve, APP, etc., area of the PMFS, reforested areas, and areas used with agriculture, pastures, etc., all properly measured.
   - 1.5. Annotation of technical responsibility (ART) of elaboration and execution.

2. Information that must be part of POAs, to be described in detail.
   - 2.1. General items
     - 2.1.1. Report of activities carried out that are part of the previous POA (from the second POA), including: brief report covering all activities carried out, positive and negative points of previous year's planning, underscoring suggestions to improve the performance of the activities, including the issues of camping infrastructure and labour security; updated map of AMF and previous UPA showing the changes since last updating.
     - 2.1.2. Map of UPA to be exploited in the current year with the points of the polygon defined in geographical coordinates, containing trees to be exploited and remaining trees, with symbols underscored in conventions, and sub-divided into units of work (UTs), in the scale 1:2,500.
     - 2.1.3. Execution time-table.
     - 2.1.4. Labour security.
     - 2.1.5. Camping infrastructure.
     - 2.1.6. Monitoring of the activities of the company.
   - 2.2. Pre-exploitation phase
     - 2.2.1. Delimitation of AMF and UPAs.
     - 2.2.2. Opening of orientation tracks of the forest inventory (IF 100 per cent).
     - 2.2.3. Forest inventory of 100 per cent of the individuals of commercial size to be exploited, as well as of those destined for next harvest (including scientific name).
     - 2.2.4. Micro-zoning: water courses, vine concentrations and other information obtained from the IF 100 per cent.
     - 2.2.5. Vine cutting (when this is the case).
     - 2.2.6. Exploitation infrastructure: primary roads, secondary roads, patios, crossing of water-courses and logging tracks, according to technical specifications (for highland PMFS).
   - 2.3. Exploitation phase
     - 2.3.1. Cutting/felling of trees.

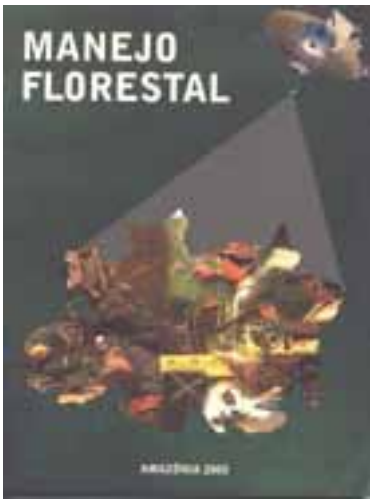
2.3.2. Logging.
2.3.3. Patio operations (for highland PMFS).

2.4. Post-exploitation phase

2.4.1. Silvicultural treatments.
2.4.2. Forest protection.
2.4.3. Monitoring of forest development.
2.4.4. Maintenance of infrastructure (for highland PMFS).

Indicator: Periodicity of assessment of PMFS's accomplishment and average percentage of accomplishment.

The POAs are analysed and later submitted to technical visits, yearly, with the employment of a set of methods and verifiers developed for this purpose. The general evaluation of the quality of forest management in Amazonia is published in a printed document, in a CD in digital form and on the Internet, through the home page.



The third indicator of Criterion 8, "the legal/juridical background that guarantees the stability of forest investments in the long run", has not been consensual and is not directly reflected in the SISPROF package (in fact, a legal/juridical background that guarantees "long-term stability of forest investments", as such, is something so broad as to clearly extrapolate forestry policy and legislation).

Criterion 9: Sustainable forest production

Criterion 9 originally had five indicators. The first four, listed below, have not been consensual, and therefore have not been considered in SISPROF:

a) annual utilization of wood and non-wood products compatible with the sustainable capacity of the resource.

b) area and percentage of forest soils affected with significant alteration in their physico-chemical properties and erosion.

c) efficiency of the systems of management and control.

d) level of production diversification.

The fifth indicator – considered for immediate application – is taken into account by SISPROF, and is described below.

Indicator: Level of utilization of environmentally friendly technologies.
Since SUDAM (1978)[46], with the help of research institutions and NGOs, Brazil has been developing a package of technical proceedings for the practice of SFM in Amazonia. Recently, Holmes *et al.* (2002)[47]demonstrated the technical and economic superiority of the package developed for the region. At the same time, IBAMA has been discussing and testing a set of verifiers that is being used in the analysis of PMFS documents and respective POAs, as well as in the technical visits, which is described in Tables 5.12 and 5.13, corresponding to the pre-exploitation and exploitation phases of management, respectively.

Table 5.12: Verifiers of the level of utilization of environmentally friendly technologies in the pre-exploitation phase of forest management

Item/description/components	Verifiers
1. Delimitation of the forest management areas (AMF) and of the annual production units (UPAs) - opening of tracks (where necessary) - placing of indication plates	- delimitation tracks of UPAs and UTs - existence of identification plates of UPAs and UTs
2. Opening of orientation tracks - internal tracks of UTs for orientation of 100% forest inventory	- tracks preferably in the east-west direction - maximum distance of 50m between tracks - markings with plates at beginning and end - markings of 25m maximum length
3. 100% forest inventory - identification and plating of trees of the species object of management	- registration of trees with dbh 10cm below - commercial diameter per species - registration of physical status and quality class of stem - coherence between field and map
4. Micro-zoning - identification of vines, topography variations, water courses, permanent preservation areas, etc.	- coherence between field and map
5. Vine cutting - when necessary, one year before cutting of trees selected for exploitation	- vines cut one year before exploitation - vines decomposed at time of exploitation
6. Infrastructure - primary roads - secondary roads - stock patios	- width of 6m for primary roads and 4m for secondary roads (east-west direction) - presence of bridges and gutters - max. 1% of the area of secondary roads in the UT - damages to remaining trees - erosion - obstruction of water courses, dead vegetation in water catchments - excess of side litter on roads and patios - depth of machinery furrows - patios of approximate dimensions of 25x20m areas of 20 to 30m^3 of exploitation per ha (at most 0.75% of the area of the UT)

Table 5.13: Verifiers of the level of utilization of environmentally friendly technologies in the exploitation phase of forest management

Item/description/components	Verifiers
1. Cutting/felling of trees - felling of trees selected for exploitation - sectioning of stems in logs (when necessary) - sectioning of usable parts of canopies - direction of fall in order to preserve remaining trees, optimise logging and natural clearings - numbering of logs	- personnel training - plating of stumps and identification of log sections (no. of tree+1/3 2/3 3/3) - height of cut (minimum) - broken trees - hollow fallen trees and abandoned in the field - waste of canopies - damages to remaining trees
2. Logging - primary transportation of logs (from felling site to stock-piling patios)	- area of logging in a maximum of 5% of the UT - maximum of 15 logged trees per main track - never cross or obstruct water courses or natural drains - damages to remaining vegetation - width of track as function of logging machine - area of soil exposure of maximum 10% of area of logging tracks (discontinuous) - erosion - lost logs (forgotten)
3. Patio operations - separation of logs for sawmilling and veneering - piling - measurement and sorting out - marking	- side litter and damage to remaining log species foreseen in the exploitation - numbering of logs (custody chain 1/3 2/3 3/3) - sorting out

Criterion 10: Conservation of forest ecosystems

Two indicators of Criterion 10 have been considered consensual and are described below:

Indicator: Proportion of areas of environmental protection in comparison with areas of permanent production.

Indicator: Measures for the protection of water courses by forest activity.

In Brazil, and in SISPROF, the two indicators are treated separately at management unit level. This is so because there is no pre-established proportion of permanent preservation area. Such protection will vary precisely due to the existence of water courses/rivers and topography. The protection of water courses is concerned with environmentally friendly practices and has been discussed above, when the indicator of criterion 9 was described, which is assessed through verifiers related to the planning of exploitation infrastructure (roads and patios) and logging tracks. In the case of Brazil, the APP are also related to the protection of water courses, and must be preserved (left untouched) at the level of the forest management unit, in accordance with the rules of article 2 of the Forest Code (Law 4771/65). The other indicators of Criterion 10, listed below, have not been consensual. Notwithstanding this, some of these indicators are considered by SISPROF, as one can see by the following comments.

Indicator: Measures to protect, recuperate and sustainably use wild populations of endangered species.

IBAMA's normative instruction no. 113/97 requires the registration of persons and companies/firms that dedicate themselves to activities that are potentially dangerous to the environment or that involve mineral, fauna, flora and fisheries products in the "Federal technical registry of activities that are potentially pollutant or users of environmental resources".

IBAMA's normative instruction no. 37-N/92 establishes the official list of endangered species of the Brazilian flora, in which, for instance, there is no explicit prohibition on the use or exploitation of any of these species through SFM (any such specific prohibition must be established in another legal or normative rule). There is also no prohibition on deforestation or conversion of forested areas to other land uses where these listed species may occur, so that the list works as a warning or precaution to be taken into account in the analyses and evaluations of projects that may contain the species referred to. In this sense, for example, the recent normative instruction 17/2001 of IBAMA, that temporarily suspended all PMFS that contained exploitation/production of mahogany (a listed species in normative instruction 37-N/92), established only one exception for the continuity of operation of these mahogany plans: the obligation to have forest certification in order to continue operating.

