CONFIDENTIAL

BRAZIL: NORTHWEST REGION ECONOMIC SURVEY

June 16, 1980

This report is based on the findings of a mission which visited Brazil during the period from October 15 to November 7, 1979. The mission was composed of:

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GLOSSARY OF ACRONYMS

ASTER-RO	Associacao de Assistencia Tecnica e Extensao Rural -- Rondonia (Technical Assistance and Rural Extension Association -- Rondonia)
BB	Banco do Brasil (Bank of Brazil)
BASA	Banco da Amazonia (Bank of the Amazon)
CEPLAC	Comisao Executiva do Plano da Lavoura Cacaueira (Executive Commission for the Cocoa Development Plan)
CETREMI	Centro de Triagem e Encaminhamento do Migrante (Migrant Orientation Center)
CIBRAZEM	Companhia Brasileira de Armazenamento (Brazilian Storage Company)
DERMAT	Departamento de Estradas de Rodagem do Estado de Mato Grosso (Mato Grosso State Roads Department)
DNER	Departamento Nacional de Estradas de Rodagem (National Highways Department)
EMATER-MT	Empresa de Assistencia Tecnica e Extensao Rural -- Mato Grosso (Technical Assistance and Rural Extension Enterprise -- Mato Grosso)
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuaria (Brazilian Agricultural Research Enterprise)
FIBGE	Fundacao Instituto Brasileiro de Geografia e Estatistica (Brasilian Institute of Geography and Statistics)
FSESP	Fundacao Servico Especial de Saude Publica (Special Public Health Service)
FUNAI	Fundacao Nacional do Indio (National Indian Foundation)

IBDF	Instituto Brasileiro de Desenvolvimento Florestal (Brazilian Institute of Forestry Development)
INCRA	Instituto Nacional de Colonizacao e Reforma Agraria (National Institute for Colonization and Agrarian Reform)
POLAMAZONIA	Programa de Polos Agropecuarios e Agrominerais da Amazonia (Amazon Agricultural and Mineral Poles Program)
POLONOROESTE	Programa Integrado de Desenvolvimento do Noroeste do Brasil (Northwest Brazil Integrated Development Program)
PROMAT	Programa Especial de Desenvolvimento do Estado de Mato Grosso (Special Development Program for the State of Mato Grosso)
SEAC	Secretaria de Agricultura e Colonizacao do Territorio de Rondonia (Rondonia Territorial Agriculture and Colonization Secretariat)
SEMA	Servico Especial do Meio Ambiente (Special Environmental Protection Service)
SUCAM	Superintendencia de Companhas de Saude Publica (Superintendency for Public Health Campaigns)
SUDAM	Superintendencia do Desenvolvimento da Amazonia (Superintendency for the Development of Amazonia)
SUDECO	Superintendencia do Desenvolvimento da Regiao Centro-Oeste (Superintendency for the Development of the Center-West Region)

SUMMARY AND CONCLUSIONS

The Setting

i. The Northwest of Brazil covers 410,000 square kilometers -- about three-quarters the size of France -- and is comprised of the federal territory of Rondonia and part of the state of Mato Grosso. It forms a part of the legally-defined Amazon region, and is heterogeneous in terms of climate, vegetation, agricultural aptitude, and population density. Until the mid-1960s, the Northwest was practically uninhabited except for scattered Indian tribes and itinerant rubber-tappers and prospectors. However, with the completion of a 1,500 kilometer highway linking the two major cities of the region, Cuiaba and Porto Velho, a massive wave of migrants started arriving in search of land and employment opportunities. Today, the population of the Northwest totals just over one million, after growing at a rate of about 14% per annum during the 1970-78 period.

ii. One of the distinctive characteristics of the Northwest, shared by few other parts of Amazonia, is the existence of climatic conditions and soils suitable for agriculture. While the extent and types of soils present in the Northwest are not fully known, existing farms are situated, by and large, in relatively fertile areas appropriate for the cultivation of tree crops such as coffee, cocoa, and rubber. Annual crops are also grown in these areas, but further research on the agronomics and economics of fertilizer use, and stronger extension services, are needed before sustained annual cropping can be recommended as an appropriate form of long-term land use. Much less is known about the agricultural aptitudes of the presently unoccupied areas of the Northwest, although preliminary surveys have indicated some additional pockets of relatively fertile soils. However, more detailed land-use capability surveys are needed in order to determine the suitability of these areas for new settlement projects based on small-scale farms (see para. xiv below).

iii. The possibility of obtaining inexpensive agricultural land has been the main attraction of the Northwest to the hundreds of thousands of migrants who have arrived spontaneously over the past decade. As of end-1979, about 18,500 migrant families had been productively settled in government-sponsored settlement projects scattered along the Cuiaba-Porto Velho highway. Others, probably the majority, have established squatters' rights on the fringes of the official settlement areas, or have found temporary employment on the farms of those already settled or in the rapidly-growing towns of the region.

iv. Official colonization projects,based on 100-hectare lots, are presently confined to Rondonia. They were started in 1970 and now total seven. These projects are under the responsibility of the National Institute for Colonization and Agrarian reform (INCRA), an agency which also has jurisdiction over the disposition of lands within 150 kilometers of an international boundary and those located within 100 kilometers of any federal highway in Amazonia. As such, INCRA is the key institution in charge of bringing order to the rapid human occupation of the Northwest. To date, INCRA has been unable to fully accomodate the huge flow of migrants entering Rondonia. The provision of land titles to prospective settlers (an essential element in the settlement process)

has lagged, as has the provision of necessary physical and social infrastructure and services. As a result, a sense of insecurity and isolation pervades much of the territory and crop losses, for lack of physical access to markets, are high.

v. The Mato Grosso part of the Northwest, like Rondonia, is being occupied primarily by migrants from the South and Northeast of Brazil. However, no federally-sponsored settlement schemes have yet been established in the state and the role of INCRA has been generally confined to regularizing the land tenure situation, a process known as "land discrimination". The land discrimination process is still far from complete in Mato Grosso and the de facto pattern of land distribution is much more heterogeneous than that of Rondonia. Within Mato Grosso, the area of older settlement north of the city of Caceres has a high potential for agricultural development. Here, the size distribution of farms is fairly equitable and the soils and climate permit an economy based on coffee and rice cultivation. Like the situation in Rondonia, the principal constraint to further development is the presently inadequate infrastructure and services.

vi. As in other parts of Amazonia, the recent and rapid human occupation of the Northwest has raised concerns about the possible impact of economic development on the natural environment and on the indigenous Amerindian population. In regard to the environment, it is increasingly evident that the wet tropical forest ecosystem is among the most complex and fragile on earth and that deforestation can have some very negative effects, including leaching and erosion of the soil and, possibly, changes in the climate. Fortunately (and contrary to the conventional wisdom), relatively little of the Northwest has been deforested to date (certainly less than 5% of the original forested area). However, the potential for environmental degradation exists and ecologists are almost unanimous in their preference for farm systems based on tree crops and/or forestry over those emphasizing annual crops. This view is, by and large, also shared by government authorities, and programs to promote the cultivation of coffee, cocoa, and rubber have already been initiated in various areas of the Northwest.

vii. The size of the Northwest's Amerindian population is not reliably known although estimates are in the neighborhood of 7,000. It is known, however, that the recent swell of migration to the region has intensified pressures on Indian lands and has increased the transmission of diseases, such as tuberculosis, measles and influenza, to which the indigenous population has little or no immunity. Though the rights of Indians are protected through the Brazilian Constitution and implementing legislation, the National Indian Foundation (FUNAI) has, for lack of funds and staff, been unable to prevent invasions of Indian lands or to provide adequate medical care when epidemics have erupted. In the future, it is inevitable that contacts between settlers and Indians will increase, and FUNAI will need to improve its capacity for ameliorating the possible negative effects of such contacts.

Emerging Regional Policy

viii. The further settlement and economic development of the Northwest is currently one of the high priorities of the federal government. To this end, a federal special program, called POLONOROESTE, was established for the region in 1980 and budgeted at Cr$59.4 billion (about US$1.24 billion at the May 1980 official exchange rate) for the 1980-85 period. In essence, POLONOROESTE is directed to helping bring order to the large, spontaneous migratory flow to the Northwest and, consequently, at increasing the productivity, incomes and social welfare of the region's present and future population. These basic objectives would be reached through the execution of a number of integrated measures. Though the details of specific projects to be financed through POLONOROESTE are still evolving, the major components of the program may be generally described.

ix. In order to help resolve the problem of inadequate physical farm-to-market access (probably the most urgent of the current problems), about 35% of the total POLONOROESTE budget would be used for the reconstruction and paving of the Cuiaba-Porto Velho highway and the improvement of the secondary and feeder roads network in the areas of greatest agricultural potential. These related measures, in themselves, should greatly benefit the region by lowering the cost, and increasing the accessibility, of inputs (both agricultural and industrial) and by facilitating the evacuation of regional production.

x. It seems clear that improving the regional transport system is a necessary, though not sufficient, step in the process of promoting the productive settlement of the Northwest. This point is explicitly recognized in the legislation establishing POLONOROESTE which, in addition to the construction and improvement of roads, also provides for the consolidation of existing settlement projects and the establishment of new ones, improvements in the region's physical and social infrastructure and services (including land titling), and measures to protect the natural environment and the interests of the indigenous population.

xi. In regard to the consolidation of existing settlement projects, it is the intention of the Rondonia government to establish a number of urban support centers (nucleos urbanos de apoio rural) in the rural areas furthest removed from the Cuiaba-Porto Velho highway. These support centers would make available to previously isolated settlers a wide range of infrastructure and services, including:technical assistance; credit, storage and marketing facilities; schools and health posts; communications facilities; and recreation areas. In addition to the production benefits these centers would bring to the settlers, they would be instrumental in creating a sense of community -- a crucial factor in the process of fixing settlers to the land. The role of INCRA in the existing settlement areas is expected to gradually diminish over the next few years as preparations are made to transfer existing settlement projects to the jurisdiction of the territory (which is expected to become a state in 1981).

xii. The major responsibilities of INCRA under POLONOROESTE would be to regularize the region's land tenure situation and to establish new settlement projects in presently unoccupied areas. The first responsibility, if carried out successfully, would significantly reduce the insecurity of many settlers who do not now possess definitive titles to their land, while increasing their opportunity to obtain investment credit through the formal banking system. Though the land tenure services of INCRA would be upgraded throughout the Northwest, high priority would be given to providing definitive titles to settlers who have already established squatters' rights on the fringes of the existing settlement projects. This measure would help fix this population to the land and, hence, take some of the pressure off the new settlement areas.

xiii. The new settlement areas would be initially located in Rondonia (to be extended later to Mato Grosso) along a road now under construction between the towns of Ouro Preto and Costa Marques. The INCRA projects would be implanted in the form of square-shaped "modules" measuring nine kilometers on a side, with the capacity to settle 120 families each on 45-hectare lots (supplemented by 3.45-hectare lots for housing and subsistence agriculture). In contrast to the earlier settlement model, legally-required forest reserves would be kept as a block. Previously, each settler was to keep 50% of his lot in its natural state. In another departure from the older model, the price of individual lots in the modules would be based on the value of the standing timber. As the land was cleared, part of the proceeds from the sale of the timber would be used to amortize the settlers' debt to INCRA. Finally, physical and social infrastructure and services would be made available in a central location, thus improving the settlers' access to them.

xiv. The eventual goal of INCRA would be to establish 100 settlement modules per year, thus absorbing 12,000 families annually. However, it has been decided to reduce the pace of implementation to 14 modules (holding 1,680 families) during 1980-81 in order that detailed land-use capability surveys, and other necessary pre-investment studies, may be carried out. If, as is possible, the land-use capability surveys show a considerable spatial variability of soils in the proposed new settlement areas, it may be necessary to vary lot sizes to conform to the agricultural aptitude of the land. INCRA is currently investigating this possibility.

xv. The specific measures aimed at protecting the natural environment and the interests of the Amerindian population are still being developed. It is expected, however, that POLONOROESTE funds will be mainly used for strengthening the administrative capacities of the agencies entrusted with these tasks (the Brazilian Institute for Forestry Development - IBDF and the Special Secretariat for Environmental Protection - SEMA in the case of environmental protection, and FUNAI in the case of Indian affairs). In regard to the environment, institution-building would be directed to improving IBDF's ability to monitor deforestation and to prevent invasions of forest reserves. It might also mean that funds would be made available for the financing of new national parks (IBDF), and ecological research stations (SEMA). Likewise, FUNAI would be strengthened and provided with funds for the demarcation and monitoring of Indian lands, the removal and resettlement of trespassers on Indian lands, the contacting of as yet uncontacted tribes, and for improving its medical services.

xvi. A forest policy for Amazonia is being developed parallel to POLONOROESTE, and its implementation should also have a beneficial impact on the future development of the Northwest. This policy, elaborated by the Ministries of the Interior and Agriculture, in effect calls for the zoning of Amazonia and the promotion of environmentally-preferred modes (e.g., sustained logging operations) of development. It also provides for the monitoring of forest reserves, Indian lands, national parks and other types of land-use zones, and for severe penalties for unauthorized land use within these zones. The implementing legislation for this policy is expected to be presented to Congress during 1980.

Agricultural Production Forecasts

xvii. In order to better evaluate the agricultural potential of the Northwest and to assess in a preliminary manner the possible impact of proposed regional development policies, an attempt was made to project regional agricultural production to 1984, 1989, and 1994. These projections were made according to three scenarios -- one representing a simple extrapolation of past trends; one assuming improvements in the regional transport system, but nothing else; and one assuming a full array of government assistance, much as proposed under POLONOROESTE. The results of this exercise strongly suggest that the Northwest has considerable agricultural potential and that the production response to public investments in infrastructure and services could be both rapid and extensive.

xviii. Under the assumptions of Scenario I (that is, extrapolation of past trends), total agricultural production could be expected to grow at a 7% average annual rate over the next 15 years. Though this is in excess of the historical growth of all Brazilian agriculture of about 5%, the absence of expanded government activity under this scenario could very well jeopardize the long-term development of the region in ways (e.g., through an aggravation of social tensions over issues related to land tenure, and needless environmental degradation) not fully reflected in the production figures. The clear preference, therefore, would be for Scenario III (which assumes a full range of government asistance). Under this scenario, not only would production be expected to grow at a 12% average annual rate (resulting in a level of production which by 1989 would be 1.2 million tons in volume, or US$728 million in value, higher than would be the case under Scenario I), but indiscriminate land clearing would be checked, and by good initial land selection, improved land titling and technical support, there would be a move toward sustained cropping (emphasizing tree crops) rather than the short-term exploitation of the land.

Conclusions

xix. The principal conclusion of the present report is that the Northwest has the potential to become a major agricultural region of Brazil, and a place where large numbers of migrants from other parts of the country may be productively and permanently settled on small-scale farms. Thus,the measures proposed under POLONOROESTE in support of the future settlement and development of the region seem justified on both economic and social grounds. Such measures also seem justified on the grounds that a sizeable population already exists in the region -- a significant proportion of which now finds itself in insecure land tenure situations and without access to basic infrastructure and services.

xx. Though the measures contemplated in POLONOROESTE deal with most of the region's major problem areas, it may also be concluded that the execution of this program will entail a higher-than-normal degree of risks. Most of these risks emanate from the basic characteristics of the Northwest: (i) its huge land area and frontier status; (ii) its rapidly-growing population; (iii) its confused land tenure situation; (iv) its fragile, and imperfectly-known, natural environment; (v) its Amerindian population, now in the early stages of contact with modern society; and (vi) its thin administrative structure.

xxi. Perhaps the greatest risk is that the administration of POLONOROESTE, and those of the executing agencies, may be unable to fully control and monitor the future occupation and development of the Northwest. Thus, the government should be prepared to accept some of the negative effects frequently associated with accelerated development in frontier areas. Included among these negative effects are likely to be: (i) continued conflicts over land-related issues, including some invasions of Indian lands; (ii) some indiscriminate deforestation and unsound farming practices; and (iii) instances of general lawlessness. While such effects are to some extent inevitable, they would certainly be more widespread and serious in the absence of the special measures contemplated under POLONOROESTE.

BRAZIL: NORTHWEST REGION ECONOMIC SURVEY

I. INTRODUCTION

1.01 The Northwest Region of Brazil is defined as the area of influence of the 1,500 kilometer Cuiaba-Porto Velho highway (BR-070/174/364). This area encompasses all of the federal territory of Rondonia, plus nine municipios located in the central and western parts of the state of Mato Grosso. In total, the Northwest covers approximately 410,000 square kilometers, or slightly less than 5% of the national territory. The 1978 regional population, including the city of Cuiaba, was estimated to be in the neighborhood of one million. While relatively short-lived economic booms (based on gold in Mato Grosso and on wild rubber in Rondonia) have lured migrants to the region in the past, most of the present population has arrived since the mid-1960s -- a period coinciding with the opening of the Cuiaba-Porto Velho highway. Despite this recent growth, however, the average population density is still less than three inhabitants per square kilometer, and vast areas of forest remain virtually uninhabited.

1.02 Within Brazil, the Northwest is perceived as a region of rich soils and great economic potential and, as such, has attracted the attention of both the public and private sectors in recent years. To the government, the region is viewed as an important future source of agricultural production for export and for domestic consumption, as well as a location where migrants from other parts of Brazil can be productively and permanently settled on small-scale farms. To private firms and individuals, the region is viewed more in terms of profits arising from current or potential initiatives in agriculture and livestock, forestry, mining, light industry, private land development, and outright land speculation and fraud (grilagem). Though the aims of the public and private sectors complement each other in many ways, the disorderly pattern of the region's past occupation makes it imperative that its future development be closely guided by the government in a manner which promotes both rational land-use patterns and social equity. If such guidance is not forthcoming, there is a substantial risk of replicating in the Northwest the highly skewed distribution of income and wealth, chronic migration, and environmental degradation observed elsewhere in Brazil.

1.03 The desire of the present government to steer the future socio-economic development of the region in the directions recommended above is evident from the Northwest Brazil Integrated Development Program (Programa Integrado de Desenvolvimento do Noroeste do Brasil-POLONOROESTE) established in 1980. At the core of this program is a project to reconstruct and pave the Cuiaba-Porto Velho highway at an estimated cost of around US$456 million, including allowances for physical and price contingencies. However, in order to maximize the economic and social benefits of this improvement in the transport system, the program also calls for the implementation of parallel projects to promote land settlement, agricultural development, and feeder roads construction in the main highway's area of influence. These parallel projects, budgeted at almost US$1 billion, are specifically aimed at improving the socioeconomic conditions of small-scale farmers already residing in the area and establishing colonization schemes to accomodate the expected flow of new immigrants.

1.04 In principle, the measures contemplated in the integrated development program could lead to significantly higher levels of output and employment in the region, coupled with a socially-acceptable distribution of income and wealth. However, the existence of certain conditioning factors imply that the successful execution of any overall development program for the Northwest will require a flexible and creative approach and exceptionally strong central management. Among the more important of such factors are: (i) the region's great heterogeneity in terms of present levels of development, natural resource endowments, population densities, structures of land ownership, availabilities of physical and social infrastructure and services, and other socioeconomic variables; (ii) its extremely high rate of population growth based mainly on immigration; (iii) the rudimentary knowledge of its soils, forests, and population; (iv) its precarious transport system, particularly roads; (v) the undefined land tenure situation prevailing in some areas; (vi) its fragile natural environment subject to rapid degradation after clearing; (vii) the existence of an indigenous population subject to threats from new immigrants over land rights; and (viii) the weak managerial capacities of some potentially important executing agencies.

1.05 The basic purpose of the present report is to describe the physical and human environments of the Northwest, with a view to assessing this region's potential and prospects for sustained economic development. 1/ Emphasis will be placed on further describing the aforementioned conditioning factors and on analyzing how they influenced in the past, and might influence in the future, the design and implementation of public policies, including POLONOROESTE. As implied in the previous paragraph, the available statistical information on the Northwest is limited, often outdated, and of questionable quality -- a problem which is common to most dynamic frontiers. It was frequently necessary to choose among several conflicting sources of information or to extrapolate from limited field observations. Thus, while the descriptions and analyses contained in the present report are believed to be based on the best information available, the report's findings may be subject to a wider margin of error than would be those of studies of less dynamic regions of older settlement.

1/ Another Bank report (Settlement and Agricultural Development of Brazil's Central-West Region, Report No. 1435-BR, issued July 25, 1977) with a similar purpose was carried out for a geographical area which included the state of Mato Grosso (before its division into two states on January 1, 1979).

II. DEVELOPMENT PLANNING FOR THE NORTHWEST

2.01 The elaboration of plans and the execution of programs for the development of the Northwest involve a host of agencies at different levels of government. The development of the Northwest entails benefits (e.g., improving the national balance of payments and domestic food supply, providing settlement areas for poor migrants from other parts of the country, promoting national integration, etc.) which transcend regional boundaries. At the same time, subnational governments in the region have neither the financial resources nor the administrative capacities to mount a comprehensive development effort. For these reasons, the role of the federal government is currently dominant. The present chapter briefly describes the basic administrative structure of the Northwest and the federal special programs operating in the region. Recent development plans elaborated by the state of Mato Grosso and territory of Rondonia will also be described and evaluated. Specific comments and recommendations pertaining to the major federal, state, and territorial executing agencies are scattered throughout subsequent chapters.

A. Administrative Structure

Federal

2.02 At the federal level, it is the Ministry of the Interior that is largely responsible for administering and monitoring regional development programs. The federal Secretariat of Planning (SEPLAN), however, also plays an important role by setting national planning objectives (which the regional plans must follow) as well as broad guidelines for public expenditures. In order to decentralize regional development efforts, a number of regional development agencies, all linked to the Ministry of the Interior, have been established over the years and it is the intention of the present government to further strengthen them. Two of these agencies, the Superintendency for the Development of Amazonia (SUDAM) and the Superintendency for the Development of the Center-West Region (SUDECO), have overlapping jurisdictions in the Northwest.

2.03 SUDAM is the principal planning agency for "Legal Amazonia", which, in addition to Rondonia and Mato Grosso (the Northwest), includes the states of Para and Amazonas, the federal territories of Amapa and Roraima, and parts of the states of Maranhao and Goias. It is headquartered in Belem and is responsible for elaborating the overall development plans for Amazonia, for administering fiscal incentive funds in collaboration with the Banco da Amazonia (BASA), and for administering and monitoring the federal special programs in its jurisdiction (except those operating in the Northwest). SUDECO, whose main offices are located in Brasilia, is in charge of development planning for the Center-West, defined as the Northwest, plus the states of Mato Grosso do Sul, Goias, and the Federal District, and for administering and monitoring a number of federal special programs (including those operating in the Northwest) not under the responsibility of SUDAM. Unlike SUDAM, SUDECO does not administer fiscal incentive funds.

Territory, State, and Local

2.04 Parallel to the regional development agencies are the governments of the federal territory of Rondonia (with 7 municipios) and the state of Mato Grosso (with 9 municipios included in the Northwest region). Rondonia, has been a federal territory since 1943, and is considered a "decentralized unit" of the federal government, linked to the Ministry of the Interior. Its governor is nominated by the Minister of the Interior and confirmed by the President of the Republic. Rondonia has little financial autonomy and taxes normally in the sphere of the states (principally the value-added tax - ICM) are collected by the federal government and returned to the territory upon the approval (by the Ministry of the Interior) of a spending plan. In 1978, such funds accounted for about half of Rondonia's budgetary resources. These funds are supplemented by various revenue-sharing arrangements, the most important being the State and Territorial Participation Fund which accounted for 26% of Rondonia's total revenues in 1978. Municipal government is at an embryonic stage in the territory, but the present administration of Rondonia is seeking to strengthen the local administrative apparatus as part of its preparations for statehood, expected in 1981.

2.05 The present state of Mato Grosso was established on January 1, 1979 when the former state of Mato Grosso was divided into two parts, the southern portion becoming the state of Mato Grosso do Sul. As a result of this division, which left the state with two-thirds of the land area of the former state, but only one-third of its population and economic activity, Mato Grosso has been undergoing severe financial difficulties. In addition, the new state of Mato Grosso includes the former capital, Cuiaba, and it has been obliged by stringent civil service laws to maintain much of the payroll of the old state. In order to ease this financial problem, a federal Special Development Program for the State of Mato Grosso (PROMAT) was established in 1977 to supplement the state's budget (see paras. 2.14-2.16 below for more details).

2.06 The strength of local government varies considerably within Mato Grosso. The most developed municipios tend to be located in the area of older settlement between Cuiaba and Caceres. In the frontier areas of the state (i.e., Vila Bela and Aripuana), municipal governments, like those of Rondonia, are at an early stage of development and frequently require financial and technical assistance from the state.

B. Federal Special Programs

2.07 Three federal special programs are currently operating in the Northwest: PROMAT, POLONOROESTE, and POLAMAZONIA (Amazon Agricultural and Mineral Poles Program). As mentioned above, the responsibility for the administration and monitoring of these programs lies with the Ministry of the Interior (through SUDECO), in collaboration with SEPLAN, other federal ministries, and the subnational governments involved in the programs' execution. A discussion of these programs' objectives and accomplishments to date follows.

POLONOROESTE

2.08 POLONOROESTE, established in 1980 through Decree ___ of _____, is Brazil's newest special program and the first specifically designed for the entire Northwest. Its primary objective is to promote the orderly settlement of the region through government support of productive activities, and the implantation of economic and social infrastructure. The reconstruction and paving of the Northwest's main overland artery (the Cuiaba-Porto Velho highway) had been considered by the Ministry of Transport as early as the mid-1970s, but it was not until 1979 that the government officially called for a program in which highway construction was integrated with agricultural development and settlement. In this year, Regulation (Portaria) 126, signed by the Ministers of Interior, Transport, and Agriculture, established an interministerial working group charged with the task of designing a settlement strategy for the region, and of proposing specific settlement and infrastructure projects. The findings of this working group were subsequently issued as a two-volume report. 1/ Although hastily prepared, this document served to highlight the problems and potential of the Northwest. It also stimulated a constructive debate in regard to the approaches that could be taken to bring order to the region's agricultural development and settlement. A broad consensus was finally reached on this point and, while the details of specific projects are still evolving, the main thrust of the interministerial report now forms the basis of POLONOROESTE.

