SUMMARY

Summary

Chapter 1 Introduction

1.1 Background of the Study

The Brazilian Government requested for a technical cooperation related to the "Master Plan Study on Degraded Areas Restoration in the State of Pará" to the Government of Japan in May of 1998. In response to the request, the Japan Government, through the Japan International Cooperation Agency (JICA), sent a Project Formation Study Team in April 1999, to evaluate the possibilities for such cooperation. Then, a Preliminary Study Team was sent in December 1999 to discuss the Scope of Works (S/W) with the Pará Government. Based on the S/W, the Study Team composed by specialists was sent for the realization of the Study. And, the results of the Study are elaborated in this report.

1.2 Objectives of the Study

The Study objectives are as follows:

1. Elaboration of the Master Plan in concern with the Recuperation Plan of Degraded Areas in the Micro region of Marabá in Pará State, of which the main items are as follows:
   a. Recuperation of Natural Forests;
   b. Reforestation for the Utilization of Forest Products;
   c. Introduction of Agroforestry Activities, etc.

2. Technical Transfer of the Methodology applied in the Study and in Planning to the Brazilian Counterpart personnel.

1.3 Study Area

The Study Area encompasses 5 municipalities (Marabá, São João do Araguaia, São Domingos do Araguaia, Brejo Grande do Araguaia and Palestina do Pará) of the Marabá Micro region, in the State of Pará, with an approximate area of 20,000 km^2. Regions outside the Marabá Micro region can be taken into consideration, if necessary, for the collection of existing information and recommendations.

1.4 Scope of the Study

The Study is accomplished to reach the proposed objectives including the following works:

a. Collection and analysis of data and related information;
b. Analysis of satellite images of the degraded areas;
c. Elaboration of the map of the existing degraded areas (1/100.000);
d. Analysis of limiting factors, potentials for recuperation and technical alternatives for the recuperation of the degraded areas;
e. Analysis of basic guidelines of recuperation of the degraded areas;
f. Elaboration of the master plan of recuperation of the degraded areas;

g. Elaboration of the map of the plan of recuperation of the degraded areas.

Chapter 2 Socioeconomic Conditions

2 Socioeconomic Characteristics of the Study Area

The micro region of Marabá, which is the Study Area, is located at the southeastern portion of Pará State, bordering the Tocantins State to the east through the Araguaia river. The Marabá urban center is the socioeconomic center of the micro region, and the Transamazônica and PA-150 (Belém-Santana do Araguaia) highways and the Carajás railway cross this center. This region is being directly influenced by the Carajás Project which focus on the mining in Carajás. The Marabá urban area functions as the Carajás development center and, at the same time, as the center of cargo flow of agricultural related products in the region.

The micro region development was always related to the land ownership issue. The period starting in the 70's, when the essential development started, can be divided into three phases: the land concession (70's), land conflicts (80's), and conversion to familiar agriculture (from the 90's till now).

The Study Area presents the following socioeconomic characterization:

a. Existence of several social problems: great influence of the Carajás Project; a strong demographic growth; several occurrences of invasion and occupation by the landless farmers; several occurrences of land conflict.

b. Most of the population are migrants coming from other regions, without knowledge about the local natural conditions and the traditional production systems. This includes from the large-scale land owners coming from the south of Brazil (cattle raisers) till the settlers and occupants coming from the northeast of Brazil.

c. The region has been developed since long ago and now has the larger degraded area in the Amazon region.

d. The deforestation continues in a fast pace for the exploitation of wood, expansion of pasture land and implementation of new settlements.

e. From the 5 municipalities of the micro region, Marabá is the one with the largest territory, population and outstanding socioeconomic aspects, exerting great influence in the whole region. On the other hand, the other 4 municipalities are far from having the Marabá conditions.

f. Since the construction of the Transamazônica highway, countless colonization and settlement projects were or are being implemented in the whole micro region.

g. Many times the settlers go away when having a personal problem or due to production problems. In rural areas, the job opportunities are limited creating a large contingent of potential unemployed people.

h. In general, the infrastructure and social conditions are precarious, in terms of roads, water supply, sanitation, electric energy, storage and transports. Particularly, in the municipality of Palestina do Pará located at the extreme eastern portion of the micro region, the conditions are extremely precarious, and this being considered the poorest municipality.

i. There is a large number of cases of endemic diseases such as malaria in the whole micro region, especially in the municipality of Palestina do Pará and in the settlements.

j. There are some relatively favorable localities in regard to transports, served by the Transamazônica highway, Carajás railway and by the waterway system Araguaia-Tocantins.

Chapter 3 Natural Conditions

3 Natural Characteristics of the Study Area

The Study Area, which lies in the southeastern State of Pará has a distint natural characteristics, especially in terms of topography, soil and climate, which altogether have a significant influence on the land capability potential and limitations for various activities such as agriculture, pasture and silviculture. The natural conditions of Marabá munipality, which covers about 76% of the Study Area, have a slightly different natural conditions in comparison with other four municipalities, especially the topography, which reaches an altitude of around 700m in the western part of Marabá.

The specific natural characteristics of the Study Area are as follows:

a. The Study Area has a diversified relief presenting hilly areas, plateaus and lowland areas (varzeas) along some of the tributaries of Tocantins and Araguaia rivers. Topography is one of the critical factors in the Study Area, which limits the capability of land for agriculture purpose.

b. The most predominant soils are the red yellow Argissols (Podzolic soil), red yellow Latosols, Lithic Neosols (Lithosols) and Quartz Neosols (Quartz Sands). These are extremely weathered acidic soils with a granulated soil structure. Except for the nutrients cycled in organic matter, the soils are very low in nutrients and therefore a careful fertilization is necessary.

c. Except for small parts of the Study Area in Marabá , Brejo Grande do Araguaia, and Palastina do Pará , most of the area has restricted aptitude for traditional agriculture and therefore technical application and improved cultivation management practices such as adaptation of suitable varieties, application of fertilizers, irrigation etc. are essential for higher agicultural production.

d. According to Koppen classification, the area is situated between the transition area from Aw to Am. . The average annual temperature is 26^{o}C with an average annual maximum and minimum temperatures of 31^{o}C and 22^{o}C respectively. Relative

humidity is high, oscillating between 73% and 93%.

e. The rainy season starts from December and ends in May and the dry season is from June to November. Rain fall is around 1,500 to 2,000mm/year. Most of the Study Area has a hydric deficiency between 400mm and 500mm, demanding the use of irrigation during the dry season.

f. The Study Area is included in the river basins of Itacaiunas river, Araguaia river and Tocantins river and their tributaries. Several other smaller rivers such as the Gameleira, Tapirapé, Vermelho, Cinzento, Preto etc. are also part of this river basin.

g. The vegetation in the Study Area is composed of Submontana Dense forest in plain relief (the largest area) and Mixed Open Forest (cocal). The alluvial forests are found along the banks of Araguaia, Tocantins and some river islands. In several different areas of the Study Area, there are large portions of cleared forests that have been open for pasture and cattle grazing. It has led to the appearance of a secondary forest (capoeiras) in different stages of regeneration.

Chapter 4 Present Conditions of Forest and Degraded Areas

4.1 Forests in the Study Area

The forest area in the municipality of Marabá, with the predominance of Dense Forest of Terra Firme, occupies approximately 70% of the municipality total area. In the Serra dos Carajás, in the western region of Marabá municipality, there is the large National Forest of Carajás. Other natural forest areas do not have a significant size, being distributed only in the forest reservations along the water streams, mountain ranges and hills. Besides, these natural forest areas are surrounded by secondary forests affected by logging and fires.

4.2 Degradation Conditions

(1) Causes of Degradation

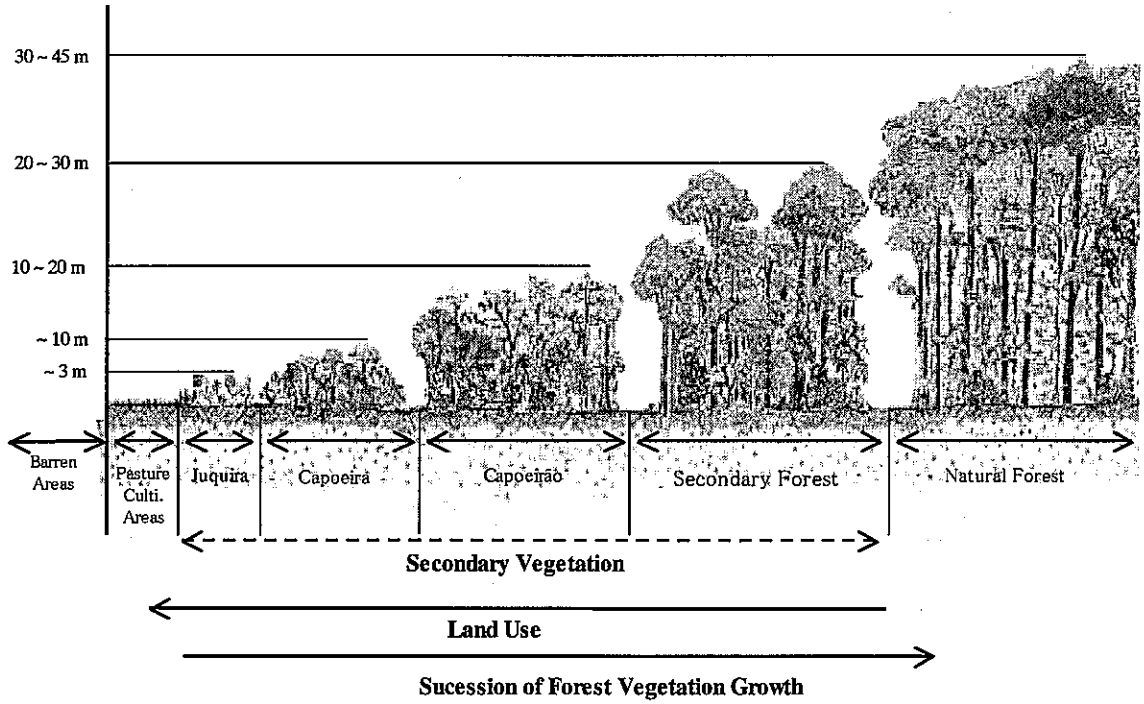
The main land uses that are causing agricultural and environmental degradation in the Amazon are as follows: (i) Animal Husbandry Activity : The activity responsible for most of the agriculturally and environmentally degraded ecosystems in Amazon is the animal husbandry activity. (ii) Shifting Cultivation: The traditional agriculture carried out in the Amazonian region is the shifting cultivation system. This practice of slash-and-burn is intercalated with fallow periods. Although the secondary forest can play an important part in ecological terms, this agriculture form is one of the largest causes of the agricultural degradation of the point of view of the agricultural production. (iii) Extraction of Wood: Each year, the wood extraction affects, a wide area of primary forest. Fortunately, the forests regeneration rapidly takes place after the extraction of wood, unless the fire spreads out in these forests.

(2) Vegetal Succession

The vegetal succession starts with native species when the areas utilized for agriculture

abandonment of land used for production are many times the drop in productivity due to the occurrence of diseases and pests, and the soils deterioration due to the frequent use of fires. The high cost of control of invading plants of native species also contributes for the land abandonment. These situations motivating the land abandonment are consequences of the degradation process classified as agricultural degradation. The secondary system of vegetal succession starts in these abandoned areas.

The agricultural cultivation areas or abandoned pastures present a progress according to the vegetal succession above described, evolving from juquira to capoeira and capoeirão, finally attaining the natural forest recuperation.



Degraded Areas and the Vegetation Succession Process

(3) Degradation of Pasture

It can be deduced that the pasture degradation can be caused by the following reasons and actions: (i) Investment Lack; (ii) Lack of Initial Control of Weeds; (iii) Insufficient Technical Assistance; (iv) Fire without Control; (v) Deterioration of Pasture caused by Continuous Grazing; (vi) Unrealized Reform of Pasture; (vii) Succession of Forest Vegetation.

4.3 Description of Degraded Areas

(1) Degraded Areas Object of the Study

The degraded areas are interpreted, for this Study, as the land that suffers the negative consequences of anthropogenic interventions on the structure and functioning of an ecosystem (or part of it), i.e., losses of soils productive capacity (biomass productivity) and of biodiversity (fauna and flora), and of environmental functions. The degradation has a quantitative aspect in the loss of soils productivity and a qualitative aspect in the loss of

biodiversity and of environmental functions which transcend the affected areas, such as impacts on the hydrological cycles, accumulation of sand on rivers, local and regional climate. Furthermore, the degradation also results in economic losses such as the reduction of forest products possible to be extracted and the loss of crops and pastures productivity. At last, the Degraded Areas are interpreted as the land that suffers drop in its productive capacity.

(2) Classification of Degraded Areas

According to the analysis results about the appearance of degraded areas confirmed in the vegetal succession process, the degraded areas are classified into 4 types: juquira, capoeira, capoeirão and barren lands.

4.4 Distribution of Degraded Areas and their Transition along the Time

(1) Distribution of Degraded Areas

In the municipal district of Marabá, which occupies approximately 76% of the Study Area, forests represent 64% (including 18% of reservations), degraded areas 13%, and cultivation areas and pastures 23%. The western portion of the municipality is occupied by natural reservations, and most of the degraded areas are concentrated along the Carajás railway and the State road PA-150. The municipality of São João do Araguaia has only 17% of forest areas, and approximately 54% are occupied by degraded areas. In particular, in the area between the Araguaia river and the federal road BR-230, which connects the urban areas of Marabá and Estreito, located by the federal road BR-10, the degraded areas are scattered in the shape of fish spine along the north-south road.

The municipality of Brejo Grande do Araguaia present similar situations to the municipality of São João do Araguaia. In the area between the Araguaia river and the federal road BR 230, at the northern portion, degraded areas dominated by babaçu area spread out, occupying approximately 35% of the municipality total area. The municipalities of São Domingos do Araguaia and of Palestina do Pará present a similar tendency, where the forest areas represent 40% and 41% respectively, occupying almost half of the total area of each respective municipality. The degraded areas represent 18% and 14% respectively, being spread out in the surroundings of pastures and at the border with forests.