Indicator: Area and percentage of forests affected by natural processes or diverse agents (plagues, illness and fire, among others) and by anthropogenic action.

Deforestation in the Amazon region is monitored by INPE, and by IBAMA through the control of deforestation authorizations (an action that will become more effective with the full implementation of SISPROF, and with its extension or application through federative pacts with the states of the region), as well as through the monitoring of forest fires (PREVFOGO). In SISPROF, the control of PMFS and of their authorized exploitations can easily provide information on the referred indicator, at the forest management unit level, for each rural property whose areas are subject to this type of activity, i.e. forest management.

Indicator: Regeneration rates and structure of forest ecosystems.

At the management unit level, the characterization of the forest structure of 100 per cent of the species to be exploited (from 10cm below the diameter to be exploited) is required. The issue of the regeneration rate of the forest, in its turn, is taken into account from the requirement that each company must have a monitoring plan of the development of the forest under management.

Indicator: Measures for conservation of the soils.

The measures for soil conservation are considered in items 8 and 10 of Tables 5.12 and 5.13, respectively.

Criterion 11: Local socio-economic benefits

Indicator: Number of direct and indirect jobs and income level.

In Brazil there still is a predominance of informal relations of employment in forest activities. Such informality is favoured by the existence of three main factors: the Brazilian labour legislation, which is out-dated and whose discussion and revision are in course; the seasonality of forest activities; and the traditional absence of the state in distant areas where the activity occurs. Once SISPROF is in the process of being established, the verifiers employed for the social indicator will be restricted to the conditions of work/labour and life in the forest campings, which are described in Table 5.14.

Table 5.14: Verifiers related to social conditions in the practice of sustainable forest management

Item/description/components	Verifiers
1. Security/safety in labour/work conditions - safety materials and equipment adequate for each activity - personnel training in labour safety - training in first-aid	 - company's plan for labour safety - use of individual protection equipment - availability of first-aid material - availability of transportation for work teams
2. Camping infrastructure - water, barracks, bathrooms, garbage, etc.	 - conditions in relation to needs

The other indicators of this criterion discussed in the Tarapoto process have not been consensual, and thus have not been considered by SISPROF. They are:

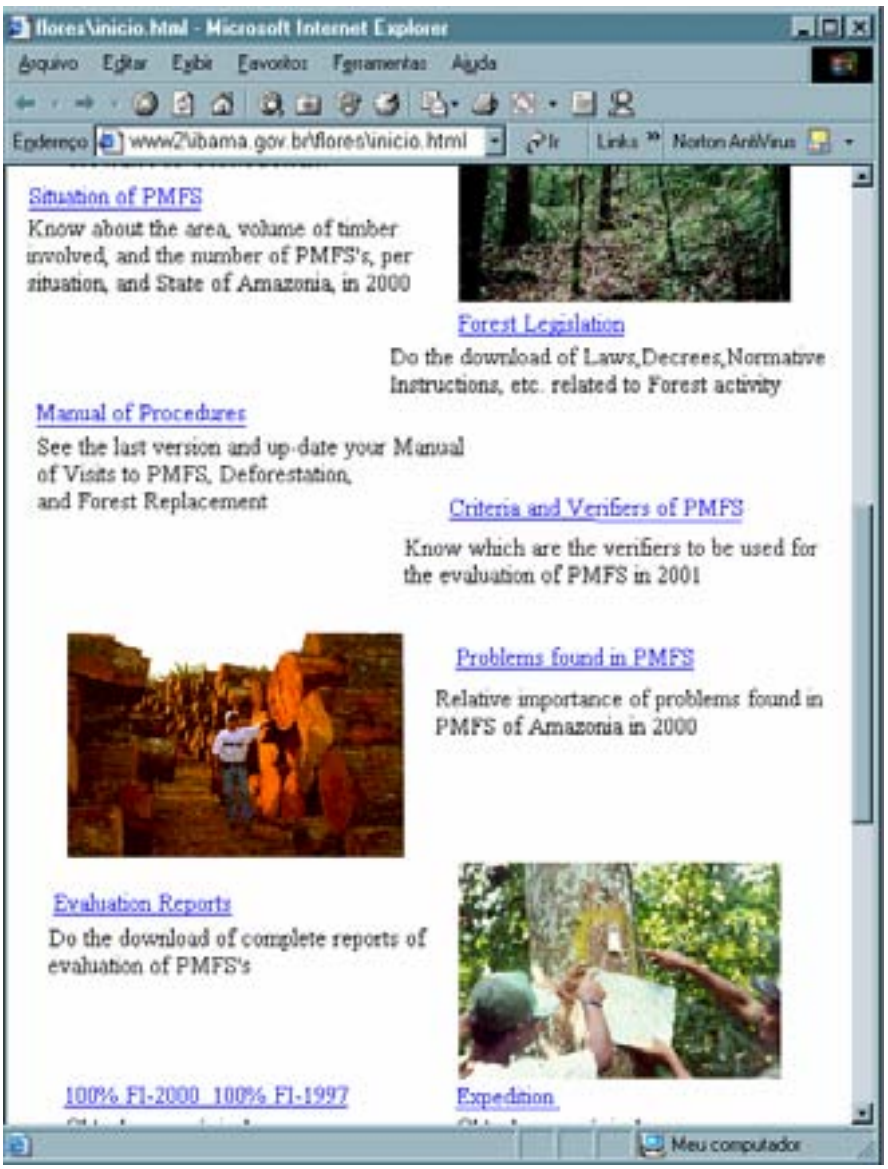
a) quality of life of local populations;
b) profitability and rate of return of forest management;
c) efficiency of production systems and of transformation of forest products;
d) impact of economic use of the forest on the availability of forest resources considered important to local populations;
e) nature and quantity of benefits derived from forest management;
f) annual quantity of products per hectare;
g) added value of production;
h) mechanisms of consultation and effective participation of local communities in the management of forest resources, depending on the scale of management.

5.2.5 The home page of PMFS in SISPROF

Although most cities of Amazonia still do not have Internet services, all capitals and almost all cities with more than 100,000 inhabitants can count on these services. Even forest engineers responsible for the elaboration and execution of PMFS who reside in small towns – which is not very commom – frequently go to the bigger centres. The forest management website in IBAMA's home page (see Figure 5.13) has been developed with the aim of reaching these professionals as well as the syndicates, forestry producer associations and the technicians of municipalities and OEMAs who deal with the issue.

Its main usefulness is to give technical support to the professional, through answers to questions that are forwarded through e-mail; to provide copies of and clarify doubts on legislation, besides getting suggestions in this regard aiming at its improvement; to publicize projects, businesses, enterprises and professionals; to disseminate training and update courses and other material. The home page was inaugurated in 1999. It has various internal links, totalling 338 files in 35 folders. Among the most useful sections for IBAMA's technicians, who work in distant places, there is the possibility of getting any updated section of the manual of technical visits, as well as a copy of any piece of legislation related to forest management. Through the home page, there is also an assistance service to professionals of the sector on legislation interpretation, technical orientation, and others. Since its inception, the page has responded to more than 200 questions on the more different aspects of forest management and related areas. As has been said, the submission of applications and the selection results for the "forest residence" are also carried out through the home page. Another service that has had quite a success is the "bank of curricula vitae", through which those interested in hiring forest professionals research among the more than 80 currently available, distributed in areas such as forest management of multiple use, community forest management, management of fauna, forest seeds, forest economics, forest products and international trade, among others.

Figure 5.13: Illustration of IBAMA's home page on PMFS



5.2.6 The nucleus of support to forest management (NAMF)

NAMF was created by IBAMA's normative instruction 182/2001 of 5 December 2001. Its necessity resulted in that year from the importance being attributed to the updating courses promoted by IBAMA. The need for a regular promotion of courses and the differences in specific conditions of each state or municipality is now more clearly demonstrated thanks to the assessment provided by the application of quality verifiers, requiring a structure of personnel exclusively dedicated to the subject.

The following attributions became the competence of NAMF, besides the promotion of courses: the production of technical manuals, the publicizing of businesses; direct support to small projects, mainly the community ones; and, more to the future, the conduct of the process of formalizing the "forest residence" and the creation of a national centre for the formation of professionals for multiple use sustainable forest management (CONFLORESTA).

5.3 SISPROF and local communities, with emphasis on sustainable forest management plans (PMFS)

5.3.1 Forest management and local communities: a brief history

Forest management for rural communities, such as rubber-tappers, riverains, indigenous people and peasants, really began to be discussed by IBAMA from the demand of the communities themselves, who began to practise forest exploitation in a technical way with the help of NGOs. In 1996 the first community forest management project was submitted to IBAMA. It was a rural agricultural settlement project, where the peasants, helped by EMBRAPA/Acré, decided to use the legal forest reserve areas of their properties through SFM. The second project to be submitted to IBAMA, in 1997, was conducted by an NGO of the state of Acré, the CTA/Acré, together with a community of rubber-tappers from the extractivist reserve of Porto Dias.