2.09 According to its implementing legislation, POLONOROESTE's principal undertakings during the 1980-85 period are to be: (i) paving the Cuiaba-Porto Velho highway; (ii) construction and consolidation of the secondary and feeder roads network and of basic infrastructure; (iii) implantation and consolidation of settlement projects; (iv) execution of land tenure regularization services; (v) support of agricultural, forestry and agroindustrial activities; and (vi) environmental preservation and support of indigenous communities. The budget for POLONOROESTE for the 1980-85 period totals Cr$59.4 billion, approximately US$1.24 billion at the May 1980 official exchange rate. Slightly more than half of this budget would be allocated to new settlement schemes and land tenure services (see Table 1). Sources of funds for the entire period have not yet been identified, but the Cr$2.3 billion budget for 1980 may be broken down as follows:

1/ Ministries of Interior, Agriculture, and Transport, Programa Integrado do Desenvolvimento do Noroeste do Brasil (Brasilia, 1979).

Table 1

POLONOROESTE: BUDGET ESTIMATE, 1980-85
(billions of mid-1980 cruzeiros)

New Budget proposal as of 6-8

Transport	**Cr$17.9**	23.2
- Cuiaba-Porto Velho highway	13.4	19.2
- Feeder roads	4.5	4.0
Settlement and Land Tenure Services*	**31.3**	11.0
Support Services	**6.4**	6.4
- Agricultural research	1.2	
- Technical assistance	4.0	
- Storage	1.2	
Social Infrastructure	**2.0**	2.0
Complementary Actions**	**1.8**	1.8
Total	**Cr$59.4**	Cr.$ 44

* New projects only

** Environmental protection and support of indigenous communities.

road as % of program

.23%

Orig. 594 | 134.0
1138
1521

rev. .43%

444 | 192.00
1776
1446
1332
105

Amount	Source	Purpose
Cr$800 million	PROTERRA*	Cuiaba-Porto Velho highway (Min. of Transport)
Cr$500 million	Loan from BNDE**	Settlement (INCRA)***
Cr$500 million	PROMAT	Rural development and feeder roads (State of Mato Grosso)
Cr$500 million	POLAMAZONIA	Rural development and feeder roads (earmarked for territory of Rondonia)
Cr$2.3 million		

* Program for Land Redistribution and Support of Agroindustry in the North and Northeast Regions.

** National Development Bank.

*** National Institute for Colonization and Agrarian Reform.

2.10. It is premature to discuss the accomplishments of POLONORDESTE. The preparation of the agricultural development and settlement, feeder roads, environmental, and Indian protection components, though proceeding well, is still at an early stage, and the reconstruction and paving of the Cuiaba-Porto Velho highway is only just beginning. However, the integrated nature of the program, its concentration in an area with a rapidly growing rural labor force and considerable agricultural potential, and its explicit concern for the natural environment and the indigenous population, represent a vast improvement over previous road-building programs in the Amazon region in which such factors were generally absent.

POLAMAZONIA

2.11. POLAMAZONIA, created through Decree 74,607 of September 25, 1974, operates in 15 areas of "Legal Amazonia" selected for their development potential. Its principal objectives are: (i) the incorporation of regional resources into the national productive process; (ii) the improved distribution of income; (iii) the promotion of productive activities oriented toward both local consumption and export; (iv) the fixing of population through the creation of employment and improvements in the quality of life; and (v) the improvement of urban infrastructure. POLAMAZONIA effectively began operations in July 1975.

2.12. During the 1975-78 period, Cr$1.1 billion in 1978 cruzeiros (US$61 million), or about 14% of POLAMAZONIA's total budget, was allocated to Rondonia. An additional Cr$478 million (US$17 million), 16.3% the program's total annual budget, went to the territory in 1979. The funds for 1979 were distributed among 24 projects for physical infrastructure in transport and energy

(47% of the total), health and education (21%), support of agriculture and industry (20%), and urban development (13%). Virtually all of the POLAMAZONIA budget allocated to Rondonia in 1980 would be used for financing projects associated with POLONOROESTE.

2.13. Many of the specific projects receiving POLAMAZONIA funds in Rondonia in 1979 were also granted resources through this program in previous years. This was the case, for example, with agricultural research and technical assistance; land tenure services; the construction of grain storage facilities in Ariquemes, Ouro Preto, Ji-Parana, and Vilhena; support of agroindustrial projects in Porto Velho and Ji-Parana; and the initial phases of the highway planned to link Costa Marques with Ouro Preto. Other projects, completed during the 1975-78 period, include: (i) a road from Ariquemes to Rio Machado (in the cassiterite mining area0; (ii) improvement of the airports in Porto Velho, Ji-Parana, and Guajara-Mirim; (iii) the preparation of urban development plans for Porto Velho, Ariquemes, Ji-Parana, Pimenta Bueno, and Vilhena; (iv) urban water and sewer projects in Ouro Preto, Cacoal, Jaru, Ariquemes, Presidente Medici, and Vilhena; (v) a study of industrial opportunities in the territory; the installation of a major health facility in Ji-Parana and of smaller health posts in Espigao d'Oeste, Riozinho, Ariquemes, Pimenta Bueno, Jaru, Ouro Preto, President Medici, Cacoal, and Vilhena; and (vii) studies for the implantation of a major hydroelectric project at the Cachoeira Samuel.

PROMAT

2.14. PROMAT was established through Complementary Law 31 of October 11, 1977 at the time of the decision to divide the former state of Mato Grosso. It was to run for ten years, starting in 1979, with an expenditure program to be elaborated by a special federal commission under the coordination of SUDECO. SUDECO, in turn, contracted the basic studies and the preparation of a six-year investment program (1980-85) for Mato Grosso to the Joao Pinheiro Foundation.

2.15. The principal concerns of the federal government in Mato Grosso, to be partially dealt with through PROMAT, are the precarious nature of the state's physical infrastructure, especially energy and transportation, and the current financial crisis described above. The subregions of the state given priority for PROMAT funds by the federal government include the area of influence of the Cuiaba-Porto Velho highway and, secondarily, the Pantanal and the areas of influence of the Cuiaba-Santarem highway (BR-163), and highways BR-158 (in the area of Barra do Garcas) and AR-1 (in the private colonization area in the municipio of Aripuana). It was originally felt that PROMAT funds should not be used in parts of Mato Grosso already encompassed in other federal special programs, but a decision was subsequently reached to repass a portion of the 1980 budget to POLONOROESTE (see para. 2.09 above).

2.16. Owing to a national policy of reducing public expenditures, relatively little was accomplished during 1979, PROMAT's first year of operation. The original investment program, which gave emphasis to transportation (26% of the total), urban development (7%) and rural development (3%), could simply not be carried out for lack of funds. The initial budgetary allocation to Mato Grosso of Cr$1.7 billion was first reduced to Cr$1.4 billion and then to Cr$450 million. The funds actually received were used exclusively for covering

the state's current expenditures. In order to make up for the shortfall in 1979, Cr$1.05 billion in addition to the regular PROMAT allocation has been promised to Mato Grosso for 1980.

C. State Development Plans

2.17. In addition to the Joao Pinheiro investment plan for PROMAT mentioned above, there are two other multi-sectoral development planning documents with a state/territory scope. The first of these, the I Plano Geral de Governo para o Estado de Mato Grosso (I PAGEMAT), was prepared for the government of Mato Grosso by CAEEB (Companhia Auxiliar de Empresas Eletricas Brasileiras), a government enterprise subordinated to the Ministry of Mines and Energy. The second, the I Plano de Desenvolvimento de Rondonia (hereafter I Plano), was prepared by the Secretariat of Planning of the territory.

I PAGEMAT

2.18. The I PAGEMAT, which covers the period 1980-84, is an attempt to develop a growth strategy for the new state of Mato Grosso. Throughout the document, the Center-West, in general, and Mato Grosso, in particular, are viewed as "natural alternatives" for migration and agricultural expansion. The economic growth strategy proposed in the I PAGMAT is a variation of the primary export-based model, although a degree of industrial processing is called for in order to maximize value-added locally and state tax revenues. Emphasis is given to investments in physical infrastructure, particularly energy and transportation, with the objective of attracting private capital to the state. In general, economic growth promoting measures are given explicit precedence over social development programs.

2.19. The expenditure program proposed in the I PAGEMAT totals Cr$42 billion in June 1979 cruzeiros (US$1.8 billion) to be disbursed over the 1980-84 period. As implied above, the largest budgetary allocations are to the transport, energy, and agricultural sectors, accounting for 24%, 20%, and 17%, respectively, of the total. With regard to transportation, the principal concern of the plan is with the paving of the primary road system (including the Cuiaba-Porto Velho highway) and the implantation of feeder roads (with first priority given to the Caceres/Barra do Bugres area). In the energy sector, the I PAGEMAT gives major emphasis to the construction of major hydroelectric projects near Cuiaba. Finally, in agriculture, the plan recommends that priority be given to the establishment of storage and marketing facilities, and meat packing plants.

2.20. Most investment would be concentrated in the axis formed by the cities of Cuiaba, Caceres and Rondonopolis (the latter falling outside of the POLONOROESTE area). However, the I PAGEMAT is essentially an indicative document, and the availability of resources to finance the proposed investment projects would depend on transfers from the federal government, PROMAT funds and other sources, and, thus, on a process of negotiation between the state and federal administrations.

I Plano

2.21. The principal objective of the I Plano would be to facilitate the transformation of Rondonia into a state. In order to accomplish this, the plan recommends that economic and social development over the 1980-85 period be based on: (i) balanced population growth through the settlement of previously unoccupied areas and the development of agricultural and silvicultural activities; (ii) the intensification of mining operations, particularly cassiterite; (iii) the establishment of industries for processing regional raw materials, especially agricultural commodities; and (iv) the development of urban support centers in rural areas.

2.22. According to the I Plano, present and future migrants should be productively settled in the territory through the development of a colonization model which includes the necessary physical and social infrastructure as well as sufficient lots for those seeking land. It goes on to state that proposed improvements in the social services should be primarily directed at existing settlement areas, and that these services should be provided, together with production services, through urban support centers to be established in the more isolated parts of the presently occupied official colonization projects. In short, the basic guideline for settlement would be to provide assistance to small farmers through the provision of physical infrastructure and a variety of services, while taking advantage of, and reinforcing, existing concentrations of population at all levels of Rondonia's emerging urban hierarchy.

2.23. The I Plano proposes a total budget of Cr$64.4 billion in 1979 cruzeiros (US$2.4 billion) between 1980 and 1985 — an amount substantially larger than the POLONOROESTE budget for the same period. Among the 15 sectors included in the expenditure program, the most important are "regional development" (26% of the total), planning and administration (17%), agriculture and food supply (14%), and transportation (11%). The largest individual expenditure items contemplated in the I Plano are: the paving of the Cuiaba-Porto Velho highway (budgeted at Cr$8.3 billion); general administration of the territory (Cr$6.4 billion); the provision of low-income housing (Cr$6.1 billion); the construction of secondary and feeder roads (Cr$5.7 billion); the implantation of a hydroelectric facility at Cachoeira Samuel near Porto Velho (Cr$4.9 billion); and colonization and land tenure services (Cr$4.5 billion).

General Observations

2.24. It is evident that the I PAGEMAT and the I Plano were elaborated, for the most part, independently of the interministerial report and POLONOROESTE. Though most of the investments contemplated in POLONOROESTE (e.g., road construction, settlement schemes, and the provision of other physical and social infrastructure and services) are also included in the state/territory plans, some of the additional concerns of the state and territorial governments, particularly in regard to energy, urban development, and administration have not been explicitly considered in the new federal special program for the region. In subsequent discussions between federal and state/territorial officials it was agreed that POLONOROESTE would be primarily directed at resolving problems in the rural areas of the region, and that energy and urban development programs would need to be financed either through local funds or through other programs of the federal government.

III. POPULATION, MIGRATION AND SOCIAL INDICATORS

A. Population Growth and Spatial Distribution

Total Population Estimates

3.01 Brazil's last complete demographic census was conducted in 1970. Inter-censal estimates, based on 1960-70 demographic growth tendencies, have been made by FIBGE (Brazilian Institute of Geography and Statistics), but the estimates for the Northwest have not taken adequate account of the extremely high rates of migration to the region over the past decade (see paras. 3.08-3.19). However, demographic surveys commissioned by the territorial and state governments were carried out in Rondonia in 1976 and in Mato Grosso in 1978, and they provide reasonably accurate estimates of the total population in those years. Both surveys are based on SUCAM's (Superintendency for Public Health Campaigns) comprehensive cadastre of dwellings compiled as part of the national malaria eradication program. In the case of Rondonia, the total population in 1976 was arrived at by multiplying the number of dwellings identified in the territory by a factor of five -- roughly the average number of persons per household in Brazil. The 1978 estimates for Mato Grosso were calculated in an essentially similar manner, and were corrected by the state geography and statistics department on the basis of municipal school enrollments and voter registration figures.

3.02 The resulting estimated population of Rondonia in 1976 was on the order of 353,000, and that of Mato Grosso (the part within the survey area) in 1978 was 536,000. Based on the 1970-76 average annual growth rate, the 1978 population of the former was estimated to be around 519,000. Hence, one may assume a total regional population in 1978 of slightly more than one million (see Table 2).

Population Densities

3.03 Because the Northwest is a frontier area in the process of settlement, its average population density (about three inhabitants per km2) continues to be far lower than the national average (about 14 inhabitants per km2). Moreover, given the heterogeneous nature of the region in terms of such factors as means of access, agricultural potential, and land ownership patterns, it is not surprising that average population densities vary considerably among municipios. In general, average densities tend to be relatively highest in older urbanized areas, such as Varzea Grande (96 inhabitants per km2), and in recently occupied farming areas enjoying relatively easy access. Municipios falling into the latter category include Mirassol d'Oeste and Cacoal (about eight inhabitants per km2), Barra do Bugres (six inhabitants per km2), and Ji-Parana (five inhabitants per km2). In contrast, population densities considerably below one inhabitant per square kilometer may be observed in Aripuana, Vila Bela, and Guajara-Mirim. Though many factors explain these extremely low population densities, the most important are difficulty of access, concentrated land ownership and, in the case of Guajara-Mirim, limited soils suitable for small-scale farming.

Table 2

NORTHWEST REGION: TOTAL POPULATION, LAND AREA, AND POPULATION DENSITY, 1978

State/Municipio	Population	Area (km^2)	Density (inhabitants per km^2)
MATO GROSSO	536,200	167,144	3.21
Aripuana1/	4,200	27,300	.15
Barra do Bugres	55,100	9,433	5.84
Caceres	126,700	36,143	3.51
Vila Bela	23,500	60,633	.39
Mirassol d'Oeste	35,300	4,233	8.34
N.S. do Livramento	13,000	6,315	2.06
Pocone	24,500	16,691	1.47
Tangara da Serra	25,100	5,684	4.42
Varzea Grande	65,800	682	96.48
Cuiaba (city)	163,600	n.a.	-
RONDONIA	518,900	243,044	2.13
Ariquemes	59,900	35,918	1.67
Cacoal	63,700	8,000	7.96
Guajara-Mirim	34,000	73,654	.46
Ji-Parana	123,300	23,203	5.31
Pimenta Bueno	55,500	17,049	3.26
Porto Velho	137,200	53,846	2.55
Vilhena	45,300	31,374	1.44
NORTHWEST REGION	1,055,100	410,158	2.57

1/ Area west of the Rio Roosevelt only.

Source: Ministries of Interior, Agriculture and Transport, Programa Integrado de Desenvolvimento do Noroeste do Brasil (Brasilia, 1979); and mission estimates.

General Growth Patterns, 1960-78

3.04 The most striking demographic characteristic of the Northwest, and probably the most significant for regional planners, is the extremely high rate of population growth this region has experienced in recent years, particularly since 1970. As indicated in Table 3, the region's total population increased at an annual average rate of 6.8% during the 1960-70 period, and accelerated to a 13.6% rate during 1970-78. Population growth during both periods was thus much greater than could be explained by natural rates of increase alone. The data also indicate important intraregional variations in the population growth rate. During the 1960s, Mato Grosso's population grew at a rate far above that experienced by Rondonia, owing primarily to the rapid growth of Cuiaba and the municipios of Caceres and Barra do Bugres, the latter two of which received a large contingent of rural migrants during the decade.

3.05 From 1970 to 1978, the situation described above reversed, with Rondonia's population growing at the extraordinarily high rate of 21.3%, versus the still very substantial 9% rate registered in Mato Grosso. Within Mato Grosso, the areas of most rapid population growth have been the Cuiaba-Varzea Grande urban agglomeration and the rural zones to the north, including the municipios of Barra do Bugres, Caceres, Vila Bela, Mirassol d'Oeste, and Tangara da Serra. In Rondonia, recent demographic expansion has occurred almost exclusively within the boundaries of the former municipio of Porto Velho, that is, in or near the official agricultural settlement areas adjacent to the Cuiaba-Porto Velho highway.1/

Table 3

NORTHWEST REGION: AVERAGE ANNUAL RATES OF POPULATION GROWTH, 1960-70, 1970-78, 1960-78
(%)

State/ Territory	Time Period		
	1960-70	1970-78	1960-78
Mato Grosso /1	7.8	9.0	8.3
Rondonia	4.7	21.3	11.8
Northwest Region	6.8	13.6	9.8

/1 Includes city of Cuiaba and excludes municipio of Aripuana.

Source: FIBGE, Censo Demografico, 1960 and 1970; Table 1.

Rural-Urban Growth Patterns

3.06 At the time of the 1970 census, the population of the Northwest was distributed more or less equally between rural and urban areas, with a slight

1/ The former municipio of Porto Velho has been recently subdivided into five new municipios: Ariquemes, Ji-Parana, Cacoal, Pimenta Bueno, and Vilhena. The latter also occupies a part of the former municipio of Guajara-Mirim.

predominance of rural population in Mato Grosso (50.9%) and of urban inhabitants in Rondonia (53.6%). Official estimates for 1978 suggest that this urban-rural demographic balance has remained essentially unchanged, although rural areas have apparently grown somewhat faster than urban centers in northwestern Mato Grosso and in Rondonia. As was the case with rates of population growth, however, significant inter-municipal differences exist with respect to the urban-rural population distribution.

3.07 The rate of urbanization in the Northwest, like the rate of population growth generally, has been very rapid, especially since 1970. This may be observed in the two major urban "poles" of Cuiaba-Varzea Grande and Porto Velho whose populations grew at 6.2% and 12.3% per annum, respectively, during the 1970-78 period. It may be even more readily observed in the smaller cities and towns of Rondonia (e.g., Ariquemes, Ouro Preto, Vilhena, Cacoal) situated adjacent to the Cuiaba-Porto Velho highway, where average annual growth rates above 50% are not uncommon. In Mato Grosso, outside of the Cuiaba-Varzea Grande urban agglomeration, the rate of urbanization has been considerably lower.

B. Migration

3.08 As implied by the high growth rates discussed above, migration has been responsible for most of the post-1970 demographic expansion of the Northwest. Even before this period, however, migration to areas of Mato Grosso such as Cuiaba and the municipios of Caceres and Barra do Bugres explained much of their population growth. While most migrants to Cuiaba came from other parts of the state (especially nearby rural areas), those arriving in Caceres and Barra do Bugres generally originated in rural areas of the states of Minas Gerais, Sao Paulo, and Espirito Santo. The migrants to Caceres and Barra do Bugres were apparently motivated by the availability of inexpensive land in state government settlement projects that were being implemented at the time, and often arrived in the region with financial resources derived from the sale of their previous landholdings. Pre-1970 migration to Rondonia occurred on a much smaller scale than in Mato Grosso (roughly 25,000 versus 100,000). The Northwest and Southeast were the regions of origin for approximately 60% and 20%, respectively, of the total flow.

3.09. Prior to 1970, unlike the more recent situation, the principal motive for migration to Rondonia was the opportunity for employment in extractive activities such as rubber-tapping and Brazil-nut gathering, and cassiterite and gold mining. With the improvement of the Cuiaba-Porto Velho highway in 1969 and the rapid spread of information (sometimes erroneous) about the high quality of soils and wide availability of inexpensive or "free" land in the area cut by the highway, the flow of migrants to the Northwest, and particularly to Rondonia, increased sharply. The implantation of a number of official agricultural settlement projects in Rondonia also tended to reinforce the attractiveness of the Northwest to potential migrants. In addition to these "pull" factors, it would appear that several factors acted to "push" rural workers from the South and Center-West of Brazil. Among the factors most frequently cited are: (i) agricultural mechanization and a consequent

decline of rural employment opportunities; (ii) sales of smallholdings to large commercial farmers seeking to expand the production of export crops, particularly soybeans; (iii) excessive fragmentation of landholdings through inheritance in regions of earlier small farmer settlement, such as northern Parana and southern Mato Grosso; (iv) the substitution of agricultural production by ranching activities; and (v) periodic climatic problems (especially frosts) in southern coffee-growing regions.

Size and Time Pattern

3.10 The total size and time pattern of the migratory flow to the Northwest during the past decade is not fully known. However, given the estimates of total population presented earlier, and assuming a 3% per annum rate of natural increase for the region, the total flow must have been on the order of 600,000 (375,000 to Rondonia and the balance to Mato Grosso). In regard to the time pattern, one knowledgeable researcher argues that the flow of migrants to Rondonia has tended to accelerate since 1974. 1/ As illustrated in Table 4, the available data on migrants passing through the Migrant Orientation Center (CETREMI) in Vilhena during the 1976-79 period generally corroborate this assertion, although one may observe considerable annual variations. 2/ Though these variations may only reflect deficiencies in the statistical base, some authorities attribute them to the implementation, and subsequent abandonment, of a government-sponsored program to discourage migration to Rondonia. 3/

1/ See G. Martine, "Recent Colonization Experiences in Brazil: Expectations Versus Reality". Paper presented at the" Symposium on Internal Migration and Development," Cuernavaca, Mexico, September 18-21, 1978.

2/ Seasonal variations are also important. In recent years, roughly two-thirds of the migratory flow has entered Rondonia during the drier months (April-September).

3/ The data contained in Table 4 greatly understate the total annual flow of migrants; possibly by as much as 100-200%. This is mainly because CETREMI only counts those persons declaring themselves to be migrants, and because young children are excluded from the totals. Moreover, until very recently, CETREMI only processed migrants entering the territory during the daylight hours when the facility was open.

Table 4

NUMBER OF PERSONS PROCESSED AT RONDONIA MIGRANT ORIENTATION CENTER (CETREMI), 1976-79*

1976	17,129
1977	6,319
1978	12,723
1979	29,550**

* Excludes children under 5 years of age.

** Partially estimated.

3.11 This program contained elements of both persuasion and coercion. The first element is best exemplified by the propaganda campaign mounted in late 1977. The major feature of this campaign was the distribution in the states of Parana, Mato Grosso, Minas Gerais, and Espirito Santo (areas from which much of the migration was coming) of pamphlets describing the potential risks and hardships involved in migrating to Rondonia. 1/ In addition to this attempt at persuasion, it is reported that highway police were employed to force the return of trucks carrying migrants. It is suspected, however, that many migrants posing as "tourists" crossed the border in buses or entered the territory during hours when the control post was unmanned. 2/

Origin and Destination

3.12 A rough comparison of the migrants' places of birth and previous residences before arriving in Rondonia can be extracted from the INCRA and CETREMI data. As of early 1977, the INCRA data reveal that about one-third of the settlers (colonos) surveyed were born in Minas Gerais, 10% in Bahia, and roughly 5% each in Parana and Ceara. However, the CETREMI data, which are tabulated on the basis of previous residence, convey quite a different picture. According to this source, of those migrants surveyed between August 1977 and March 1979, about 30% of all family heads had come from Parana, with roughly an equal percentage last residing in Mato Grosso. Much smaller numbers of migrants had come directly to the territory from Minas Gerais, Espirito Santo, Sao Paulo, and the Northeast.

1/ These pamphlets read as follows: "Rondonia has soils of excellent quality for agricultural exploitation. But, for all practical purposes, these lands are already occupied. Therefore, only a limited number of lots are available for sale. Moreover, a large part of these lands (over 2 million hectares) are located either in official colonization projects or in areas which have been ceded by INCRA, in public auction, to farming and cattle-ranching companies." Cited in G. Martine, op. cit.

2/ See C. Mueller, "Recent Frontier Expansion in Brazil: The Case of Rondonia." Paper presented at the conference on the Development of Amazonia in Seven Countries, Cambridge, England, September 23-26, 1979.

3.13 The data cited above suggest either that a significant change occurred after 1977 with respect to the migrants' geographical origin, or that many of the settlers who last resided in Parana and Mato Grosso were born somewhere in the southeast or northeast of Brazil. While both of these hypotheses may be correct to some extent, in all probability the latter accounts for most of the discrepancies between the two sets of data. This contention is supported by the findings of a University of Brasilia study on the Ouro Preto colonization project. Of the settlers surveyed for this study, roughly 55% were born in Minas Gerais and Espirito Santo, as compared with only 10% in Parana and Mato Grosso. On the other hand, among those who had lived in more than one place before arriving in Rondonia, nearly half had resided in Parana and Mato Grosso, this being especially the case for settlers born in Minas Gerais and the Northeast. Overall, 71% of the Ouro Preto colonos had lived in at least two places, and 27% in at least three places, prior to entering the territory.