In a general view, at the center-southern portion of the municipality of Marabá, in most of the São João do Araguaia municipality and at the northern portion of the municipality of Brejo Grande do Araguaia, the large scale degraded areas are spread out. The total area of the degraded areas found in these 3 municipalities is of 2,976 km^2 (14.9% of total area of these municipalities), and this is larger than the total area of any of the 4 municipalities, except Marabá (Fig. S-1).

(2) Transition of Degraded Areas Along the Time

Observing the transition in the 4 periods, we can observe the transformation of forest areas into degraded areas or cultivation or pasture areas. The degraded areas increased approximately 1,300 km^2 in 14 years between 1986 and 2000, recording an increase of approximately 1,000 km^2 in 6 years between 1986 and 1992. On the other hand, the cultivation and pasture areas also increased 2,700 km^2 in 14 years between 1986 and 2000,

recording an expressive expansion of approximately 1,500 km^2 in 6 years between 1992 and 1998.

The municipality of Marabá has the higher proportion of forest areas. Observing its transition in the 4 periods, the forest areas at the eastern portion of the municipality were transformed into degraded areas, with a tendency of degraded areas progress to the west. However, the extension of these areas are varying considerably each year, and the babaçu areas increased more than 100 km^2 in the two periods from 1986 to 1992, and from 1992 to 1998. On the other hand, the natural forests deforestation reached 2,400 km^2 in 14 years. In the municipality of São João do Araguaia, the degraded areas are increasing while the forest areas are diminishing. It is specially remarkable the expansion of babaçu palm trees areas, representing more than 94% of the degraded areas in 2000. The degraded areas are mainly concentrated along the federal road, with a tendency of spreading out at each year.

The conditions in the municipalities of São Domingos do Araguaia and Palestina do Pará is characterized by the expansion of agricultural cultivation and pasture areas. The degraded areas, including babaçu palm trees areas, did not present a significant difference during the 4 periods. In the municipality of Brejo Grande do Araguaia, there is an accentuated deforestation and the degraded areas are expanding, and from 1998 on most of it was dominated by babaçu. A tendency of gradual expansion of degraded areas of agricultural cultivation and of pastures can be observed along the main federal roads.

Chapter 5 Present Conditions of Agrosilvipastoral Activities

5.1 Agriculture in the Study Area

In the micro region of Marabá, basic products such as rice, cassava, feijão beans and maize are being largely produced through the slash-and-burn system. In parallel to this basic agriculture, the cultivation in small areas of products such as fruit trees and products that can be industrialized such as banana, pineapple, orange, mango, coffee, watermelon, avocado, cacao, coconut and black pepper is also being carried out. In the period 1993-1998, the production of feijão beans was relatively stable while there was a strong increase in the production of rice and maize in 1994, and cassava in 1995.

5.2 Animal Husbandry Activities in the Study Area

The bovine creation in the Study Area has been the most popular sector of the cattle breading. The main activity is the bovine recreation, where the small scale producers also produces milk, when the large scale producers realized the fattening. Among the bovines in the Study Area, the Nelore and Zebu species prevail for meat production. They have resistance to high temperatures and are not exigent in food. In the case of dairy bovine, there is a race of Gir of the Zebu genus and hybrid Girolanda (Gir x Holandesa). The micro region has actually about 380 thousand heads of bovine, and half is located in Marabá municipality. The large scale producers can not be compared to the small ones in term of creation control, once they have well structured installations and use professional and experienced labour. They can be compared to the cattle breading management realized in temperate zones.

The pastures of Braquiarão (*Brachiaria brizantha*) and Quicuio-da-amazônia (*Brachiaria*

humidicola) are the most used. When the objective is the fattening, the Capim Colonião is also partially used. The pasture monoculture is generally used in the Study Area, having few cases of consortium pastures. Considering the fact that the medium pasture area in small and medium properties is 50 ha, the support capacity is estimated in 0.88 heads/ha. On the other hand, in a well managed large property, although there are no detailed data, can be estimated in an occupation rate of 1.5 to 2.0 heads/ha that seems to be near the reality of the region pasture.

5.3 Silviculture in the Study Area

According to the Forestry Inventory of the Wood Potential Preliminary Evaluation of the Municipality of Marabá, the total volume of wood with diameter larger than 45 cm at the chest height is of 122.13 m^3/ha and the number of trees is of 28.27/ha in the dense forest. On the other hand, the Forestry Management Project, started in 1998 in the Municipality of Marabá, shows the fact that the removal of wood is occurring with ipê, jatobá, cedar, angelim, tatajuba, in the order of the extracted wood volume.

In the Study Area, COSIPAR, a company producing pig iron, is carrying out the large scale industrial reforestation with eucalyptus with the use of cloning technology. The wood production (for the production of firewood and for processing) in the Study Area, with the predominance of the municipality of Marabá in 60%, tends to be reduced. In the municipality of Marabá, wood logs, firewood, vegetal charcoal and castanha-do-brasil are being extracted from the natural forests. The extraction of castanha-do-brasil presents a decreasing tendency.

5.4 Present Conditions of the Rural Producers

The rural producers in the Study Area can be classified into 3 groups according to the land ownership: (i) large-scale producers who utilizes the large-scale farm for the re-breeding and fattening of the bovine cattle; (ii) small-scale producers carrying out familiar agriculture through the slash-and-burn cultivation system, and also a small-scale animal husbandry; and (iii) medium-scale producer who expanded his cultivation area with a tendency in concentrating in animal husbandry activities.

The small-scale producers have as main activities of the production of rice, cassava, and maize through the slash-and-burn system, besides the animal husbandry through the extensive system, with slight variations depending on the period of permanence in settlements. In the cultivation areas prepared with fire, the yield drops after 2 to 3 years of utilization. Then the areas are abandoned for recuperation through the natural succession. When these areas are considered recuperated, they are again utilized through the slash-and-burn system. In the Study Area, the tendency of introducing extensive animal husbandry by planting pasture after fire, besides the use for cultivation was observed despite de small size of the properties.

The producers with areas from 100 to 1,000 ha are classified as medium-scale producers. The main activity of these producers is the animal husbandry. While the producers with areas from 100 to 200 ha carry out multiple agricultural activities, still maintaining the familiar agriculture, the others with larger areas tend to concentrate in animal husbandry, oriented to the expansion of pastures. The producers with more than 1,000 ha are considered as large-scale producers. For this Study, the large-scale producers were classified into 3 groups according to their activities: (i) meat cattle husbandry, encompassing breeding and

re-breeding; (ii) meat cattle husbandry, specialized in fattening; and (iii) meat cattle husbandry, specialized in genetic improvement.

Chapter 6 Conditions of Processing and Marketing of Agrosilvipastoral Products

6.1 General Characteristics

In the Study Area, the major agrosilvipastoral products are produced through family agriculture, animal husbandry farming and wood extraction activities. The family agriculture is carried out basically by the farmers who live on subsistence agriculture and extravitism activities, where the surplus is normally sold to the local market. However, the middlemen are mostly benefited due to the trade of this surplus. These traders live in the area for a long time and, in general, they own their transport with which they visit the rural producers collecting the surplus of their production. The relationship of market of the family agriculture in the micro region of Marabá is marked by an intense process of intermediaries, which cause the lowering of the prices paid to the rural producers, where as there is a high price for the same products in the consumer market.

6.2 Conditions of Wood Extraction Sector

The wood extraction in the micro region is carried out mainly in the Municipality of Marabá and São Domingos of Araguaia. In spite of the increase of demand in the national and international market, the wood extraction is decreasing in the municipalities, because of the shortage due to the estrangement of the production sources (forests) provoked by the intense extraction in the area. Due to this reason, an effort of the wood extraction industries for the implementation of reforestation projects is observed in the micro region, and there is a more rigorous control in the direct and indirect exploration of the existing reservations. The derived products of the forest exploration are: woods in log, sawed, coal, firewood and furniture. However, a great part of the high valued wood production is not concentrated in the micro region.

6.3 Agroindustrial Activity

When the improvement and the commercialization of the primary products originating from of the family agriculture is not done by the middlemen, it is carried out by cooperatives or associations of small rural producers. Family units were observed processing their own products; however in this case these units sell their products to acquaintance, pedestrians and middlemen who visit their properties. In these cases, there is a direct improvement in the family income and the life of the producer, however they are still quite isolated cases in the study area.

In general, the technological level of agriculture in the Study Area is low and there is a high ration of farmers involved in family agriculture with subsistence farming. The main crops cultivated are: rice; corn; cassava; beans and banana. There is a lack of physical structure that is needed for the concentration and organization of production for the market globalization.

6.4 Conditions of Products of Animal Husbandry

The main products processed in the Marabá micro region are the frozen products derived of pulp of fruits and milk produced by the family agriculture. The processing and the marketing are carried out through small agribusinesses of the private initiatives, the municipalities and the cooperatives. The main product of commercialization in the region is the pulp of the cupuaçu. Although there is a certain concentration of the product in the micro region, the volume is not sufficient enough to meet the demand due to unsteady production. Dairy products are sold through the dairy products processing factory in the region. While a part of the processed products is marketed in cities of the Northeast eastern, there are also informal trades directly from the producer to the consumer.

As for the animal husbandry, the main product is the beef cattle, which is sold to the areas closer to Belém (Castanhal), Araguatins of the State of Tocantins and the cities of the Northeast region. The Marabá micro region doesn't enjoy the benefit derived from the verticalization of the processing and marketing of the bovine meat.

Chapter 7 Main Policies and Plans for Recuperation of Degraded Areas

7.1 Environmental Policy of Pará State

The correct use and effective protection of the State natural resources were reinforced with the regulation and approval of specific laws for the sector. In 1995, the Pará State Environmental Law (Law no. 5887) that disposes about the state environmental policy was sanctioned. This law is a reinforcement of the existing federal laws, taking into consideration the specific characteristics of the State natural resources, and with the objective of protecting the Pará State forests, thus avoiding the disappearance of extinction threatened species.

7.2 Plans Related to Recuperation of Degraded Areas

(1) Forestry Complex - PROECO Program of Ecological Compensation for the Use of Forest and Altered Areas in Pará State

This program is planed to be implemented in 68 municipalities of Pará State, with a total area of 727,606 km^2, with the aim of reducing the pressure for the occupation of new areas of native forests in regions not much utilized, in special those regions supplied with social infrastructure, improving their productivity and economy. The program basically proposes 2 alternatives: the introduction of the agroforestry system and reforestation in degraded areas whose owners are large- and small-scale producers; and the implementation of sustainable forestry management by companies and rural communities. The applied methodologies are as follows: 1) reforestation of 50,000 ha/year (20,000 ha of annually implemented reforestation with dendê; 20,000 ha of annually implemented reforestation in forestry consortiums for the production of wood; 5,000 ha of reforestation implemented for firewood; and 5,000 ha of agroforestry systems implemented with forest species; and 2) implementation of forestry management in 10,000 ha/year of native forest; and the re-composition of exploited forest in the rate of 10,000 ha/year.

The program also stimulates the entrepreneurial reforestation in degraded areas, with wooden native and exotic species of which there are already technological knowledge and successful concrete experience, and with species which are fundamental for the regional economy. Besides this, the program shall foster the agroforestry system in consortium with forest species and agricultural crops for small- and medium-scale producers. The institutional framework for the Program implementation includes the participation of SECPRO (Secretariat of Production), SECTAM, EMATER, Bank of Pará State, EMBRAPA, FCAP, BASA, among others.

(2) Pará State Development Plan

The Pluriannual Plan 2000/2003 (PPA) of the State Government has the following guidelines: a. Develop without destroying, b. Construct the social peace, c. Reduce the regional inequalities. The strategic macro objectives proposed by the State Government for four year are as follows: a. Reform and modernize the State, b. Improve the life quality, c. Expand and diversify the productive basis.

The concept of this strategic objective encompasses actions in the economic ambit aiming at:
(i) Impeding the progress of the productive frontier in order to raise the soil utilization rate;
(ii) Stimulating the formation of productive chains through the production verticalization; and
(iii) Developing and diffusing alternative technologies for the rational exploitation of natural resources, promoting the modernization of productive technologies.

7.3 State Organizations

(1) SECTAM – Executive Secretariat of Science, Technology and Environment

SECTAM is the State organization responsible for the coordination, execution and control of activities related to the scientific and technologic development and to the protection and conservation of the environment in Pará. It was created in May of 1988 by the Law no. 5457. However, SECTAM started to have a defined organization chart and to actually operate only in July of 1993. The upper management of SECTAM is carried out by two directorships: the Directorship of Science and Technology, and the Directorship of Environment. Several Coordination offices performing activities in the fields of Technical-Scientific Studies, Diffusion of Technologies, Support and Fostering of Productive Sectors, Licensing and Inspection, Environmental Protection and Projects Evaluation are subjected to these two Directorships. Among the SECTAM attributions, there is an incentive to the use of appropriate technologies for the sustainable development, associating the preservation of natural resources to the improvement of quality of life of the people.

(2) SAGRI – State Secretariat of Agriculture

SAGRI, as a State organization, coordinates the Pará State agricultural sector, with the objective of promoting the effective development of political leadership, of the socioeconomic aspect, and of the regional productivity, according to the federal and State policies. The main activities of this Secretariat are as follows: solution of the agricultural sector problems; improvement of the State methodology utilized in the agricultural development; the fostering of production, commercialization and supply of agricultural products, taking into consideration the problem of natural resources reduction; and the

implementation of the administration system of agricultural activities in the State. Therefore, SAGRI is not the competent organization for the recuperation of degraded areas, although has the function of controlling the appearance of degraded areas from the view point of the agricultural activities.

(3) EMATER - Pará – Technical Assistance and Rural Extension Company

EMATER is the official organization of Technical Assistance and Rural Extension, rendering specialized services in the fields of agrarian and human sciences, spreading technological knowledge and information in the rural area of Pará State. Founded with the name of ACAR – Pará, in December 3, 1965, by determination of the State Government and through the joint efforts of the Secretariat of Production, the Brazilian Association of Credit and Rural Assistance, Bank of Amazon – BASA, Superintendency of the Amazon Economic Valorization Plan – SPVEA, Bank of Pará, Agronomy School of Amazon and Federal Authority of Agriculture, became through the Decree no. 9.958, of December 29 of 1976, the Pará State Technical Assistance and Rural Extension Company – EMATER-PARÁ, public company of private rights, connected to the State Secretariat of Agriculture.