At the time, the submission of an environmental impact assessment report (RIMA) was legally obligatory in the case of areas bigger than 2,000 hectares, and since the Porto Dias project had 3,000 ha this seemed to be a necessity. Nevertheless, the 3,000 ha were composed of ten distinct usufruct rubber-tappers, whose areas were contiguous. Willing to save the resources that would have to be spent for the elaboration of RIMA, the CTA asked that the issue be discussed with IBAMA, which finally took place in Brasilia at the end of 1997. Officially, that was the first time that IBAMA discussed technically and legally not only the need for specific rules towards simplified forest management for smaller producers, but also rules for forest management to be practised by organized groups, that is, community forest management. The discussion evolved, and in 1998, through federal decree 2788 of 28 September 1998, simplified forest management and community forest management were formally admitted as categories in the legislation concerning forest management in Amazonia. Decree 2788 also excluded the obligation of RIMA's submission for all modalities of forest management.

5.3.2 The specific norms for communities: all the advantages of companies and simpler bureaucracy

Since 1998 the rules for the practice of sustainable forest activity in general have been subject to simplifications, and those related to community forest management and small rural producers have also evolved in this sense. Until 1998, a rubber-tapper who decided to exploit commercially the timber of his forest – due to the low returns of rubber extraction – would be forced to hire a forest engineer and follow all the steps that any other company would have to undertake, in order to approve a PMFS. Of course, rubber-tappers and other traditional communities of the Amazon did not hire anyone. Most times they would sell timber illegally, abandoning forest activities, and go into agricultural practices that are all much less subject to any kind of bureaucracy. Currently, this same rubber-tapper, if owner of an area up to 500 ha and if choosing to exploit his forest in a low intensity intervention (up to 10 m^3/ha), needs only to fill in an one--page form and submit it to IBAMA together with the list of trees that he intends to cut.

Organized in associations or cooperatives, the group may opt for community forest management, another alternative foreseen in the law, which would allow them to exploit their forest in a large-scale type of intervention, with a single PMFS valid for all the representatives of the association or cooperative. Another facility offered to the traditional inhabitant of the forest is the acceptance of a simple declaration by his cooperative or association proving his residence and the size of his area. This is a great step forward, since the previous requirement was that he have an approval document from an official land institution, and this prevented most traditional communities from using their forest resources in a legal and sustainable way.

5.3.3 The current participation of community projects in forest management

At the beginning of 1998, the first meeting of communities that practised SFM took place in Placido de Castro (Acré). There were 12 groups from the most different parts of the region, in different stages of practice. Since then, such meetings have been taking place every year, and at the last one, in Gurupá (Pará), there were more than 100 people, representing more than 60 organized groups involved and interested in

SFM. On the whole, considering forest activity in general, the participation of community or simplified forest management is still insignificant, as Figures 5.14 and 5.15 show:

Figure 5.14: Relative weight of the number of PMFS per social aspect

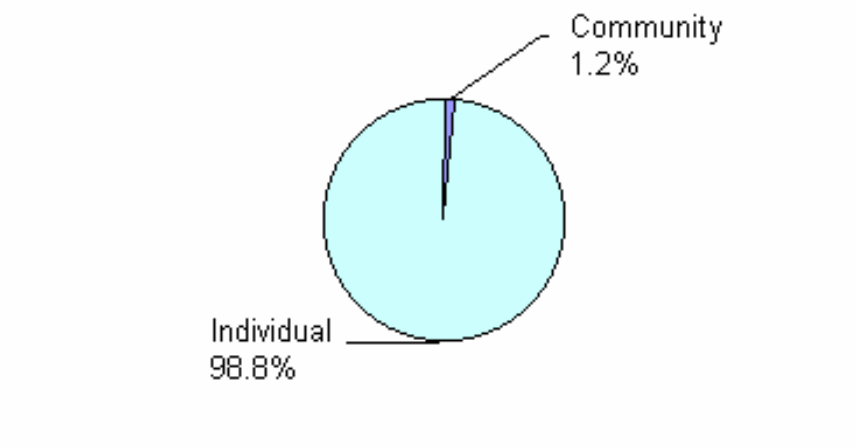
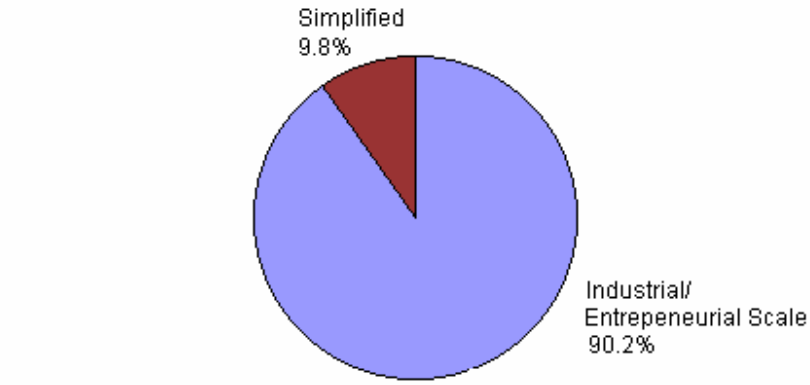


Figure 5.14 shows the relative importance of community forest management in terms of the number of projects. The 1.2 percentage is yet greater than the weight of community management in terms of total volume of wood of PMFS. In this case, community management corresponds to only 0.3 per cent of the total volume. The simplified management category, in terms of complexity of the plans, has a bigger share in the total number of plans than community management, corresponding to 9.8 per cent of the total, as can be seen in Figure 5.15.

Figure 5.15: Relative weight of the number of PMFS per complexity



5.3.4 NAMF and communities

In accordance with its internal regulations, NAMF will give priority to activities with which communities are involved. This importance is clear when we look at Brazilian statistics that demonstrate that small and medium rural properties may be responsible for about 30 per cent of deforestation in the Amazon region. In its Brasilia office NAMF will make a room available, with computer, fax and a secretary, to receive representatives of communities when they come to Brasilia to solve problems related to their projects. At the same time NAMF will work with one person in each state who will be responsible for collecting the communities' requests and for passing them through onto Brasilia.

5.4 Activities, equipment and methodology of action after the gathering of field data on PMFS

5.4.1 Geo-processing and geo-referencing in the control and monitoring of PMFS

5.4.1.1 Field equipment used for getting geo-referenced information

The field teams that carry out technical assessments of PMFS use GPS for the geo-referencing of areas. The model that is currently mostly used is the GARMIN 12. The information collected by it can be easily transported, through a cable, to the computer. Another piece of equipment that is also used is the AutoTrac, which is placed in the vehicles and allows not only the monitoring of the teams moving on their routes, through computer in Brasilia, but also immediate communication with them.

5.4.1.2 Field-data processing, elaboration of maps and readiness of data

While the SISPROF data bank is not fully operational in the Amazon, the bases will be using the PMFS-Base programme for the control and registration of the results of technical field visits. The processing of data initiates when, from the remote base, the programme button "Send data" is touched and the information is automatically transferred, via e-mail, to Brasilia. Once the SISPROF "data bank" pillar has been developed in parallel with the "validation of data" pillar (which includes the methodology of field visits, quality verifiers, annual report, amongst other items), specific software is also developed (for temporary/provisional use) for storage, transmission and processing of data related to the results of the field visits. For this temporary support, at and from the bases, the PMFS-Base programme has been developed to store the information that results from the visits and to transmit it to Brasilia.

The PMFS at headquarters programme has been developed also for the headquarters of DIREF in Brasilia, and is used for gathering all information from the PMFS-Base of each support base, and consolidating and processing the data for the elaboration of the annual report. The PMFS-Base's function will lapse as soon as the SISPROF "data bank" is totally operational, which is foreseen for mid-2003. PMFS headquarters, in turn, will be replaced later because of the statistical routine activities of consolidating information, as long as friendly routines are developed for the processing of data in the "data bank" module.

The PMFS-Base programme (developed in Access) does not store all information gathered in the field visits. Some will be only a part of a process or specific PMFS. What the PMFS-Base programme compiles and sends to Brasilia, from the different parts of the region, is the necessary information for a more general assessment of forest activity, that is: holders of PMFS, responsible technicians, authorized volumes, areas, geographical location, level of quality of the operations of management and situation of PMFS after the visit (whether or not it has been considered apt for the continuation of its activities).

The other information, collected during the process of analysis and technical visits to each PMFS, refers to specific issues of each project, such as: details about the maps, minimum inventoried diameter, distance between orientation tracks of the 100 per cent FI, distance between stock-piling patios, commitments of improvement assumed by those technically responsible, etc. Such information is important for the follow-up of each PMFS, and thus remains stored in each project file and in the data bank. The file received from each base is stored in a specific directory, which is already linked to another programme (also in Access), the PMFS headquarters, which has the task of processing the information received from the bases. From then on, PMFS headquarters follows two distinct routes: the first carries out the cross-checking and the consolidation of information and provides the tables needed for the creation of graphs and assessment of the situation and quality of PMFS; the second provides the listings and geo-referenced information for the creation of location maps of PMFS in the states.

Tables and graphs

The tables of PMFS headquarters are forwarded to specific places of the Excel sheets. From there, they are automatically formatted and transported, with a standard layout, to the final document, which constitutes the report. At the same time, the Excel sheets also automatically produce the illustrative graphs of the consolidated information, which are also transported to the final report. Thus, besides writing the report, the writer also needs to interpret the tables and graphs.