3.14 Within Rondonia, migrants have gone primarily to official colonization areas. Moreover, during the past few years, the overall flow has become more directed to the central and northern parts of the territory. During the period from August to October 1977, for example, the principal destinations were: Colorado (39%), Cacoal (18%), Vilhena (14%), Ji-Parana (9%), and Ariquemes (8%). During the first three months of 1979, slightly more than half of the migrants interviewed at the CETREMI post intended to head for Ariquemes (27%) and Ji-Parana (25%). With respect to Mato Grosso, the destinations of migrants may be indirectly inferred from the data on the changes in agricultural employment between 1970 and 1975. On this basis, one may hypothesize that the most intense inflows occurred in the municipios of Vila Bela (where the total number of persons employed in agriculture in 1975 was up 300% from the 1970 level, Barra do Bugres (up 265%), Caceres (up 230%), and Cuiaba and Varzea Grande (up 215%). This hypothesis is consistent with the data on spatial patterns of population growth between 1970 and 1978.

Age, Sex and Employment Experience of Migrants

3.15 The available data indicate that the migrant population of Rondonia is predominantly young, male and from an agricultural background. The INCRA data on settlers in official colonization projects, for example, shows that about 46% of the population is under 15 years of age, as compared to the national average in this age bracket of about 42%. This age structure implies a high dependency ratio and a great potential demand for social services, particularly health and education. For the overall settler population, the male-female ratio is on the order of 1.1. However, the average rises to 1.3 in the rural areas and falls to 1.0 in urban zones. These ratios suggest that many males migrate alone and that employment opportunities in the territory are strongly differentiated by sex.

3.16 Most migrants to Rondonia have come from rural areas and the principal reported occupation of the family head has been agriculture. Between March and December 1978, approximately 70% of all migrants interviewed at the CETREMI post originated in rural areas, although the share of families coming

from urban areas tended to rise during the period. 1/ This latter tendency continued in early 1979. During the first quarter of 1979, for example, 44% of all migrants entering the territory originated in towns and cities. Paralleling the change in the rural versus urban origins of migrants to Rondonia, an increasing percentage of family heads report non-agricultural occupational backgrounds. While in 1977 roughly 90% of all household heads gave their occupation as farmers, this share had fallen to about 50% by the first quarter of 1979. Throughout the 1977-79 period, the most important non-agricultural occupations have been those associated with transportation, construction, domestic activities, and commerce.

3.17 The INCRA data on migrants settled in official colonization projects reveal that the previous agricultural experience of most has included the cultivation of perennial (unspecified) crops. However, it appears that relatively few colonos had made use of rural credit, or had marketed their produce through formal channels (e.g., wholesalers, cooperatives, public agencies) prior to arriving in Rondonia. Table 5 summarizes the available information on these aspects disaggregated by project.

3.18 From Table 5, it may be observed that, on the average, 62% of the settlers in the official projects had worked with perennial crops in their places of origin. However, considerable inter-project variations in this average are evident; ranging from a high of 84.3% in the case of Rolim de Moura to a low of 41.1% in the case of Sidney Girao (the latter being, possibly coincidentally, the least successful INCRA project in Rondonia). In the projects for which data is available, less than one-fourth of the settlers had ever used rural credit. For those who had, the most frequently cited source was the Banco do Brasil. Finally, the majority of settlers, independent of whether they worked with annual or perennial crops, had before coming to the territory marketed their produce exclusively through intermediaries.

3.19 In sum, the available information for Rondonia suggests that many, if not most, of the recent settlers have come from market-oriented, albeit relatively low-income, agricultural backgrounds. These data also suggest the need for a strong extension service to provide advice on agronomic techniques (especially those pertaining to tree crops), the use of rural credit, marketing, and cooperative development. Moreover, the actions of this extension service would need to be flexible enough to take into account the wide differences in agricultural experience among the settlers.

1/ On the basis of a sample of farmers interviewed in 1977 as part of the state planning secretariat's study on migration, it would appear that about 80% of the recent migrants to Mato Grosso originated in rural areas.

Table 5

RONDONIA: PREVIOUS AGRICULTURAL EXPERIENCE OF SETTLERS IN OFFICIAL COLONIZATION PROJECTS
(% of total household heads)

Project	Perennial Crops *	Use of Credit	Informal Marketing **
Rolim de Moura	84.3	16.0	80.2
Ji-Parana	68.9	18.2	67.3
Ouro Preto	71.1	48.0	68.6
P. de Assis Ribeiro	50.9	19.9	27.5
Sidney Girao	41.1	-	75.9
Adolfo Rohl	85.1	-	44.7
MEAN	62.0	23.5	57.5

* Exclusively, or in association with annual crops.

** Exclusive use of intermediaries.

Source: M. H. da Trinidade Henriques, "Diagnostico e Perspectivas para o Territorio Federal de Rondonia: Demografia" (Brasilia, 1979).

C. Education and Health

3.20 The development of any region is constrained to the extent that its population is undereducated and/or in poor health. However, certain factors complicate the education and health problems of the Northwest and make them especially difficult to deal with. First of all, the origins of most of the migrants appear to be extremely humble, and hence they may be expected to bring with them the poor education and health standards prevailing in their places of origin. Second, the age structure of the migratory flow is such that the potential demand for social services, particularly education and health, is unusually high. Third, the process of deforestation and rapid settlement causes changes in the environment which may, in turn, increase the incidence of certain tropical diseases, especially malaria, to which the majority of migrants have no resistence. 1/ Fourth, the absence of an adequate secondary and feeder roads network in the region tends to isolate the new settlers and thus impede their physical access to education and health facilities now concentrated in the cities and towns. Fifth, because of the incipient stage of settlement and agricultural development in many parts of the region,

1/ Moreover, it should be pointed out that the migrants often bring in diseases (e.g., measles, influenza, tuberculosis) to which the indigenous population has no resistance (see Chapter IV).

the extra demand for public education and health services generated by the new migrants is not, in the short run, accompanied by an equivalent increase in the means to finance these services at the local level. Finally, health planning (and to a certain extent education planning) is impeded by the lack of an adequate statistical base upon which to make decisions. With these factors serving as a general background, the following paragraphs describe the education and health conditions currently prevailing in the region and comment on government programs in these sectors.

Education

3.21 The available evidence shows that recent migrants to Rondonia have been, on the whole, very poorly educated. In this respect, INCRA data reveal that over 50% of the family heads in the official colonization projects are illiterate, with the average illiteracy rate rising to almost 70% in the case of the Adolfo Rohl project. Of those settlers who had received some formal education, no more than 2% in any project had graduated from primary school. The educational status of migrants to rural areas of Mato Grosso is also low but, on the average, considerably better than that of settlers in Rondonia. Of some 1,000 migrants interviewed in 1977, about 36% of the family heads were found to be illiterate. Among those with some formal education, 9% had completed four or more years of schooling.

3.22 The large and continuing inflow of migrants and their school-aged children has put considerable strain on the region's educational system. This is particularly evident in the case of Rondonia, where the number of primary and secondary school students increased by 240% (from 41,148 to 140,311) between 1975 and 1979. Though the number of schools in the territory has also increased rapidly in recent years, as of 1978 about 28% (roughly 32,000 persons) of the 7-14 years population cohort was not enrolled in primary school. At the secondary level, almost 90% (about 34,000 persons) of the eligible population (15-18 years) was not enrolled in school. In Mato Grosso, the rates of non-attendance at the primary and secondary levels in 1977 were 25% (29,000 persons) and 58% (20,000 persons), respectively.

3.23 In Rondonia, the most serious deficiencies in the educational system are found in the rural parts of new settlement areas. Here the chief problems are lack of physical access to the formal educational system, which tends to be concentrated in the towns and cities, and the inability to attract qualified teachers. In response to these problems, settlers in Rondonia have constructed a large number of "provisional" schools on the basis of self-help arrangements and have staffed them with members of the local community. Though these grass roots efforts are commendable, they are clearly inadequate. As of 1978, there was a shortage of almost 900 classrooms in the territory. Moreover, in 1979 only 17 of the 1257 teachers in the rural areas (1.3% versus 61% in urban areas) of the territory were officially qualified (habilitados). However, a teacher training facility is now operating in Ji-Parana and others are expected to be established in the near future. It remains to be seen, though, whether, once trained, these teachers will return to the rural areas where salaries and living conditions are generally the poorest.

3.24 Though the available information is sketchy, it would appear that the problems of rural education in Mato Grosso are similar to those observed in Rondonia -- deficient infrastructure, poorly-trained teachers, and limited physical access. In regard to the first aspect, official statistics for 1977 show a deficit of around 700 classrooms for the entire survey area. Unfortunately, the statistics do not allow a spatial disaggregation of this deficit, but it must be presumed that a major proportion is accounted for by rural areas. Likewise, the statistics do not permit a urban-rural breakdown of teachers' qualifications. However, in municipios characterized by recent occupation, such as Aripuana and Vila Bela, less than half of the primary school teachers have themselves completed a primary education. This may be compared to the situation in the older urbanized areas of Cuiaba and Varzea Grande where 95% of the primary school teachers have a secondary level or higher education.

3.25 In the short-run, it will be extremely difficult to substantially improve the rural education system of Mato Grosso given the current financial problems of the state and the municipios, the latter responsible for rural education. However, some stop-gap measures, such as the state paying teachers' salaries in the poorer municipios, and sub-contracting educational services to private colonization companies located in the far north, are now in effect. In addition, state authorities look with favor on a new rule which obliges cattle ranches receiving fiscal incentive funds to provide primary schooling to the children of their employees.

Health

3.26 As mentioned previously, the dearth of health statistics for the Northwest makes it virtually impossible to evaluate current conditions precisely. Owing to the isolation of much of the population, deficient infrastructure, and poor diagnostic capabilities, both births and deaths tend to be under-recorded. Thus, traditional measures of health conditions such as life expectancies and infant mortality rates are either not available or of questionable reliability. Still, the available evidence suggests that regional health conditions are generally poor.

3.27 In Rondonia, the part of the region for which health statistics are most complete, the average infant mortality rate in 1978 was on the order of 137 per 1,000 live births; a rate 40-50% higher than the national average. Within the territory, the infant mortality rate ranged from a "low" of 84 in the municipio of Guajara-Mirim to an extraordinarily high 414 in Ji-Parana. According to the Rondonia health secretariat, the most common transmissible diseases in the territory are malaria, leishmaniasis, measles, and whooping cough; the most frequent causes of death (1977-78) are malaria, hepatitis, tuberculosis, and measles. 1/ Work accidents associated with land clearing are also cited as a major health problem.

1/ In 1977 the leading causes of death in Mato Grosso were infectious and parasitic diseases, respiratory ailments, and anemia. No further details are available.

3.28 Of the health problems listed above, malaria is without a doubt the most serious threat to the new settler -- both in Rondonia (to the north of Cacoal) and in the Guapore Valley of Mato Grosso. In recent years, about one-third of the national total of malaria cases have been reported in Rondonia. 1/ Malaria is certainly not new to the region; a large number of malaria-related deaths reportedly occurred during the construction of the Mamore-Madeira railroad at the turn of the century. Nevertheless, the rapid and disorganized settlement of the region over the past ten years has created conditions which greatly exacerbate the situation. First of all, the new settlers from the south and northeast of Brazil usually have no immunity to the disease and often arrive in the territory weakened from the long journey and from other health problems such as intestinal parasites. Second, the process of land-clearing has disrupted the natural environment in ways which have frequently created new breeding grounds for the anopheles mosquito vector. Third, the houses of the new settlers are often provisionally built without walls and hence provide little protection against mosquito bites. Finally, the nomadism of the migrant population has greatly facilitated the transmission of the disease.

3.29 The highest incidence of malaria tends to be found in the newest settlement areas -- the towns of Ariquemes and Jaru in Rondonia and the municipio of Vila Bela in Mato Grosso are currently major focal points of the disease. In these areas the incidence of malaria has been in the neighborhood of 50% in recent years, and government actions to eradicate the disease have amounted to little more than holding actions. Overall responsibility for the anti-malaria campaign rests with SUCAM, a federal agency linked to the Ministry of Health. SUCAM operates throughout the Northwest and in 1978 sprayed about 175,000 residences with DDT. Spraying operations, however, have been hampered by the lack of walls on many houses and by some resistance on the part of the population. Health officials expect that the incidence of malaria will fall when the rate of new settlement starts to decline, but doubt that the disease will ever be completely eradicated from the region.

3.30 Like the case of education, regional health manpower and infrastructure is inadequate and tends to be concentrated in urban areas. A brief summary of the available indicators bears this out. As of 1978, about 335 physicians were working in the region; yielding a population-to-physician ratio of around 3,000:1. However, since 75% of these doctors practiced in Cuiaba and Porto Velho, the ratio in areas outside of these cities must have been on the order of 6-7,000:1. This may be compared to the national average of about 1,650 persons per medical doctor. The regional population-to-hospital bed ratio, a common proxy for health infrastructure, is also substantially higher than the national average of 260:1. In 1978, there were about 2,500 hospital beds in the Northwest, about equally divided between Rondonia and Mato Grosso. This would imply a regional average of about 400 inhabitants per hospital bed. Over half of these beds, however, were located in the capital cities.

1/ The number of reported malaria cases in Rondonia in 1978 totalled 37,501. Local health officials estimate that for every reported case there are probably three unreported cases.

3.31 In Rondonia, general public health services are coordinated by the territorial secretariat of health. 1/ However, in the towns along the Cuiaba-Porto Velho highway (from Ariquemes south) these services have been sub-contracted to the federal Foundation for Public Health Services (FSESP). As of 1979, FSESP operated nine health facilities of various levels of complexity in the territory, and four others were under construction. This agency has also implanted five urban water supply systems. The state of Mato Grosso has raised the possibility of entering into a similar agreement with FSESP to provide health services in the southern portion of the Cuiaba-Porto Velho highway, but this has not yet been finalized. Though the services of FSESP are generally of high quality, the problem of delivering health care to the rural population remains unresolved because this agency's facilities and manpower are concentrated in urban areas. However, it is expected that the current plan of the Rondonia government to establish urban support centers (nucleos urbanos de apoio rural) away from the main highway should ameliorate the situation considerably. As currently envisaged, these support centers would contain not only health posts, but schools as well (see Chapter VI, paras. 6.28-6.29 for more details).

D. Population Projections

3.32 It is extremely difficult to estimate the future population of the Northwest because the baseline data are precarious and because the determinants of the size and pattern of the migratory flow are not sufficiently known. In the past, demographers have grossly underestimated the extent of expected migration and, accordingly, population projections have invariably erred on the low side. The FIBGE and University of Brasilia population projections for Rondonia are cases in point. For 1980, FIBGE predicted a total population for the territory of 172,000; a figure that was probably purpassed during the first half of the 1970s. A University of Brasilia researcher, in turn, predicted a 1980 population of 442,000. Even this latter estimate probably underestimates the real total by as much as 300,000 inhabitants.

3.33 For purposes of regional planning, the federal government has recently projected the population of the Northwest to 1985 and 1988. These estimates assume that the reconstruction and paving of the Cuiaba-Porto Velho highway will be carried out and that feeder roads construction and agricultural development and settlement projects will be implemented in the highway's area of influence. The baseline data for the projections were the same as those presented in Table 2. The results, shown in Table 6, indicate that the regional population should reach two million in 1985 and almost 2.8 million by 1988. This implies an average annual growth of population during the 1978-88 period of about 10.2%. The projections also imply that migration to Rondonia should average about 70,000 individuals per year through 1988; annual migration to Mato Grosso should amount to around 45,000. These estimates of the expected migratory flow are considerably higher than the totals inferred for the decade of the 1970s and undoubtedly reflect the "pull" of the proposed highway and agricultural development and settlement projects.

1/ The provision of health care services to the indigenous population is the responsibility of FUNAI. The nature of these services is discussed in Chapter IV.

Table 6

NORTHWEST REGION: POPULATION PROJECTIONS, 1985 and 1988

State/ Territory	Total Population 1985	Total Population 1988	Rural Population 1985	Rural Population 1988
Rondonia	1,125,786	1,457,925	551,635	728,962
Mato Grosso	973,431	1,320,621	496,450	660,310
Northwest	2,099,217	2,778,546	1,048,085	1,369,272

Source: Ministries of Interior, Agriculture and Transport, Programa Integrado de Desenvolvimento do Noroeste do Brasil (Brasilia, 1979).

IV. AMERINDIANS

4.01 Since the colonial period, Brazil's Amerindian population has fallen from an estimated two to five million to a present-day population of less than 200,000. This dramatic decline has been the result of a combination of factors, including early slave raiding expeditions, exposure to disease, and intermarriage. More recently, the progressive occupation and economic development of Amazonia has placed the Amerindian population -- most of which is comprised of sedentary agriculturalists -- in an increasingly precarious position. Diseases transmitted by new settlers have decimated whole tribes and illegal seizures of Indian lands have reduced the area available for traditional hunting, fishing and agricultural activities.

A. Legislation

4.02 The legal status of the Indian is defined in the Brazilian Constitution of 1969, the Indian Statute of 1973, and in a series of laws and decrees enacted between 1967 and 1980 which established and governed the National Indian Foundation (FUNAI). Until 1969, Brazilian law had formally recognized Indian rights of ownership to the land which they inhabited. The Constitution of 1969 modified this doctrine, so that land occupied by indigenous peoples is now considered to be the property of the State. However, the State guarantees the inalienability of these lands and protects Indians' rights to possession, use, and the income earned from natural resources. This legal precept also appears in the Indian Statute, which also specifies a number of measures for the protection of the Indian population and culture.

4.03 However, the Indian Statute also specifies several reasons for which the guaranteed rights of the Indians may be suspended. These include:

(i) to end fighting between tribal groups;

(ii) to combat serious epidemics that threaten the survival of the native community;

(iii) to maintain national security;

(iv) to carry out public works of interest to national development;

(v) to repress widespread disorder; and

(vi) to work valuable subsoil deposits of outstanding interest for national security and development.

It is clear that these qualifications can, and in some cases have, reduced the effectiveness of the legal guarantees provided in the Indian legislation. Nevertheless, it is important to note that the main thrust of the legislation is to provide for protection of the rights of the Indian population in ways which duly recognize their cultural distinctness and their need, given their existing economic systems, for large areas of land.

B. Institutions and Administrative Structure

4.04 The Indian Protection Service (SPI), established in 1910, was the first agency to deal with the problems of the Amerindians in Brazil. In 1967, as a result of serious criticisms and charges of corruption within the SPI, a new agency, FUNAI, was established. The growing emphasis on development of the Amazon in Brazil since 1970, and the creation of the National Integration Program (PIN) with its ambitious sub-programs of highway construction, mineral and other natural resource surveys, and agricultural development; the SUDAM fiscal incentive program; and official and spontaneous settlement, have intensified the pressures on Indian lands. This, consequently, has made the role of FUNAI as a mediator between "developmentalists" and advocates for the defense of the Indians increasingly important.

4.05 FUNAI often needs the cooperation of other agencies in order to fulfill its mission of protecting Indian interests. This is particularly true with respect to INCRA, which is called upon to take responsibility for the relocation of squatters who invade Indian lands. In general, it has been difficult for FUNAI to enlist the cooperation of other state and federal agencies. This is due, in a large part, to the weak support FUNAI has received from the federal government.

4.06 FUNAI is administratively linked to the Ministry of Interior, like the territorial governments, SUDAM, and SUDECO. However, its objectives often conflict with those of the other, more economic development oriented, institutions. Another serious problem in the history of FUNAI has been the chronic shortage of funds which has forced postponement of many programs, including the demarcation program for Indian lands. Initially, the deadline for demarcation was December 1978, but this has since been extended indefinitely.

4.07 FUNAI has a large administrative headquarters in Brasilia, in which the Presidency, Advisory Groups, Associated Groups, Administrative Superintendency, and Executive Departments are located (see Figure 1). The Executive departments are responsible for FUNAI's direct work with the Indians. The Community Planning Department, originally responsible for community farming, health, education, and research, is now responsible only for research. The Assesoria de Planejamento (ASPLAN) has assumed the planning function. The Indian patrimony department is responsible for commercial activities which involve Indian lands, resources, or production (including handicrafts). These activities include:

(i) leasing Indian lands, generally for agricultural use;

(ii) cutting and milling timber on Indian lands, either by lessees or by the department itself;

(iii) raising cattle;

(iv) marketing Indian handicrafts; and

(v) mapping, measurement, and demarcation of lands.

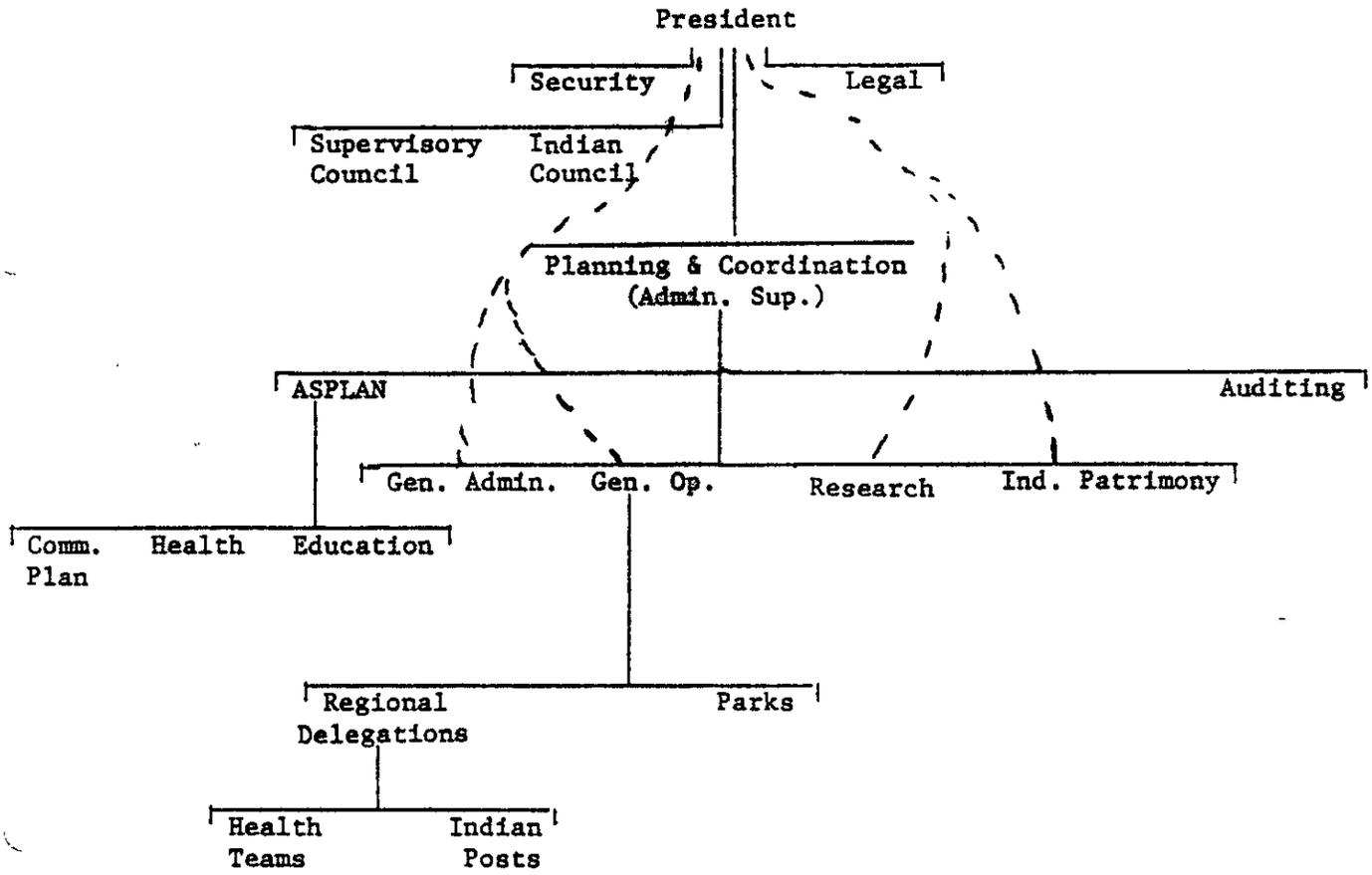
Finally, the general operations department is responsible for the regional delegations, which are responsible for Indian posts, parks and reserves.

4.08 It is at the Indian posts where daily contact is maintained with the indigenous population. Each post is equipped with a medical dispensary and is staffed by a post manager, nurse's aide, and general purpose workers. The area, population, and number of villages attended by these posts varies considerably, sometimes encompassing a large area with a dispersed population. During the early 1970s, Indian post managers were given a training course organized by the education division with lectures on basic anthropology, medical care, accounting, and other relevant subjects. This training was discontinued in the late 1970s.

4.09 The regional delegations also maintain mobile health teams which consist of a doctor, dentist, nurse, and laboratory technician. These teams carry out routine inspection missions and emergency missions (e.g., for the control of an epidemic). In general, the mobile health service operates only in the area of its regional delegation, but in emergency cases it may be called upon to assist a delegation other than its own. Transport for the medical teams is provided by FUNAI, which employs boats, small aircraft and, in emergencies, an air taxi service.

Figure 1

FUNAI: Organizational Chart



4.10 The FUNAI administrative structure separates the planning and implementation departments. For example, community development and health programs are planned by the ASPLAN, but implementation of those programs is the responsibility of the general operations department. Another complication is that Indian Patrimony programs are elaborated independently of ASPLAN, which raises the possibility that conflicts will exist in programs for the same area. Recent news reports suggest, however, that steps are being taken to improve inderdepartmental coordination.

4.11 FUNAI suffers from low morale among post managers, who are the most consistent link between the Indians and the institution which acts on their behalf. The separation between the local level personnel and the Brasilia headquarters of FUNAI mainly arises from the fact that communications are sent through the regional delegate. Also, high policy-making positions are often filled with political appointees who change when governments change, rather than with career personnel who thoroughly understand Indian problems.

4.12 Finally, FUNAI suffers from a shortage of basic equipment with which to maintain its operations, that is, radios, boats, vehicles, and aircraft. Delays in communication, and consequent delays in responses to problems (such as epidemics) could be minimized if the posts were better equipped. It should also be added that posts sometimes remain unattended, often for three months or more, a result of delays in personnel transfer or hiring.

4.13 The FUNAI structure could be strengthened with three basic modifications or improvements:

(i) increased and consistent financing to permit the establishment of additional Indian posts, to improve the equipment and supplies of the posts, and to develop a staff of sufficient number and quality to maintain these ports; and

(ii) allowing more direct communication between local and Brasilia staff, to help remove the isolation and some of the frustration of the former.