(4) ITERPA – Land Institute of Pará

ITERPA was created in 1975 with the goal of coordinating the issues related to the land in the implementation of the Pará State agricultural policy. Its main activities are as follows: the definition of municipal boundaries, the demarkation of limits between the private properties and public areas, the solution of disputes for land caused by the illegal occupation, and the promotion of re-utilization of abandoned areas.

Chapter 8 Problems, Limiting Factors and Potentials for Recuperation of Degraded Areas

8.1 Condições da Recuperação de Áreas Degradadas

(1) Necessity of Recuperating Degraded Areas

The Plan for Recuperation of Degraded Areas shall be elaborated in such a manner that the recuperation models can be applied practically for each type of degraded areas, taking into consideration the region’s traditional familiar technologies and the new imported technologies. It is also important to analyse the activities and organization of the concerned organizations and the possible sources of financial resources necessary for the execution of the degraded areas recuperation. The elaboration of the Plan for the Recuperation of Degraded Areas shall allow the improvement of residents lives quality through the improvement of their income and through the generation of job opportunities, as well as through the land use in a sustainable manner, and consequently avoiding the deforestation and improving the forest functions, thus contributing to the Amazon region natural forests preservation and to the stability of the global environment.

(2) Characteristics of Distribution of Degraded Areas

According to the satellite images analysis (as of 2000) and the field surveys, the distribution

of degraded areas in the Study Area was identified as follows.

Distribution of Degraded Areas (km^2)

Degraded Areas / Municipality	Marabá	São João do Araguaia	São Domingos do Araguaia	Brejo Grande do Araguaia	Palestina do Pará	Micro region of Marabá
Juquira	196	7	35	22	29	289
Capoeira	505	11	50	15	23	604
Capoeirão	806	21	102	28	42	999
Babaçu area	382	640	64	343	50	1,479
Barren land	0	0	0	0	0	0
Total	1,889 (12.5%)	679 (53.7%)	251 (17.9%)	408 (35.3%)	144 (14.3%)	3,371 (16.9%)
Total Area	15,105	1,265	1,400	1,156	1,008	19,933

In the Study Area, the degraded areas represent approximately 17% of the total. The juquira and capoeira areas occupy around 1 to 4% of the total area of each municipality. The capoeirão represents approximately 7% in the municipality of São Domingos do Araguaia, while in the other 4 municipalities it represents 2 to 5%. Babaçu is present in a higher proportion in the municipalities of São João do Araguaia and Brejo Grande do Araguaia, specially occupying more than half of the total area of São João do Araguaia. The bare land is almost inexistent, except for the sand beaches along the rivers.

(3) Basic Guidelines of Recuperation of the Degraded Areas

The recuperation of degraded areas shall promote the stability of the productive system and the permanence of producers, with the land use being carried out in an economic and environmentally sustainable manner. This shall contribute for the pressure exert by the deforestation and forest fires on the remaining natural forests. The recuperation of degraded areas can be accomplished through the introduction of the agrosilvipastoral system, i.e. the inter-cropping among agriculture, animal husbandry and silviculture, replacing the traditional monoculture system of agriculture and animal husbandry. The inter-cropping system is more efficient for the tropical rain forest region ecology than the monoculture. The animal husbandry, however, can not be eliminated considering that represents an attractive (easy and safe) activity to the small-scale farmers.

8.2 Problems and Limiting Factors in the Recuperation of Degraded Areas

Natural Conditions	a. Due to uneven relief, agriculture is restricted to the traditional method in most of the areas. b. The soils have a low fertility, and a careful fertilization is necessary to accomplish the soil improvement for the agricultural production. c. The area presents a water deficiency and the use of irrigation is necessary for agriculture in the dry period
Socioeconomic Conditions	a. Very complex land ownership conditions, which make it difficult for the planning. b. Inexistence of appropriate studies of development strategies using the zoning. c. Deficiencies in the social infrastructure, inadequate education and health conditions d. Difficulties for the small rural producers to access to the agricultural

	credit e. Low quality of the products and high transportation cost.
Production Aspects Agriculture	a. Precariousness of the production infrastructure b. Deficiency on the technological knowledge about agricultural production c. Difficult to create an organization among the settlers
Animal Husbandry	a. The pressure of the exploitation of the forest areas is increasing. b. Deterioration of the pasture due to the over use and the use of the fire c. Instability in the land ownership due to the intense pressure of the occupation of land areas.
Silviculture	a. Lack of forest management due to inexistence of appropriate organizations b. The technical aspects of the tropical forestry is not structured c. Lack of conscience of the population regarding the environmental matters and the maintainable administration of the forestry.
Institutional Aspects	a. The cooperation within the related organizations are not sufficient enough to accomplish the programmed goals. b. There is no effective system of technology diffusion to the rural producers. c. Most of the small farmers who need the technical support are not assisted appropriately.
Executive Aspects	a. The responsible public agencies do not have the conditions to execute their responsibility, due to personnel's inadequacy and insufficient financial resources.

8.3 Potentials for the Recuperation of Degraded Areas

The degraded areas typified as Juquira, Capoeira and Capoeirão, when abandoned, start the process of vegetal recuperation through the formation of the secondary vegetation. To economically recuperate these areas, the promotion of productive activities in the agrosilvipastoral system is necessary. Forestry production and fruits cultivation through the combination of reforestation, agroforestry and silvopastoral activities, as well as through the reform of pastures, aim at the recuperation of degraded areas.

As concrete measures we can mention the following: the cultivation of forest species with commercial value (fruit species, species to be used as roughage, shadowing trees) in the degraded pastures / juquira; the improvement of pastures management including the silvopastoral system; the reforestation with fast growth forest species; the reforestation in the intercropped heterogeneous system; and the reforestation in the homogeneous and uniform system with exotic species. We can also mention: the inter-cropping cultivation of fruit species through the utilization of the biomass potential in the capoeira and capoeirão areas; the reforestation and enrichment with forest species with commercial value, among others (Fig. S-2). It is worthy to mention that the babaçu areas will be treated and classified as Juquira, Capoeira and Capoeirão due to their peculiarity as degraded areas in the Study Area. On the other hand, the capoeira and the capoeirão will be, in general, treated jointly due to their similarity in terms of recuperation measures, except special cases.

(1) Potentials for Recuperation through the Agricultural Development

In the Study Area, the main activities are the agricultural cultivation through the

slash-and-burn system and the animal husbandry. In order to promote a more sustainable land use, the agriculture carried out utilizing forest species, i.e., the agroforestry system is efficient since allows the generation of economic value in the form of wood, wood for the production of firewood and charcoal, fruits, roughage, products that can be industrialized, also through the introduction of fruit species. As ecological effects, we can mention the soil improvement and fertilization, the mitigation of the microclimate, the reduction of erosion, the improvement of the soil water holding capacity, as well as the shadowing of animals and agricultural products, among others. The inter-cropping cultivation of various forest and fruit species controls the attack of diseases and pests possible through the homogeneous cultivation, offering a diversification of agricultural products and thus the stabilization of income.

(2) Potentials for the Recuperation of Degraded Areas through Animal Husbandry

The methodology proposed for the recuperation of degraded pastures is the mechanized plowing, the application of manure and the re-planting of pastures (Veiga, 1995). However, in case of the degradation of large pasture areas utilized through the extensive system, such as in the Study Area, the reform of pastures is economically difficult. However, the silvopastoral system, with the introduction of forest species in the animal husbandry activity, induces the increase of the soil organic matter through the forest species planted in the pastures, raises the nutrition level of the soil utilized by the trees roots system and offers shadow to the animals, as well as contributes for the mitigation of the microclimate and for the reduction of the attack of diseases and pests.

(3) Potentials of Recuperation through the Development of Silviculture

The degraded areas include several forest species from bushes to big trees that usually do not produce any economic value in the form of wood or fruits. As an alternative to economically recuperate these degraded areas, the development of silviculture through the selective use of high economic value native and exotic forest species is possible.

8.4 Feasibility of Applicable Technologies

(1) Selection of Species for the Agroforestry System

Annual products, short cycle perennial products and intercropped arboreous forest species shall be planted, creating a multiple layers structure. The products adopted in the Study Area are presented in the following table according to their heights.

Classification of Agricultural Products, Fruit and Forest Species according to their Height

1st Layer	Annual crops with maximum height of 1 meter	Feijão beans, Pineapple, Rice, etc.
2nd Layer	Annual crops with an approximate height of 1 meter	Cassava, Maize, etc.
3rd Layer	Short cycle perennial fruit species with maximum height of 2 to 3 meters	Banana, Papaya, Passion Fruit, etc.
4th Layer	Perennial fruit species with maximum height of 6 meters	Cupuaçu, Orange, Acerola, etc.
5th Layer	Palm trees	Açaí, Pupunha, Coconut, etc.
6th Layer	Fruit and Arboreous Species	Castanha-do-Brasil, Mahogany, Paricá, etc.

Source: Sistema Agroflorestal. 2000. P. S. Miranda.

Cupuaçu is a native species in the Study Area, being a perennial fruit species with good

commercialization and production conditions. The cupuaçu cultivation is increasing in the last few years. The inter-cropping cultivation, being the cupuaçu the main species, presents a high application feasibility. In this case, the annual crops and the short cycle perennial fruit species are removed after harvest, finally remaining the cupuaçu, other fruit species and the forest species.

(2) Introduction of Forest Species Utilized as Roughage

In the Amazon region animal husbandry, experiments with forest species that can be used as roughage are difficult to find. The utilization of this type of species complements the roughage with proteins and also assures the supply of food even during the dry season, thus contributing to the development of the intensive animal husbandry and to the production sustainability. The possible leguminous species for this purpose are hereinafter listed.

Leguminous Species for Roughage in the Amazon Region

Popular Name	Scientific Name	Origin	Legumi-nous	Characteristics
Caliandra	*Caliandra calothyrsus*	Native	*	Good for roughage. Grows in capoeira.
Cassia	*Cassia siamea*	Exotic	*	Good for roughage despite the low contents of protein.
Gliricidia	*Gliricidia sepium*	Exotic	*	Largely used for living fence.
Guandu	*Cajanun cajan*	Exotic	*	Good for roughage. Largely used in Central America.
Leucenas	*Leucaena leucocephala*	Native Exotic	*	Originating at the Occidental Amazon. Does not grow in acidic soil.
Leucenas	*Leucaena hibridos**	Exotic	*	A variety of the *Leucaena Leucocephala,* adapted to acidic soil.
Erythrina	*Erythrina spp.*	Native Exotic	*	Mainly utilized for fertilization. The toxic species requires special care to be utilized as roughage.

Source: Manual Agroflorestal para Amazônia. Instituto Rede Brasileira Agroflorestal. (REBRAF) 1996.

(3) Selection of Forest Commercial Species

The commercial value forest species planted in the Amazon region until now include exotic species such as Eucalyptus, Pine tree, Caribaea, Gmelina, and recently Teak and African Mahogany. On the other hand, the native forest species are very assorted and more than 60 species are being utilized at the lumber-mills as commercial species. Taking into consideration the growth results and the access to commercial species seeds, the following 30 species shall be adopted for reforestation in the Study Area.

Selection of Species for Reforestation in the Study Area

	Characteristics	Species Name
Native Species	Group A (fast growth rate)	Paricá, Faveira, Morototó, Parapará, Cuaruba, Sumaúma, Ucuúba
	Group B (produces good quality wood)	Andiroba, Red Cedar, Freijó, Mahogany, Tachi Branco
	Group C (produces fruits besides good quality wood)	Bacuri, Castanha-do-Brasil, Copaíba, Piquiá
	Group D (produces wood for heavy structures)	Angelim Pedra, Jutaí-Açu, Maçaranduba
	Group E (produces good quality wood)	Cumaru, Ipê Amarelo, Ipê Roxo, Jacarandá-do-Pará, Muirapiranga, Sucupira, Tatajuba
Exotic Species	Good for homogeneous reforestation	Eucalyptus
	Produces good quality wood	African Mahogany, Teak
	Produces wood and fruits	Jack fruit Tree

8.5 Models for the Recuperation of Degraded Areas

The Study Area producers develop activities that vary in manner and scale. The measures to be adopted for the recuperation of degraded areas are thus also various. In order to concretize the sustainable land use, recuperating the degraded areas, the alternatives for an adaptable land use for each manner and scale of agricultural activity have to be analyzed. The applicable models for the recuperation of degraded areas in different activities are herein on listed.

a. Model 1: Inter-cropping Cultivation of Fruit Species using Irrigation (Cupuaçu x Passion Fruit) (From the 7th year on, the reforestation of shadowing forest species which are utilizable as roughage is carried out)
b. Model 2: Cultivation of Agricultural Products Inter-cropped with Fruit and Arboreous Forest Species (Rice, Maize, Feijão bean x Banana, Cupuaçu, Castanha-do-Brasil)
c. Model 3: Agricultural Products Inter-cropped with Trees Utilizable as Roughage (Rice, Maize, Feijão bean, Pineapple x Cupuaçu)
d. Model 4: Silvopastoral System Inter-cropped with Coconut, etc. (Coconut, Neem, Trees Utilizable as Roughage x Braquiária)
e. Model 5: Reform of Pastures using Babaçu, etc. (Babaçu, Trees Utilizable as Roughage x Braquiária)
f. Model 6: Reforestation using Fast Growth Species (Reforestation with Parika)
g. Model 7: Heterogeneous Inter-cropped Reforestation (Several Manners of Strip Planting)
h. Model 8: Heterogeneous Reforestation in the Taunya System
i. Model 9: Heterogeneous Intercropped Reforestation using Rubber Tree
j. Model 10: Uniform and Homogeneous Reforestation using Exotic Species (Reforestation using Eucalyptus)

The general table of the degraded areas recuperation models, the target producers, and the type of degraded areas is presented as follows.