Listings and geographical location

Another path of PMFS headquarters provides a table with the geographical location of PMFS and other basic information about them, which after being transformed in DBF format is exported to the ArcView, the software used for the elaboration of maps. In the ArcView, the data basis of maps is already totally finished (vegetation physiognomies, municipality limits, water basins, etc.), and it varies only in accordance with the table coming from PMFS headquarters, which renews the situation and location of the year's PMFS in the region. From there, the maps are printed and distributed. At the same time PMFS headquarters provides the listings of management plans, which, after being formatted in Excel, are placed in another software, the Paint, in order to appear in the maps. The option for the transformation of tables into figures, through the Paint, is because of the greater ease of inserting figures instead of tables in the ArcView.

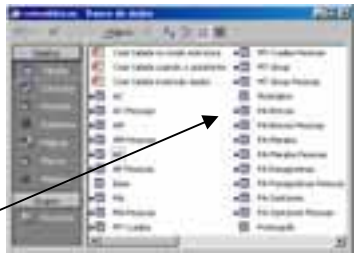
Time for preparing the report

The automation of the procedures of storing, transmitting, receiving and processing of information on PMFS, from 2002, through the linking of the employed software (Access, Excel,Word, Paint and ArcView) has proved very economical timewise. Unlike previous years, when each report was a distinct and time-consuming process, automation will allow that the 2002 report be concluded and made available in record time. Logically, it will still be necessary to work on the interpretation of data and the consequent writing. Nevertheless, if until 2001 the conclusion of the report and the updating of the home page had occurred between the months of June and July of the following year, it is expected that from 2002 these stages would be completed, at most, in March.

The diagram in figure 5.16 summarizes the described automated processing. The developed automation will allow IBAMA to issue a yearbook on the situation of forest management in Amazonia. A first volume was published for 2002, referring to the situation in 2001.

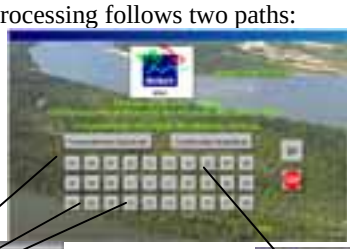
Figure 5.16: Processing of the results of technical field visits to PMFS

The processing of data is totally automatic, and initiates when, from the remote base, the key “forward data” in the programme is pressed

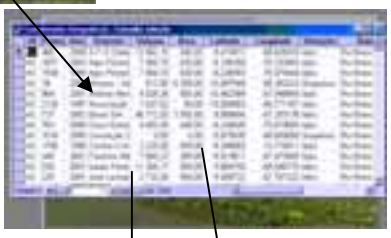


At headquarters, the table of data sent by the base is absorbed by another programme. From then on the processing follows two paths:

One of them processes numerical information

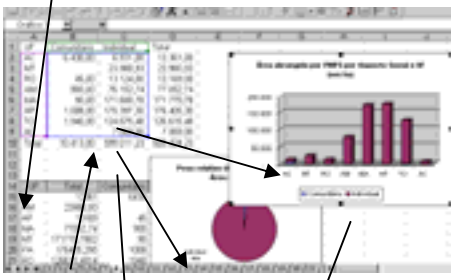


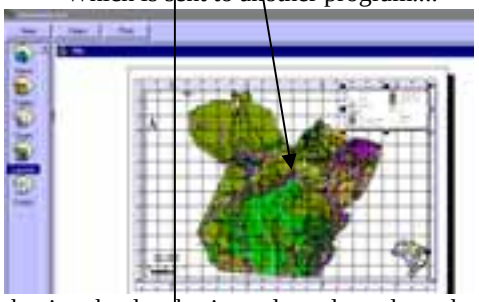
The other organizes the geo-referenced location of PMFS



The processed data are exported to a specific place…

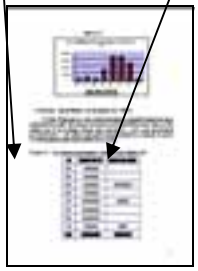
Which is sent to another program....

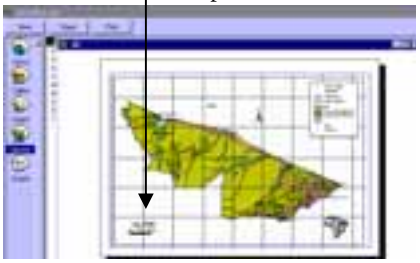




Whose resulting table is automatically formatted, and from where the graphs come out

That having the data basis ready, only updates the situation of the year’s PMFS and produces the maps





That are inserted in the Report

5.4.2 Advantages of SISPROF in the practical activities of forest management

From the point of view of monitoring and control, SISPROF already offers an advantage in the practice of forest management: as an instrument that makes monitoring and control more efficient, contributing decisively to the reduction of frauds and illegal practices that have traditionally permeated the abusive use of the forest resource in Amazonia, it can help to make unsustainable forest exploitation (and associated manufacturing and trade) more costly and, in this sense, work as an auxiliary tool in improving competitive conditions of sustainable forestry in the region.

Regarding legislation, until 1998 there was only one rule for sustainable forestry in Amazonia, and now there exist 48 basic possible combinations. Through the different forms of contact with the sector that SISPROF provides (home page, links with the remote bases during field operations, NAMF courses and the annual planning and evaluation meetings) it is possible to plan ahead and discuss the entire legislation with great command of the subject matter.

Accordingly, since it has been possible to establish which indicators and verifiers of quality were adequate for the technological, social and environmental realities of Brazilian Amazonia, and this has been incorporated in IBAMA's control and monitoring actions, which are now greatly improved by the use of an automated system like SISPROF, the quality of forest management in the region can be more effectively assessed and continuously scrutinized, thereby providing a means for the improvement of forest management itself.

The employment of verifiers for the first time in 2001 confirmed an expected finding: the low quality of forest management activity in general. Nevertheless, the system of verifiers allows us to know now, in detail, not only the problems but also the particular conditions of states and municipalities. In this sense it is also possible to make adequate plans for future actions, such as courses and training that tend to promote sustainable practice even more. At the same time, the regular use of quality verifiers will allow the follow-up of their evolution, since their time-series analysis will provide access to the good and bad results of policies and actions.

From the practical point of view of forest management, the 100 per cent forest inventory of commercial trees serves the producer as well as the controlling institution. On the one hand, that of IBAMA, it is possible to check the volume and characteristics of the species of each tree. On the other, the location of the trees, together with details of the physical conditions of the site (micro-zoning), allows for the efficient planning of the exploitation. Therefore, costs of road-building and patios, as well as costs of logging, can be considerably reduced. Such reduction, in its turn, results in less interference in the forest and reduced impact on the environment.

5.4.3 Equations of volume used for the estimate of tree volumes

There is no standard equation for estimating the volume of standing trees. It is the task of the technician responsible for the management plan to choose one and to give its justification, among the existing alternatives. Various research institutions have published equations developed for different geographical regions and forest physiognomies, among them: EMBRAPA-Pará, INPA-Manaus, FUNTAC-Acré, CETEMM-Acré, EMBRAPA-Acré and others. Besides the research institutions, there are companies that developed their own equations; one of them, in particular, Mil Madeireira (Precious Wood), has one equation for each species. According to a minute of the normative instruction under discussion, a total of two years shall be given to each firm to develop its own equation(s).

5.5 Post-exploitation activities

5.5.1 Forest management and entrepreneurial activities

5.5.1.1 Monitoring of a company's activities

The most important activity, as currently considered by IBAMA, is the self-monitoring that a company should undertake of its own practices. Technical field visits and the utilization of verifiers are already a kind of "subsidy" to companies for the planning and consequent improvement of their activities. However, field visits occur only once a year in each project. The technological package for forest management put at the disposal of companies provides a linkage of activities and requires a set of forms for the registration and planning of the activities. Such forms, once used, with date, team and registration of production, provide the means for companies to engage in practical and simple monitoring of their activities and for the identification of limiting aspects.

5.5.1.2 Monitoring the development of the forest

In 1991, when the first normative instruction on forest management was issued, in a more detailed way, establishing rules for forest activity, the method of monitoring the development of the forest had to be carried out through a continuous inventory, with the use of permanent parcels, in an intensity of 1 hectare per each 200 hectares of forest under management (0.5 per cent of sampling intensity) and measurements every five years. From the end of 1998, the choice of method for monitoring the forest was left to the discretion of the technician responsible for the management plan, together with the obligation of a 100 per cent forest inventory of the trees under management (FI 100 per cent). The DIREF/CGREF, considering the few trustworthy results obtained with the obligatory use of permanent parcels, has been recommending the inclusion of trees with 10 cm below the diameter of cut in the 100 per cent forest inventory. That is, those trees that will probably constitute the adult population of the next harvest. At the same time, it recommends that follow-up and monitoring of the remaining forest be done precisely on these trees.