(iii) creating a career service that would place career people in high decision-making positions.

C. Demarcation of Indian Lands

4.14 The demarcation of Indian lands, in a way which is clear and unmistakable, is essential to ensuring the preservation of Indian territory. FUNAI has developed a set of procedures to carry out this process. The first step, after an Indian group has been located, is to declare an area "interdicted." This is an administrative measure which prohibits the entrance of anyone, with the exception of FUNAI staff, to an area believed to be inhabited by Indians. The boundaries of the interdicted areas are only approximate, however, and little or no monitoring is done.

4.15 After an Indian group is contacted -- a process which can require as little as a month, but may last a period of years -- FUNAI is better able to identify clearly the range of the Indian lands. The second step taken is to "delimit" the area, based on information gathered in field work with the Indians. Delimitation is done on a map and, once determined, serves as the basis for a presidential decree, or a regulation of the president of FUNAI, granting to the Indians rights over those lands contained within the delineated boundaries.

4.16 The third and final step is the actual "demarcation" of lands at the ground level. According to FUNAI norms, this requires the clearing of a swath of land around the reservation wide enough for surveyors to establish boundaries, and the marking of the boundary lines with surveyors' markers. Signs are also to be posted at regular intervals. In practice, demarcation is generally not of the kind required. Sometimes a wire strand is strung around the boundary. Other times, blazes are left on trees to indicate boundaries. These last two methods are not considered to be effective, as they do not clearly show that no settlement is allowed on these lands. Wire can be mistaken for a squatter's fence; blazes disappear after a short time, and are simply ignored. Demarcation is contracted out to private firms, through the office of general operations in Brasilia. The cost per kilometer demarcated is currently estimated at Cr$35,000 (about US$700).

4.17 Discussions with Indian post managers and regional delegates indicate that the first and most important step to take with respect to protection of the rights of Indians to their land is to demarcate and monitor borders of reservations. The common wisdom is that this would discourage a good deal of the illegal trespassing taking place in the region which, many people believe, occurs out of ignorance. A proper allocation of funds with which to contract services of surveyors and others to complete the process of demarcation is clearly a priority for FUNAI.

D. The Situation of the Indians in the Northwest

4.18 It is, at present, difficult to accurately describe the situation of the Indians in the Northwest for two reasons. First, information sources (FUNAI, anthropologists, publications, etc.) disagree in their presentation of the facts, and there is no central source of information which is complete. Second, because settlement of the area has been relatively recent, new contacts with Indians are still being made and, thus, "undiscovered" tribes may still remain to be contacted. The available data on the number and location of the Northwest's Indian population is extremely sketchy and what follows below should be considered in this light.

4.19 The total Indian population of the Northwest is estimated at about 7,000. There are approximately 40 groups that make up this population, some of which are known to exist, but with whom contact has not been established. At present there is one reserve, one park, and one ajudancia: The Nambikwara reserve in Mato Grosso, the Aripuana park straddling the Mato Grosso - Rondonia

border and the Ajudancia de Guajara-Mirim in Rondonia. 1/ The size of the Nambikwara reserve is approximately 912,000 hectares and the Aripuana park about 1,672,000 hectares. The total area of the Ajudancia de Guajara-Mirim is on the order of 437,800 hectares, though the precise figure is not known. There are also about 30 smaller Indian posts scattlered throughout the region.

4.20 There are a number of areas where the lands have been "interdicted" (an area of land in which Indians are known to exist but whose needs and traditions are not known) in Mato Grosso and Rondonia. For example, the area of the Saluma tribe, east of the Cuiaba-Porto Velho highway and bordering the Nambikwara reserve, and of the Zoros tribe, north of the highway, are in Mato Grosso. A large area (approximately 878,000 hectares) southeast of Ariquemes in Rondonia is also interdicted and FUNAI is presently conducting an expedition there to contact the recently discovered Uru-eu-wau-wau tribe. 2/ It is unknown at present how much land will ultimately be reserved for these Indian tribes.

4.21 Despite the efforts of FUNAI, there are frequent reports of settlers illegally occupying Indian lands in the Northwest. This problem appears to be particularly serious in the northeast of Rondonia and in the Guapore Valley of Mato Grosso. The area of the Sete de Setembro post in Rondonia, for example, has suffered the invasion of approximately 250 settler families. Some of these families have apparently been within the limits of the post for as long as three years. Invasions of Indian lands are also reported in the following posts of the Ajudancia de Guajara-Mirim: Lage (number unknown), Guapore (ten families), Pacaas Novas (57 families). Thus, in Rondonia alone, there are over 300 families settled illegally on Indian lands. 3/ It is also reported that there are two ranches of unspecified size located within the boundaries of the Roosevelt Indian Post.

4.22 The Nambikwara group of Indians are also reported to be in an especially difficult situation as a result of invasions of their lands. This group of related tribes is indigenous to two different areas of Mato Grosso near the Rondonia border: the large area of savannah to the east of the Cuiaba-Porto Velho highway, and the densely-forested Guapore Valley to the west. As mentioned above, a large reserve has been established by FUNAI in the first of these areas, and illegal settlement on this reserve is reportedly almost non-existent.

4.23 During the late 1960s, however, a number of cattle ranches approved for SUDAM fiscal incentives (see Chapter VII, paras. 7.37-7.38) located on traditional Nambikwara lands in the more fertile Guapore Valley. This

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1/ An ajudancia is an administrative definition of an area within which lands not yet demarcated as a reserve are served by a number of Indian posts.

2/ This tribe was discovered after an attack on a family of settlers who had unknowingly settled on their land.

3/ Because of the lack of complete information this figure may understate the real situation.

occurred because FUNAI had issued "negative certificates" (certidoes negativas) stating that no Indians existed in the area. Once it became clear that Indians did, indeed, exist in the area, an attempt was made by FUNAI to relocate them to the Nambikwara reserve to the east of the Cuiaba-Porto Velho highway. There, many of the relocated Indians apparently contracted disease and subsequently tried to return to their traditional lands to the west. The remnants of these tribes now live in a precarious state on small Indian areas in the Guapore Valley of Mato Grosso, a sub-region through which a new 203 kilometer stretch (Barracao Queimado to Pontes e Lacerda) of the Cuiaba-Porto Velho highway is expected to pass (see Chapter IX, para. 9.31).

4.24 On the basis of the information presented above, it appears that the federal agencies responsible have been unable to protect Indian lands adequately from encroachment. It is believed that there are two general reasons for this failure: (i) FUNAI has received inadequate funding and support from Brasilia to carry out its functions; and (ii) the failure to demarcate and monitor borders and to expel settlers in the early stages of invasions has given the impression that Indian lands will eventually be turned over to those who establish "squatters' rights." This has led to claims for compensation from settlers who are threatened with expulsion and, as the pressure on the Indians' land grows, may well intensify the conflicts between settlers and Indians.

E. Recommendations

4.25 The implementation of POLONOROESTE will serve to further attract settlers to the Northwest and this, in turn, will intensify pressures on Indian lands and increase the transmission of diseases to the indigenous population. Hence, measures to protect the Indians during the coming years should include:

(i) steps to strengthen the administrative organization and effectiveness of FUNAI including increases in staffing, field posts, buildings, communications equipment, transportation equipment and salary and benefit scales;

(ii) actions to contact those communities that have not yet been contacted;

(iii) a program, phased in accordance with a realistic estimate of FUNAI's expanded execution capability, to complete delimitation and demarcation of all Amerindian lands in the Northwest. Such a program would set targets for kilometers of boundary to be surveyed and demarcated each year;

(iv) a program to resettle all illegal settlers now in Amerindian reservations, with specified timing for each such group;

(v) a program to monitor lines of demarcation of Amerindian lands, and protect them from future invasions. Such a program should include establishment of new Indian posts, and acquisition of additional staff, vehicles (land and air) and communication equipment, showing numbers, types and expected year of acquisition;

(vi) measures to protect and improve the health of Amerindian communities, including inter alia, a comprehensive and timely immunization program, increased numbers of doctors, paramedics and other health personnel, and buildings, vehicles and equipment; and

(vii) special measures by the National Highways Department (DNER), its consultants and contractors, and FUNAI, to avoid incursions into Indian lands by road construction teams and to protect the interests of Indians who may venture into construction camps; and measures to provide medical examinations, vaccinations, and other health services to the contractors' personnel.

4.26 The effective implementation of the above measures would help materially to shield the Indian population in the Northwest from the historically adverse effect of contact with non-Indian populations. Without such measures, the risk to the health and welfare of the Indians in the area would increase with the swelling tide of migration that may be expected once the implementation of POLONOROESTE begins.

V. ENVIRONMENTAL ISSUES AND POLICY

A. General Considerations

5.01 The Amazon region holds the world's largest standing tropical evergreen rainforest and most diverse biological stock. The forest forms a delicately balanced ecosystem, still only partially understood, in which nutrients pass very quickly into the shallow root structures of trees owing to the rapid degradation of falling detritus in the high humidity. When the forest is removed, and not replaced by other protective vegetation, the soils become fully exposed to the elements and, as such, tend to leach and erode.

5.02 A further reason for conservation of the Amazon forest is the enormous variety of flora and fauna it contains. Many species of its plant and animal life are as yet unidentified, with unknown possible value to human beings. This fact highlights the importance of basic biological research and argues for the maintenance of large biological reserves in various places in Amazonia, since the stock of flora and fauna varies greatly from one sub-region to another.

Choice of Crops

5.03 Contrary to popular thought, the extent of deforestation of Amazonia (and of Rondonia) so far is estimated by Landsat photography to be less than 2% of the total land area. However, the pace of deforestation is likely to increase with additional migration. This means that the choice of crops is environmentally crucial. Tree crops and forest industry are strongly

preferred over annuals on environmental grounds because they protect the fragile soils, reduce soil deterioration, and produce on a sustainable basis. Those tree crops grown with the most protective cover will conserve the soils longer than those with more open canopies. Similarly, those tree crops harvested without killing the tree (e.g., oil palm) are more protective of the soils than those which kill the tree (e.g., heart of palm).

5.04 The appropriate mix of crops should be determined as an integral part of the development program for the Northwest. At this stage it is clear that a sustainable, rational land use plan would include forestry, tree plantations, and perennial crops such as coffee, cocoa and rubber. However, one of the major problems in developing forestry and tree crops will be the high rate of inflow of migrants who initially exploit the land primarily with annual crops. An additional problem is that the silvics and economics of sustained forestry in the Amazonian environment are not yet sufficiently known, although the government is currently sponsoring research on these topics. Thus, forestry and tree crop-based development ought to be medium to long-term objectives of regional policy.

Energy Relations

5.05 The Northwest is currently dependent on petroleum for the bulk of its energy requirements. All the official settlement projects are based on diesel-fueled electricity and most of the region's imports and exports are carried by trucks. While there are plans to tap the hydroelectric potential of the region (see para. 8.08), little has been done to develop forest-based energy sources. This is paradoxical given Brazil's heavy reliance on foreign oil, and the huge amount of biomass present in the Northwest.

5.06 The forest may be converted into a number of alternative energy sources, including firewood, sawdust, charcoal, methyl alcohol, and biogas. Some wood or sawdust-fueled steam engines are now used in the region for powering sawmills and mining operations, but these are the exceptions. Charcoal, which is easily produced, could be used for domestic cooking and for supplying energy to some types of industry. The production of methyl alcohol and biogas (largely methane) would involve higher levels of technology than charcoal, but these energy sources could serve various additional purposes including fuel for tractors and trucks. All of the above energy sources should be considered by the government in the context of long-term planning for the Northwest, perhaps in conjunction with the ongoing research on sustained forestry alluded to in para. 5.04.

B. Government Institutions and Policies

5.07 Brazilian government policies regarding conservation and preservation of the environment have undergone many revisions since 1970. In 1972, in a paper submitted to the UN Conference on the Environment, the government emphasized the commitment to rapid economic growth and stated its belief that "... development should not be negatively affected by sometimes exaggerated

concern for preservation of the environment." Since then, the government has shown a marked and increasing concern about the environmental impact of projects in general, but especially about the effects of resource use in Amazonia. In February 1980, in a statement to a UN meeting on Tropical Forests, the government emphasized its strong interest in forest management, particularly in its potential as a substitute for energy inputs. It has indicated its intention to make a strong effort to prove the technical, ecological, and economic possibilities of sustained forest management, in order to prevent the spread of other, less desirable, forms of land use.

5.08 In May 1979, an Interministerial Commission was created by the President of Brazil, with the objective of preparing recommendations for an integrated forest policy for Amazonia. The final report of this Commission calls for the establishment of a "conservation unit system", a system providing for the development of a basic strategy for the conservation of Amazonia's renewable natural resources, and for the rational utilization of financial and human resources for the system's management and control. The general lines of action for this system, as stated in the Commission's report, would be to:

(i) establish a system of ecological and economic zoning for Amazonia; 1/

(ii) establish new, and enlarge existing, protected or conservation areas;

(iii) demarcate and regularize Amerindian lands;

(iv) bring order to the land tenure situation;

(v) establish national forest areas for multiple-purpose use with an emphasis on sustained-yield logging with natural regeneration;

(vi) strengthen the forest administration system;

(vii) intensify research efforts, and aid the development of qualified researchers;

(viii) recuperate degraded lands;

(ix) intensify river fishing, taking care to guard against over-fishing;

(x) promote conservation in education; and

(xi) re-examine and reformulate forestry legislation.

1/ The government of Rondonia has already proposed a land-use zoning plan that would reserve 50% of the territory's land area for the indigenous population and for non-agricultural uses (e.g., forest reserves, national parks, etc). An additional 20% of the area would be used for tree crops, and 30% for other uses (urban areas, industry and annual crops).

The legislation to implement the above measures is expected to be considered by the Brazilian Congress in 1980.

5.09 The major institution responsible for carrying out national forestry policies is the National Institute for Forestry Development (IBDF). IBDF was created in 1967 as a semi-autonomous organization linked to the Ministry of Agriculture. To date, its main activity has been the administration of fiscal incentives for reforestation, most of which has taken place in southern and central Brazil. However, IBDF also bears the primary responsibility in the federal government for conservation, national parks, forest reserves and similar tracts. The main tracts in the Northwest are listed below:

(i) the Pacaas Novas National Park (Rondonia) was created in October 1979. An interdicted Indian area and a forest reserve lie within this 764,800 hectare park;

(ii) the Pedras Negras Forest Reserve (Rondonia) was created in 1961 with 176,000 hectares, but recently rescinded;

(iii) the 679,000 hectare Jaru Biological Reserve (Rondonia) created in 1961, since largely lost to CEPLAC's Burareiro cocoa project; and

(iv) the Cara Cara Biological Reserve (Mato Grosso), created in 1971, eventually to cover 80,000 hectares in the municipio of Caceres on the frontier with Bolivia. A Pantanal National Park of about 300,000 hectares has been proposed, which would include this reserve.

5.10 In addition to the establishment of government conservation tracts, IBDF does not permit any private landowner to clear more than half of his property, a measure known as the "50% rule." However, if land is sold or transferred, the new landowner is free to clear 50% of his parcel, thus leading to additional deforestation. In order to close this loophole in the legislation, the Interministerial Commission has recommended the creation of central forest reserves and that new development projects (including land settlement) include forest reserves equivalent to 50% of the land available. Such reserves would be continuous and not depend on individual landowners for maintenance. This will greatly improve chances of enforcement. INCRA is now planning its new settlement schemes in accordance with the Commission's recommendation (see Chapter VI).

5.11 IBDF is presently considered to be a weak institution, lacking in funds and human resources to carry out its responsibility for supervising forest use in Amazonia. The Interministerial Commission's report makes recommendations for basic measures to strengthen IBDF, including the creation of a department of Amazonian natural forest resources, which would be responsible for implementing the forest policy being developed, and would receive adequate equipment and stations for the purposes of:

(i) surveying the land tenure situation in areas of national forest and resource reserves;

(ii) selecting areas for national forests and conservation units;

(iii) enforcing the boundaries of national parks, forests and other conservation units;

(iv) carrying out forest inventories, to identify commercially desirable species;

(v) preparing programs for logging and milling operations; and

(vi) developing long-term forest use systems, based on the development of methods of log extraction and reforestation.

Further, the Commission's report calls for the strengthening of IBDF's supervisory capacity, including the use of state and territorial agencies for such supervision. This would expand IBDF's ability to monitor and enforce conservationist practices, as well as to implement a forest policy taking into account the dual objective of economic development and conservation.

5.12 A second agency involved with environmental matters is the Special Environmental Protection Service (SEMA) in the Ministry of the Interior. SEMA was established in 1973 for the purposes of monitoring the utilization of the country's natural resources and environment, establishing pollution control norms and standards, coordinating federal pollution control activities, and assisting state pollution control agencies. This agency has established a 266,000 hectare ecological station in the Northwest (in the municipio of Aripuana, Mato Grosso) to serve as a base for the scientific study of the region's natural environment. Basic research on possible uses of the tremendously varied flora and fauna of Amazonia is still extremely scarce. Thus, the program of ecological research stations ought to be expanded. By placing them strategically in the region, it would be possible to reserve areas for study which cumulatively preserve the forest variety. SEMA and the government of Rondonia are now considering the establishment of a new ecological station in the territory.

5.13 The measures discussed above are promising, and reflect the commitment of the Brazilian government to improve their management of environmental issues in the nation and in Amazonia in particular. The proposed plans and programs will, however, require some time for implementation. In view of the rapid migration into the area, it is clear that there are some environmental risks, and that some damage will undoubtedly occur. However, by establishing usable criteria for program planning, and by promoting the process of institution-building, this damage can be kept to a minimum.

VI. LAND SETTLEMENT

A. General Background

Historical Precedents

6.01 Amazonia has long been regarded as a potential home for marginalized people from overpopulated parts of Brazil, especially the Northeast. During the rubber boom of the late nineteenth and early twentieth centuries, as well as during World War II, there was a significant flow of workers from the Northeast to gather wild rubber in Para, Amazonas, Rondonia and Acre. However, these earlier settlements, based on extractive agriculture, generally declined with the recovery of the world economy after the war.

6.02 During the postwar years, the Brazilian government has made several attempts to establish small-scale land settlement projects. In the 1960s, the Superintendency for the Development of the Northeast (SUDENE) initiated the Alto Turi Project, which was expected to settle 26,000 families on three million hectares of land. SUDENE was unable to administer the project effectively and the use of just annual crops proved to be unsuitable for the relatively weak soils of the area. Therefore, in 1972 the scale of the project was reduced to a program for 5,200 families on 939,000 hectares of land and a public company, the Companhia do Colonizacao do Nordeste (COLONE), was formed to administer the project. In its reduced form, the Alto Turi project has been moderately successful.

6.03 In 1970, President Medici announced the beginning of the construction of the Transamazon highway, which was expected to provide the means for northeasterners to find new employment opportunities in the Amazon Basin. It was then confidently predicted that as many as 100,000 families (about 500,000 persons) would be settled along the highway in ten years. To this end, major small-scale settlement projects were established near Maraba, Altamira, and Itaituba, all in the state of Para. By mid-1978, however, only 7,900 families had been settled. Administration of these projects, by the National Institute for Colonization and Agrarian Reform (INCRA), was weak and failed to provide titles which were required for credit applications. Support services, including storage, and technical assistance, also failed to reach the settlers. These failures, combined with inadequate feeder roads construction, seriously stalled the development of the projects. Partly because of these initial setbacks, the Geisel Administration, which came to office in 1974, deemphasized colonization and small-scale land settlement, choosing instead to concentrate on promoting larger agricultural and ranching enterprises associated with POLAMAZONIA.

6.04 During the period when national policies for Amazonia were shifting, migrants began pouring into Mato Grosso and Rondonia via the newly-opened Cuiaba-Porto Velho highway. When this rush occurred, the government was not prepared to allocate land, assign titles, build feeder roads, or to provide agricultural extension services and credit. Serious land conflicts and the hardships experienced by the landless migrants made clear the need for greater governmental action and control in the area if its occupation was to

be orderly and consistent with the existing ecological and economic constraints. In the Northwest of Brazil, specifically in the area of influence of the Cuiaba-Porto Velho highway, the development of a strategy to provide for such an orderly occupation, as well as the strengthening of the institution involved, is still going on. But the development of settlement schemes based on small farms will require greater efficiency from the institutions involved as well as correction of the major errors made in the previous settlement models.

National Institute for Colonization and Agrarian Reform (INCRA)

6.05 INCRA, the major agency concerned with land settlement, was established in 1970 as a result of the merger of three other public agencies which had been, since 1964, responsible for the distribution and administration of federal lands. It was at first expected to concentrate its energies on the execution of an extensive land reform in the Northeast but, as there was little political commitment to that reform, it made little progress. INCRA soon concentrated on settlement along the Transamazon highway, and subsequently on bringing order to the situation in Rondonia. INCRA has jurisdiction over the disposition of all federal lands, including land within 150 kilometers of international boundaries and 100 kilometers each side of federal highways in the Amazon region. Moreover, it must approve land division projects carried on by any entity in Brazil — federal, state or private.

B. Mato Grosso

6.06 Land settlement projects in Mato Grosso have been managed primarily by private development companies which have submitted projects to INCRA and received approval. These projects are primarily located in the central part of the state, along the Cuiaba-Santarem highway, and in the municipio of Aripuana. While it is not the purpose here to analyze the private settlements in detail, it is useful for comparative purposes to make some comments about them.

6.07 In general, settlers who enter private settlement projects in Mato Grosso are, or were, owners of land in the south of Brazil. Agricultural land in the south is expensive, and smallholders cannot compete with larger landholders to buy additional lands. Smallholders may choose, therefore, to sell their lands in the south in order to purchase larger parcels of land in the north. This initial capital, combined with the returns from timber extraction, allow the settler to support himself and accompanying family until the land is productive. Private settlement projects, because of the cost of the land, do not generally absorb settlers from the region itself. However, local persons are frequently employed as wage laborers in the projects to help with clearing the original forest. Though other opportunities for more steady employment sometimes arise, local persons are seldom able to afford a lot within the project.

6.08 The Juina project, located in the Aripuana Valley in northwest Mato Grosso, is the only public colonization scheme now underway in the state. It was initiated in 1977 by the Mato Grosso Development Company (CODEMAT), and the first settlers entered the area in late 1978. Project administration and

settler selection are based on the system used in private settlement projects (but with a modified payment schedule) so that Juina is presently the least expensive project for the prospective settler to enter. The motivations for establishing Juina were to allow the state to capture the benefits of the land sale, and to populate an area of the state with good soils.

6.09 The Juina project occupies a total area of 411,000 hectares. The project design includes an urban nucleus which has a commercial and industrial (primarily sawmills) center. Around this urban center is a belt of smaller lots (12 ha.) for private residences and the growing of fruits and vegetables. Rural lots, for agricultural production, surround the entire nucleus. They are presently divided into lots of 110, 164, and 220 hectares, though larger areas (up to 3,000 ha.) may be made available. The following data show the distribution of lots as of 1979:

	Urban	Rural
Total available:	265	1,500
Total sold:	200	500
Total occupied:	154	190

Source: CODEMAT, 1979

6.10 Initial plans for the project base land use on a combination of coffee and cocoa, supported by adequate technical extension for settlers. In fact, there is no technical assistance program at the present time. In general, settlers bring to the area whatever previous agricultural or technical know-how they acquired. It is not clear why no technical assistance has been extended to the settlers. However, the necessity for technical assistance in many phases of land clearing and crop management is evident. For example, steep slopes have been clear cut and burned which, in the first season of rains, tend to erode away.

6.11 The recent history and pattern of land settlement in Mato Grosso suggests that the state will have to modify its policies if small scale land settlement projects are to achieve a higher level of government priority. Suggestions were made by some state government officials that a possible line of approach to instituting such projects would be the expropriation of large landholdings along the Cuiaba-Porto Velho highway. Given the increasing intensity of occupation of the region and the corresponding rise in land values, such an approach would require an expensive program of compensation to the landowners. The structure of land tenure in Mato Grosso thus remains an important obstacle to the development of small-scale land-settlement project.

C. Rondonia

6.12 INCRA has been the major agency responsible for controlling and organizing the massive migratory flow into Rondonia. In fact, until the new territorial government took office in March 1979, the planning and execution of programs for land use were carried out by INCRA with little input from territorial officials. The rapid increase in the demands for services from public agencies resulting from the in-migration was the major motive for the founding of seven INCRA land-settlement projects between 1970 and 1975 (see Table 7). However, despite the rapid migration into the region and the consequent rise in social tension, it was not until 1978 that INCRA established a separate administrative office in Porto Velho to deal with the emerging problems. This office, the Coordenadoria Especial do Territorio do Rondonia, was to deal exclusively with all phases of land tenure, settlement, and organization in the area. By 1978 the need for such a unit was very serious: a five-fold increase in population had taken place with no sign of slowing and a proliferation of projects, smaller administrative units, and special issues required overall integration into a concerted plan of action.

Table 7

Size and Capacity of INCRA Settlement Projects in Rondonia

Project	Year Founded	Size (Ha.)	Family Capacity *
Ouro Preto	1970	512,585	5,133
Sidney Girao	1971	76,300	500
Ji-Parana	1972	479,737	4,756
Paulo de Assis Ribeiro	1973	293,560	2,974
Padre Adolpho Rohl	1975	456,366	4,341
Burareiro	1975	304,925	1,215
Marechal Dutra	1975	494,661	4,520
		2,618,134	23,439

* As of end-1979, about 18,500 families had been effectively settled.

Source: INCRA

6.13 The increase in the number of settlement projects, as well as the growth in demand for public services (until 1975 provided almost exclusively by INCRA in the settlement projects), made it difficult for INCRA to proportion its budget adequately between the needs for investment in infrastructure on the one hand, and current expenses on the other. In both 1977 and 1978, for instance, only 10% of the total annual budget for the projects went for investment. Furthermore, there was a shortage of trained personnel to manage the projects in Rondonia. The INCRA salary scale is not sufficient to attract skilled people from other regions of Brazil, and the staff working in Rondonia is generally young with little experience. The resulting high rate of staff turnover in INCRA projects has made continuity in planning and management a serious problem for the agency.