Models of Degraded Areas Recuperation and the Target Public

Model	Measures for Recuperation	Producer Scale			Type of Degraded Area			
		S	M	L	Juquira	Capoeira	Capoeirão	Babaçuzal
1	Cultivation of Inter-cropped Fruit Species with Irrigation	○	◎		◎	○		
2	Cultivation of Agricultural Products Inter-cropped with Fruit and Forest Species	○	◎		◎	○		△
3	Cultivation of Agricultural Products Inter-cropped with Forest Species Utilizable as Roughage	◎	◎			◎	◎	○
4	Silvopastoral System Inter-cropped with Coconut, etc.	○	◎	◎	◎			
5	Silvopastoral System Utilizing Babaçu, etc.	◎	◎	○		○	○	◎
6	Reforestation using Fast Growth Species and of the Silvopastoral System	○	○	○	◎	○		
7	Heterogeneous Inter-cropped Reforestation and of the Silvopastoral System	○	○	◎	◎	◎	○	△
8	Heterogeneous Reforestation of the Taunya and Silvopastoral Systems		○	◎	◎	◎	○	○
9	Heterogeneous Inter-cropped Reforestation using Rubber Tree	◎			○	○		
10	Homogeneous and Uniformed Reforestation using Exotic Species			○	○	○		

Remark: ◎ very much applicable, ○ very applicable, △ applicable

Chapter 9 Master Plan for Recuperation of Degraded Areas

9.1 Objectives of the Master Plan

The Master Plan for the Recuperation of Degraded Areas aims at harmonizing the economic activities and the environment of the Marabá micro region located in the Amazon region, through the sustainable land use, aiming at the recuperation of Degraded Areas.

9.2 Targets of the Master Plan

(1) Duration of the Master Plan

The duration of the Master Plan is established in 30 years, from 2002 to 2031, taking into consideration the following periods: (i) 25 years established as the target for the execution of the PROECO - Program of Ecological Compensation for the use of Forest and Altered Areas in the State of Pará, which occupies the position of the Master Plan superior plan; and (ii) the necessary time for the reforestation, agroforestry and agrosilvipastoral projects that are the main components of the Master Plan.

(2) Execution Targets

In the Study Area of the Master plan, with a total area of approximately 20,000 km^2 (2 millions of hectares), there are 340,000 ha of degraded areas, corresponding to 17% of the

total area (these figures are based on the results of the 2000 satellite images analysis). Taking into consideration of the targets established in the PROECO, the Master Plan defines approximately 3,500 ha per year (0.175% of the total Study Area) as the object area of the Recuperation Plan. If 10 years are established as the implementation period of projects directly oriented to the degraded areas, approximately 10% of the total existing degraded area in the Study Area, i.e. 35,000 ha will be recuperated.

9.3 Strategies to Attain the Master Plan Objectives

(1) Method for Attaining the Targets

The annual target of recuperation established in the Master Plan, i.e. approximately 3,500 ha per year, shall be attained through the combination of recuperation models based on applicable technologies of degraded areas' recuperation. Area units and number of projects to be annually executed, according to the technologies applicable to the manner and to the scale of each producer, are defined as follows.

Annual Plan of Execution of Degraded Areas Recuperation Models

Scale of Producer	Applied Technology	Number of Models	Unit Area (ha)	Number of Projects	Total Area (ha)
Application of Agroforestry Technology					
Large-scale Producers	Silvopastoral system intercropped with coconut plantation, etc.	4	25	2	50
Medium-scale Producers	Intercropped cultivation of Fruit species with Irrigation	1	1	50	50
	Intercropped cultivation of common crops with Fruit and Forest Species	2	1	50	50
	Silvopastoral system intercropped with coconut plantation, etc.	4	3	20	60
	Reform of Pastures utilizing Babaçu, etc.	5	5	20	100
Small-scale Producers	Intercropped cultivation of Fruit species with Irrigation	1	1	50	50
	Cultivation of Agricultural Products intercropped with Fruit and Forest Species	2	1	200	200
	Cultivation of Agricultural Products intercropped with Forest Species which can be used as fodder	3	1	100	100
	Reform of Pastures utilizing Babaçu, etc.	5	5	68	340
Sub-total				560	1,000
Application of Reforestation Technologies					
Large-scale Producers	Reforestation using Fast Growth species	6	20	5	100
	Heterogeneous Reforestation and Silvopastoral System	7	20	5	100
	Intercropped Reforestation of the Taunya and Silvopastoral System	8	50	4	200
	Homogeneous Reforestation using Exotic Species	10	300	3	900

Scale of Producer	Applied Technology	Number of Models	Unit Area (ha)	Number of Projects	Total Area (ha)
Medium-scale Producers	Reforestation using Fast Growth species	6	1	10	10
	Heterogeneous Reforestation and Silvopastoral System	7	2	20	40
	Intercropped Reforestation of the Taunya and Silvopastoral System	8	50	2	100
Small-scale Producers	Reforestation using Fast Growth species	6	1	240	240
	Heterogeneous Reforestation and Silvopastoral System	7	2	300	600
	Heterogeneous Reforestation intercropped with Rubber trees	9	1	210	210
Sub-total				799	2,500
Total				1359	3,500

(2) Components of the Master Plan

The central components of the Master Plan shall be the projects that have the degraded areas as the direct objective of their actions. Preparatory actions for the execution of central projects and assistance activities for their execution shall also be planed. Furthermore, the activities to aggregate value to the products generated at the central projects are also very important. The Master Plan components shall be formed in such a way to offer the higher multiple effect, being closely interrelated in terms of input and output (Fig. S-3).

9.4 Contents of the Master Plan

(1) Position of Master Plan

The appropriate areas for the implementation of programs and projects were selected according to the Study Area zoning, and are distributed as shown in the Map of Plans for the Recuperation of Degraded Areas (Fig. S-4).

(2) Position of Programs and Projects

The programs and projects composing the Master Plan are divided into 2 groups, i.e. policy and supporting programs which main executing agency shall be the Pará State Government, and the entrepreneurial projects which main executing agency shall be the producers (farmers) and/or their groups. Apart from this, the 3 entrepreneurial projects which will directly contribute for the recuperation of degraded areas are regarded as the Central Projects of the Master Plan.

Position of the Suggested Programs / Projects

Policy and Supporting Programs	Entrepreneurial Projects
a. Project to Study the Designation of Conservation Units in the Basins of Araguaia and Tocantins Rivers b. Project to Study the Natural Resources and Socioeconomic Conditions for the Conservation of Basin at the Northwest of Itacaiúnas River c. Program for Institutional Support to Environmental Organizations of the State and Municipalities d. Project of Land Ownership Survey, Registration and Mapping e. Environmental Education and Technical Training Program	Central Projects f. Project of Collection of Seeds and Production of Seedlings of Forest and Fruit Trees h. Project of Reforestation and Enrichment with Native and Exotic Species i. Project of Development and Improvement of Family Agriculture through Agrosilvipastoral Activities g. Project of Utilization of Organic Manure made of Sawdust, Manure and Bark of Trees j. Project of Agroindustrial Development

The Master Plan core is constituted by the Central Projects oriented directly to the recuperation of degraded areas through reforestation and planting, aiming at the prevention of additional deforestation, and consequently attaining the effect of recuperation of degraded areas productivity, aggregating economic value to them.

(3) Cost Estimation of Projects Execution

The execution costs of programs and projects, components of the Master Plan, were calculated as presented as follows. The total value of the initial investment shall be approximately R$ 86 millions, and the total operational cost shall be approximately R$ 12 millions/year.

Execution Cost of Programs and Projects

Program / Project	Initial Investment (R$)	Investment Period	Annual Operational Cost (R$)	Operation Period	Source of Resources
Project to Study the Designation of Conservation Units in the Basins of Araguaia and Tocantins Rivers	2,100,000	3 years	-	-	SECTAM
Project to Study the Natural Resources and Socioeconomic Conditions for the Conservation of Basin at the Northwest of Itacaiúnas River	2,050,000	3 years	-	-	SECTAM
Program for Institutional Support to Environmental Organizations of the State and Municipalities	5,106,000	5 years	1,153,000	5 years	SECTAM
Project of Land Ownership Survey, Registration and Mapping	5,100,000	2 years	300,000	5 years	ITERPA

Program / Project	Initial Investment (R$)	Investment Period	Annual Operational Cost (R$)	Operation Period	Source of Resources
Environmental Education and Technical Training Program	5,754,000	10 years	293,000	10 years	SECTAM
Project of Collection of Seeds and Production of Seedlings of Forest and Fruit Trees	1,846,000	2 years	750,000	10years	SAGRI / Project Benefit
Project of Utilization of Organic Manure made of Sawdust, Manure and Bark of Trees	1,811,000	2 years	228,000	15 years	SAGRI / Project Benefit
Project of Development and Improvement of Family Agriculture through Agrosilvipastoral Activities	19,545,000	10 years	1,592,000	19 years	Project Benefit
Project of Reforestation and Enrichment with Native and Exotic Species	37,043,000	10 years	3,031,000	34 years	Project Benefit
Project of Agroindustrial Development	5,836,000	2 years	4,659,000	23 years	Project Benefit
Total	86,191,000		12,006,000		

9.5 Execution Plans of Programs and Projects

The Master Plan for the Recuperation of Degraded Areas encompasses 10 components, which shall be implemented in a 30 years period, from 2002 to 2031. The Master Plan is a long-term one, and its components, programs and projects, shall be implemented systematically according to their objectives, importance and need to be implemented urgently.

The programs and projects shall be executed in 3 stages, as short-, medium- and long-terms plans, according to the period and duration of execution of each program / project. The first 5 years are considered as the preparatory period for the execution of the Central Projects of the Master Plan. During this period, the supporting system and the necessary human resources shall be developed for the implementation of the reforestation and agroforestry and silvopastoral projects. After this preparatory period, the Central Projects directly oriented towards the degraded areas shall be executed as medium-term plans. Finally, the long-term plans aiming at the increase of aggregated value shall be implemented. The execution period of Programs and Projects are shown in Fig. S - 5.

9.6 Execution Structure of the Master Plan

(1) Execution Method

The first approach projects execution shall be carried out at short- and medium-terms, preferably adopting the foreign technical cooperation and the partnership system among the federal, State and municipal organization that act in the coverage area of the Master Plan (Study Area). The other programs/projects can be implemented at long-term, mainly through the supply of credit to the small- and medium-scale rural producers, credit to be managed by a Committee for the Recuperation of Degraded Areas and operated by a Gurantee Fund of the State bank. In this stage, the participation of non governmental organizations, Syndicates of Rural Workers, Producers' Associations and Environment Protection Organizations is

extremely important since they can access credit and technical assistance in the implementation of the Programs/Projects implementation. The implementation and results of the Master Plan are directly related to the active participation of SECTAM and of the State Government as for the procurement of resources and the establishment of a structure so that the actions can be carried out in a synergic manner.

(2) Executing Organizations

The Master plan will be executed by the government of the state of Pará, through SECTAM. The execution of programs and projects, components of the Master Plan, shall be carried out with the participation and technical and economic support from the public organizations as well as local social actors, who are indispensable for their execution. The required structure encompasses the establishment of a Committee composed by technical staff of the main organizations involved with the Recuperation of Degraded Areas. This Committee shall be responsible for the described activities, according to the tendencies of the national and international financing markets. On the other hand, reforestation projects and the project of family agriculture and agroindustry project will be executed by the local population and the communities. When the international resources are used, the service rendered by consultants will be included in the execution system. SECTAM will participate as the main executive organization of programs/projects, to structure the execution system, to control and to coordinate the several organization and agencies, necessary to promote the actions. The system of execution of the Master plan is shown in Fig. S-6.

9.7 Procurement of Financial Resources of the Project

(1) Procurement of Financial resources

There are two main financial systems, which can be used for the implementation of proposed Programs/Projects .The resources of these systems are FNO and PRONAF, which are executed through several Programs. At present, the Amazonian bank (BASA) provides finance for FNO and Bank of Brazil (BB) provide finance for PRONAF. Besides, Development Fund of Science and Technology is available for financing to research institutions and NGOs to promote researches related to the recuperation of degraded areas.

(2) International Financing

At the international level, there are financial sources, multilateral financial agents such as BID and BIRD; international programs of financial cooperation such as PPG-7 and bilateral financial institutions such as the Japanese Bank of International Cooperation (JBIC) and other external cooperation organizations. In case of bilateral financing, it can be requested by the State and to be made available directly through the bank of Government of Pará or BASA to be used in specific programs/projects. It is necessary to consider a possible loan framework of the state government to attain a national guarantee for receiving loan.

9.8 Evaluation of the Master plan

(1) Economic Analysis

The value of the initial investment, operation cost / maintenance and cost of renewal of equipments and total benefits are analyzed as cash flow. IRR of the Master Plan is 4.0% using an economic discount rate of 10%, and NPV is R$ -18,420,000 at prices of July 2001, and B/C is 0.8 with the same discount rate. The results of the economical analysis show that the IRR is lower than the capital opportunity cost, the NPV is negative, the B/C is smaller than 1, and therefore the project implementation is not viable economically. However, if it is considered that the benefits of 5 program/projects of government assistance is not measurable, the contribution for the priority plans and the effects on the environmental conservation, etc., it can be considered that the project implementation is appropriate. Besides, the economic analysis of the project costs and project benefits of only 5 enterprising projects shows that IRR is 11.1% with the economic discount rate of 10%, NPV is R$ 1,695,000 and B/C is 1.02 at the same discount rate. IRR is above the opportunity cost of the capital, with a positive NPV and a B/C of above 1. Therefore the execution of the Project is considered justified economically.

(2) Socio-economic Evaluation

As stated before, the Master Plan generate the secondary or indirect intangible benefits, which are important in reviewing the validity of the implementation of the Master Plan, besides the direct or tangible benefits. However, the execution of 5 programs of supporting policies does not generate quantitative benefits, and will contribute in the sense of providing of prerequisites to implement the enterprising projects which will generate quantitative benefits. While it is necessary to reach the goals of the Master plan, it is also important to implement similar plans in other areas due to greater consequent effects than can be generated.