IBAMA has also been promoting, through the *Pró-Manejo* (a sub-programme of PPG-7, Pilot programme for the protection of the tropical forests of Brazil), a series of meetings for the establishment of a "network of permanent parcels" in the Brazilian Amazon, which relies on the participation of research institutions, NGOs and private companies that carry out continuous forest inventories in a technically satisfactory manner. It is considered that information on secondary succession of different forests followed up by the "network" will be more reliable and consequently will allow sounder policy decision-taking.

5.5.1.3 Silvicultural treatments

The single obligatory silvicultural treatment is pre-exploratory: the cut of vines of the trees that will be harvested. It is also obligatory to carry it out at least one year before the harvest, and this has to do with the difference of the felling impact when vines are still interlacing the canopies. The other silvicultural treatments, besides being non-compulsory, have been discouraged because of the following considerations: (a) there is no certainty that the expenditure incurred with silvicultural treatments will be compensated by the forest increment at the end of the cutting cycle; (b) there is no certainty about which species will be giving better return to exploitation in the next decades, and thus which should be favoured or not.

5.5.1.4 Forest protection

Forest protection includes different aspects. Some are relatively easier to control, such as the garbage in the UTs produced by the company team itself (aluminium plates, plastic bottles, chains and knives, oil cans and others) or a forest fire that can have its risk substantially reduced through the classification of neighbours and the maintenance of regular contacts with them to previously identify possible days of pasture burnings, to build fire-dispersing roads or tracks, to establish brigades and vigilantes, and counter-fires on the day of burnings. Illegal hunting and fishing have not been particularly important and are relatively easier to control. The major problem in the Amazon region has been the invasion of forest lands by rural landless

populations, which are more difficult to control and prevent, and which has provoked the interruption and cancellation of ongoing forest management plans or projects. Its final solution needs public policies that go beyond the frontier of forestry issues themselves.

5.5.1.5 Infrastructure maintenance

The maintenance of infrastructure refers mainly to surface levelling of stock-piling patios and roads, the unblocking of water and sewage gutters, and the refurbishing of bridges, when necessary. It is recommended that maintenance be undertaken just after exploitation, before the beginning of the rainy season. Otherwise, the defects and irregularities will be aggravated by the rain, thereby resulting in greater expenditure. The execution of infrastructure maintenance operations, in the year following that of exploitation, is advisable only when logging and transport activities are extended until the beginning of the rainy season; thus very little time is left for them. Most entrepreneurs and those technically responsible resist carrying out infrastructure maintenance operations after exploitation, due to the costs that they incur. Nevertheless, this trend is likely to change with time, on the one hand because of the possibility of multiplying the uses of the forest, due to the 100 per cent forest inventory, such as the exploitation of seeds and other products, and, on the other, because of the employment of the system of exploitation control by volume, as an alternative to the conventional system of control by area. Both alternatives will benefit from a well-conserved road network.

5.5.1.6 The cutting cycle and the control system by volume

For a high intensity exploitation of timber (bigger than $10m^3$/ha) the minimum cutting cycle to be planned is 25 years. This time-period can be adjusted in accordance with the results of the monitoring of the forest's development. For low intensity exploitations (smaller or equal to $10m^3$/ha), that have specific rules, the cutting cycle is 20 years, though it can also be adjusted due to the growth of the forest. An alternative, recently incorporated in the legislation, is the "Regime of exploitation control by volume", and not by area as those mentioned above. In this case, the exploitation intensity is limited to $1m^3$/ha/year and may occur in the whole area under management (AMF). The control regime by volume allows the holder of the PMFS to choose which individuals are going to be exploited considering their physical characteristics and the market, independently from their location.

5.5.2 The system of monitoring and control of post-exploitation activities of forest management

5.5.2.1 Quality verifiers

At regional level, monitoring will be carried out through two sources: (i) taking into account the information consolidated from the evaluations of the forest management units, and (ii) taking into account the discussions and the results obtained from the network of permanent parcels referred to above. At the management unit level, the verifiers employed for the evaluation of post-exploitation activities have already been discussed in item 5.2.3, together with the Tarapoto criteria and indicators.

The expression "indication of verifiers" is related to the environment (vegetation, topography) as well as to the social and economic (technological level) diversities found in the region. Such diversity permits a wide range of alternatives to be practised in disagreement with the parameters defined by the verifiers, without necessarily meaning a loss of quality to the activity.

For example, in Pará State, in flat areas, it is recommended that the UTs have 100 hectares, that the distance between secondary roads be 250m and that the logging tracks be previously planned. Nevertheless, in Amazonia, in the Manaus region, where topography is fairly accentuated, the UTs have only 10 ha and have no logging tracks, since logs are extracted with steel cables. Likewise, there are management plans in *varzea* forests, where not even patios or roads exist, and there are also management plans carried out by traditional populations where agricultural tractors and animal traction are used. The description and the parameters of verifiers related to post-exploitation activities are described below. The quality of post-exploitation activities in areas of PMFS is assessed from the following indicators and verifiers.

1. Silvicultural treatments
    a) Description/components: suppression of remaining trees; vine cutting of remaining trees; substitution of vine areas to favour natural or artificial regeneration (when this is the case).
    b) Indication of verifiers: coherence between planned and executed (not obligatory).

2. Forest protection
    a) Description/components: protection against invasion, fire, illegal hunting and fishing, as well as of the environment in general.
    b) Indication of verifiers: personnel education and fire prevention plans in burning season and firebreaks where necessary, environment protection agents, absence of garbage.

3. Maintenance of infrastructure
    a) Description/components: operations for recuperation of primary and secondary roads, and stock-piling patios after exploitation activities, unblocking of gutters, levelling of road beddings after exploitation or in the coming summer.
    b) Indication of verifiers: verify coherence between what was planned and executed, check field notes/slips.

4. Monitoring of forest development
    a) Description/components: continuous inventory with permanent parcels, temporary parcels or periodical sampling of trees.
    b) Indication of verifiers: check coherence between what was planned and executed.

5.5.2.2 Technical field visits/inspections

Until mid-2001 the exploitation authorizations (AUTEXs) could only be given to holders of PMFS through an appraisal of a technical visit to the area to be exploited. This procedure had two disadvantages. The first had to do with the resulting difficulties for entrepreneurs, because of the seasonality of exploitation activity, which tended to render them subject to the performance of the field visit teams, a performance that was frequently undermined by official institutional bureaucracy (notably slow in liberating resources for daily stipends, for the repair of vehicles, etc.).

The second disadvantage was that the technical field team could only assess what had already been carried out in the previous year, and therefore it would not be possible to alter or analyse the planning of activities in the face of an intact forest that was still dependent on the authorization to start business. Currently, the liberation of the exploitation authorization is done through the presentation and analysis of the POA, and the visit is carried out alongside the implementation of activities.

5.5.2.3 Projects in maintenance/recomposition

Maintenance or recomposition projects are those whose area of forest management does not have a sufficient number of annual production units (UPAs) for a complete cutting cycle. In these cases, after exploitation of available UPAs, the project enters into a stand-by situation until the first exploited UPA completes the cutting cycle. This situation is possible because Brazilian legislation allows that a forest management plan be elaborated for a single UPA. In this case, in the year following its exploitation, such PMFS would be in maintenance or recomposition.

6. The costs of SFM and of SISPROF

This section presents estimates for the costs of what could be seen as the scope of a comprehensive "system" towards the sustainable use of forest resources in the Brazilian Amazon that would encompass (i) the exploitation and use of the resources themselves and (ii) the monitoring and control of such exploitation and use by the public sector.

As will be recalled, in its early stages SISPROF referred only to a part of the present system of control, the data bank. The system performed independently of the other pillars and in parallel with some other internal, already computerized, IBAMA systems, such as SISMAD (commercialization of wood and wood-products), SISPROT (administrative protocol of documents and processes), SISREG (technical registry of activities, firms, professionals, etc.) and others. With the conception and development of the "validation of data" and "geo-processing" pillars, the control system came to be seen as a "whole" constituted of interdependent parts. The acronym SISPROF was maintained and the "data bank" pillar incorporated the old SISMAD. The three pillars – now SISPROF – nevertheless are restricted to the role of the state in enforcing and promoting the sustainable use of forest resources through the employment of a modern computerized and integrated set of instruments capable of providing greater effectiveness to the actions of the public power in promoting, monitoring and controlling the use of the resources.

The basis of a "system" for the sustainable use of forest resources is directly related to the operations of exploitation and use of the resources, as well as to the monitoring and control of these activities. That part of the system referring to the exploitation of the resources itself is in charge of those that directly perform these activities for their own private economic benefit, that is, private companies, organized rural communities, rural producers, etc. Nevertheless, such exploitation, to be a legitimate and integral part of a "system" of sustainable use of the country's forest resources, must respect three basic premises, namely, to be carried out in an ecologically sustainable, economically viable and socially just manner, something that must be reflected in standards, norms and rules established by the public power and subject to assessment and verification.

Figure 6.1 gives a brief idea of the scope of this more comprehensive "system" of SFM.

As has been remarked previously, at present it is possible to distinguish in Amazonia 48 basic different combinations of forest management, which can be classified in accordance with the object of management – or forest resource under management, the social character, the complexity of the exploitation, the environment and the control regime of the management. Such combinations mean significant differences in legislation, techniques, technology, costs and production rates. Consequently, a certain "technological package", which could comply with those three premises mentioned above, would correspond to each of these combinations.