6.14 The lack of long-range planning in the establishment and implementation of the INCRA projects in Rondonia had an overall negative impact on the situation in the territory. The promise of land with good soils already had a strong attractive power for southern and northeastern rural workers. The additional prospect of entering an INCRA settlement project, often nurtured by stories from friends and relatives who had moved into the territory, reinforced the tendency to migrate. However, as described in the next section, INCRA has yet to meet the minimum requirements for establishing an effective settlement system in the territory.

6.15 Past INCRA project design. Over the past decade, the Integrated Colonization Project (PIC) has been the model used by INCRA for land settlement schemes. It consists of three phases of operation:

(i) selection of the settlement site, mapping of 100-hectare lots, and selection of settlers;

(ii) establishment of the urban nucleus consisting of the project headquarters, offices of other public agencies working in the project, and residences for public employees; and

(iii) construction of infrastructure and completion of titling according to project specifications.

With the completion of the third phase — which means that all settlers have definitive title to land, road access to markets and urban centers, and health and school facilities -- the projects are to be transferred to state authorities. Of the seven existing projects in Rondonia, only Sidney Girao is considered ready for transfer to territorial administration, a process known as emancipacao. Present plans call for transfer of the other six projects by the end of 1981.

6.16 The physical layout of each of the settlement projects is essentially the same. The total area of the project is mapped, and then a grid-like pattern of roads conforming to rectangular 100-hectare lots is superimposed upon it. In theory, feeder roads are to be built prior to the arrival of the settlers. In practice, however, INCRA has fallen far behind the needs of the settlers for roads as well as titling. Because titling and road construction are the basis for the settlers' access to credit and markets it is worthwhile to review INCRA's historical performance in these two areas.

6.17 Titling. Until 1979, INCRA used a two-stage titling system, the purpose of which was to title only those settlers who had demonstrated a commitment to remain in the project. After registering with INCRA (generally when the INCRA agent visited the farmer) colonists received the Autorizacao de Ocupacao (AO), a provisional title recognizing their right to settle and work the land but not conferring ownership. Seasonal crop credit was made available for those with the AO. After a two-year interval and a visit by INCRA agents to evaluate the progress of the settler, the Titulo Definitivo (TD) was issued, a formal title of ownership with the restriction that no sale or transfer could be made without INCRA approval for a period of five years. With the TD, both production and investment credits were made available to the settler.

6.18 The system described above had two major disadvantages. First, the system severely limited the farmer's access to credit for at least a two-year period (not counting the period prior to receipt of the AO) and hence made settlement much more difficult. Second, the requirement of a number of documents of personal identification often delayed the processing and issuance of titles. In an effort to resolve this latter problem, the Army undertook a campaign to issue full and adequate documentation to settlers in the projects. However, inadequate documentation on the part of applicants continues to delay the processing of titles.

6.19 Table 8 shows how uneven performance has been in titling. The maximum number of titles issued during any one year (1978) was 2,586. In 1974, no titles were issued, despite the fact that four of the seven projects had already been initiated. A large part of the problem in titling results from a shortage of staff in the field and the difficulty of access to farm sites. In the Ouro Preto project, for example, only three technicians responsible for processing documents were assigned to the settlement division in mid-1979. One result of the uneven distribution of titles has been the development of a land tenure situation which varies according to the distance of the settlers' lot from the Cuiaba-Porto Velho highway. In general, the area of definitive titles extends in a band extending to 20 kilometers on either side of the road. The area between 20 and 40 kilometers on either side of the road consists primarily of lots with provisional titles. Beyond that range any documentation of landholding is scarce, and it is in this area that land tenure is most unstable.

Table 8

TITLES ISSUED BY INCRA IN RONDONIA SETTLEMENT PROJECTS, 1973-78

		Realized					
	Target	1973/74	1975	1976	1977	1978	Total	% of Target
Ouro Preto	5,133	78	1,059	985	114	696	2,854	57
Sidney Girao	500	0	101	157	32	93	383	76
Ji-Parana	4,756	0	387	492	0	415	1,294	27
Paulo de Assis Ribeiro	2,974	0	0	0	0	712	712	24
Padre Adolpho Rohl	4,341	-	85	903	28	115	1,131	26
Burareiro	1,214	-	0	0	0	158	158	13
Marechal Dutra	4,520	-	0	0	0	397	397	8
Total	23,438	78	1,632	2,537	174	2,586	6,929	29

Source: INCRA, Porto Velho

6.20 Recently, the new national INCRA administration has given increased emphasis to titling, and staff from other divisions have been assigned to this task. The system also has been streamlined in accordance with the aim of speeding transfer of the projects to territorial jurisdiction. The required personal identification documents have been cut from eight to only three, and titles can be approved directly in Porto Velho instead of Brasilia as was previously the case. Most importantly, INCRA has apparently decided to rescind the two-tier system and to issue definitive titles to qualified settlers with no waiting period. The pace of titling is expected to accelerate as a result of these procedural changes and it is estimated that 5,000 definitive titles were distributed in 1979.

6.21 Roads. Roads are a major element in the success or failure of any settlement project, as they guarantee access to markets, to medical care and schools, and to technical assistance agents working in the field. As with titling, INCRA performance in road building has been erratic. In 1973 only 150 kilometers were built, while in 1976, 1,258 kilometers were built (see Table 9). Moreover, the ratio of kilometers of road per settler, given the grid-like configuration used by INCRA, is a relatively high 0.33. In contrast, the Alto Turi project in Maranhao, which uses a different settlement pattern to serve a number of settlers equal to the Ouro Preto project, has a ratio of 0.07 kilometers per settler. Project design thus demands a fairly heavy road construction component. However, INCRA has neither been able to meet the demand for roads nor used an effective project design to minimize this requirement.

Table 9

INCRA ROAD BUILDING IN RONDONIA PROJECTS, 1971-78
(Kilometers)

	Target	Realized						% of
		1971/74	1975	1976	1977	1978	Total	Target
Ouro Preto	1,770	567	94	428	31	0	1,120	63
Sidney Girao	224	142	0	26	0	0	168	75
Ji-Parana	1,427	172	40	237	142	32	623	44
Paulo de Assis Ribeiro	1,003	56	105	245	150	0	556	55
Padre Adolpho Rohl	1,300	n.a.	406	0	0	0	406	31
Burareiro	896	n.a.	23	106	36	96	261	29
Marechal Dutra	1,123	n.a.	10	217	85	63	375	33
Total	7,743	937	678	1,259	444	191	3,509	45

n.a. = not available.

Source: INCRA, Porto Velho.

6.22 It should be pointed out that the figures for road construction are deceptive, as most "roads" are narrow and only seasonally useful. In the Ouro Preto project, for instance, it is estimated that during the dry season roads give access to 70% of the project area while during the rains access drops to only 10%. As rice and corn are harvested during the rainy season, much of this production is lost owing to lack of access to proper storage facilities or to markets.

6.23 Two efforts involving greater colonist participation have been made to ease the road situation. In 1978, road construction and maintenance was carried out through a program of limited cooperation between INCRA and settlers in which settlers paid for fuel and INCRA provided machinery for the work. In 1979, this effort was expanded, and coordination was passed by INCRA to the Secretariat of Agriculture and Colonization (SEAC) of the territory of Rondonia. This effort involves the participation of all agencies working in the projects, as well as municipal governments and settlers. It is centrally coordinated by the SEAC and involves specific commitments of manpower, funds, and material resources by all participants. 1/

6.24 To serve the areas of most critical need, it was estimated that 1,500 kilometers of roads would be required by the end of 1979 and, according to the SEAC, this target was reached. However, owing to unforeseen detours it is now estimated that an additional 400 kilometers will be necessary. The results of this self-help effort have been quite positive, both in the sense of pooling resources to meet the critical need for roads and in providing a basis for coordinating agencies such that further similar community development efforts may be possible. However, despite the positive effects this type of community effort may have, such a program makes a significant demand on settlers whose first priority is to care for their farms.

6.25 Support Services. 2/ In 1974, INCRA began to reduce its responsibilities in the settlement projects by passing the responsibility for providing specific services to other state and federal agencies. These other agencies were to provide the necessary support services--adequate credit facilities, storage areas, technical assistance, and medical and educational services--that would help fix the settler to the land. While there are some project-to-project differences, the interagency division of responsibilities is usually as follows: Technical Assistance and Rural Extension Association-Rondonia (ASTER-RO): technical assistance for rubber, cattle, and subsistence crops; Executive Commission for the Cocoa Development Plan (CEPLAC): cocoa development, including, technical assistance research, and marketing; Brazilian Agricultural Research Enterprise (EMBRAPA): farm system and crop specific research; and Special Public Health Service (FSESP): medical assistance.

1/ Settlers are responsible for clearing a 30 meter wide stretch of forest along the road path; government agencies provide technical direction, machinery, and funds.

2/ A more detailed evaluation of the existing agricultural support services in the Northwest is contained in Chapter VII.

6.26 In general, though performance varies from agency to agency, the administrative set-up outlined above has been ineffective in implementing services on a scale large enough to adequately serve the settler population. To a great extent, the performance of a given agency has depended on the availability and consistency of funding, the ability to pay salaries that attract qualified personnel, and local managerial capability. The lack of cooperation among agencies operating in the projects has also been a problem. Examples include lack of coordination in the use of vehicles (at present each agency maintains its own fleet of vehicles) and overlap in the provision of some services leading to conflicting instructions to the farmers. This problem is primarily a reflection of coordination the piecemeal approach to land settlement so far taken by INCRA.

D. Proposed Settlement Programs

6.27 The population forecasts for the 1980s, which assume migratory inflows even larger than those of the previous decade, clearly suggest that settlement programs for the Northwest will need to be expanded considerably. In addition, steps will need to be taken to consolidate existing settlements in order to rectify the errors in planning and execution discussed above. Although the past performances of INCRA and other agencies involved in land settlement have often been less than ideal, much useful experience has been accumulated -- experience that is now being utilized to guide the design of new programs.

Consolidation of Old Settlement Areas

6.28 In order to consolidate areas of older settlement, the Rondonia government, under the direction of the SEAC, has developed a plan to extend the present network of support services to locations situated from 20 to 80 kilometers on either side of the Cuiaba-Porto Velho highway. This plan calls for the establishment of a number of urban support centers (*nucleos urbanos de apoio rural* - NARs) at strategic locations in the rural zone. These proposed support centers would be of various sizes, depending upon the population to be served. Smaller ("primary") centers would be linked to larger ("district"), market-oriented centers, and a system of storage, which would permit settlers to hold crops until prices were better or to move them to where transport was easier, would help deal with the current problem of crop losses. NARs would also contain a technical assistance agent, schools, health posts, a commercial district, recreation facilities, and police, telephone, and postal agencies. The new territorial development company (CODERON) would be responsible for managing the network's production and marketing system, perhaps also acting as a buying agent for the Bank of Brazil.

6.29 The major advantage of the proposed network of NARs is that it would provide previously-isolated settlers with access to economic and social services which until now have been available almost exclusively to settlers located in or near the urban centers along the main highway. In economic terms, this implies that the incomes of many producers would

increase over current levels as a result of greater access to technical assistance on the one hand, and a decline in their dependence on intermediaries for credit and marketing services on the other. The social well-being of these producers and their families would also be greatly enhanced through the greater availability of schools, health posts, communications facilities, and recreation areas. Moreover, a significant secondary benefit of the NAR network would be the creation of a sense of community among the settlers -- a crucial ingredient in the process of fixing them to the land.

The New INCRA "Module"

6.30 In the light of past experience, INCRA has recently modified its settlement model in an attempt to remedy some of the major problems observed in existing settlements. This new approach calls for the establishment of settlement "modules" starting in 1980 in Rondonia along the partially-constructed Ouro Preto to Costa Marques road. Each module would be in the shape of a square, nine kilometers on a side, with 45-hectare lots assigned to each of 120 families for the cultivation of cash crops. In addition, 3.45-hectare lots on the inner perimeter would be provided for fruit and vegetable cultivation as well as for housing. Forest reserves would be kept separately. The rule established by IBDF, which requires that all projects maintain 50% of their area as natural forest, would be respected by keeping such reserves. Within each module there would also be "contingent reserves", areas which could be used for expansion of the commercial district, installation of small industries, or for settling families whose original lots turned out to have poor soils.

6.31 The cost of the land to the settler would be set at one-half of the value of the wood on his lot. A sawmill would be installed in the center of the module to which the settlers would sell their wood as they cleared their lots. The sawmill would, in turn, deduct 50% of the sale price of the wood and return 50% to the settler. The portion of the proceeds retained by the sawmill would be used to liquidate the settlers' debt to INCRA. Since the average settler is capable of clearing about three hectares of land per year, the lot would be fully paid for in an average of 15 years.

6.32 INCRA calculates that between 1979 and 1984 total demand for lots by settlers in the area of influence of the Cuiaba-Porto Velho highway will be on the order of 72,000. Their original program for meeting this demand is presented below: 1/

1/ INCRA has subsequently decided to reduce the pace of settlement during the first few years of implementation (see para. 6.33 below).

Table 10

INCRA SETTLEMENT OBJECTIVES IN RONDONIA, 1979-1984
(No. of families)

	1979	1980	1981	1982	1983	1984	1979/1984
Demand for lots:	26,000	30,200	19,800	12,000	12,000	12,000	72,000
Families in area:	20,000	24,200	12,800	3,000	-	-	-
New Migrants:	6,000	6,000	7,000	9,000	12,000	12,000	-
Supply of lots:	1,800	17,400	16,800	12,000	12,000	12,000	72,000
Division of existing lots:	30	2,000	2,000	-	-	-	4,030
Consolidation of old projects:	1,770	3,400	2,000	-	-	-	7,970
New Projects (modules):	-	12,000	12,000	12,000	12,000	12,000	60,000
Families not attended:	24,200	12,800	3,000	0	0	0	-

Source: INCRA

6.33 Issues and recommendations. There are four primary issues which need to be considered in evaluating the proposed INCRA program. First, even in the best year during the period 1970-78, the maximum number of titles issued was only 2,600 (in 1978) and the maximum number of kilometers of road built was 1,259 (1976). If the program were to proceed as proposed, a total of 17,400 titles would need to be issued in 1980 alone, and 4,000 kilometers of road would need to be built if the major problems of titling and road access are to be dealt with adequately. These objectives far exceed past performance and would require extensive administrative reform to be practically feasible. INCRA is aware of this issue and has recently decided to reduce the pace of new settlement to 14 modules (accommodating 1,680 families) during the first twelve months of implementation (1980-81). In order to reduce the pressures for new projects, it has also decided to rapidly provide titles to settlers now occupying lands on the fringes of older settlements. 1/ Though these recent steps will help deal with the short-term situation, they must be accompanied by further measures to strengthen INCRA for the longer-term task of settling the 100,000-150,000 new migrants per year expected to be entering the Northwest during the 1980s.

1/ INCRA estimates that there are around 16,000 families currently awaiting lots in official settlement projects in Rondonia. It is though that a large proportion of them are occupying land bordering the older settlement areas.

6.34 Second, soil surveys are presently inadequate to make a proper evaluation of the agricultural aptitude of remaining unsettled areas in the area of influence of the Cuiaba-Porto Velho highway. It has already been noted by agronomists that the present pattern of land use in Rondonia may result in declines in soil fertility as a consequence of improper cropping patterns and erosion. Thus, a strengthening of the technical assistance agencies, the carrying out of detailed soil surveys, the development of farm systems based upon local agricultural research, and the adequate provision of inputs would all be necessary in order for new settlers to have a high probability of success. Moreover, it is likely that individual lot sizes would have to be varied according to topography and the agricultural aptitude of the land, since preliminary observations indicate that, in the areas of better soils, 10-hectare plots of coffee or cocoa may be all that can be handled effectively by family labor.

6.35 Third, it is unrealistic to introduce new modules into empty areas and to settle farmers only after the basic infrastructure has been established. Historically, the occupation of Rondonia has been disorganized because migrants are always on the land before INCRA. The effect of starting a program on such a large scale may be to attract settlers to "poles" where project services are quickly rendered inadequate due to rapid increases in demand.

6.36 Finally, an evaluation of the impact of establishing new settlement projects on the territorial government is necessary. Rondonia is moving towards statehood, and a smooth mechanism for the transfer of projects to state (or territorial) jurisdiction should be instituted from the beginning. Continuity in the funding and maintenance of adequate support services for settlers are principal elements in creating stable settlement patterns. If, after a short period, such support collapses, the result is often an increase in social tension which may generate yet another migratory cycle.

VII. AGRICULTURE

A. Introduction

7.01 The agricultural development of the Northwest is still at an early stage, especially in the more isolated areas away from the main highway. 1/ However, the potential for increasing production is considerable. In contrast to most other parts of Amazonia where agroclimatic conditions are generally unfavorable, the Northwest has areas of soils suitable for crops and a pronounced dry season which inhibits the propagation of plant diseases. The region also has a rapidly growing rural labor force resulting from the large migratory inflows and, in Rondonia and the older developed area of Mato Grosso, a fairly equitable division of farm areas.

7.02 It is increasingly evident that, despite the favorable factors mentioned above, inadequate infrastructure and support services, a confused land tenure situation, the weak administrative capabilities of key institutions, and a number of other factors are impeding the full realization of the Northwest's agricultural potential. A discussion of these constraints and the formulation of recommendations as to how they may be overcome is a major objective of the present chapter. First, however, it is useful to review briefly the regional resource base and present agricultural development patterns.

B. Resource Base

Climate

7.03 The climate of the Northwest favors plant growth. Monthly mean temperatures within the region are between 21 and 27 C^{o}, and sunshine hours average from 30% of the potential maximum in the wetter months to 80% in the dry season. Mean annual rainfall ranges from 1,200 mm in the southernmost parts of the area (Cuiaba and Caceres), to 1,800-2,000 mm at Vilhena and in the agricultural areas to the north of Cuiaba and Caceres, and to 2,200 mm in the center and west of Rondonia. In all areas there is a single summer rainy season increasing from five months duration (November-March) in parts of Mato Grosso to seven (October-April) in Rondonia. The rains open and close with a month of intermediate rainfall, leaving a dry season of five months (March-September) in southern Mato Grosso and three months (June-August) in Rondonia.

Topography

7.04 The topography of the region is highly variable. The northern and eastern sections consist of the geologically ancient sandstone plateau, mostly gently undulating at around 500 meters altitude, which forms the southern

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1/ As of 1975, for example, agriculture accounted for only 18% of Rondonia's net product. No recent social accounts are available for Mato Grosso, but in 1970 the agricultural sector's relative participation in the old state's net product was just over 30%.

limit of the Amazon basin. The southern and western sections of the region consist of undulating country at around 200 meters which merges into riverine swamp and drains into the Amazon and Paraguay rivers. The eroded edge of the plateau forms the watershed between the Amazon and Paraguay basins and varies from a distinct escarpment to a band of broken terrain which can be over 200 kilometers wide. In Mato Grosso, the Cuiaba-Porto Velho highway runs from 20 to 200 kilometers south of the plateau edge until it approaches Vilhena, which lies on the plateau. In central Rondonia, the plateau edge is indistinct, and the highway traverses undulating terrain, then descending into more level country some 200 kilometers before Porto Velho.

Main Vegetation Types

7.05 The Northwest region comprises six principal types of vegetation -- three forest and three grassland types. As Table 11 indicates, these six types differ greatly in extent and grade into each other. The three types of Amazon forest are evergreen wet forest, semideciduous forest and wet varzea forest. The latter is lowland, occasionally flooded forest; the two former types are upland forest. Major tree species, such as cerejeira, mahogany, and Brazil nut, occur throughout the region although with different abundancies. All the tree species, prime grade as well as lowest quality, are dispersed throughout the forest and rarely occur in homogeneous stands, making extraction time-consuming and costly. The evergreen canopy is about 20 to 30 meters in height with emergents to 50 meters, whereas the semideciduous canopy is lower by five to 15 meters. The semideciduous forest contains more Brazil nut and babacu, whereas the varzea forest contains more rubber.

7.06 The three types of non-forest vegetation are cerrado or savanna, grassland or campos, and sedge meadow. Sedge meadows or inundated varzea grasslands are very appropriate for water buffalo and rice. Grasslands or campo limpo usually occur on uplands and provide inferior grazing. Cerrado, a variably treed form of savanna, also is an upland formation, often on plateaux with poor grazing and almost negligible wood value. The southwest portion of the region is occupied partially by the Pantanal, a 173,015 square kilometer mosaic of vegetation nearly all of which is flooded seasonally. The Pantanal teems with wildlife and supports a cattle industry. Most of the southern portion of the region (in Mato Grosso) is covered by this mixture of swamp, sedge meadow, grassland, and cerrado with patches of woodland and forest.

Table 11

NORTHWEST REGION: MAJOR VEGETATION TYPES

Vegetation Type	Region*		Rondonia		Mato Grosso	
	Km^2	%	Km^2	%	Km^2	%
Upland wet forest	696,181	47.2	191,514	78.8	504,667	41.0
Wet varzea forest	16,472	1.1	16,472	6.8	-	-
Semideciduous forest	39,160	2.7	-	-	39,160	3.2
Cerrado	493,738	33.5	20.701	8.5	473,037	38.4
Campo Grassland	54,808	3.7	14,357	5.9	40,451	3.3
Pantanal	173,015	11.7	-	-	173,015	14.0
Rocky scarp	1,219	0.0	-	-	1,219	0.1
TOTAL	1,474,593	100.0	243,044	100.0	1,231,549	100.0

* Does not conform to concept of "Northwest Region" used elsewhere in survey because data for Mato Grosso refer to total land area of old state.

Source: FIBGE, Anuario Estatistico do Brasil - 1978

Soils and Land Capability

7.07 At present, the nature and extent of the various soils occurring in the Northwest is not precisely known. The only soil survey for the region as a whole is at a scale of 1:5,000,000 and was published by the Brazilian Agricultural Research Enterprise (EMBRAPA) in 1975. The findings of this survey, summarized in Table 12 in terms of land-use capability, indicate that more than half of the region's land area is suitable ("good" or "moderate") for annual or permanent crops. However, the areas which prove on more detailed survey to be suitable for agriculture may differ from the figures shown.

7.08 Although the state of pedological knowledge of the Northwest is still far from ideal, it is possible to broadly identify the types and locations of the major soils. The dominant soils of the region are red-yellow podzols formed by prolonged weathering of poor parent materials. In Rondonia, extensive areas of good red-yellow eutrophic podzolic soils are found on both sides of the Cuiaba-Porto Velho highway between Ariquemes and Pimenta Bueno. Similar soils also occur in the Colorado area interspersed with fertile terra roxa soils. The northern part of the territory (between Ariquemes and Porto Velho) is dominated by a belt of low fertility/high aluminum content red-yellow and yellow latosols, the latter following the Mamore-Guapore Valley in a wide swath southwest from Guajara-Mirim. Areas of highly erodible quartz sands of low intrinsic fertility occur to the east of Pimenta Bueno under both forest and cerrado. In Mato Grosso, the areas of better soils derived from more favorable parent materials are concentrated to the north of Caceres (some 800,000 hectares) and in the Guapore Valley between Vila Bela and Vilhena (900,000 hectares).

Table 12

NORTHWEST REGION: LAND CAPABILITY CLASSIFICATION

Class	Region '000 ha.	Region %	Rondonia '000 ha.	Rondonia %	Mato Grosso* '000 ha.	Mato Grosso* %
Good	399	1.0	399	1.6	0	-
Moderate	21,845	57.1	19,167	78.9	2,678	19.2
Marginal	6,002	15.7	0	-	6,002	42.9
Unsuitable	10,041	26.2	4,739	19.5	5,302	37.9
Total	38,287	100.0	24,305	100.0	13,982	100.0

Note: "Good" = suitable for annual or permanent crops with stable yields for about 20 years and only a gradual subsequent decline.

"Moderate" = suitable for annual or permanent crops, but with some restrictions; yields expected to decline after 10 years if no soil additives are employed.

"Marginal" = capable of supporting annual crops for two to three years with severe restrictions; may be suitable for tree crops.

"Unsuitable" = not usable for any agricultural purpose.

* Excludes municipio of Aripuana.

Source: EMBRAPA survey at scale of 1:5,000,000.

Labor Force

7.09 Data on the regional agricultural labor force are contained in the 1975 Agricultural Census. At the time of the census, approximately 202,000 persons were employed in agriculture in the Northwest, of which 136,000 were 14 years of age or over. The total labor force was divided about equally between Rondonia (51%) and Mato Grosso (49%). Within Rondonia, over 90% of the agricultural labor force was concentrated in the former municipio of Porto Velho, that is, in the areas closest to the Cuiaba-Porto Velho highway. In Mato Grosso, almost three-fourths of the labor force was located in the older developed area of Caceres, Mirassol d'Oeste, Tangara da Serra, and Barra do Bugres. As of 1975, the municipio of Aripuana (west of the Roosevelt River) was practically empty with only 49 persons identified as working in agriculture.

7.10 During the 1970-75 period, the regional agricultural labor force increased very rapidly, reflecting the intense migratory flow and the establishment of the INCRA settlement projects. The average annual growth rate for the entire Northwest was 25%, with the labor force of Mato Grosso growing at about 13% and that of Rondonia increasing at a phenomenal 38%. Despite these high growth rates, farm labor is reported to be in short supply in the region, particularly during the land clearing and harvest seasons. As a result, wages tend to be relatively high (up to Cr$200 per day in some of the colonization projects versus Cr$100-130 in the Northeast), and sharecropping arrangements are very favorable to the sharecropper. 1/ Under a typical coffee development scheme, for example, the sharecropper receives a parcel of cleared land and the coffee seedlings. He plants the coffee, intercropped with rice and corn, and keeps 100% of the production during the first three years. After this initial period, the sharecropper has the option of planting new coffee under the same scheme, or maintaining and harvesting the older coffee stands, for which he receives 50% of the crop.