(3) Comprehensive Evaluation

Through the implementation of the Master Plan it would be possible to predict that the living conditions of local people in and around the Study Area will be greatly improved, which comes from an increase in agricultural production, increase in employment opportunity, expansion of income through the recuperation of the degraded areas. The implementation of the Master Plan is highly expected to stabilize the inhabitants' living and welfare conditions in the Study Area, and to have a deep impact on production activities and to contribute to the national economy. As a result, it is estimated a reduction in the natural forest destruction.

So, the Master Plan is not feasible economically, if evaluated through the measurable benefits. But, the socio-economic impacts evaluated from intangible benefits are also considered to be significant. Moreover, the implementation of the Project is justified to be feasible from technical and organizational operational viewpoints. Accordingly, it is recommended that a high priority should be given to the Project for its implementation in the early stage.

Chapter 10 Implementation Plans for Programs and Projects

10.1 Importance of Programs / Projects

In this chapter, the implementation plans will be analyzed for each program/project, which shall be implemented based on the Implementation Plan of the Master Plan. The core of the Master Plan consists of 3 projects including “Collection of Seeds and Production of Seedlings”, “Reforestation and Enrichment” and “Development and Improvement of Family Agriculture”, which are the Central Projects that will directly contribute to the recuperation of degraded areas through reforestation and cultivation activities in these degraded areas. The Central Projects are implemented not only for achieving the main direct objectives of the Master Plan, but also for applying the recuperation plans of degraded areas to the other regions of Pará State, representing as the technological models for the recuperation of degraded areas. The executing organizations of the Central Projects will be mainly formed by the rural population, such as settled farmers, and small-scale and medium-scale producers. Therefore, these Projects have to be implemented in an appropriate manner in terms of generation of income and work opportunities, mitigation of poverty and regional development. Besides, the Central Projects will exert a great influence on the implementation of the Master Plan, due to their relatively large scale.

10.2 Project of Collection of Seeds and Production of Seedlings of Forest and Fruit Trees

(1) Target

Plantation area for 2 projects is totally 35,000ha, and is divided to 10,000ha in the Project of development and improvement of the family agriculture through activities agrosilvipastoris, and 25,000ha in the Project of reforestation and enrichment with native and exotic forest species. Average the number of seedlings varies with characterization of each adopted system, which is estimated as 220 seedlings in the former project each project, and 640 seedlings in the latter project. Thus, the total number seedling required in the first Project is 220,000 seedlings and 1,600,000 seedlings and in the Project of reforestation and enrichment with native and exotic forest species. And the total requirement will be 1,820,000. Considering the need to supply seedlings to the producers other than the referred 2 projects, the target of annual production is 2,500,000 seedlings. The duration of execution of this Project is 12 years including 2 years for the preparatory phase starting from 2005.

(2) Project Details

The main activities include setting up forest nursery with a total capacity of producing 2,500,000 seedlings annually and establishing a germ plasm bank to assure the supply of seeds of good quality, including spike seedlings. Besides, a system of collecting, handling, stocking distribution of high quality seeds should be established. For that purpose, germ plasm bank should be established, especially, of fruit and native forest species in 7 places adjacent to the 7 centers of forest nursery. In the main forest nursery center, the management research facilities and the seed storage house will be set up. The surplus of seedlings will be distributed to the farmers who don't participate in the referred 2 projects, for which the technical support will be accomplished by charging the farmers for the assistance.

(3) Project Area

In the initial stage of the Project, the collaboration of EMBRAPA and AIMEX is also necessary to assure the collection of seeds. For that purpose, the administration nucleus and research facilities will be built in Marabá to control the conservation and the storage of seeds and the production of seedlings. The forest nursery should also be set up in other 4 municipalities in dispersed places, considering the access to the areas of the implementation of the Project of development and improvement of the family agriculture and of the Project of reforestation and enrichment. Adjacent to the forest nurseries, germ plasm bank will be established. The maximum distance to transport seedlings of the forest nursery to the planting areas will be of 30 km. As to forest species of fast growth such as Eucalyptus, the seedlings will be produced partially in consignment in the existent forest nurseries of ASSIMAR and of COSIPAR that possess the latest technology.

(4) Project Schedule

The Project period is planned to be 12 years. Project schedule is divided into preparation phase and execution phase. Preparation phase includes land acquisition, soil preparation, nursery establishment, establishment of research and management facilities, acquisition of seeds, equipment and materials, and establishment of germ plasm bank. The execution phase includes nursery management, production and distribution of seedlings, and technical assistance for the project.

(5) Coordinating Organization, Executing Agencies and Related Organizations

The coordinating organization of the Project will be SAGRI, and SECTAM and EMATER should provide technical assistance for the project. EMBRAPA, AIMEX and FUNAI should participate as supporting organizations contributing to the handling of seeds of native forest species and the establishment of germ plasm stocks. Executing agencies in the municipality of Marabá will be composed of SEAGRI and FETAGRI and other agricultural cooperatives that control most of the existing settlements in the municipality. ASSIMAR and COSIPAR shall make available of their existing facilities and technologies, once they possess forest nurseries in a bigger scale. In the other 4 municipalities , Secretariat of Agriculture (and of Environment) of each municipality will participate as executing agencies.

(6) Costs and Benefits of the Project

The costs of the Project consist of initial investment of R$ 1,846,000 (in the period of 2 years) and annual costs of operation and maintenance of R$ 750,000 (in the period of 10 years). The average annual quantitative benefits is R$ 1,250,000 (R$ 0.7/seedlings x 250,000 seedlings/ year), and they will be obtained in 10 years period, starting from 6th year upto 15th year.

(7) Economic Analysis

Based on the cash flow analysis between project cost and project benefit, IRR of this project is 23.0%, and net present value is R$ 747,000 with a 10% discount rate as of July, 2001. Cost- benefit ratio is 1.19 with the 10% annual discount rate. As the results of economic analysis, it is found out that IRR of this project is higher than opportunity cost of capital with

a positive net present value and benefit cost ratio is higher than 1. Therefore the execution of the Project is considered justified economically. And, the project is highly justifiable economically even among the 3 central projects. Besides, this project should be executed so that it will be feasible to execute the other two central projects.

(8) Financial analysis

The financial analysis is for the purpose of evaluating the financial viability of the Project by identifying the proper rate of return, based on the benefits and costs derived from project implementation. The project shows an Internal Rate of Return (IRR = 24.1%) with generation of benefits after a short period (3 years), offering a considerable financial viability. Besides, as its average annual benefit (R$ 1,250,000) is higher than the annual O.M cost (R$ 750,000), the Project is considered viable in financial management. Since the initial investment is relatively low (R$ 1,850,000), the procurement of public finance for its implementation is considered to be feasible.

(9) Important Observations

The production of seedlings needs a high number of good quality seeds. To minimize the ecological risk, the selection of main trees to collect seeds and the conservation of seeds are important. Therefore it is indispensable to obtain the technical cooperation of EMBRAPA and AIMEX, which possess high experience in the area. In the Study Area, the experiences of the industrial reforestation of the metallurgical company and the production of seedlings should be incorporated and should settle down a system of mutual complementation through the interaction with such enterprises.

10.3 Project of Development and Improvement of Family Agriculture through Agrosilvipastoral Activities

(1) Metas

The implementation period is ten years from 2007, and considering a rate of 1,000/hear, a total of 10,000ha will be implemented to establish agroforestry systems in degraded areas of focusing mainly on small and medium scale farm lands. The plan for recuperation of degraded areas includes 690ha for small scale farms, 260ha for medium scale farms, and 50ha for large scale farms.

(2) Project Details

The forest and fruit species will be planted in the following space densities: 277 plants/ha for the planting of fruit trees with irrigation; 277 plants/ha for the planting of fruit trees tree plantations; 100/ha in fruits and fodder legume plantations; 100/ha silvopastoral systems using coco palms; 100/ha in pasture systems using babaçu palms. Agricultural crops, fruits, and pasture, etc. are introduced between the planting of the fruit trees and the forest species.

A compost stock house facility shall be installed to store the organic fertilizer of sawdust and trees bark in the farm of each producer. The deposit will have the maximum capacity of 10 tons and it should have the high roof for the best ventilation and the roof of anticorrosive, since the organic fertilizer contains microorganisms. The ground should be cemented to avoid

the leak of nutrients contained in the organic fertilizer. One unit (a tractor and a truck), is to set up every 20-30 families, and 20 units should be stationed at every year, and 200 unit arranged for 10 years. Extension lecture room has to attach to garage house of a tractor and a track, to be used for activity of technical extension. Apart from planting and harvesting periods, the tractor and the truck shall be rent out to neighborhood farmers in the other projects.

(3) Project Area

Most of the executing organizations will be formed by the small and medium producers, being 560 producers benefited annually. The planting of fruits with irrigation will be accomplished in 100 projects/1,000 ha in the dry areas in the southeastern region of the Study Area. The planting of fruit trees with forest tree species will be implemented in 200 projects/200 ha and it is implemented in 50 projects/50 ha in Marabá municipality. The planting of fruit trees with high profit forest species will be implemented in 100 projects /100 ha, in which half is planted in the Municipality of Marabá and other half in the other municipalities. The silvopastoral system in consortium with coconut etc. will be implemented in 22 projects/110 ha in the medium and big producers in the surroundings of Marabá and in the southeastern region of the Study Area considering commercialization of products. The silvopastoral system with babaçú will be accomplished in 88 projects/440 ha in the southeastern region of the Study Area.

(4) Project Schedule

The Project will be implemented in 10 years period. The schedule includes preparation of land, acquisition of organic fertilizer, seedlings, equipment and materials, surveying, installation of facilities and agricultural activities. The organic fertilizer will be supplied by the 'Project of Utilization of organic fertilizer', and the seedlings will be supplied by the 'Project of collection of seeds and production of seedlings'. The monitoring will be accomplished by the support of the agricultural activities.

(5) Coordinating Organization, Executing Agencies and Related Organization

The coordinating organization of the Project will be SAGRI, being supported by SECTAM in all the aspects of the Project. EMATER should support the administration of the Project as the extension organization. EMBRAPA and AIMEX should provide the technical support. The participation of INCRA is necessary to implement the projects in the communities of settlements. The department of agriculture each municipality, COCAT, ASSIMAR, FETAGRI shall establish a new organization in cooperation with association of small and medium scale farmers for executing the project. As executing organizations, they should involve small and medium producers who practice the family agriculture, and associations of producers.

(6) Project Cost and Benefit

The Project cost includes initial investment of R$ 19,545,000 (in the period of 10 years) and annual costs of operation and maintenance in R$ 1,592,000 (in the period of 19 years). On the other hand, the benefits of the Project vary from one year to another, with an annual average of aprox. R$ 3,850,000, which will be expected for 19 years starting from the 6th year to 24th year.

(7) Economic Analysis

Based on the cash flow analysis between project cost and project benefit, IRR of this project is 20.6%, and net present value is R$ 3,135,000 with a 10% discount rate as of July, 2001. Besides, the cost- benefit ratio is 1.21, with the same annual discount rate. As a result of economic analysis, it is found out that IRR of this project is higher than opportunity cost of capital with a positive net present value and benefit cost ratio is higher than 1. Therefore the execution of the Project is considered justified economically. Besides, the Project has qualitative benefits such as generation of job and income, quality of life of the small and medium producers through family agriculture, and therefore it is considered appropriate to implement the Project.

(8) Financial analysis

TIR is higher than the discount rate of 10% for all the types of producers, being positive NPV and B/C values of above 1. Therefore the execution of the Project is considered justified financially. Besides, the annual income increment is of satisfactory level, being possible for the financial management of the Project. On the other hand, the consideration of a preferential treatment of financing etc. is necessary, although it is possible to repay even if an agricultural financing is used for an initial investment.

(9) Important Observations

In the Study Area, it is difficult to obtain seedlings of fruit species and the soils have low fertility status. Therefore, at first it is necessary to reach the goals of the 'Project of Collection of Seeds and Production of Seedlings' and of the 'Project of Utilization of Organic Fertilizer', to obtain necessary materials in the culture of forest and fruit species. It is also necessary to establish cultivation technologies so that the executing organizations, such as the farm families, can introduce new forest species and new agricultural products, carrying out the productive activities in a sustainable manner. And, it is indispensable to carry out the technical training successfully through the Program of Technical Training.

10.4 Project of Reforestation and Enrichment with Native and Exotic Species

(1) Target

The target is to accomplish reforestation and enrichment in degraded areas of 25,000 ha belonging to the large, medium and small scale producers, for 10 years period starting from 2007. Sustainable forest management is needed to recuperate the degraded areas degraded with aggregation of the economical value to those areas. Reforestation will be accomplished with goals of attaining 2,500 ha/year, being distributed as 1,050 ha for small scale farmers, 150ha for medium scale farmers and 1,300 ha for large scale farmers.

(2) Outline of the Project

The reforestation enrichment project is shall cover 2,500ha of degraded areas through applied technology of reforestation and forestry ecosystems. Spacing density in mixed plantations per ha is as follows; 500/ha in fast growing tree plantation, 264/ha in 4 different tree species plantations; 264/ha in mixed Taunya plantations; 714/ha in mixed plantations with rubber trees (rubber 476/ha) and exotic tree species - 1,111/ha. Mixed rubber tree plantation to

provide value added management shall include easy processing facilities, and a small rubber latex processing facility.

(3) Project Area

The farmers of each scale is responsible in executing the project, including 3 technical model (Model of reforestation of fast growing trees, model of multiple plantation (Silvopastoral), and Model of multiple reforestation using Rubber) for small scale farmers. Target area is around PA settlement of INCRA. Plan for reforestation area is approximately 1-2 ha, and the total area is 750 units per year.

In the properties of medium scale producers, the reforestation with species of fast growth will be accomplished in an area unit of 1 ha/project and the multiple plantation shall be carried out in an area unit of 2 ha/project. The annual implementation of 32 projects is foreseen in the central area of the Marabá municipality and in the municipalities of São João of Araguaia, Brejo Grande do Araguaia, and Palestina do Pará.

For large scale farmer, plan areas for Reforestation with fast growing trees and Multiple plantation each year will be 20 ha / unit in central Marabá, São João do Araguaia, São Domingos do Araguaia and Brejo Grande do Araguaia. 17 units are planned to be implemented annually. Plan for Multiple plantation in Taunya System and Reforestation using exotic species is to carry out in central Marabá and other 4 municipalities.