Through field visits carried out in 2001, it has been found that out of the 48 possible basic combinations 10 would already have been in practice in the region. Among them, those that involve wood/timber in high lands, and are carried out in an individual character by companies or persons, on an industrial scale and through a control regime per area, account for more than 84 per cent of the total number of PMFS in Amazonia (see Table 6.1).

Figure 6.1: Diagram of a system of sustainable forest management

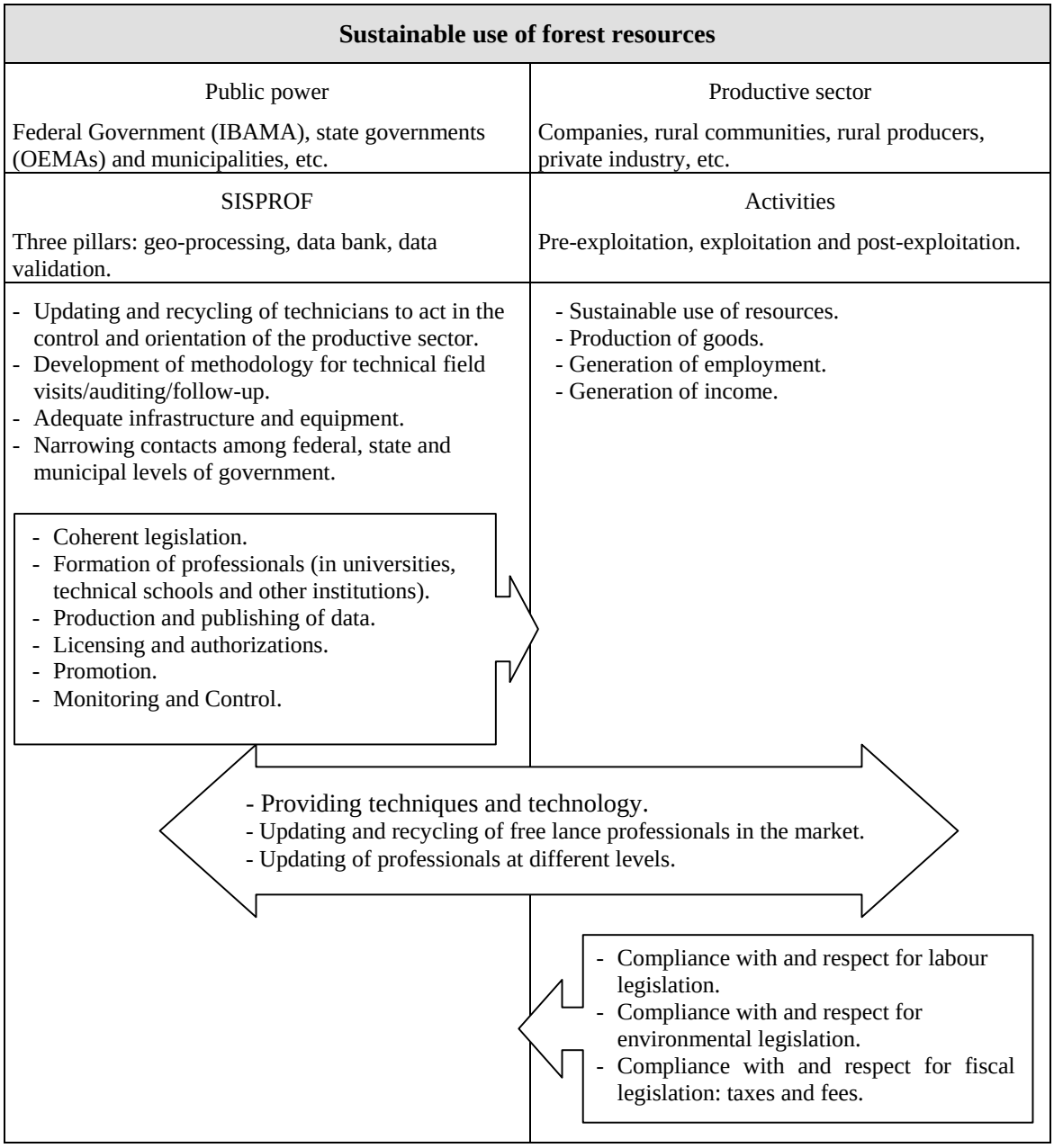


Table 6.1: Number of PMFS visited in 2001, according to classification of management

N	Object	Environment	Social aspect	Complexity	Control regime	Quantity of PMFS
1	Timber	Highland	Individual	Industrial scale	Area	916
2	Timber	Highland	Individual	Simplified	Area	103
3	Timber	Lowland	Individual	Industrial scale	Area	29
4	Palm-heart	Lowland	Individual	Industrial scale	Area	19
5	Timber	Highland	Communal	Industrial scale	Area	8
6	Timber	Highland	Communal	Industrial scale	Volume	1
7	Timber	Highland	Communal	Simplified	Area	1
8	Timber	Highland	Communal	Simplified	Volume	1
9	Palm-heart	Lowland	Communal	Industrial scale	Area	1
10	Palm-heart	Lowland	Communal	Simplified	Area	1
TOTAL						**1080**

Brazil already has at its disposal a "technological package" for the most representative combination (number 1 in Table 6.1), that is, a series of pre-defined technical procedures concerning pre-exploitation, exploitation and post-exploitation activities of forest management. The development of such a package originated from SUDAM studies and trials back in 1978[46], in

Curuá-Una, Pará, when for the first time inventory and mapping of 100 per cent of tree individuals (so-called logistical inventory) was carried out, together with the establishment of 100 ha of units of work, the planning of logging tracks and other procedures. Since then, various governmental research institutions – such as INPA (National Research Institute of Amazonia) and EMBRAPA – and other non-governmental organizations (like IMAZON and TFF) and also private companies (like Mil Madeiras) have been making significant contributions to this Brazilian technological package aimed at the sustainable exploitation of timber in the Amazon. IMAZON and TFF, for example, have been involved in the Amazon with research and development of reduced impact logging (RIL) systems. RIL systems are being developed worldwide in response to societal demands for forest conservation and environmental protection. Briefly put, RIL systems use a set of best harvesting techniques that reduce damage to the residual forest, reduce soil disturbance, protect water quality, reduce fire risk and help maintain regeneration and protection of biological diversity. The FAO model code of forest harvesting, for instance, provides the basis for the design of RIL systems, and typically includes most, if not all, of the following activities: pre-harvest inventory and mapping of trees, pre-harvest planning of roads and tracks/trails, pre-harvest vine cutting, directional felling, efficient utilization of felled trunks, minimum ground disturbance, etc.

As put forward by Holmes, T.P. *et al.*[47], although relatively little is, as yet, known about the economics of RIL, the available evidence suggests that RIL systems and methods provide multiple financial, marketing and labour force advantages. Recent research in the Amazon, such as that carried out by Barreto, P. *et al.*[48] of IMAZON, show that RIL increased profitability relative to conventional logging. Other evidence suggests, for example, that RIL techniques reduce the volume of timber wasted in harvesting operations, decreasing average cost and increasing the volume of timber supplied from a fixed resource base. Although limited, these results tend to throw some doubts on presumptions that ecologically benign harvestings are always more expensive and result in losses of competitive advantages *vis-à-vis* conventional logging.

The question of whether or not SFM is technically and economically possible in the natural forests of Amazonia has been an issue subject to some research, but with results that tend to be controversial and, therefore, whose conclusive evidence, at least for some, may still depend on further verification to be more definitively established on a general level. Since it is not our purpose to deal with this debate and

controversy here, we limit ourselves to presenting estimates of the costs of forest management activities based on the available evidence of RIL systems currently being applied in the region, recognizing that these RIL systems and methods, though not sufficient, are a necessary component in the design of SFM systems. The costs presented in Table 6.2, extracted from Holmes, T.P. *et al.*, op.cit., are considered representative for eastern Amazonia, as well as for more capital-intensive firms that work in bigger, relatively flat, areas and with an exploitation intensity between 20 to 30 m^3/ha.

Table 6.2: Forest management costs in eastern Amazonia (based on RIL activities) – US$/$m^3$ – 1996

Activity	Cost (US$/$m^3$)
Pre-harvest	**1.04**
Block layout	0.22
Inventory	0.42
Vine cutting	0.12
Data processing	0.09
Mapmaking	0.19
Harvest planning	0.16
Tree hunting	0.00
Tree marking	0.13
Road planning	0.02
Log deck construction	0.01
Infrastructure	**0.55**
Road construction	0.14
Log deck construction	0.14
Skid trail layout	0.27
Harvest	**3.14**
Felling and bucking	0.62
Skidding	1.24
Log deck operations	1.28
Support, logistics, supervision	**0.32**
Activities sub-total	**5.21**
Overhead	**0.52**
Stumpage cost	**7.61**
Waste adjustment	**0.09**
Training	**0.21**
Total cost	**13.64**

Notes: (1) Overhead refers to administrative support (office, phone, fax, computers, etc.); (2) Stumpage cost refers to price of "harvesting rights" on a per hectare basis, divided by standard volume.