C. Current Development Patterns

7.11 Agricultural development began in the southern portions of the region in the 1940s, while in Rondonia little land was cleared until the 1970s. The extent of land utilization therefore varies, being greatest on the better soils, and particularly in the older developed areas of Mato Grosso (the municipios of Mirassol d'Oeste, Tangara da Serra, Barra do Bugres, and the northern part of Caceres). The data in Table 13 summarize the estimated areas under seeded and natural pasture, crops, and extractive activities and forestry as of 1978. It should be noted that about 80% of the region's land area (60% of Mato Grosso and 92% of Rondonia) was not utilized for any of the activities listed above. Presumably, much of this unused land is still in the public domain.

1/ As of November 1979, the daily minimum wage in Rondonia was about Cr$80.

Table 13

NORTHWEST REGION: AGRICULTURAL LAND USE, 1978

State/Territory	Total	Unused	Extractive and Forestry	Seeded Pasture	Natural Pasture	Annual and Tree Crops*
Rondonia						
'000 ha	24,304.4	22,255.4	802.2	907.0	121.0	219.0
%	100.0	91.6	3.3	3.7	0.5	0.9
Mato Grosso**						
'000 ha	13,981.4	8,447.0	853.0	1,664.0	2,772.0	245.4
%	100.0	60.4	6.1	11.9	19.8	1.8
Region						
'000	38,285.4	30,702.0	1,655.0	2,571.0	2,893.0	464.4
%	100.0	80.2	4.3	6.7	7.6	1.2

* Probably overestimates actual area. Some double-counting present owing to intercropping.

** Excludes Aripuana.

Source: INCRA Cadastre, 1978

Production Practices

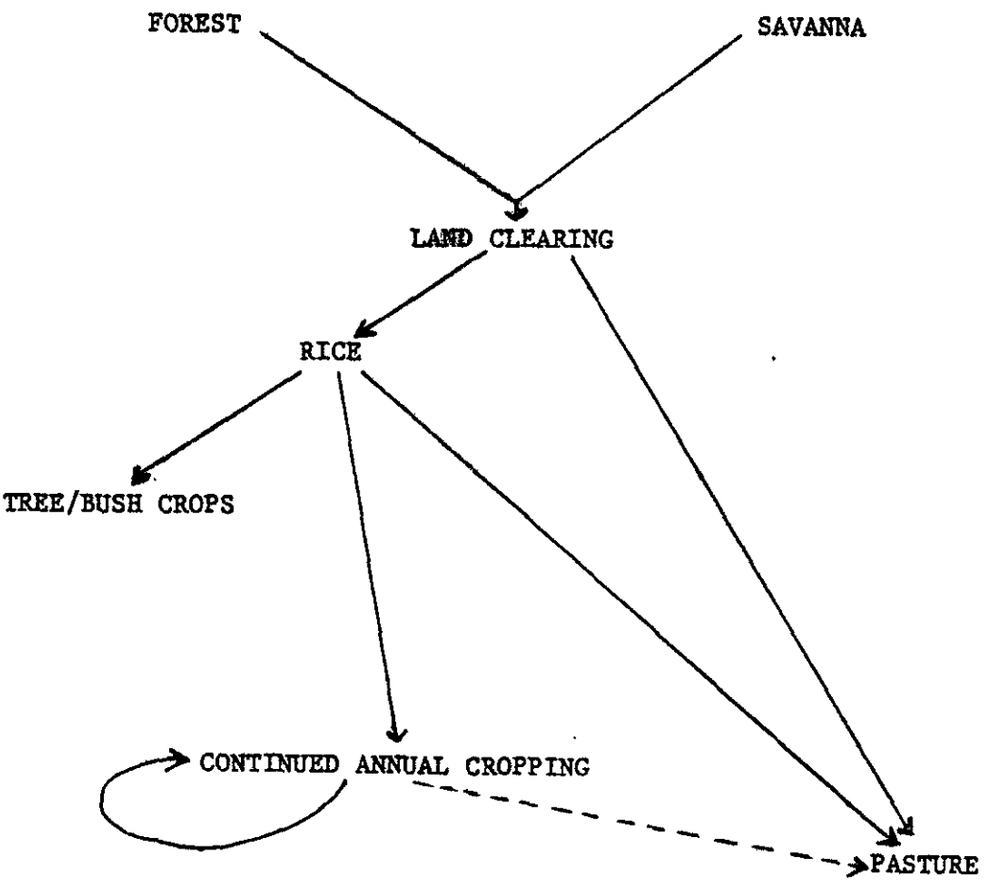
7.12 At present, the dominant system of agricultural development in the Northwest is highly traditional. That is, the forest or cerrado is cleared; the timber of a few valuable species is extracted; and the remaining debris is burned. This sequence is usually followed by a single upland rice crop, although several annual crops may be planted if soil fertility is adequate. Fertilizers and lime are seldom used and seeded pasture may eventually degenerate or be invaded by scrub to the point where it produces very little, depending on the quality of the soil and level of management applied. Meanwhile, clearance of new land continues.

7.13 On better soils, particularly in recent years, there has been a move to more intensive land use. In such areas, tree crops have been planted on a substantial scale, and repeated annual crops are cultivated either in pure stand or as intercrops. Here there is some use of fertilizers and lime, but it is too early yet to know whether soil correctives can permit annual crops to be grown indefinitely on an economically viable basis. It should be pointed out, however, that experiments with corn and beans carried out at the EMBRAPA station in Manaus have shown that the use of fertilizers can be profitable to farmers in the region (The sequences described above are shown diagrammatically in Figure 2).

7.14 Coffee is the most widely planted tree crop in the Northwest. Since many settlers in the region originate from traditional coffee growing areas, production practices are similar to those in the South. Intercropping is widespread and pesticides are often used. However, present spray programs are reportedly unable to completely eradicate the coffee leaf rust present in the area. Cocoa is well suited to the better soils of Rondonia, and its cultivation is supported by the CEPLAC technical assistance and credit programs (see paras. 7.39 and 7.44). Sweet bananas are often interplanted to give shade for the first three to four years and to provide income before the cocoa comes into bearing (usually in the third year). Witch's broom disease (vassoura de bruxa) is the most important production problem, but is usually controlled by a combination of sprays and pruning. Rubber, although native to Brazil, has never been grown on the scale of Asian countries due to the ravages of South American leaf blight (Microcyclus ulei). However, the climate of Rondonia does not favor leaf blight and this, combined with the availability of modern fungicides, has led to a government program (PROBOR) to promote the cultivation of rubber in the territory. This program stipulates that only annual intercrops may be grown but, owing to their desire for a higher cash income during the rubber's six to seven year maturing period, many farmers have interplanted with coffee or cocoa.

Figure 2

SEQUENCE OF LAND USE UNDER PRESENT SYSTEM OF AGRICULTURE



Production and Yields

7.15 Throughout the region, agricultural development is rapid and is often going on in inaccessible places. Government crop statistics are based on rough estimates by a few technical staff who also have other duties, there being neither systematic recording of planted areas nor output to estimate yields. For annual crops there is no indication whether the area recorded is intercropped or in pure stand, and it is possible that the same hectare of intercropped land is recorded more than once. The figures cited below should therefore be regarded as very tentative.

7.16 Crops. Table 14 shows basic production data for various key crops as of the late 1970s. The figures for the most recent year available (1978) indicate that the land area devoted to the main annual crops is increasing at 20 to 30% annually in Mato Grosso. In Rondonia, the emphasis is on tree crops with the cultivated area increasing at up to 40% per year. Crop yields show few variations over recent years, but marked differences from 1970 levels. In Mato Grosso, for example, rice has fallen from 2.0 to 1.5 metric tons per hectare, corn from 1.9 to 1.5, and beans from 1.3 to 0.5. In Rondonia, rice and corn both increased from 0.9 to 1.7 metric tons per hectare. Average tree crop yields say little owing to the high proportion of plantings which are still immature. The changes in yields cited for Mato Grosso might be partially explained by the fact that the quality of land being cleared has progressively declined as better areas were occupied. So far, such yield declines have been avoided in Rondonia because of the continued availability of land with better soils.

Table 14

MATO GROSSO AND RONDONIA: AREA, OUTPUT, AND YIELD DATA FOR KEY CROPS, 1978-79

Crop	Mato Grosso (1978) Area ('000 ha)	Output ('000 mt)	Yield (mt/ha)	Rondonia (1979) Area ('000 ha)	Output ('000 mt)	Yield (mt/ha)
Rice	131.0	187.7	1.4	76.2	128.0	1.7
Corn	38.4	55.6	1.5	40.9	67.9	1.7
Beans	37.8	17.1	0.5	15.9	10.7	0.7
Manioc	8.0	120.4	15.0	10.7	144.5	13.5
Banana	2.3	18.1	9.9	23.9	92.0	7.1
Coffee	23.7	n.a.	n.a.	25.8*	27.0	2.0
Cocoa	n.a.	n.a.	n.a.	24.9**	0.5	0.2
Rubber	n.a.	n.a.	n.a.	1.0	n.a.	n.a.

n.a. = not available.

* Area actually producing = 13,700 hectares.

** Area actually producing = 2,400 hectares.

Sources: CEPA-MT; CEPA-RO.

7.17 Though the production figures for each crop are small in comparison to national totals, 1/ average annual growth rates (with the exception of manioc, bananas, and sugar cane in Mato Grosso) have been extremely high (generally in the 20-30% range) over the past decade. However, these high growth rates are mainly due to the rapid increase in the land area under cultivation and the small bases upon which they were calculated. The gross value of the crops listed in Table 14 is about Cr$2.9 billion at 1979 prices, or approximately US$95 million at the official exchange rate.

7.18 Livestock. Official statistics show about 1.2 million head of cattle in Mato Grosso, but only 130,000 head in Rondonia. However, the Rondonia herd is reported to be increasing at over 30% per year, while for Mato Grosso it is static. The total annual offtake of cattle in the Northwest is about 150,000 head. Assuming an average carcass weight at slaughter of 220 kg, total regional beef production would amount to some 33,000 metric tons per year, with a value of Cr$2 billion at 1979 prices (US$65 million). Dairying is of local importance around towns in Mato Grosso and Rondonia. The only data received for Mato Grosso refer to 1976 and 1977 and show an increase from 12 to 20 million liters of milk. The current annual production level in Rondonia is on the order of 10 million liters.

7.19 Timber. Much of the land suitable for agriculture, especially in Rondonia, is under forest which contains a range of commercial varieties. The volume of standing timber has been estimated at 85 m^3 per hectare in the Vila Bela area of Mato Grosso and between 100 and 170 m^3 per hectare in Rondonia. However, loggers often extract only the most valuable species, and the remaining timber is burned or allowed to rot. Thus, the effective yield per hectare is seldom more than 5 m^3 of timber, and sometimes as little as 1 m^3.

7.20 According to IBDF, legal timber exports from Rondonia increased from 22.5 million m^3 in 1974 to almost 90 million m^3 in 1978. In addition, much timber is consumed within the territory where most houses are constructed of wood. Fuel and fence posts are the next largest local consumption items. Unfortunately, no estimates are available for local consumption, or for production illegally exported to avoid paying sales taxes and the compulsory reforestation fee of Cr$33.60 per m^3 extracted. It is estimated that 75% of all timber exported is cerejeira, with the balance accounted for by mahogany (15%), and other woods of lower quality (5%). The value of timber legally exported from Rondonia in 1978 was Cr$246.7 million, or about US$13.5 million at the official exchange rate.

1/ The national production of rice in recent years has been in the 8-10 million ton range; that of coffee has been in the range of 6-7 million tons.

D. Land Tenure 1/

General Considerations

7.21 As is the case in many frontier areas, the land tenure situation in the Northwest is exceedingly complex, fraught with problems, and subject to rapid change. In fact, the existing uncertainties over boundary lines and rights of possession must be considered one of the major constraints on the region's agricultural development. To a certain extent, the land tenure problems of today are rooted in the region's historical dependence on extractive activities. At the turn of the century, large imperfectly surveyed tracts of land, principally in the Guapore Valley of Rondonia, were occupied by persons exploiting the region's stands of wild rubber. Apparently little of this occupation was legally sanctioned, but a number of dubious titles issued during this period are still used to claim private ownership over vast landholdings.

7.22 Improvements in overland access to the region in the mid-1960s further complicated the regional land tenure situation. The construction of the Cuiaba-Porto Velho highway had the dual effect of facilitating migration to the region and increasing land values in the highway's area of influence. The combined impact was to create a land rush of large proportions in which corporate cattle interests, private settlement companies, land speculators, migrants and others competed for the choicest real estate. Since the pre-existing land structure was so poorly defined, this land rush was (and continues to be) the source of innumerable legal irregularities and much social tension; most attributable to the sale of fraudulent titles to prospective settlers by groups known as grileiros, and to the invasion of public, private, and Indian lands by squatters (posseiros).

Land Distribution Policies and Procedures

7.23 As discussed in Chapter VI, INCRA has jurisdiction over most of the land in the area of influence of the Cuiaba-Porto Velho highway. In such newly opened frontier regions, one of the first tasks of INCRA is to assess the validity of pre-existing private claims to land so that the remaining lands (terras devolutas) can be assigned a use. In order to accomplish this, the agency initiates a process known as "land discrimination" through which contested land claims are examined and resolved either through administrative or legal procedures. Under the administrative procedure, the legitimacy of land claims is decided by a three-member commission composed of the president (who should be a lawyer), an agronomist, and a secretary. The judicial procedure, which employs normal legal channels, is used for appeals to administrative decisions and in cases where the administrative procedure breaks down.

1/ This section mainly refers to the situation in areas outside of official settlement projects. The situation in the latter is more fully discussed in Chapter VI. The issue of Indian land rights is discussed in Chapter IV.

7.24 Squatters' rights. The claims of squatters are taken into account in the discrimination process. Posseiros occupying less than 100 hectares of public land, for example, have a legitimate claim if they have been present for at least 12 months, have cultivated the land using family labor, and have no other land in their name in Brazil. Upon fulfillment of these conditions, such persons may be provided with a provisional document (licenca de ocupacao) which they must hold for at least four years before receiving a definitive land title. 1/ During this waiting period, the farmer is only eligible for production credit.

7.25 Posseiros claiming over 100 hectares, and who have the resources for cultivating larger tracts of land, are permitted to make preferential bids when the land is offered for sale at public auction. Under this scheme, the posseiro has the right to match any bidder and to have the value of the improvements he has made count toward the price of the land. Deforestation is considered to be a land improvement, thus providing an incentive for the cutting of trees. Tracts of up to 3,000 hectares may be sold under this procedure; sales of larger tracts must be approved by the federal senate.

7.26 Land tenure projects. In order to facilitate the land discrimination process, INCRA has established a number of land tenure projects (projetos fundiarios). At present there are four such projects in Rondonia (Alto Madeira, Corumbiara, Guajara-Mirim, and Jaru-Ouro Preto) and a like number in Mato Grosso (Caceres, Diamantino, Cuiaba, and Vale do Araguaia). 2/ Work on these projects began in the mid-1970s.

7.27 Within Rondonia, all the land bordering the Cuiaba-Porto Velho highway has been discriminated and assigned a use. The land with better soils has been assigned to INCRA settlement projects, with the exception of one private colonization scheme (CALAMA S.A.) along the highway. The remaining area has been sold at auction or is claimed by posseiros whose definitive titles have yet to be processed. The present status of the discrimination process in Rondonia, by land tenure project, is as follows:

Project	Total Area ('000 ha.)	Area Discriminated (%)
Alto Madeira	5,570	42
Corumbiara	5,990	98
Guajara-Mirim	7,045	79
Jaru-Ouro Preto	5,699	65
TOTAL	24,304	72

The land use designations resulting from the discrimination efforts (as shares of the total land area) are: colonization, 11%; Indian reserves, 11%;

1/ It should be pointed out that under existing legislation a posseiro may be legally evicted from his claim if he has occupied privately-owned lands without permission. In such cases, the owner is obliged to indemnify the posseiro for any improvements he has made on the land. If during a 20-year period the legal landowner has made no attempt to evict the posseiro, the latter may apply for legal title to his claim.

2/ The Vale do Araguaia and Diamantino land tenure projects fall outside of the Northwest region; the others in Mato Grosso are at least partially included.

forest reserves, 8%; public auction, 10%; "claims still being regularized", 11%; "under study", 21%; and "to be discriminated", 28%.

7.28 As of end-1978, some 4,562 licencas de ocupacao, and 658 definitive titles, had been issued to persons claiming land in Rondonia outside the official colonization projects. An additional 658 licencas and 442 definitive titles were scheduled for delivery during 1979. These numbers are very low considering the size of the farm population outside official projects and uncertainties concerning land tenure continue to be evident (see paras. 7.30-7.38 below).

7.29 The available information on the activities of INCRA in Mato Grosso is very sketchy, but it would appear that less has been accomplished than in Rondonia. According to the report of the Mato Grosso Land Tenure Commission, 1/ INCRA has discriminated 1.5 million hectares of the 2.3 million hectares in its four land tenure projects. But after five years of work, including the examination of over 10,000 land claims, less than 500 definitive titles have been issued. Concerning this situation, the Commission's report further states that if the titling process is not speeded up, a new discrimination process may need to be initiated to take into account the claims of new migrants to the state. The state itself issued some 1,500 titles to farmers occupying land to the west of Caceres (Rio Branco) during the 1960s and early 1970s, but since this area was within 100 kilometers of a federal highway (Cuiaba-Porto Velho) and thus under INCRA jurisdiction, these titles were subsequently invalidated. However, it is reported that INCRA plans to revalidate these titles in the near future.

Types of Land Tenure

7.30 Owing to the confused land tenure situation prevailing in most of the Northwest, little is known about the distribution of land tenure arrangements by type. Data available from the 1975 Agricultural Census are summarized in Table 15. It appears that most farm units in the region are run by "owner-operators" and "squatters." These two groups account for about 85% of the establishments and almost all of the area under farms. Farms operated under tenancy and sharecropping arrangements account for about 14% of the establishments and have average sizes of 11 and 20 hectares, respectively.

7.31 The data suggest that the tenure situation of many producers is insecure, and indeed it is probable that the number of non-owners was underestimated by the census. First of all, the census coverage corresponds to only 2% of the region's land area. Secondly, the census does not reflect the intense migration to the region which has taken place since 1975. Finally, the census does not provide information on the apparently frequent practice according to the Mato Grosso Land Tenure Commission, of issuing several titles to a given parcel of land.

1/ This Commission was established in 1979 for the purpose of identifying areas of social tension in the state caused by irregularities in the land tenure situation. The state's Vice-Governor served as the Commission's President.

Table 15

NORTHWEST REGION: DISTRIBUTION OF FARMS BY MAJOR TENURE GROUPS, 1975

	Region		Rondonia		Mato Grosso	
Tenure Groups	% farms	% area	% farms	% area	% farms	% area
Owner-Operators	55.4	87.5	66.1	78.4	42.7	92.2
Tenants	10.4	0.6	1.7	0.2	20.6	0.9
Sharecroppers	3.5	0.4	3.4	0.8	3.6	0.2
Squatters	30.8	11.5	28.9	20.8	33.1	6.7
TOTAL	47,088	9,001 km^2	25,483	3,082 km^2	21,605	5,918 km^2

Note: The total land areas (as opposed to farm areas) of the region, Rondonia, and Mato Grosso are: 410,158 km^2, 243,044 km^2, and 167,144 km^2, respectively.

Source: FIBGE, Censo Agropecuario, 1975

7.32 Given the slow pace of titling observed over the past few years, it is reasonable to assume that the majority of the new settlers in the region have entered into tenancy or sharecropping arrangements with already established farmers, or have invaded public or private lands in newly opened areas. In Rondonia, for example, recently arrived families often take up residence on lots of others, usually relatives, and work for the owner until INCRA provides them with their own lots. Another common practice is for the new settler to stake a squatters' claim on the fringe of an official colonization project, while at the same time working as a laborer on one of the farms within the project.

7.33 The incidence of farmers without titles is also high in the Mato Grosso portion of the survey area. At present, there are estimated to be some 30,000 posseiro families residing in the state, of which almost one-fourth (6,400) are in the municipios of Caceres, Barra do Bugres and Vila Bela. Though no information is available on the proportion of these families illegally occupying privately-owned land, the Mato Grosso Land Tenure Commission has identified 34 areas in the zone of influence of the Cuiaba-Porto Velho highway where conflicts over land tenure issues have arisen. The largest number (eight) of these areas are found in Vila Bela, followed by Caceres (seven), Barra do Bugres (six), Tangara da Serra (six), Mirassol d'Oeste (three), Pocone (two) and Livramento and Varzea Grande (one each). For these areas, the Commission has recommended that a special program be set up to accelerate the regularization of land claims and to establish at least a minimum level of infrastructure.

Farm Size

7.34 Data on the size distribution of farms, drawn from the 1975 Agricultural Census (Table 16), indicate that a major proportion of the region's area under farms is in the hands of large landholders. More specifically, while farms of over 1,000 hectares comprised only 2.3% of the total establishments, they accounted for over two-thirds of the land area under farms. In contrast, smaller farms (up to 100 hectares) conscituted about two-thirds of the establishments, but only 7% of the land area.

7.35 The data summarized above, though clearly indicating a concentration of farm ownership in the region, do not adequately reflect the significant intraregional variations in the size distribution of farms. Such variations are an important characteristic of the land tenure situation in the Northwest and are attributable to a number of factors including differences in land-use capability, the rate and extent of settlement, historical precedents, and government policy. As Table 16 shows, large differences in the size distribution of farms are evident even at the state/territory level of disaggregation. From this perspective, farm areas appear to be far more evenly distributed in Rondonia than in Mato Grosso. Small (up to 100 hectares) and medium (100-1,000 hectares) sized farms account for about two-thirds of the farm area in the former but less than 15% of the area in the latter. The relatively more equal distribution of farms in Rondonia is largely attributable to the implantation of the INCRA colonization projects which, as discussed

Table 16

NORTHWEST REGION: SIZE DISTRIBUTION OF FARMS, 1975

Area Interval (in hectares)	Region		Rondonia		Mato Grosso	
	% farms	% area	% farms	% area	% farms	% area
< 10	35.0	0.8	19.1	0.5	53.8	0.9
10 - 100	30.2	6.1	28.0	10.0	32.8	4.0
100 - 1,000	32.4	25.8	51.8	56.3	9.7	10.7
1,000 - 10,000	2.0	28.8	1.0	16.8	3.2	35.0
> 10,000	0.3	38.6	0.0	16.4	0.5	50.2
TOTAL	47,149	9,001 km^2	25,483	3,082 km^2	21,666	5,919 km^2

Note: The total land areas (as opposed to farm areas) of the region, Rondonia, and Mato Grosso are: 410,158 km^2, 243,044 km^2, and 167,144 km^2, respectively.

Source: FIBGE, Censo Agropecuario, 1975

earlier, are based on 100-hectare lots. 1/ As yet, no INCRA colonization projects have been established in Mato Grosso, and settlement has generally proceeded on an ad hoc basis. Consequently, there is a wider array of farm sizes in the state, including a number of very large corporate cattle ranches.

7.36 Within Mato Grosso, the greatest concentrations of small and medium-sized establishments occur in the municipios of Varzea Grande, Caceres, Mirassol d'Oeste, Tangara da Serra, Barra do Bugres and, to a lesser extent, in Nossa Senhora do Livramento. In these areas, average farm sizes range from 49 to 195 hectares, versus the 273 hectare average for the entire Mato Grosso portion of the survey area. By and large, these are areas of older settlement where agricultural development, based on annual and tree crops, is already at a fairly advanced stage, but where intense in-migration may still be observed.

7.37 The largest farms in Mato Grosso tend to be located in the municipios of Aripuana, Pocone and Vila Bela. In all three areas, establishments larger than 1,000 hectares account for well over 90% of the total area under farms. With regard to Aripuana, the highly skewed pattern of farm size distribution is largely due to the physical isolation of the area which, until recently, has impeded its occupation by migrants. In the two other municipios, the high incidence of large farms is associated with the predominance of extensive cattle raising. Particularly in Vila Bela, livestock development has been encouraged by the federal government through the provision of generous fiscal and credit incentives to corporations desiring to implant projects in the area.

7.38 Registered corporations may reduce their income tax liabilities by up to 50% if the resulting savings are invested in approved projects located within the legally defined Amazon region. Such funds may be used to finance up to 75% of the project. Land purchases are not financed through fiscal incentives, though the value of the land may be counted toward the minimum 25% share of "fresh money" to be contributed by the project owners. Between 1967 and 1972, 16 such projects, ranging in size from 13,000 to 152,000 hectares, located in the municipio of Vila Bela and were approved for fiscal incentives administered by SUDAM. However, in recent years this form of development has been discouraged by the government and proposals for livestock projects in forested areas of Amazonia are no longer approved by SUDAM.

E. Government Support Services

Agricultural Research

7.39 Agricultural research in Rondonia is mainly the responsibility of the Brazilian Agricultural Research Enterprise (EMBRAPA), although specific studies on cocoa are undertaken by the federal cocoa development agency (CEPLAC) in Ouro Preto, and simple fertilizer trials by the territorial extension agency (ASTER-RO) under an agreement with the FAO. An EMBRAPA research station is located just outside of Porto Velho and is staffed by 14

1/ The impact of the INCRA projects on the distribution of farm sizes is reflected in the census data which show the average farm size in Rondonia falling from 230 hectares in 1970 to 121 hectares in 1975.

agronomists. During 1979, investigations were programmed in the following areas: rubber, cattle, coffee, corn, beans, rice, soils, and water buffalo. Research work is carried out at the Porto Velho station, in the Ouro Preto colonization project, in Pimenta Bueno, and in six private holdings in Vilhena, Cacoal, and Ji-Parana.