(4) Project Schedule

The Project period is planned as 10 years. The seedlings will be provided by the ‘Project of collection of seeds and production of seedlings of the forest and fruit species’. Project schedule includes soil preparation, soil improvement, plantation, inter-medium cuttings, pruning, and cuttings. It also includes plantation and harvest of legumes. Forestry plantation should be established against forest fire, and road should be constructed between those plantation for the transport of the logs and of the heavy machines.

(5) Coordinating Organization, Executing Agencies and Related Organization

SECTAM will be the coordinating organization of the Project and SAGRI and EMATER will participate as extension organizations for the administration of the projects. EMBRAPA and AIMEX shall provide technical support in reforestation. As executing organizations, the project shall include from small scale farm households to large scale farm households and a council of administration shall be created to control the executing organizations. In this context, the farmers will be represented by SEAGRI of each municipality and cooperatives and, the medium and big scale producers and private companies will be represented by ASSIMAR and COSIPAR.

(6) Project Cost and Benefit

Initial investment cost of the project is R$ 37,043,000 (investment period of 10years), and annual maintenance cost is R$ 3,031,000 (project period of 25years). On the other hand, Annual average benefit is R$ 6,624,000, from 6th year to 39th year for a period of 34 years.

(7) Economic Analysis

Based on the cash flow analysis between project cost and project benefit, IRR of this project is 6.5%, and net present value is R$ -590.000 with a 10% discount rate as of July, 2001. Besides, the cost benefit ratio is 0.78, with the same annual discount rate. As a result of economic analysis, it is found out that IRR of this project is lower than opportunity cost of capital with a negative net present value and benefit cost ratio is lower than 1. This means that the project can not be justified through economic analysis. However, it is considered appropriate to implement the Project from the viewpoint of the possible qualitative benefits through the preservation of the environment.

(8) Financial Analysis

IRR is lower than the discount rate of 10% for all the types of producers, with negative negative NPV values and B/C of less than 1. Therefore the execution of the Project can not be justified from the financial point of view. Besides, the annual increment of income increment is in a relatively low level. Therefore, in order to make it possible, a suitable financial administration is necessary through a lower interest rate to calculate IRR and for the finance like PRONAF, with favorable conditions: low interest rate, and a longer payment period. Moreover, it is indispensable to provide support for the operation through the establishment of a security fund for the initial investment.

(9) Important Observations

The reforestation projects take a long time to obtain the investment return, being considered to be less attractive for investors. On the other hand, small and medium scale producers have limited financial capacity. Therefore it is necessary to introduce a financing system for reforestation projects with favorable conditions, which can motivate the participation in the Project. For the supply of seedlings and for the establishment of silviculture technologies, it will be indispensable to attain the success in reaching the goals of the other Projects of the Master plan, especially, the production of seedlings and the technical training.

10.5 Plans of Priority Activities

In order to implement the entire Master plan, the organizational strengthening of the involved organization and the formation of the human resources are extremely important. Therefore the activities with these objectives in the policy support program should be initiated as fastest as possible. The Program of Institutional Support to the Environmental Organizations of the State and Municipalities and the Program of Environmental Education and Technical Training are of high priority from the point of view of formation of the human resources in the areas of institutional administration and of diffusion of technologies. Therefore, the above mentioned programs should be executed focusing on the main executing organizations including SECTAM, ITERPA, SAGRI, EMATER, and the secretariats of environment of municipalities who will participate in the Master plan as coordinating organizations and the executing organizations of the individual projects. The technical training program shall focus on the farm households who will participate as executing organizations of the Central Projects and the extension officers and technicians who are in charge in activities of organization of the producers.

The implementation of these programs needs technical support of more industrialized

countries with wider experience, for which international technical cooperation shall be requested. In regard to specialization of the technical cooperation, the main areas are the policies and administration of environment, environmental education, technology of the agroforestry and reforestation systems, technical training and diffusion of technologies, farmers' organization, agribusiness etc. Inviting suitable experts in the pertinent areas should also be analyzed.

Chapter 11 Conclusions and Recommendations

11.1 Conclusions

The Brazilian Amazon tropical forest is considered as one of the most important factors that affect the environment of the whole planet. However, degraded areas are expanding in the Amazon region since deforestation is advancing rapidly in the last few years. The deforestation in Para State, which is one of the largest states in the Amazon region, presently reaches to about 20% of the state's total area that corresponds to 250,000 km^2. As a result, approximately 15% of the total area is supposed to be going through a degradation process, resulting in a low economic land productivity. The expansion of degraded areas not only affect the regional environment, but also restrains the land use and the productive activities, thus affecting the living conditions of the rural population and their economic activities. Consequently, it hinders the improvement of the living conditions of the local population as well as the regional economic development.

In this context, it is necessary to look for appropriate alternatives of sustainable use and improvement of land productivity through the re-incorporation of degraded and/or abandoned areas that suffered the deterioration of their land productivity and decline of economic capacity. Therefore, the recuperation and the sustainable use of degraded areas will intensify the use of productive areas and will prevent further deforestation of agricultural frontier in the natural forest areas. Consequently, this project will contribute to the preservation of global environment through the preservation of the natural forest and the improvement of forest functions in the Amazon region.

The Master Plan encompasses 10 components to be implemented in 30 years period. The components, i.e., programs and projects are interrelated, and shall be implemented systematically. The core of the Master Plan consists of Central Projects directly oriented to the recuperation of degraded areas through direct actions of reforestation and implementation of agroforestry and agrosilvopastoril systems that can maintain the sustainability of those areas. In order to implement the Central Projects effectively, it is indispensable to implement supporting activities such as the strengthening and improvement of concerned organizations, training of human resources, technological diffusion, increase of technical capacity and production through mechanization and availability of modern production inputs, activation of the agricultural product market and strengthening of the processing sector, and infrastructure expansion.

On the other hand, several socioeconomic problems exist in the microrregião of Marabá as the external factors such as complex system of identification of land properties, invasion and illegal occupation of lands, poverty, low education and technical level of farmers, few job opportunities, non-organized rural population, precariousness of the social infrastructure,

population increase, expansion of settlement projects, continuous deforestation of natural forests, lack of environmental conscience, financial difficulty, market economy, and decentralization of the power, which can affect the execution and operation of the Master plan, inhibiting the projected effect. Especially, the social problems can cause a strong impact in the implementation of the programs and projects. This Master plan was elaborated considering the need to lessen eventual difficulties in the execution, taking into account of the possible maximum external conditions. It is important to implement the Master plan, giving enough considerations to the characteristics of the social structure, social and economic problems in reference to the culture of the rural population, among others.

Therefore the execution of the Master Plan will contribute for the sustainable land use in the microregion of Marabá, harmonizing the economic activities with the environment, and allowing the recuperation of degraded areas through an ordered development. Furthermore, the Master Plan shall exert a multiplying effect by preventing a higher loss of natural forests, becoming a model for the recuperation plan of degraded areas, thus contributing to the recuperation of these areas and to the preservation of natural forests in other regions of the Pará State. For this reason, it is extremely important to implement the Master Plan for the recuperation of degraded areas as fast as possible.

11.2 Recommendations

(1) Immediate Implementation of the Recuperation Plan for Degraded Areas

The State Government and the concerned organizations involved in the recuperation of degraded areas shall improve the inter-institutional relationship and work actively together in a systematic way to make it possible for the most effective implementation of the Master Plan in order to achieve the expected positive results. On the other hand, this Master Plan for the Marabá microregion represents a model for the PROECO master plan, destined for the whole State, to recover the State's degraded areas.

The implementation of short term plans, mentioned in this Master Plan, aiming at the strengthening and improvement of environment related organizations, the environmental education and the technical qualification, is necessary not only to attain the targets of the Recuperation Plan of the Degraded Areas in the Marabá microregion, but also for the execution of other similar plans in other regions of the State. In this concept, the short term programs/projects, as well as the corresponding supporting policy shall be implemented with priority and immediately.

(2) Strengthening of Coordinating Organization of the Programs/Projects

The Government of the Pará State, mainly SECTAM as the executive organization, will have a central role in promoting the efficient implementation of programs and projects of the Master Plan, coordinating the work with concerned federal, State and Municipal organizations. Other organizations such as ITERPA, SAGRI, EMATER, etc., which are the possible executing agencies of individual programs/projects, shall actively participate in the Master Plan implementation. These organizations can improve their activities with new responsibilities and thus their institutional strengthening through equipment improvement of the supporting infrastructure, and training of human resources involved in the management and administration of projects are needed.

(3) Technical Training and Organization of Producers

The reforestation and cultivation technologies shall be absorbed by the settled farmers and small-scale producers, since they are the main actors in the implementation of the Central Projects. This is necessary so that the productive activities can be established in a sustainable manner through the introduction of new forest species and agricultural products. Technical training is an indispensable task for the region's local population considering their cultural origin and the educational level. For this purpose, the concerning organizations shall actively be involved in the technological diffusion activities. Furthermore, the immediate training of extension and guiding workers shall be carried out.

On the other hand, in order to promote the permanency of rural producers in their properties and to concretize the sustainable land use, the following actions are necessary: 1) promotion of farmers' organization; 2) organizational qualification in management and administration; 3) diffusion of communal agricultural activities including technical training, new technologies and agro-industrial technologies aiming at the aggregation of value-added agricultural products. Apart from this, it is important to promote the development, the diffusion and guidance on the applicable technologies and the practices aiming at the productivity improvement. The execution of these actions requires the technical assistance of more industrialized countries with accumulated experiences on these aspects and results, and thus attaining an efficient foreign technical cooperation is essentially recommended.

(4) Approach of the Land Ownership Issue

The complexity of the land ownership issue in the Amazon region is an obstacle for the medium and long terms investment actions, hindering the implementation of projects concerning to the recuperation of degraded areas. Therefore, this problem shall be at first solved in an appropriate manner so that the programs/projects subjected to degraded areas can be implemented. The Project of land ownership survey, registration and mapping, which is one of the integral components of the Master Plan, is extremely important because it provides the necessary basic conditions for the execution of the central projects such reforestation and enrichment, development and improvement of family agriculture, among others.

It is indispensable to deal this issue as soon as possible in order to execute the programs/ projects for the recuperation of degraded areas. Thus, the referred Project has high priority. Technical assistance concerning to the integration and operation of the system, as well as concerning to the installation of necessary equipment for the systematization of land ownership information, therefore, is essential.

(5) Necessity of Zoning

The effective and economic use of degraded areas shall be analyzed as an integral part of a rural or regional development plan, since this theme concerns to both the deforestation prevention and to the generation of income and work opportunities for the rural population. In other words, the mitigation of poverty and the regional economic development shall be mutually incorporated in this analysis. In this context, the Ecological-Economic Zoning, that supplies basic information for future development plans, is an efficient methodology for the analysis of land use in the degraded areas.

In view of the fact that the forests deforestation for the extraction of wood and for the agricultural exploitation, legally or illegally carried out, still persists, apart from the fact that the settlement projects are increasing, the Government of Pará State shall complete the task of land use zoning as soon as possible. Through this zoning work, the preservation areas, the exploitable areas and the development targets are classified and identified, and thus the expansion of degraded areas caused by a disorganized land use (development) can be avoided. This methodology, therefore, is indispensable for the preservation of the Amazon region natural resources and environment, as well as to assure the economic activities of the rural population.

(6) Improvement of Credit System and Financial Resources Procurement for the Projects

The small- and medium-scale rural producers cannot implement new projects for recuperation of degraded areas with their own resources due to their limited financial capacity. Besides, there are many obstacles to access the existing credit lines. Therefore, a long term credit line with low interest rates, applicable to forestry projects, shall be made available considering that even the fast growth forest species requires at least 15 years until the logging time. The establishment of a credit system with favorable conditions of financing for the small and medium scale producers, through the creation of a new special fund of the State government, aiming at the implementation of the Master Plan shall be useful.

On the other hand, considering that the State faces a budgetary restriction, the Government of Pará shall analyze the possibility of procuring financing resources for the implementation of the Master Plan for the Recuperation of Degraded Areas, searching for international financing sources, from international organizations and from bilateral cooperation agreements. The government shall particularly search for environment oriented financing, which presents favorable finance conditions.

(7) Governmental Responsibilities

The development of the Amazon region was stimulated by the Federal Government under the policy “Land without people to people without land”. This development was promoted starting from strategic areas, which allows the opening of natural forests mainly for the agricultural exploitation and for the implementation of colonization projects. This development policy aimed at the integration of the Amazon region and to fight against poverty, giving priority to the poorest class of the population such as the landless rural workers and to the unemployed people from the Northeast and Southeast regions of Brazil. In this context, the colonization projects implemented together with the construction of roads have caused a demographic explosion in the Amazon region, and consequently allowing the degradation of areas. In this context, the Federal and State Governments, therefore, shall assume their responsibility, working for the recuperation of degraded areas.

The recuperation of degraded areas in the Amazon region is an important issue at the national level. The Federal and State Governments shall establish a system that allows the active participation of executing agencies, analyzing the measures concerning to the technical assistance, fiscal incentives and other subsidies that allow the implementation of the Master Plan. The governmental organizations shall also monitor the programs/projects for the recuperation of degraded areas so that they do not induce even more the deforestation process or exert negative influence on the environment. Furthermore, they shall improve the methods of application of forest technologies such as the forest management, considering that the

currently applied forest management has caused a partial deterioration of the natural forest. The correct utilization of applicable technologies, therefore, is extremely important. In this context, the appropriate certification system of wood origin shall be analyzed, to promote recuperation projects such as the reforestation projects in the degraded areas, considering the existence of non governmental organizations that grant the sustainable forest management certificate (SELO VERDE – GREEN SEAL) based on international criteria.