As reported by Simula, M.[43], although cost estimates for forest management in the Amazon appear to vary among authors, and higher figures than those in Table 6.2 may have been found, the cited author believes that the costs estimated by Holmes, T.P. *et al.*, op.cit., are still reasonable indications, even though local factors (accessibility, commercial volumes, etc.) can have a major impact.

Table 6.3: IBAMA's direct costs of visits (field visit fees) and price of ATPFs or stamps – per m^3 of wood/timber

Type of charge	Unit of measurement	US$/m^3
Previous technical field visit for establishment of PMFS		
-area ≤ 250 ha	US$ 87.00 (flat price)	0.03 [1]
-area > 250 ha	US$ 87.00+US$ 0.16 per additional ha above 250 ha	0.0096 [2]
Follow-up technical field visit on PMFS		
-ibid to above	ibid	ibid
-ibid to above	ibid	ibid
ATPF (for logs)	US$ 3.00 per ATPF	0.27 [3]
Stamp of forest origin		
Green Stamp (logs from PMFS	US$ 0.30 per m^3	0.30
Red Stamp (logs from deforestation)	US$ 0.60 per m^3	0.60
Brown Stamp (processed timber from PMFS origin)	US$ 0.60 per m^3	0.60
Brown Stamp (processed timber from deforestation)	US$ 1.20 per m^3	1.20
Blue Stamp (processed timber of PMFS origin for export)	US$ 0.60 per m^3	0.60
Blue Stamp (processed timber from deforestation for export)	US$ 1.80 per m^3	1.80

Notes: (1) based on an average area size of 125 ha, and on $25m^3$/ha intensity of exploitation ; (2) based on an average area size of 570 ha, and on $25m^3$/ha intensity of exploitation; (3) based on an average transportation cargo size of $11m^3$ of logs per truck. Exchange rate used was R$3.30/US$1.00.

Table 6.3 provides average values for the two specific costs charged by IBAMA on those that carry out PMFS, and/or transport timber, and/or process timber: the technical/auditing visit fees, and ATPFs or the stamps of origin. These are costs directly borne by PMFS holders, timber transporters/merchants or manufacturers. As can be seen from Table 6.3, costs of auditing visits (previous and follow-up technical visits) amount to almost US$ 0.02 per m^3 (average cost for management plans with 570 ha area), while ATPFs are worth US$ 0.27 per m^3, or a stamp of origin that would cost US$ 0.30 per m^3. PMFS technical auditing visit fees would therefore add a very small burden to the costs of forest management activities in Amazonia, as presented in Table 6.2. The costs of ATPF or stamps of origin would be supported by the other agents of the chain of custody, namely, transporters/merchants and manufacturers that buy and/or process timber (logs) from PMFS.

Contrary to what Simula, M., op.cit., suggests, the costs currently charged by IBAMA do not seem to be a cause of concern in terms of the additional burden levied on forest management specifically, since these more direct costs of control (previous and follow-up technical auditing) are, as we show, much less than the costs of preparation of the strategic annual operational forest management plan – pre-harvest and harvest planning (as is generally asserted and as stated by Simula, control should cost less than planning).

As can be seen, if we move up on the scale of control of the other links of the chain of custody, IBAMA's charges are relatively much higher. The unit cost per m^3 of timber (logs) transported out of a PMFS site, as currently charged by IBAMA, is US$ 0.27 in the case of ATPFs, or will be US$ 0.30 in the case of the new control document that shall replace the ATPFs, the "Green stamp of origin". Even so, and looking at the costs of forest management in Table 6.2, this maximum additional cost of US$ 0.30/m^3 does not represent too heavy a burden on the unit costs of managed logs that are transported and enter into the gates of manufacturing/processing units in the Amazon.

Having looked at the monitoring and control prices/costs imposed directly by IBAMA on the production and circulation of timber (logs) from PMFS, we should now attempt to see whether or not, and how much,

the new SISPROF instruments would increase the costs of controlling and ensuring the availability of sustainable timber in the Amazon. Are the control fees currently imposed by IBAMA (or proposed by IBAMA, in the case of the stamps of origin) sufficient, or not, to cover the new costs of SISPROF and, therefore, are these costs borne entirely by the agents directly involved in the production and circulation of timber from PMFS? What would be the increment in "transaction costs", due to the control provided by the new system, in terms of carrying out forest management in Amazonia?

Table 6.4, on the costs of SISPROF, provides the values of expenditure incurred by IBAMA in (i) conceiving and developing the system, (ii) establishing it, and (iii) operating and maintaining it. Items (i) and (ii) are investment costs borne by the Federal Government/IBAMA, i.e. "once for all" expenditures, already incurred by Brazilian society, that were necessary to create the system, while item (iii) would be running expenses necessary for operating the system efficiently on a yearly basis and, therefore, necessary to ensure that, through its operation, the purposes of the control system are being accomplished or, in other words, necessary to guarantee a systematic and adequate capacity of recovering the investments that have been made by Brazilian society. It should be remembered that the "validation of data" costs refer solely to PMFS, while the costs of the other pillars, "geo-processing" and "data bank", refer to all three basic activities that the system aims to control, that is, they include the execution of the controls related to processing authorizations/deforestation licences, forest replacement and PMFS, as well as the subsequent issuing of the respective ATPFs or stamps of origin.

As may be gathered from Table 6.4, the grand total amount of SISPROF's costs has reached the considerable sum of US$ 6.76 million, out of which US$ 2.762 million have been accounted for as investment costs (conception and development plus establishment of the system) and US$ 3.998 million as operation and maintenance costs (these computed on a yearly basis).

Table 6.4: The costs of SISPROF

Stages/processes of SISPROF	Unit	Unit cost (in US$ 1.00)	Total cost (in US$ 1.00)
1. System's conception and development			**586,195.00**
1.1 Geo-processing			**160,305.00**
1.1.1 Human resources			
Consultant/developer	01 (06m)	2,500.00	15,000.00
Geo-processing technician	02 (12m)	1,500.00	36,000.00
1.1.2 Images/maps/licences			
Landsat images (digital)	220 (/year)	315.00	69,300.00
Vegetation maps/land use 1:100,000	650	28.50	18,525.00
ArcView licence	60	358.00	21,480.00
1.2 Data bank			**350,690.00**
1.2.1 Human resources			
SISPROF Coordinator	01 (24m)	2,600.00	60,000.00
System analyst/data bank manager	01 (24m)	2,000.00	48,000.00
Programmer/developer	02 (24m)	1,200.00	57,600.00
IBAMA's technicians (part-time 50%)	03 (24m)	1,000.00	72,000.00
Stamp/security document consultant	01 (06m)	1,500.00	9,000.00
1.2.2 Licences/software			
Oracle licence (two processors)	02	31,725.00	63,450.00
Delphi 5.0 licence	12	189.00	2,268.00
Linux server licence	01	572.00	572.00
Windows 2000 XP	60	320.00	19,200.00
Microsoft Office Professional XP	60	310.00	18,600.00
1.3 Validation of data			**75,200.00**
1.3.1 Human resources			
Consultant/developer	02 (18m)	2,000.00	72,000.00
1.3.2 Images/charts/licences			
ArcView	4 licences	150.00	600.00
Office premium	4 licences	330.00	1,320.00
Windows	4 licences	320.00	1,280.00
2. System's establishment			**2,176,313.30**
2.1 Geo-processing			**42,000.00**
2.1.1 Training to operate with the ArcView	100 tech.	420,00	42,000.00
2.2 Data bank			**1,051,270.10**
2.2.1 Human resources			
Technicians for analysis and registry of data in 23 bases of IBAMA	46 (12m)	1,000.00	552,000.00
Digitizers in IBAMA's bases	46 (12m)	350.00	193,200.00
2.2.2 Equipment			
File server DELL 2600	01	18,570.00	18,570.10
Pentium IV HD20Gb, 256 MB	60	782.85	46,971.00
Laser printer of 8 ppm	23	370.00	8,510.00
Ink-jet printer	16	114.50	1,832.00
Pentium IV Notebook, active matrix	03	1,285.70	3,857.00
2.2.3 Training of technicians			
Training for operation of SISPROF in 23 bases of IBAMA	23	800.00	18,400.00
Training for IBAMA's technicians			