7.40 To date, the main priority of EMBRAPA has been pasture research, but this is changing to give more emphasis to rubber and coffee cultivated with intercrops. In 1980, work will be extended to soybeans and wheat, and to fruit crops in general. In pastures, evaluation of new grass and legume species is under way, and promising results are evident on the red-yellow latosols characteristic of the region. A project to further investigate water buffalo production is scheduled to start in 1980; as yet no work is planned with pigs or other small animals. Work on subsistence crops is mainly directed at variety evaluation and fertilizer experiments.

7.41 Following the division of the original state, Mato Grosso is without any agricultural research facilities. The establishment of such facilities, to be partially financed by a World Bank loan (No. BR-1249) to EMBRAPA under the first agricultural research project, is planned for 1981. In the meantime, a few variety tests and other simple agronomic trials are done by the state extension service (EMATER -MT) to try and fill the gap.

Agricultural Extension

7.42 Institutions providing agricultural extension services in Rondonia are specialized by crop: all annual crops, tree crops (except for cocoa and coffee), and livestock are under the responsibility of ASTER-RO; cocoa is the responsibility of CEPLAC; and coffee will be the responsibility of the Brazilian Coffee Institute (IBC), which has recently received authorization to start work in the territory. ASTER-RO, established in 1971, is the principal institution providing technical assistance to low-income farmers; about 65% of its budget is devoted to this end. Within this program, farmers are provided with assistance in improving the production practices and marketing of rice, corn, beans, coffee, manioc and livestock. Instruction is also provided in the areas of health, nutrition, and education. The central office of ASTER-RO is located in Porto Velho, and there are two regional offices, in Ji-Parana and Pimenta Bueno, and nine local offices covering the various INCRA colonization projects. The number of local level extension agents was 46 in 1978 and 45 in 1979.

7.43 During 1978, some 5,800 farmers were assisted by ASTER-RO, implying a farmer-to-extension agent ratio of 125:1. However, the number of farmers assisted fell by more than half in 1979 as a result of insufficient funds for vehicle purchase, maintenance and operation, which seriously limited the mobility of the extension agents. The shortfall in funds was primarily caused by INCRA's decision to revoke its financial support for ASTER-RO, support which had previously accounted for between 35-40% of the latter's budget. Subsequently, the Rondonia agriculture secretariat has agreed to assume responsibility for INCRA's portion of the budget.

7.44 As mentioned previously, CEPLAC has an extension service to provide cocoa growers with assistance in technical matters and in obtaining credit from the PROCACAO line. 1/ The agency maintains a regional office, a local office and a research station in Ouro Preto staffed by six agronomists, three tree crop specialists, and 11 middle-level technicians working as extension agents. CEPLAC is also represented in Porto Velho (one upper-level professional), Cacoal (two agronomists and four extension agents), Ariquemes (three agronomists and four extension agents), and Jaru (two agronomists and seven extension agents).

7.45 The principal responsibility for extension work in Mato Grosso rests with the state office of the federal Technical Assistance and Rural Extension Enterprise (EMATER-MT). This agency has 35 field extension staff based in the area of influence of the Cuiaba-Porto Velho highway. They are supported by 21 headquarters staff in Cuiaba. Six of the Cuiaba staff operate the state seed testing laboratory and seven are engaged full time in support programs for cooperatives. Thirty-five extension staff are graduates (20 agronomists, 14 veterinarians and a forester), and they are supported by 15 technicians (14 agricultural, one zoological). The department has one vehicle for every two field staff and adequate facilities for preparing written and audio-visual extension material. Salaries are reasonably competitive with alternative private-sector employment. The service aims to work with groups of 15 to 20 farmers, each field man supporting about five groups. This gives a theoretical coverage of about 3,000 farmers.

7.46 The effectiveness of EMATER-MT is hampered by the large distances which have to be traveled, and no coverage is possible between Vila Bela and Vilhena. Access is difficult except to farms located on main roads, and even here it is often restricted during the rainy season when advice is most needed. As a result, extension staff often have to wait for farmers to come to them, rather than vice versa. Further limitations arise from the lack of valid extension messages due to the absence of supporting adaptive research, and to the other duties which extension staff also have to undertake which, in addition to the gathering of crop statistics, include technical appraisals of credit applications on behalf of the Banco do Brasil, and family health programs.

Storage

7.47 In Rondonia, the Brazilian Storage Company (CIBRAZEM) operates 14 warehouses - six equipped for grain drying and cleaning - with capacities from 2,400 to 9,000 mt and a total capacity of 48,000 mt; 73 people are employed and the annual budget in 1979 was CR$31 million. A further small amount of storage is operated by cooperatives and the private sector. In Mato Grosso, storage is divided between CIBRAZEM (2,400 mt), the state storage enterprise--CASEMAT (36,000 mt) and the private sector (72,000 mt). Rice is the main

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1/ The PROCACAO program, established in 1977, calls for an increase in Brazilian cocoa output to 700,000 tons by 1992, and includes the planting of an additional 100,000 hectares (out of a national total of 330,000) for Rondonia.

product stored, although corn, beans, coffee, Brazil nuts and pasture seeds are also handled in smaller amounts. Both administrations have plans to build more warehouses which, in the case of Rondonia, would be sited off the main road and within colonization schemes.

7.48 Utilization of existing public sector storage is highly variable between seasons and usually well below theoretical capacity. The main reason is the difficulty which the farmer experiences in transporting his rice, harvested during the rains, from his farm to the main centers in which most existing warehouses are located. Lack of marketing credit may also force farmers to sell immediately after harvest without storing, even though they would get a better price by delaying. Thus, even though there may be a need for increased storage and especially for greater drying capacity, it seems unlikely that it will all be used effectively unless the constraints imposed by lack of access and credit can first be removed.

Credit

7.49 Credit is available to producers from a range of government programs including POLAMAZONIA, PROTERRA, PROPEC, PROCACAO and PROBOR. Funds are allocated for medium and long-term capital investment, seasonal or production credit, and marketing. Until December 1979, interest rates ranged from 10 to 18% with no monetary correction. Presently, both principal and interest are adjusted by a factor equal to 40% or 70% (depending on the size of the loan) of the national monetary correction index (ORTN).

7.50 The principal credit channel is the Banco do Brasil (BB) which has five branches in Mato Grosso and five in Rondonia. In Rondonia in October 1979, BB had a portfolio of Cr$900 million (US$36 million) covering about 8,000 contracts. In Mato Grosso, 1977 BB disbursements were estimated to total almost Cr$1.7 billion, of which 56% was for investment, 32% for production and 12% for marketing. The next most important official credit channel is the Banco da Amazonia (BASA). Significant amounts of credit also reach agriculture from the private sector, mainly from the Brazilian Discount Bank (BRADESCO), with six branches in Rondonia. In total, there are 25 bank branches in Rondonia and 12 in Mato Grosso.

7.51 Despite the apparent availability of adequate funds and the existence of bank outlets in major population centers, the credit needs of many producers are not satisfied. Most farmers have no land title and are therefore at a disadvantage when seeking rural credit. Those with title often have difficulty in reaching the urban areas where applications must be made. Finally, the bureaucratic procedures of the banks, which often require loan decisions to be referred from branches to central offices, can result in serious delays.

Cooperatives

7.52 The cooperative sector is poorly developed despite government support programs through INCRA and the agricultural extension services. There are only six operational cooperative societies in Mato Grosso and six in Rondonia, four in each area being concerned with agricultural production. Other cooperatives have failed from lack of management ability or enthusiasm among members and several of the survivors have severe financial problems. Total membership is less than 2,000 and even in Rondonia, with its preponderance of small farmers, excludes less than 5% of the farming population.

F. Present Constraints and Recommendations

7.53 Agricultural production is constrained by numerous factors, many of which interact with each other. Among those discussed below, the limitations imposed by poor physical access, lack of land title, and inadequate support services are of the most immediate concern.

Physical Access

7.54 Main roads are often impassable in the rainy season and the network of feeder and farm access roads is poorly developed. It is therefore difficult, and sometimes impossible, for the farmer to market his output when he wishes. If he can do so, transport is costly. If he cannot move the crop himself, he may sell to an intermediary at far below the urban market price. Alternatively, the crop may spoil while held on the farm -- on-farm losses have been estimated at up to 50%. In each case farm gate returns are lowered, leaving little incentive to produce. Poor roads, by restricting the inward transport of bulky inputs, such as lime or fertilizers, and limitting the farmer's access to government extension services and to neighbors, also constrain intensive land-use and innovation. The farmer is instead pressed toward the exploitive use of land under extensive grazing; the cattle can at least be walked to market at the end of the rains. In order to rectify the problems caused by poor access, the regional secondary and feeder roads network must be upgraded and expanded in the areas of greatest agricultural potential. (More detailed recommendations pertaining to regional roads are presented in Chapter IX, paras. 9.26-9.32).

Land Title

7.55 The fact that many farmers do not have title to their land is the second major constraint to production. With no guarantee of occupancy, there is little incentive to abandon the present low input/low output systems of production or invest in long-term farm improvements. Furthermore, much labor may be wasted in excessive land clearance undertaken as a means of establishing occupancy for titling purposes. The land discrimination process should be concluded as expeditiously as possible and titles issued with a minimum of bureaucratic delay to qualified farmers occupying land in areas already discriminated.

Support Services

7.56 Agricultural research, which is at present confined to Rondonia, needs to be focused more directly on the production problems currently faced by farmers. Research should therefore initially concentrate on topics such as: (i) selection and evaluation of crop varieties with better local climatic adaptation and disease resistance; (ii) crop timing and production techniques aimed at intensifying production per hectare of land cleared, and increasing net financial returns per man day of available family labor; (iii) development of improved methods to reduce losses during crop growth and post-harvest; and (iv) development of species mixtures and management systems

to increase the stability and carrying-capacity of seeded pastures. The delivery of research results to farmers, via demonstration plots and other techniques formulated by a production-oriented extension service, also needs to be given more support. In addition, access to production and investment credit should be improved through the establishment of additional bank agencies (postos avancados) in the various settlement areas. This measure would, in turn, need to be coupled with improvements in the efficiency of the extension services--the principal link between the farmer and the bank. To be effective, the above measures would depend on prior improvement of farm access, so that there are adequate incentives for farmers to respond to advice, and adequate access to the inputs needed to do so.

Crop Drying and Storage

7.57 The use of existing crop drying and storage facilities is often denied to farmers because facilities are in main centers which they cannot reach. Improved access would have to be accompanied by expanded facilities to handle present levels of production. Some post-harvest loss could also be avoided by the establishment of simple on-farm storage facilities, and by greater attention to preliminary sun-drying when weather permits.

Climate, Soils and Zonation

7.58 The high rainfall favors crop growth, but compounds the access problem because it accelerates the deterioration of roads. It thus accelerates post-harvest losses of crops which cannot be rapidly dried and stored. Combined with high humidity, rains also promote the development of weeds, pests and diseases (see para. 7.60 below). Partly due, again, to the access problem, farmers lack the technical skills and materials to make the best returns from the potentially usable soils, while many, through lack of knowledge, or a desire for short-term gain, have cleared and subsequently abandoned unsuitable soils, causing avoidable ecological damage.

7.59 In order to limit ecological damage in the future, land capability surveys should be made at a scale of 1:250,000 to cover all unoccupied areas considered likely to contain soils which have potential for agriculture and which are not already allocated to another purpose (forest and biological reserves, ecological stations, national parks, etc.). Agricultural zones should be delimited for those areas where potential is confirmed, and the remaining land should be allocated to non-agricultural uses. Within the agricultural zones, land capability surveys should be done at scales ranging from 1:25,000 to 1:100,000, depending on the potential intensity of land use, to form a basis for infrastructure and settlement planning. The feeder road network should then be concentrated within the identified agricultural zones. Given the high rates of migration to the region, it is clear that current settlement plans cannot be completely halted pending the outcome of the land capability surveys and zoning exercise recommended above. However, such measures should be given high priority and completed as soon as possible.

Weeds, Pests and Diseases

7.60 Weeds are few in newly cleared forest land, but the humid climate fosters rapid establishment if they are left uncontrolled. Forest regrowth can lead to the eventual abandonment of seeded pasture. Many pests and diseases also develop rapidly. Rice blast and insect pests of maize are particularly common, and diseases of beans are severe unless planting is so late in the rains that there is an alternative risk of loss due to drought. Witch's broom disease in cocoa, South American leaf blight on rubber, and coffee leaf rust have already been mentioned. Although so far none of these constraints are overwhelming, they may raise production costs and/or reduce yields, and impose a need for resistant varieties which cannot always be met by the existing sources.

Labor Availability

7.61 In the future, labor shortages are likely to continue (see para. 7.10). Much of the area recently put under tree crops is in larger holdings than can be managed by the labor of a single family. Most immigrants arriving in the area with the aim of making a living in agriculture are seeking land, and will develop a plot of their own, legally or illegally, rather than seek paid employment. As plantings of coffee and cocoa mature, the availability of hired labor for harvest is therefore likely to become an increasing constraint, unless new arrivals are systematically given more opportunities to participate in tree crop farming -- for instance as sharecroppers.

G. Production Forecasts

7.62 The agricultural production of the Northwest is expected to increase rapidly over the next decades as immigration and the incorporation of new land continues. In order to show the order of magnitude of this expected growth, projections of production were attempted for the years 1984, 1989, and 1994. These projections were disaggregated spatially and were further broken down into total, marketable, and exportable production. Moreover, recognizing the paramount importance of public sector activity in the region, the projections were made according to three separate scenarios. 1/ The basic assumptions of these scenarios are as follows:

Scenario I

7.63 The first scenario envisages the future essentially as a continuation of past trends. That is, it is based on the assumptions that there will be no special investments to improve the Cuiaba-Porto Velho highway or the feeder roads network; no strengthening of institutions responsible for land-use zoning, Indian affairs, and environmental protection; and no improved land titling or additional technical support for agriculture. Inappropriate land is developed by inappropriate means, leading to a continuation of the present,

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1/ More detailed information on the methodology and underlying assumptions of these projections are presented in Annex I.

largely exploitative, methods of agriculture. Yields decline in the medium and long terms. Market access becomes increasingly difficult as the agricultural perimeter expands, preventing access to inputs and leading to larger on-farm losses because farmers cannot evacuate their production.

Scenario II

7.64 The second scenario represents the future with investment in the upgrading of the Cuiaba-Porto Velho highway and an improved feeder roads network; but without the measures needed to establish agricultural zones, to ensure that feeder roads go only into areas with agricultural potential, to demarcate and protect non-agricultural areas, and to provide basic technical and social infrastructure in the agricultural zones. The present exploitative production patterns continue, but on a larger scale. Indiscriminate access to good and bad land accelerates the declining trend in yields, although on-farm losses are smaller due to better market access.

Scenario III

7.65 The third scenario represents the future with a full range of government assistance along the lines proposed in the previous section and in the legislation establishing POLONOROESTE. More specifically, the upgrading of the Cuiaba-Porto Velho highway and improvement of the feeder roads network is linked to a comprehensive program of agricultural development. The latter would include measures to ensure that land is zoned according to agricultural potential and that feeder roads, physical and social infrastructure, and services (including land titling) are implanted only in agricultural zones. Institutions responsible for non-agricultural reserves would be strengthened to prevent, as much as possible, land clearing in these areas. Indiscriminate land clearing would be checked and, by good initial land selection, improved land titling and technical support, there would be a move toward sustained cropping, emphasizing tree crops, rather than the short-term exploitation of land. Better land plus research and technical support would lead to an upward trend in yields in the medium to long terms, and the integration of feeder roads with agricultural support would reduce on-farm losses.

Results

7.66 The results of the forecasting exercise described above are summarized in Tables 17 and 18. In the first of these tables, the expected production of various commodities which would be available for sale either intra or extraregionally are shown for the years 1984, 1989, and 1994. From this table it may be readily observed that the agricultural potential of the Northwest is considerable, especially if government activity in the region expands along the lines and to the extent envisaged under Scenario III. The average annual growth of agricultural production between 1979 and 1994 could be in excess of 12%, as compared to the real historical growth rate for all Brazilian agriculture of about 5% per annum. Potential rates of growth are particularly high for tree crops and, under the conditions of Scenario III, the regional production of cocoa in 1994 would be close to the national total reached in the late 1970s.

TABLE 17

NORTHWEST REGION: FORECAST OF MARKETABLE AGRICULTURAL SURPLUSES FOR 1984, 1989 and 1994*

('000 metric tons)

	BASE	SCENARIO I			SCENARIO II			SCENARIO III		
	1979	1984	1989	1994	1984	1989	1994	1984	1989	1994
Tree Crops										
Coffee	39	81	136	160	92	138	180	110	234	345
Cocoa	4	24	54	71	27	59	88	34	113	210
Rubber	-	-	3	10	-	4	12	-	9	35
Annual Crops										
Rice	246	389	561	680	428	788	1,214	473	850	1,229
Corn	95	142	210	262	165	254	326	152	304	500
Beans	13	19	26	25	25	30	30	31	63	102
Bananas	12	20	34	56	20	36	62	20	36	52
Other**	91	131	190	170	165	199	206	164	204	150
	500	806	1,214	1,434	922	1,508	2,118	984	1,813	2,675
Livestock	55	64	80	101	64	79	101	78	104	133
Timber	221	375	550	628	426	713	963	618	1,119	1,602
TOTAL	776	1,245	1,844	2,163	1,412	2,300	3,182	1,680	3,036	4,410

* Total production less on-farm consumption and losses.
** Includes manioc, groundnuts, cotton, and soybeans.

Source: IBRD, Northwest Economic Survey mission.

7.67 Even if government activity remains at current levels, the growth in agriculture over the next 15 years could be on the order of 7% annually. However, this finding does not imply that the proposed improvements in the region's physical and social infrastructure and services should not be carried out. On the contrary, by not making such improvements the region would be foregoing almost 2.3 million tons of agricultural production per year by 1994. In addition, failure to institute measures dealing with the regularization of land ownership, environmental protection, Indian rights, and land-use planning could very well jeopardize the future development of the region in ways (e.g., through an aggravation of social tensions and needless environmental degradation) not fully reflected in the production figures.

7.68 Future market conditions for the major traded agricultural commodities of the Northwest are mixed. For coffee, real prices are expected to decline gradually until the mid-1980s and then rise moderately for the rest of the decade. The real unit price in 1989 (US$2,800 per mt at 1980 constant prices), however, is expected to be only slightly more than half that reached in 1977-79 (US$5,089 per mt). Under the assumptions of Scenario III, the annual coffee production of the Northwest could, by 1989, be accounting for about 15% of the national total, equivalent to approximately 5% of world imports. The market for cocoa is expected to weaken considerably over the present decade, owing primarily to high levels of world production assumed for the late 1980s, and the increasing success in the use of cocoa substitutes in chocolate and confectionery. As a consequence of these factors, the unit price of cocoa at 1980 constant prices is expected to decline by about 50% over the decade, from US$3,857 per metric ton in 1977-79 to US$1,980 in 1989. Under Scenario III, the Northwest's output of cocoa could account for 20% of Brazil's total, and equal 7% of world imports by 1989. In contrast to coffee and cocoa, the market prospects for rubber, rice and timber are good and their real unit prices are projected to increase at annual rates averaging 0.8%, 2.6%, and 1.8%, respectively, over the 1977-79 to 1989 period.

7.69 Despite the fact that prices for coffee and cocoa in both 1984 and 1989 are expected to be lower than those prevailing in 1977-79, the real value (at border prices) of the combined production of coffee, cocoa, rubber, rice and timber should increase substantially. Under all three scenarios, coffee continues to be the most important cash crop, followed by rice, timber, and cocoa (see Table 18). The value of rubber production is expected to remain at relatively low levels throughout the projection period. Under the assumptions of Scenario III, the total value (in constant 1980 US dollars) of the five commodities in question is expected to reach around US$769 million by 1984 and US$1.7 billion by 1989, the latter figure being over five times the 1979 baseline. The large differences between these totals and those attained under Scenario I are particularly striking (US$209 million in 1984 and US$728 million in 1989) and suggest that the proposed US$1-1.5 billion program aimed at upgrading the regional road network, coupled with measures to improve land use planning and agricultural practices, could have a very rapid and high return.

TABLE 18

NORTHWEST REGION: ESTIMATED VALUE OF KEY TRADED AGRICULTURAL COMMODITIES IN 1984 AND 1989*

(millions of constant 1980 US$)

	Base	Scenario I		Scenario II		Scenario III	
	1979	1984	1989	1984	1989	1984	1989
Coffee	142.8	211.4	391.7	240.1	397.4	287.1	673.9
Cocoa	13.5	68.4	106.9	77.0	116.8	96.9	223.7
Rubber	-	-	5.9	-	7.9	-	17.7
Rice	115.0	178.6	269.8	196.5	379.0	217.1	408.9
Timber	58.8	101.6	172.2	115.4	223.2	167.5	350.2
Total	330.1	560.0	946.5	629.0	1,124.3	768.6	1,674.4

* Based on forecasts of marketable surpluses as shown in Table 17 .

Source: IBRD, Northwest Economic Survey mission

VIII. INDUSTRY

8.01 Industrial activity is still of relatively little significance in the Northwest. The industrial sector of Mato Grosso accounted for only 9% of the state's product in 1970 and, as late as 1978, was the source of just 5% of its value-added tax (ICM) revenues. Industry is of far greater relative importance to the economy of Rondonia, accounting for about 20% of the territory's product in 1975, but almost all industrial production is attributable to a few large-scale cassiterite mining operations. 1/

8.02 At the time of the 1970 Industrial Census, the Northwest contained a total of 584 industrial establishments, employing about 3,500 persons. In Mato Grosso, industry was (and still is) concentrated in the Cuiaba-Varzea Grande urban agglomeration (accounting for 73% of the firms, 84% of the employment, and 65% of the value-added), although Caceres is emerging as an important second-level center. In 1970, about three-fourths or Rondonia's industrial establishments were located in Porto Velho, with most of the balance being accounted for by firms in Ji-Parana and Guajara-Mirim.

A. Industrial Structure

8.03 As is typical of natural resource and agricultural frontier areas in rapid expansion, industrial activities in the Northwest are of two basic types: extractive or primary product/raw material processing activities or local service industries, especially those involving food processing, furniture making, and construction. Firms are generally small and characterized by relatively primitive technologies and low levels of fixed capital investment, the large mining companies being the major exception. This industrial structure is typical of both Mato Grosso and Rondonia. In the former, for example, among the 652 industries registered by the state Secretariat of Finance in April 1977, 22% were food processing establishments (primarily grain drying and cleaning operations, and small bakeries), 18% were construction firms, 12% were sawmills, and 11% were vehicle repair shops. In Rondonia, 36% of all industrial establishments registered by the territorial Secretariat of Planning in 1978 were sawmills, 29% were food processing activities, 11% were furniture making operations, and 9% were brick and tile making enterprises.

8.04 The available data permit us a more accurate view of industrial structure and growth in Rondonia than in Mato Grosso. Since 1970, the number of establishments in Rondonia has doubled, and industrial employment has grown at about the same rate. Lumber, food processing, and non-metallic mineral establishments predominate. The recent growth of lumbering concerns is a consequence of the process of land clearance and settlement in the territory. From the standpoint of employment, mining, lumber, food products, and non-metallic minerals (brick and tile making), are the most important

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1/ Rondonia, northwest Mato Grosso, and southern Amazonas are estimated to contain 82,000 metric tons of cassiterite, or 95% of Brazil's proven reserves of this mineral.

industrial subsectors. In terms of the total value of industrial production, 1975 data reveal that cassiterite mining activities accounted for 53%; sawmills, 15%; rubber processing plants 11%; rice processing firms, 5%; and furniture makers, bakeries, frozen fish plants, and brick and tile makers, 2% each. Three subsectors were thus responsible for more than three-fourths of the total value of industrial production in the territory.

8.05 Most industrial establishments in Rondonia are relatively small, the major exception being the cassiterite operations which average more than 400 employees per firm. All other activities, except rubber processing (with 35 employees per firm) had an average of ten employees. In nearly all cases, part of the output of these firms is exported either to the south (Sao Paulo, Rio de Janeiro, Minas Gerais, and Rio Grande do Sul), or to the north (Acre and Manaus). However, processed Brazil nuts and some of the lumber production are also sold on international markets.

8.06 Small firms are also the rule in Mato Grosso. According to 1977 data, there were only 31 firms having more than 50 employees in this part of the Northwest. Two firms having more than 1,000 employees were both located in Cuiaba, one being a large construction company (with a total of 2,149 workers), and the other the state electrical energy company (with a total of 1,588 employees). Outside the Cuiaba-Varzea Grande area, and with the exception of a single wood-processing operation (and two medium-sized food processing and non-metallic minerals firms) in Caceres, industrial establishments were all relatively small. The largest employers in Barra do Bugres, Mirassol d'Oeste, Pocone, Tangara da Serra, and Vila Bela, for example, are sawmills which employ up to 20 workers each. In 1977, the total industrial employment in these municipios amounted to only 58 jobs, as compared with 292 positions in Caceres, 1,416 in Varzea Grande, and 7,952 in Cuiaba (of which 6,606 were in construction and electrical energy production).

B. Constraints and Prospects

8.07 The relative insignificance of industrial activity in the Northwest is primarily the result of serious deficiencies in physical infrastructure and a reduced, albeit rapidly growing, regional market. The principal obstacles to regional industrial development as seen by local government officials and entrepreneurs alike, are an inadequate supply of electrical energy and poor roads. The former represents an obvious constraint on industrial activities which demand large quantities of electrical energy, while the latter results in high freight costs sharply reducing the competitiveness of local manufactured products in extra-regional markets and increasing the cost of necessary inputs and raw materials originating both within and outside the region.

8.08 Both Mato Grosso and Rondonia are currently attempting to increase their electrical energy generating capacity and to improve their primary and feeder road systems. Construction of the 217 MW Samuel hydroelectric facility and associated transmission lines would significantly increase the supply of energy in the northern part of Rondonia, between Porto Velho and Ji-Parana. Plans in Mato Grosso to increase hydroelectricity capacity are concentrated in the area near the capital, extending as far east as Rondonopolis and as far

west as Caceres. The paving of the Cuiaba-Porto Velho highway will have a significant effect in reducing freight costs, especially in Rondonia, both of imported and local inputs and final products, thereby directly stimulating industrial production in the territory.