(8) Active Participation of Local Population

The reduction of natural forests and the increase of degraded areas in the Amazon region can be considered as the results of the extraction of forest wood species with commercial value, as well as the results of the establishment of pastures and large-scale farms. As direct or indirect perpetrators of deforestation, public enterprises such as the implementation of settlement projects and the construction of hydropower plants and roads have been involved on one side, and the extractions of wood for domestic use by the rural residents and for the production of firewood and vegetal charcoal for industrial use have been observed on another side. The forest fires, caused by the use of fire in agriculture in the slash-and-burn system and in pasture management, are also considered as critical causes of deforestation. Therefore, the rural population responsible for the degradation of areas shall become aware of their responsibility, to actively participate in the recuperation projects.

The local social actors represented by the executing agencies of the Central Projects of the Master Plan shall play the main role for implementing these projects. Their participation is indispensable, although they present different living conditions, technological and educational standards, apart from different manners of activities exploitation and financial capacity, among others. Therefore, the programs/projects coordinating organizations shall apply alternatives of recuperation and implementation methods compatible with the executing agencies, aiming at their broad participation. Simultaneously, they should diffuse among the rural population the concept that the execution of the Master plan can generate jobs and income in the area.

(9) Effective Utilization and Protection of Forests

The Amazon region natural forest is considered as the source of production not only of for wood but also of for several other forest products such as fruits, nuts, medicinal plants, resin, raw materials for handcrafts, food, fibers, roughage, etc. These forest products generate an important income for the rural population, mainly for the poorest class of farmers and landless rural workers. The efforts oriented towards the protection and preservation of the Amazon forest, therefore, shall also be oriented towards the mitigation of poverty, the improvement of quality of life, the region’s economic development, and the mitigation of the regional inequalities. For this purpose, the utilization of forests in a sustainable manner is indispensable (Conservation Units – Indirect Use and Conservation Units – Direct Use). In this sense, the existing programs shall be effectively utilized such as the Extraction Reserves-RESEX, Sustainable Development Reserves-RDS, through which the remaining natural forests can be exploited in a sustainable manner.

Also from the viewpoint of the protection of genetic resources of the commercial value forest species with commercial values, as well as of the capacity of forests in regard to retention of CO_2, the recuperation of the degraded areas as well as their ecosystem and the protection of the ecosystem in general are considered as a fundamental issue. The recuperation of degraded

areas represents the aggregation of value to the land that suffered the decline of its economic value. Here, the economic value does not mean simply the renewal of agrosilvopastoril resources. For instance, the implementation of eco-tourism in abandoned pasture areas after the reforestation for the ecosystem recuperation can also be considered an action for the aggregation of economic value. The programs that allow this type of activities, such as the RPPN – Private Reserve of Natural Patrimony, shall be effectively adopted. We can infer that the RPPN has significant effects on the utilization of legal reservation areas of rural properties, besides also preventing the invasion and illegal occupation of land by the landless rural workers. RPPN is also important because of its involvement of the private sector in the preservation of areas, without the governmental intervention. Apart from this, the clarification and systematization of the agrarian issue through the implementation of the Project of Land Ownership Survey, Registration and Mapping, which is one of the components of the Master Plan, will allow the effective development of the RPPN program, allowing the inclusion of more forest areas in this program.

(10) Enlargement of the Effects of the Master Plan

The Master plan will be applicable to other areas of Pará, as a model of the plan for recuperation of degraded areas. The techniques of the proposal and methodology of the plan of recuperation of degraded areas discussed in this Study is indispensable to promote PROECO for the development of a wider region. An early execution of Feasibility Study (F/S) and the materialization of programs/projects are important so that the results of this Study may be advanced to the next stage. In the next phases, the socioeconomic problem of the objective area should be well analyzed so that they can be considered in the elaboration of the plan and in the execution of the project.

It is indispensable to properly formulate a Feasibility Study (F/S) in order to implement the development activities of agriculture, livestock and silviculture appropriately as appropriate technological measures for recuperation of degraded areas. The development plan should contain agrosilvopastoril activities in a sustainable manner, including technological measures of systems of agroforestry and silvipastoril and reforestation to the Central Projects of this Master plan. Besides, the characteristics of the objective area should be diagnosed accurately and to elaborate the adapted plan which suits the regional characteristics. Therefore, to execute a more appropriate development study, the participation of a study team composed of experienced experts will be indispensable and international technical cooperation shall be immediately requested for the execution of the study at the early stage.

The micro region of Marabá is favored by its strategic situation of its location, since it is located in the center of the degraded areas in the State and it is also located where the main highways pass through. Hence, the Master Plan has great perspectives to be extended to other regions of Pará State with the following characteristics: 1) Northeast Region (Paragominas, Tomé-Açu, etc.) is provided with social infrastructure, and there are a large number of farmers with high technologies. It is a region where wood extraction activities are realized historically and are still being carried out. There are many sawmills along the PA-150; 2) South Region (Redenção, Conceição do Araguaia, etc.) that suffers a strong population pressure with a strong demand for the land possession, with a large devastated forest areas for the agriculture and animal husbandry exploitation, considered as environmentally hazardous areas and Cerrado areas; and 3) Transamazônica region (Altamira and Santarém) with colonization and settlement projects planed by the Federal Government, under a strong influence of rural people coming from the Northeast of the Country, and provided with roads

(difficult to access during the rain season) and electrification. The immediate execution of a Feasibility Study (F/S) in the next phase is extremely important for the Northeast Region.

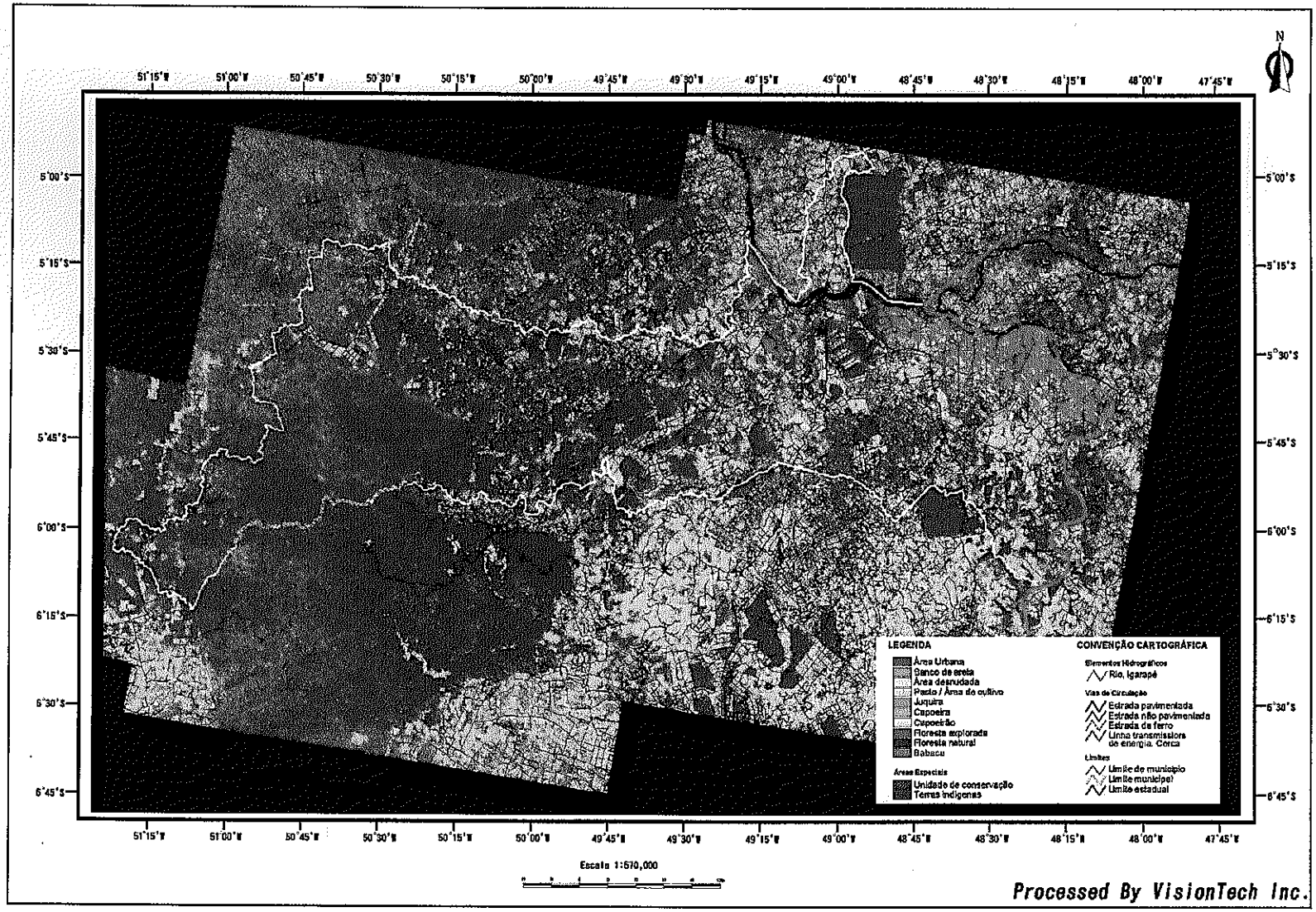


Fig. S-1 Map of Existing Conditions of the Degraded Areas (2000)