Stages/processes of SISPROF	Unit	Unit cost (in US$ 1.00)	Total cost (in US$ 1.00)
2.2.4 Making/establishing stamp	54	420.00	22,680.00
Making of stamps (for 12 months)			
Publicity material and training (manuals,	9,000.00	0.02	180,000.00
folders, posters, etc.)	15,000	0.35	5,250.00
2.3 Validation of data			**1,083,043.20**
2.3.1 Equipment and materials			
Pick-up with four-wheel traction	46	20,000.00	920,000.00
AutoTrac	46	2,000.00	92,000.00
GPS+cable, antenna, connector	72 kits	503.10	36,223.00
Office material (various)	23 kits	100.00	2,300.00
Equipment for field visits	72 kits	260.00	18,720.00
Fax sets	23	200.00	4,600.00
Furniture for bases	23	300.00	6,900.00
2.3.2 Other services			
Telephone line	23	100.00	2,300.00
3. System's operation and maintenance			**3,997,975.18**
3.1 Geo-processing			**105,300.00**
3.1.1 Purchase of images and geo-referenced charts	220/year	315.00	69,300.00
3.1.2 Maintenance/technical assistance to			
operational bases of IBAMA	02 techs.	1,500.00	36,000.00
3.2 Data bank			**888,600.00**
3.2.1 Human resources			
Technicians for analysis and registry of data in 23 bases of IBAMA	46 (12m)	1,000.00	552,000.00
Digitizers in IBAMA's bases	46 (12m)	350.00	193,200.00
Technicians of IBAMA headquarters	03 (12m)	1,000.00	36,000.00
Data bank manager	01 (12m)	2,000.00	24,000.00
Programmer/developer	01 (12m)	1,200.00	14,400.00
3.2.2 Maintenance of equipment/network			
Micro-computers/printers	23 bases/year	900.00	20,700.00
Expedient material: printer cartridges, toner, CDs and paper	23 bases/year	1,500.00	34,500.00
Maintenance of IBAMA's network	23 bases/year	600.00	13,800.00
3.3 Validation of data			**3,004,075.18**
3.3.1 Human resources			
Consultant/developer	02 (12m)	2,000.00	24,000.00
Temporary technicians for field visits (wages plus daily stipends)	54 (04m)	3,840.00	829,440.00
IBAMA's technicians for field visits (wages, social duties, plus daily stipends)	54 (04m)	5,280.00	1,140,480.00
Digitizers			
3.3.2 Equipment and materials	1,400 forms	0.63	882.00
Reproduction of the digital manual Forms for visits on PMFS	200 CDs	1.00	200.00
3.3.3 Other hired or paid services	1,400 forms	0.48	672.00
Execution of field visits (air travel tickets, consumption material, etc.)	1,400 visits	528.20	739,480.00
Making of the digital report			
Printing of annual report	15,000 CDs	2.00	30,000.00
Distribution of annual report	5,000 books	3.00	15,000.00
Hosting of the home page	390 (posting)	4.00	1,560.00
3.3.4 Training	1 page	241.18	241.18

Stages/processes of SISPROF	Unit	Unit cost (in US$ 1.00)	Total cost (in US$ 1.00)
Forest management courses for recycling IBAMA's personnel	2 courses	30,000.00	60,000.00
Forest management courses for other technicians and professionals (costs of instructors only)	28 courses	840.00	23,520.00
Training for technical field visits and operation of the accessory programmes	150 participants	560.00	84,000.00
3.3.5 Other events			
Promotion of annual meeting for evaluation, and planning for next	91 participants	600.00	54,600.00
4. Grand total (1+2+3)			**6,760,483.48**

In terms of annual operation and maintenance, more specifically related to field actions for monitoring and controlling PMFS, which include training and other support actions in forest management (item 3.3 of Table 6.4), it can be verified that a total of US$ 3.004 million would be necessary, every year, to provide an efficient implementation of this part of SISPROF. Assuming that the present total authorized exploitation volume of timber (logs) from audited and apt PMFS in the Amazon is of the order of 9 million m^3, it would cost US$ 0.33 per m^3 of timber for IBAMA to run this part of the control apparatus, yearly.

Now, that figure is quite higher than the control fee of almost US$ 0.02 per m^3 currently charged by IBAMA to PMFS holders/producers to cover costs of technical/auditing field visits. Therefore, there would seem to be an amount of US$ 0.31 per m^3 of managed timber that is borne by federal budget, and thus by society at large. But it can also be seen that the US$ 0.31 difference per m^3 could be in part, if not totally, dissipated by the charges imposed on the other links of the chain. When we bring in the total costs of US$ 0.994 million necessary for the annual operation and maintenance of the other pillars of the system (geo-processing and data bank) and divide these costs only by those same 9 million m^3 of managed apt timber – which would mean a control cost of US$ 0.11 per m^3 of timber (logs) coming from PMFS and entering the market, as opposed to the present US$ 0.27/m^3 (in the case of ATPFs) or US$ 0.30/m^3 (in the case of the proposed "Green Stamp") charged by IBAMA – it becomes clear that the surplus that IBAMA gets here can serve to reduce by US$ 0.16/m^3 or US$ 0.19/m^3 the apparent total loss that it had to support.

Although it may appear that there remains a difference (because the form of calculation takes into account only managed timber) of US$ 0.15/m^3 or US$ 0.12/m^3, that IBAMA may still have to bear, it should not be forgotten that this loss may certainly be offset by the gains that IBAMA gets from the fees charged on each m^3 of timber (logs) that comes from authorized deforestation (were the costs of "validating data" from deforestation taken into account, the end-result of control costs per m^3 of authorized and transported timber leaving deforestation sites would be much lower than the present fees charged by IBAMA, either in the case of ATPFs, as well as, and even more, in the case of the proposed new fees of the "Red Stamps"). This is particularly fortunate, since deforestation would then end up paying for the control costs of forest management, at least from the point of view of the workings of SISPROF and the fees charged (even more in the case of those proposed) by IBAMA.

What emerges quite clearly from the above discussion is that the system is capable of paying for itself. The more forest management there is in the Amazon, i.e. the more there are PMFS that are well controlled, apt and producing timber in the region, the cheaper will be the unit costs of control per m^3 of sustainably managed timber. Moreover, the system does not at all "overcharge" or burden forest management. On the contrary, given the bases and lines on which it is built, SISPROF is rightly formulated in terms of how much and who should be bearing the greater portions of monitoring and control costs of forest management, i.e. those that have to pay the higher fees to cover these costs are those located in the other

links more towards the end of the timber chain of custody, namely, merchants and manufacturers and, of course, those that use timber from deforestation. Forest management thus appears to be stimulated by SISPROF. From the point of view of these features, it is doubtful whether any other existing proposal with regard to a monitoring and control system for forest management in the Brazilian Amazon can outrank SISPROF.

7. CONCLUSIONS AND RECOMMENDATIONS

The measures that regulate access to forest resources in Brazil are characterized by the coercive nature of their command and control, and therefore remain in direct conflict with economic incentives that drive private activities, which makes their implementation and enforcement difficult.

Notwithstanding this, in the last years, enforcement of the laws and regulations concerned with the access and use of forest resources in the country, and particularly in the Amazon, has improved considerably, and more modern instruments of control, monitoring and inspection of deforestation and timber exploitation activities in the natural forests of Amazonia have been instituted and implemented, providing new partnerships and some integration of actions among federal and state governmental agencies. The development and the recent start, although still partial, of SISPROF's operation in the Amazon region is an outstanding testimony of such an effort.

Effectiveness or ineffectiveness of the enforcement of laws and regulations depend on many things: political willingness to exercise control, difficulties to overcome contrary to local political interests, lack of severity in implementation, loopholes that favour fraud, insufficient financial and material resources, the size or dimension of a target region, like the Amazon, where there are enormous areas and agents to be monitored, etc., etc.

Effectiveness or ineffectiveness of enforcement certainly depends on whether or not the control instruments have been rightly conceived to be comprehensive enough in incorporating and attending to all the requirements, dispositions and principles of the law and its regulations. In this respect, it could be said that SISPROF has tried its best to cope with such a necessity. In the case of Amazonia, as we have endeavoured to show, any modern system of control had to be sufficiently inclusive to take into account the whole chain of custody of extraction and processing of forest resources, ranging from where they are obtained (landholdings) to the units where they are finally processed.

A remarkable feature of the system, as we underscored, lies in its form of control providing latitude for not overcharging or imposing an additional burden on forest management in Amazonia, an activity that needs more favourable treatment in the region. In fact, the system is capable of paying for itself without compromising that objective. SISPROF will undoubtedly allow Brazilian society to have a more transparent and reliable assurance of the performance of forest-based or related activities implemented at the management unit level. Federal government, and IBAMA, will be more capable of reporting on the monitoring of these activities, and on their progress towards sustainability. SISPROF must become fully operational in order that its instruments achieve greater effectiveness, as well as to facilitate more integration and sharing of competence among federal and state government institutions in Amazonia. On the basis and experience of the system's more complete functioning, international cooperation with other Amazonian countries could also be envisaged, especially for harmonizing efforts concerning reporting on progress towards the objectives of SFM as foreseen, for instance, in the regional Tarapoto process of criteria and indicators. On these grounds, the experience of IBAMA with the implementation of SISPROF shall be of great value to other similar institutions in the region.

Finally, it must not be forgotten that, although necessary, SISPROF is not sufficient to hold deforestation or to revert the predatory pattern of forest resource exploitation in Amazonia. More powerful incentives move people in the direction of converting forest areas to other more profitable land uses in the absence of concrete economic value for those areas. Indeed, it is difficult to curb such behaviour with legal and control instruments only. To increase the chances and profitability of SFM in Amazonia, other more efficient, incentive-oriented policy mechanisms are needed and must urgently be established. The full functioning of SISPROF and its instruments will certainly be an indispensable support for any such coming mechanism aimed at transforming forestry into a permanent, sustainable activity in the Brazilian Amazon.

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List of tables, maps and figures

Tables

Maps

Figures