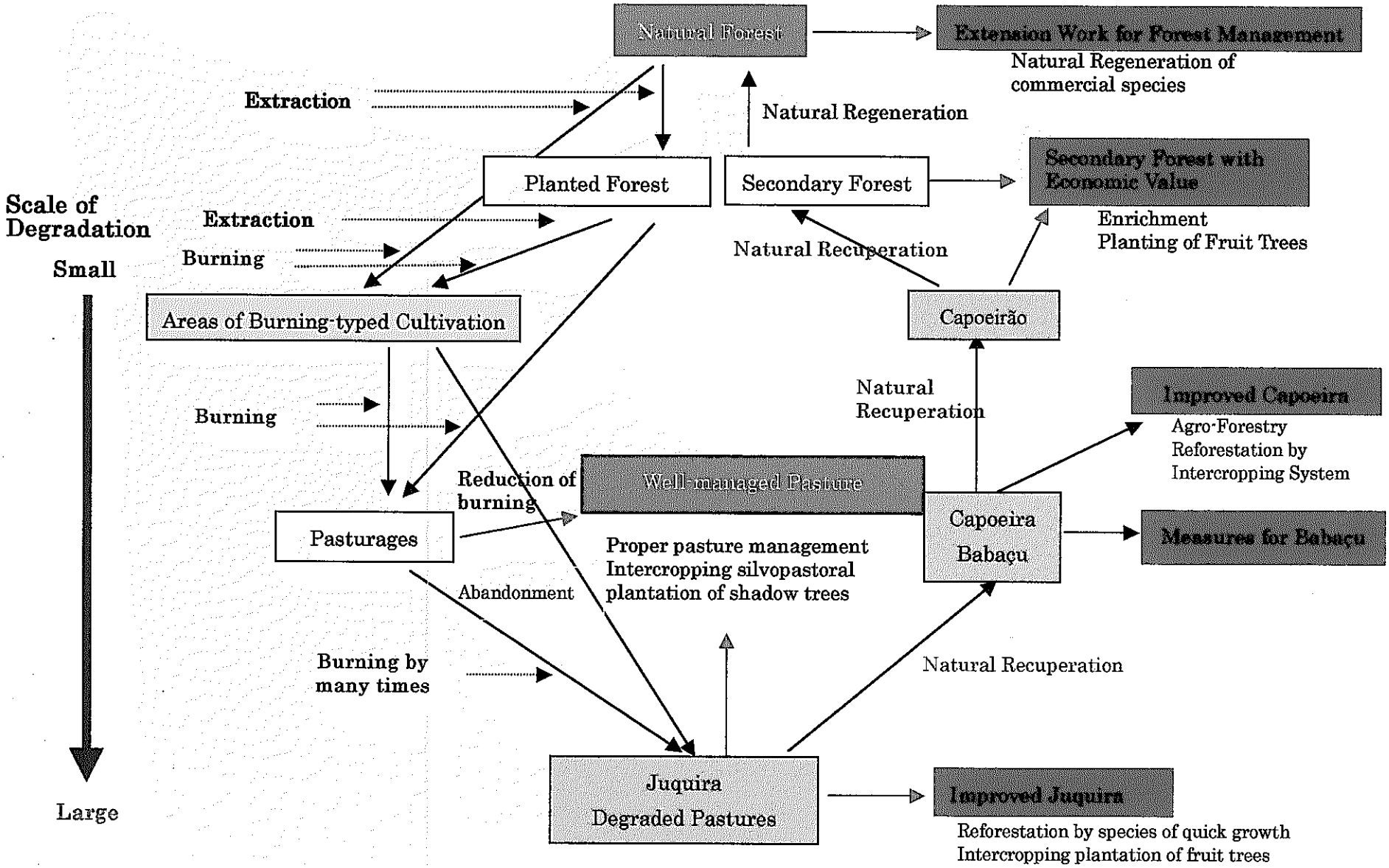


Fig. S-2 Basic Concept of Degradation Process and Recuperation of Degraded Areas

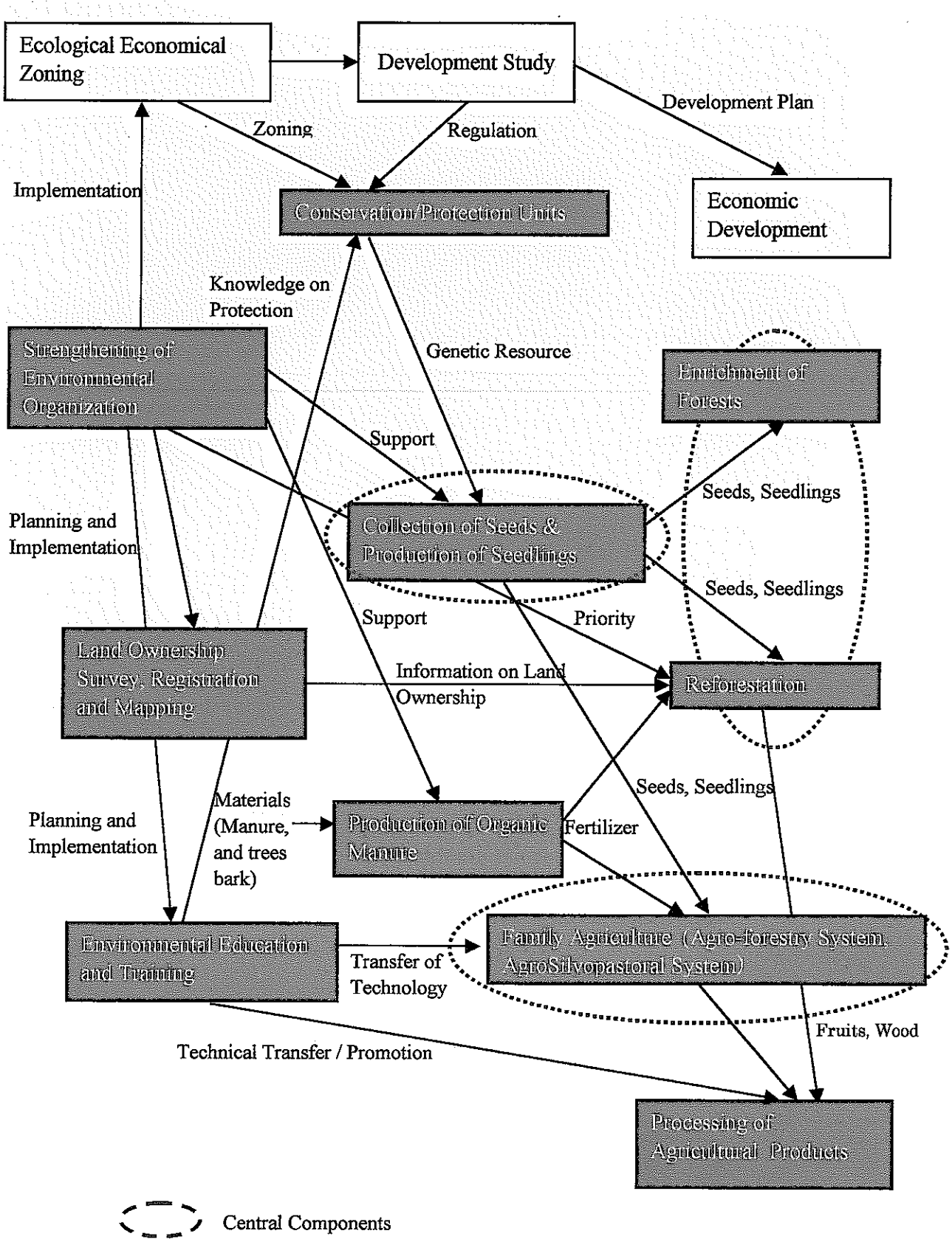


Fig. S-3 Relationship of the Factors in Formulation of the Master Plan

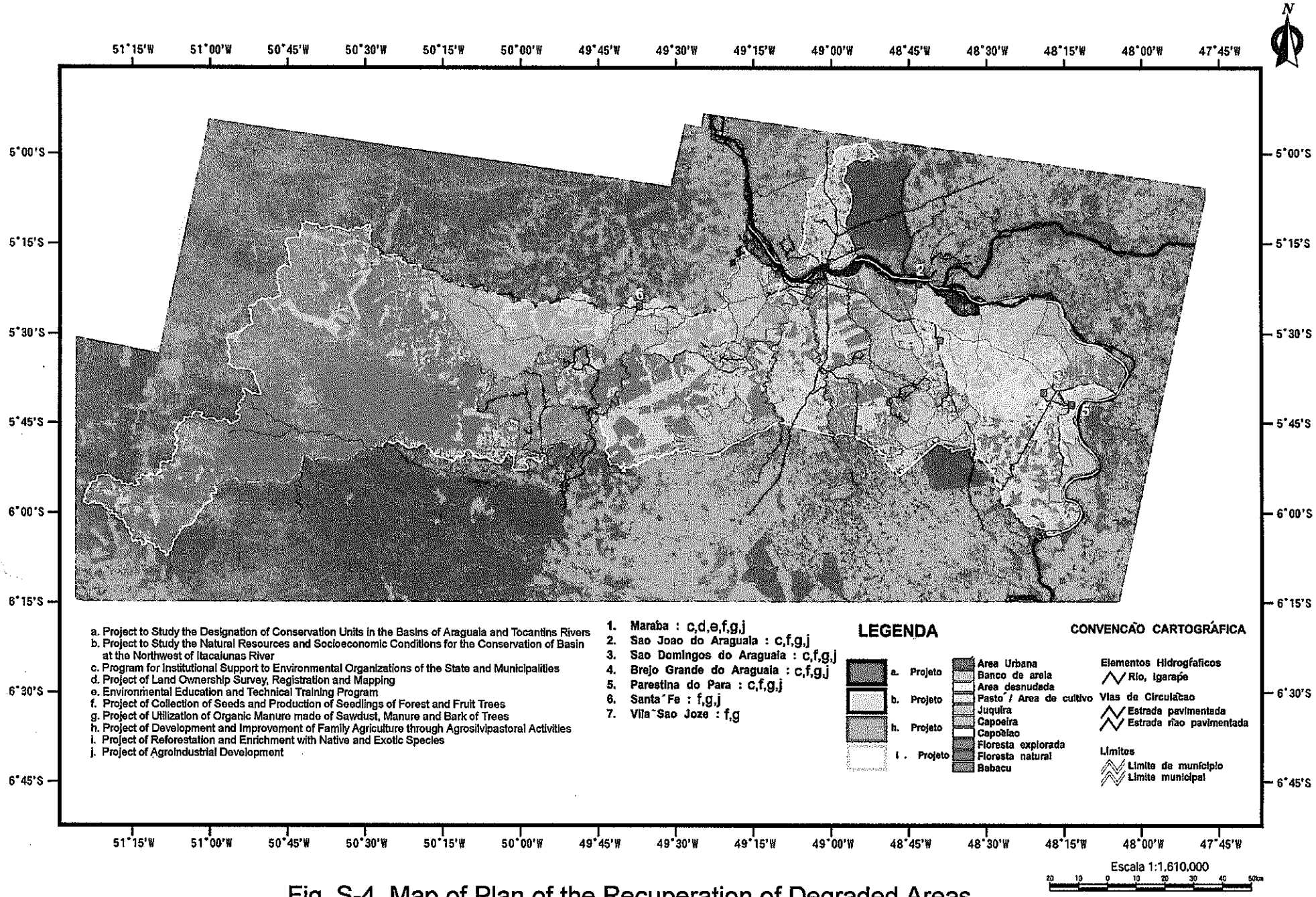
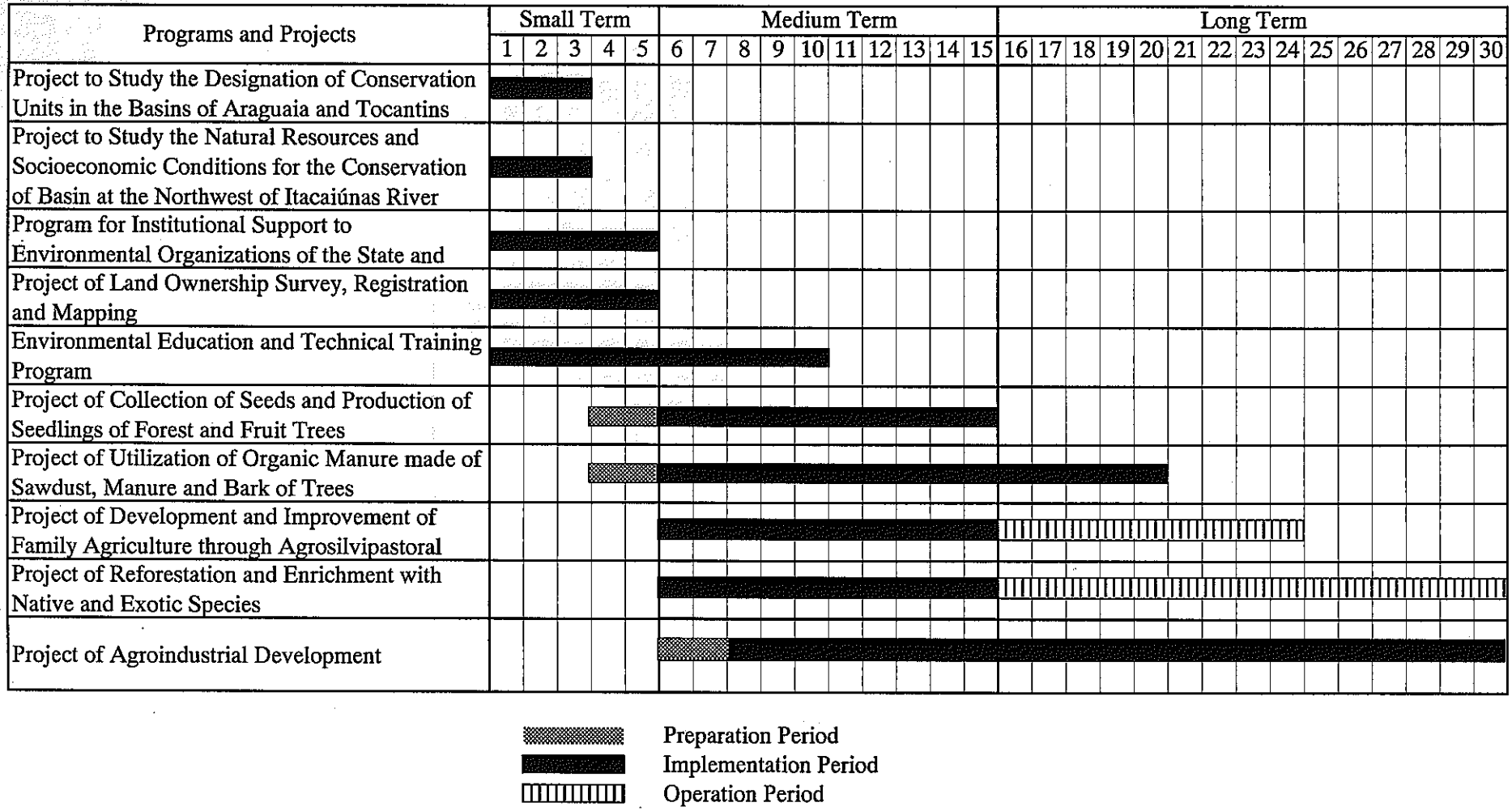


Fig. S-4 Map of Plan of the Recuperation of Degraded Areas

Fig. S-5 Period of Execution of Programs and Projects



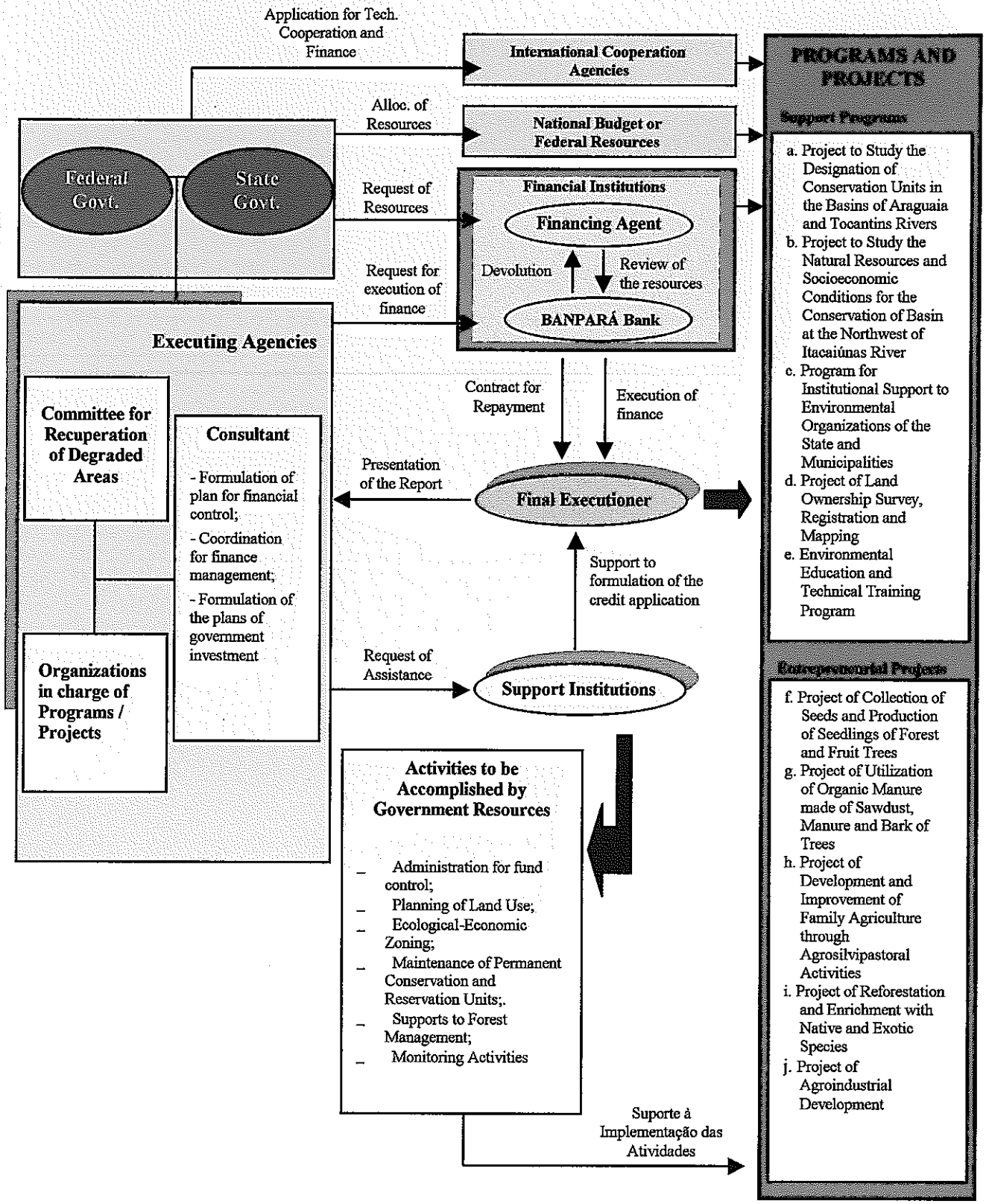


Fig. S-6 Structure for Implementation of the Master plan