8.09 The current rates of migration and population growth in the region, moreover, guarantee the growth of local markets for a broad range of final consumption and intermediate commodities, many of which are now imported from the South. Prospects over the medium run also continue to be very good for the major extractive industries in the region, especially those based on cassiterite, lumber and extractive agricultural products. Agroindustrial production, in turn, should expand significantly, especially as the production of coffee and cocoa in colonization areas in Rondonia increases, as well as the continued production of cattle in Mato Grosso and rice and other food products in both Mato Grosso and Rondonia.

C. Industrial Policy

8.10 The principal instrument of local industrial policy in the Northwest is the creation of industrial districts, consisting of lots for the installation of manufacturing activities sold to private entrepreneurs at nominal prices and with physical infrastructure provided by the state government. An industrial district has begun in Cuiaba, and three firms, employing 180 people, have already located there. Five additional firms are scheduled to initiate operations in the near future. Nearly 300 firms have expressed interest in the industrial district of Cuiaba, most of which are in the lumber, food processing, or construction materials industries. The government of Mato Grosso also intends to install a smaller industrial district in Caceres. The government of Rondonia plans to establish industrial districts in Porto Velho, Ji-Parana and Vilhena.

8.11 In addition to the installation of industrial districts and the improvement of energy and transport infrastructure, both the state of Mato Grosso, through its Secretariat of Industry and Commerce, and the territory of Rondonia, through the Secretariat of Planning, are studying industrial development opportunities to stimulate the private sector (both local and non-local capital) to initiate activities in sub-sectors where there is a local comparative advantage. More specifically, Mato Grosso is preparing industrial profiles for the following products: lumber, grains, vegetable oils, rubber and rubber products, babacu, vegetable charcoal, meat processing, leather and leather goods, dairy products, sugar refining, alcohol, and cement products. Rondonia is analysing investment opportunities in: fruit processing, tile and brick making, soaps, wooden furniture, and animal feeds. Both Mato Grosso and Rondonia also plan to provide technical assistance to small and medium industries. In Rondonia, finally, plans also exist to use POLAMAZONIA funds to implant meat processing and dairy operations in Porto Velho, as well as a cocoa processing establishment in Ouro Preto. A second dairy products operation is scheduled for implementation in Ji-Parana in 1981.

8.12 In Mato Grosso, a state Secretariat of Industry, Commerce, and Tourism and an Industrial and Commercial Development Council have recently been installed, and the government also plans to create a general development credit program (carteira) in the state commercial bank destined, in part, to promote industrial investments. The use of ICM reductions as a fiscal incentive to industrial activities on the local level is also being considered in both Mato Grosso and Rondonia, although no specific measures have yet been taken. While Mato Grosso and Rondonia are both in Legal Amazonia, to date neither has been a significant recipient of SUDAM fiscal incentives for industrial projects. But both the state and territorial governments wish to increase local participation in this program. Rondonia, moreover, is currently seeking to have the full benefits of the Manaus Free Trade Zone extended to Porto Velho in order to stimulate industrial development. 1/

1/ At present, only imports of "first necessity" items are permitted to enter Rondonia duty free. For more details on the Manaus Free Trade Zone, see D.J. Mahar, "Fiscal Incentives and the Economic Development of Western Amazonia", Brazilian Economic Studies, 2(1976), pp. 147-74.

IX. TRANSPORTATION

A. Overview

9.01 The construction of the Cuiaba-Porto Velho highway has had, and continues to have, a profound effect on the rate and pattern of the Northwest's occupation and development. In fact, before the 1960s much of the region was inaccessible (except with great difficulty) by overland means and both population and economic activity were largely confined to riverine areas. Today, rapidly growing towns and cities exist at numerous points along the highway and a significant increase of agricultural production may be observed in the hinterlands. However, the present condition of the main highway is now a major constraint on the future development of the Northeast. So too is the region's inadequate system of secondary and feeder roads, which hampers farm-to-market access, as well as the population's use of social infrastructure and services. In light of the government's intention to improve the transport system as part of its overall development program for the Northwest, it is useful to describe the present situation in more detail, calling special attention to some of the more important problems and issues.

B. The Present System

9.02 The Northwest is served by air, river and road transport. Of the three, overland transport is the most important in terms of moving goods and people within the region, and between it and the rest of Brazil. In 1978, the region was estimated to have produced about 1.1 million tons of goods, mostly agricultural products (about 900,000 tons), wood either in logs or semi-processed (about 130,000 tons), cattle (about 30,000 tons), and minerals (mainly cassiterite in Rondonia). About 513,000 tons are estimated to have been exported from the area; 98% by truck and the rest by air and river transport. An estimated 840,000 tons of goods were brought into the region, consisting mainly of manufactured products and construction materials originating in the Sao Paulo area, fuel and oil mostly barged in from Manaus, and household goods accompanying the strong migratory flows.

Airports and Landing Strips

9.03 There are 28 airports in the Northwest. Two of them (Cuiaba and Porto Velho) are main line, trunk airports capable of handling jet aircraft, and two are secondary paved airports (Ji-Parana and Guajara-Mirim). The 24 remaining facilities, with gravel and earth runways, are scattered throughout the area. In addition to these airports, there are countless landing strips at smaller localities and farms. Air navigation facilities in the region are reported to be poor and widely scattered, making flying in the area hazardous, particularly during the rainy season when demand for this mode of transportation is high.

9.04 In Rondonia, and to a certain extent in Mato Grosso, it has been mainly the federal government that has taken the initiative of providing public airports and landing strips. Local authorities in the region are still financially and structurally too weak to undertake these activities alone. However, the government of Rondonia and INCRA have set up a joint program to build landing strips at remote localities and this effort is having a favorable impact on the economies of some of the official colonization projects.

Navigable Rivers and Ports

9.05 Some of the rivers of the Northwest flow north toward the Amazon (practically all rivers in Rondonia) and some flow south toward the Parana and the Plate (practically all rivers in the Mato Grosso part of the region). There are two important navigable river systems in Rondonia -- the Madeira and the Mamore-Guapore. The latter is an affluent of the first, but not connected to it by navigation owing to a series of rapids located between Porto Velho and Guajara-Mirim. The Madeira is formed by the Beni and the Mamore rivers, both of which mark the border between Brazil and Bolivia. It runs for 3,240 kilometers before joining the Amazon only a short distance from Manaus. Like most amazonic rivers, it is wide (over 800 meters at places) and deep (about ten meters on average). However, its curves are often narrow, and the navigable channel is constantly shifting. Moreover, the many floating logs in the river (giving the river its name) are hazardous to navigation. Nonetheless, the Madeira is navigable year-round for ships and barges of up to 600 ton capacity, from its mouth to Porto Velho.

9.06 Porto Velho is the region's only port on the Madeira. However, it is a precarious facility built on a river bank in one of the few areas close to Porto Velho without a silting problem. The port's limited infrastructure consists of two small cranes (1.5 tons at 30 meters and 4.5 tons at 20 meters), a paved yard, and a storage shed. As such, it is inadequate for handling large volumes of freight. The port of Porto Velho is administered by the federal port authority (PORTOBRAS) which, in view of the difficulties of operating the facility, intends to carry out a study to relocate it. In addition to the PORTOBRAS facility, there are a number of private wharfs and landings used by small, local shipping enterprises which operate mostly mixed passenger and freight services to riverine communities to the north.

9.07 The Mamore-Guapore system borders Rondonia on the south where it delimits the Brazil-Bolivia border. It is navigable, with restrictions in the summer, from Guajara-Mirim in Rondonia to Vila Bela in Mato Grosso -- a distance of about 1,100 kilometers. There are no port facilities along the banks. In general, the area through which this system flows is swampy and periodically inundated. Hence, most economic activities, except for the exploitation of rubber, tend to be seasonal.

9.08 Both the Madeira and the Mamore-Guapore river systems were the major avenues of access to Rondonia in the past, when the regional economy was mostly based on the extraction of natural rubber. Since the Mamore and Madeira could not be joined by navigation, a railway was built between Porto Velho and Guajara-Mirim to move the rubber produced in the area. However, with the decline in the demand for rubber, the railway lost most of its traffic and has since been abandoned and replaced by a road.

9.09 There are two important navigable rivers in the Mato Grosso part of the survey area: the Paraguay, which eventually runs into the Parana and, in turn, into the Plate; and the Cuiaba, one of the Paraguay's affluents. The Paraguay river rises north of Caceres at the foot of the Parecis plateau and runs south through Caceres where it becomes navigable for its next 1,300 kilometers. It is joined by the Cuiaba about 950 kilometers south of Caceres, continues parallel to the Brazil-Bolivia border and at Coimbra, becomes the Brazil-Paraguay border. Of relevance to the survey area is the 720 kilometer section from Caceres to Corumba in Mato Grosso do Sul, where the river is navigable for ships and barges of up to 500 tons. At Caceres there are limited port facilities which include a transit shed and a conveyor loading belt. The situation is similar at Ladario (located next to Corumba) where a rail terminal of the Estrada de Ferro Noroeste do Brasil exists. Despite its limited facilities, the waterway is reported to have been used successfully in recent years by grain shippers from the Caceres-Mirassol d'Oeste area.

9.10 The Cuiaba river is an important affluent of the Paraguay. It runs 625 kilometers before joining the latter (of which 367 kilometers are navigable) between Porto Cercado and the junction. Porto Cercado is 145 kilometers by road from Cuiaba and has had a growing cement traffic in the last few years. At present, the only port facility available at Porto Cercado is owned by the Itau Cement Company, but the Mato Grosso state government has plans to build a wharf there. This wharf would facilitate navigation destined for riverine communities in the state and for those located in Mato Grosso do Sul (including the rail terminal at Corumba).

Highways and Roads

9.11 Highways and roads are the core of the Northwest's transport system. In Mato Grosso part, there are two highway axes which concentrate all area flows: BR-163/364, the northern route from Cuiaba to the Rondonia border; and BR-070/174/364, the southern route, which passes through the cities of Caceres, Porto Espiridiao, and Pontes e Lacerda before joining the northern route close to the Rondonia border. 1/ There is just one spinal axis in Rondonia, that is, BR-364. These routes are all federal highways and represent the heart of the regional network. In total, there are 1,303 kilometers of federal highways in the Mato Grosso part of the region, and 1,519 kilometers in Rondonia. Except for 45 kilometers in Mato Grosso and 75 kilometers in Rondonia, all highways are unpaved. About half are gravelled and the rest are earth and natural terrain roads. Quite a few of them, particularly in Rondonia, are essentially tracks opened for seasonal use.

9.12 The federal highway network is generally in fair condition. However, some sections, particularly the more travelled ones of the primary axis, have deteriorated to a very bad condition. In fact, during the rainy season, these poor sections may be cut off altogether, isolating much of the Northwest from the rest of Brazil for weeks at a time. During the last few rainy seasons, for example, BR-364 has been closed to all vehicles with more than two axles.

1/ The southern route in Mato Grosso, plus BR-364 in Rondonia, is commonly referred to as the Cuiaba-Porto Velho highway.

9.13 Responsibility for the federal network rests with the National Highways Department (DNER). While DNER maintains a well staffed regional office in Mato Grosso, it has no representation in Rondonia. Federal responsibilities in Rondonia are shared between DNER's regional offices in Cuiaba (1,500 km away) and in Manaus (1,000 km away). Owing to the remoteness of the region and its border-area status, DNER, in turn, has delegated its responsibility for maintaining the most important sections of the federal network to the Army. However, maintenance has been difficult, and parts of the Cuiaba-Porto Velho highway have deteriorated to a point where normal maintenance is no longer feasible and where only a reconstruction of the highway would ensure year-round traffic.

9.14 In addition to the federal network, there are 1,313 kilometers of state highways and roads -- 1,082 kilometers in Mato Grosso and 231 kilometers in Rondonia. Except for 76 kilometers which are double surface treated, and 250 kilometers which are gravelled, all state roads in the survey area are earth roads. Their condition is generally poor, and many are only seasonal roads. In Mato Grosso, responsibility for state highways rests with the state Highway Department (DERMAT). In Rondonia, this function is exercised by the Secretariat of Works and Public Services. This latter agency is, however, understaffed and is responsible not only for roads but also for other public works and services in the territory. DERMAT, in contrast, is well-staffed and reasonably well-equipped. Moreover, recent investments in equipment by the state government have significantly improved its maintenance capability.

9.15 Finally, the study area has about 6,500 kilometers of municipal roads, distributed about equally between Mato Grosso and Rondonia. These are local roads generally of a very low standard. A few are collector roads built in accordance with some engineering criteria, but most are feeder roads built without engineering designs on the basis of self-help arrangements (mutirao). Elsewhere in Brazil, responsibility for these local roads would normally rest with the municipal government of the area in which they were located. In the Northwest, however, few municipalities are capable of carrying out this function. In Mato Grosso, the state government has been assisting some municipalities with equipment and engineering know-how. In Rondonia, very limited assistance is provided. Because the construction standards of state and municipal roads are similarly low, it is difficult to identify clearly (particularly in Rondonia) the scope and area of action of the different levels of government in road building and maintenance.

9.16 In addition to the overall lack of local roads in the Northwest (there is 1 kilometer of local roads for every 50 km^2 of area in Mato Grosso and 1 kilometer for every 75 km^2 in Rondonia), there is a serious problem with the maintenance of the few roads that do exist. Since local roads are generally those which provide direct access to the farming areas where most economic activities are presently taking place they should be able to support year-round traffic. Yet these roads were built, for the most part, to engineering standards that do not allow them to stay open year-round.

9.17 In sum, the Northwest's highway and road system is weak. The federal spinal network requires reconstruction and, as will be suggested below, paving as well. The state network is of an extremely low standard and hardly ever maintained. Thus, to ensure year-round access, it would need both upgrading and systematic maintenance. Finally, the local network is limited and in poor condition and also needs to be upgraded and maintained adequately. While these numerous tasks might be carried out efficiently by the federal, state and municipal agencies presently operating in Mato Grosso, the organization in Rondonia is, at present, less capable of doing so. This crucial issue will be discussed more fully in a subsequent section.

C. Current Traffic Flows

Air Transport

9.18 Two main trunk carriers serve the Northwest--VASP (Viacao Aerea de Sao Paulo) and Cruzeiro, a Varig subsidiary. Both airlines provide regular daily service to Cuiaba and Porto Velho from other parts of Brazil with modern jet aircraft. One regional carrier, TABA (Transportes Aereos da Bacia Amazonica), operates in the region with smaller aircraft and regularly serves towns like Guajara-Mirim, Ji-Parana, and Vilhena. There are also a number of air taxi services operating mostly out of the capital cities. Considering only the main trunk carriers, the airports of Cuiaba and Porto Velho had a combined through-put of 155,000 passengers in 1977, the most recent year for which such data are available. In the same year, these two airports handled a rather insignificant 2,000 tons of air freight. However, despite this low level of activity, air transport is, when road conditions are poor, about the only means of connecting the region with the south.

Inland Navigation

9.19 Porto Velho is the most important inland port of the region. It is served by a number of small shipping companies and occassionally by ships of the government-owned Amazon Shipping Company (ENASA). There are, however, no regular services. Traffic is quite imbalanced at Porto Velho and inbound flows are over four times greater than outbound flows at the PORTOBRAS-operated facility (34,000 and 8,000 tons, respectively, in 1978). Although overall traffic is reported to be higher on the private wharves and landings near Porto Velho (about 160,000 tons in 1978), the imbalance of inbound to outbound traffic is estimated to be on the order of eight to one.

9.20 A number of small companies provide intraregional transport services on the Mamore-Guapore river system. It is estimated that the largest of these companies, the Guapore Navigation Service, carries only about 2,700 passengers, and 1,500 tons of freight, per year. The Paraguay system in Mato Grosso is also serviced by comparatively small shippers, the largest being the government-supported Plate Basin Navigation Service (SNBP). Unfortunately, no official data are available on the overall traffic on this river system or on the freight handled by the two major ports in the survey area, Caceres and Porto Cercado. According to one unofficial report, about three million sacks (roughly 150,000 tons) of rice were shipped from Caceres to the rail terminal

in Corumba (Ladario) in 1978. Though this report probably exaggerates the tonnage actually hauled, it does point out the possibility of further utilizing river-road or river-rail connections. This, and the more intensive use of the Madeira river, would appear to be the only reasonable inland navigation prospects for the future.

Road Transport

9.21 Road transport accounts for the vast majority of regional traffic flows. In 1978, an estimated 1.3 million tons of freight, and well over five million passengers, were carried by this means. Though complete information on the composition of freight carried overland is not available, it would appear that the major items are those typical of a frontier area at an early stage of development. Regional exports consist mainly of primary goods such as minerals, lumber, and agricultural products; and imports are mainly manufactured goods such as machinery, parts, chemicals, and pharmaceuticals.

9.22 Though the flow of vehicles along the main trunk highway (Cuiaba-Porto Velho) varies seasonally, the average daily flow may be inferred on the basis of estimates of annual production and available traffic counts. Such calculations indicate that the flow of through trucks, which starts at around 25 trucks per day in Porto Velho, progressively rises to 200 trucks per day at the Rondonia-Mato Grosso border, and to about 500 trucks per day at Caceres. However, the estimates tend to understate the total flow since they do not take into account local traffic near important towns or the flow of vehicles other than trucks. Taking these additional factors into account, one arrives at the following estimate of the overall average daily traffic along the Cuiaba-Porto Velho highway in 1979:

Section	Average Daily Traffic (no. of vehicles)
Porto Velho *	200
Porto Velho to Ji-Parana	80
Ji-Parana*	470
Ji-Parana to Vilhena	200
Vilhena*	380
Vilhena to Pontes e Lacerda	250
Pontes e Lacerda*	700
Pontes e Lacerda to Porto Espiridiao	400
Porto Espiridiao*	700
Porto Espiridiao to Caceres	850
Caceres*	1200
Caceres to Varzea Grande	700
Varzea Grande*	1200

* Within city limits, or about 5 km. from the center of town.

9.23 Virtually no information is available on traffic flows on state and local roads. Yet, a sizeable proportion of the passengers and freight moved on the main trunk roads originated in areas removed from the main highways and, therefore, must have initially used the secondary and local network. Since the latter is almost three times more extensive than the federal network, flows on it should be, on average, about one-third as great, that is, on the order of 100 vehicles per day. However, given the uneven spatial distribution of economic activities in the region, one would expect wide variations from this average. In short, there is no generalized method of estimating traffic on the state and local roads. Only case-by-case reviews of activities in relevant sub-areas would provide the necessary information.

D. Estimated Future Traffic Flows

9.24 Because road transport accounts for such a large proportion of regional traffic flows, it is important to estimate the future development of such traffic to assess its implications for future project design. Based on the agricultural, forestry and livestock production estimates for 1979, 1984, 1989 and 1994 presented in Chapter VII, estimates were made of likely traffic on BR-364 for 1985, 1990 and 1995. In order to arrive at these traffic estimates, the forecasts of exportable agricultural surpluses (see Annex I, Table 9) were allocated first to specific municipios and road construction lots, thus establishing a direct link between production and traffic. Next, certain assumptions were made concerning average truck payload capacities and the composition of the traffic flow (the proportion of trucks in the total flow). Finally, the forecasts of exportable agricultural surpluses were divided by the assumed average truck payload capacities to obtain estimated truck traffic flows; to these were added the estimates of non-truck traffic to obtain estimated total average daily traffic. The results of this exercise are as follows:

Section	Average Daily Traffic (no. of vehicles)		
	1985	1990	1995
Porto Velho *	1570	2420	3560
Porto Velho to Ji-Parana	360	610	970
Ji-Parana *	1140	1960	3230
Ji-Parana to Vilhena	430	730	1160
Vilhena *	830	1400	2250
Vilhena to Pontes e Lacerda	550	930	1440
Pontes e Lacerda *	1660	2730	4200
Pontes e Lacerda to Porto Espiridiao	940	1520	2300
Porto Espiridiao *	1380	2270	3410
Porto Espiridiao to Caceres	1470	2450	3690
Caceres *	2010	3390	5100
Caceres to Varzea Grande	1160	1950	2960
Varzea Grande *	190	3200	4900

* Within city limits, or about 5 km from center of town.

9.25 The main axis of the region, the Cuiaba - Porto Velho highway, is also part of a wider national network which links up with recently paved roads to the south of Cuiaba and with the existing, but precarious, road from Porto Velho to Manaus. The Porto Velho - Manaus highway (BR-319) is not likely to be improved in the near future, because the extremely difficult terrain conditions make any works on it exceedingly expensive. Thus, BR-364 is not expected to play any significant role in diverting flows that currently move between the south and southeast of the country and the north and Manaus.

E. Issues and Recommendations

General

9.26 Based on the review of the existing transport system, current traffic flows, and anticipated future flows, the future development of the sector should center around improving the safety of air transport, increasing the efficiency of river transport, and expanding and upgrading the highway and local roads network. Major new investments in infrastructure, however, are indicated only for the latter. There seems to be ample capacity available in river and air transport, and the nature of the Northwest's development, with its emphasis on expanding the agricultural frontier and consolidating existing agricultural undertakings, would indicate that providing access to farms should receive precedence.

9.27 Though the future demand for, and supply of, transportation services will most likely be concentrated on the main highway network and year-round state and local roads, the reported lack of adequate air navigation facilities is a matter of serious concern, particularly because passengers, rather than freight, are primarily involved. A thorough study of this problem therefore seems warranted. With regard to inland navigation, a more efficient interface between trucks and ships needs to be achieved on both the Madeira and Paraguay rivers. While this would generally entail improvements in administration, labor productivity, and equipment on the land and river sides of the interface, a detailed study is needed.

9.28 Roads and highways will require the largest infrastructure investments. First of all, given the level of traffic flows and the generally poor condition of the Cuiaba-Porto Velho highway, it will need to be reconstructed and paved. Secondly, the region's inadequate state and local roads network will require expansion and upgrading in close coordination with existing and proposed agricultural development and settlement programs. Federal and state agencies operating in the region have already proposed, and are currently preparing the necessary studies to implement, both undertakings (see paras. 9.30-9.32 below). However, it will be necessary to strengthen the agencies directly involved, especially in Rondonia. Furthermore, provision would have to be made for the future maintenance and continued construction, as needed, of additional highways and roads.

9.29 Before undertaking the ambitious program described above, intergovernmental responsibilities and financial obligations need to be clearly defined. Given the embryonic stage of municipal government in much of the region (particularly in Rondonia), the responsibility for local roads may need to be assumed by the state and territorial governments. A coordinated program and budgeting system also needs to be established. Under this system, programs would be carried out by the responsible administrative entity according to an overall action plan tailored to take into account each entity's financial capacity. Finally, the executing agencies need to be strengthened through improvements in both staff and equipment. In sum, taking care of the road transport needs of the Northwest should not be just an exercise in building infrastructure, but also one of building the institutions that would be responsible for this subsector's future development.

Reconstruction and Paving of the Cuiaba-Porto Velho Highway

9.30 Plans to improve the Cuiaba-Porto Velho highway were first considered in 1974. At that time, DNER commissioned detailed engineering designs for the highway's reconstruction and paving. Since the completion of these studies, about 117 kilometers (42 km. at the Cuiaba end and 75 km at the Porto Velho end), of the highway's 1,470 kilometer total length, have actually been reconstructed and paved. Of the roughly 1,350 kilometers remaining, the government has decided that the reconstruction and paving of 284 kilometers (167 km from the site of the proposed Samuel hydroelectric project to Ariquemes in Rondonia, and 117 km from Fazenda Lima to Caceres in Mato Grosso) would be the responsibility of the Army. The rest (Caceres to Ariquemes) would be carried out by private contractors.

9.31 The cost of reconstructing and paving the 1,350 kilometers is estimated at end-1979 prices to be about $456 million, including allowances for physical and price contingencies. Initial expectations are that these costs will be financed under POLONOROESTE using funds from the National Integration Program (PIN) 1/, DNER's budget, and a loan requested from the World Bank. The government expects that the works will be completed during the three-year period from 1981 to 1983 2/. Execution of the highway project should present no unusual engineering problems. However, special care will have to be taken in the design and construction of the section from Rio Rondon and Barracao Queimado to prevent further erosion of embankments and cuts. Measures to protect Amerindians in the area will also be necessary, particularly when constructing the proposed new stretch of the highway between Barracao Queimado and Pontes e Lacerda near the Rondonia-Mato Grosso border (see Chapter IV, paras. 9.22-9.23).

1/ PIN was created by the federal government in 1970 for the purpose of financing infrastructure development in Amazonia and the Northeast.

2/ This scheduling may be somewhat optimistic because there is a six month rainy season during which relatively little can be done, and because the pace of road-building by the Army has been relatively slow in recent years.

Local Roads Program

9.32 As noted, the region's local collector and feeder roads system is seriously deficient. Present plans call for the construction of 4,500 kilometers of collector roads between 1980 and 1985; 2,000 kilometers in Mato Grosso and 2,500 kilometers in Rondonia, figures which may be reduced after detailed appraisal. The road construction program in Mato Grosso would be concentrated in areas along the Guapore river, while in Rondonia, roads would be built both for the purpose of incorporating new areas and to serve existing colonization and settlement projects. The cost of constructing collector roads is estimated at Cr$1 million (US$20,000) per kilometer.

BRAZIL: NORTHWEST REGION ECONOMIC SURVEY

Methodology for Agricultural Production Forecasts

1. The production forecasts are based for the most part on assumed population growth, on the premise that the existing relationship between the extent of agricultural activity and the number of people involved will remain about the same. Thus, the area of land cleared annually and the total area under annual crops follow population growth initially. In the longer term, both land clearance and the area devoted to annual crops are assumed to lag somewhat behind population growth, reflecting the increasing urbanization of the population. In the case of tree crops (coffee, rubber, and cocoa) logistical limits are assumed at the outset, owing principally to constraints on the supply of planting material. The underlying assumptions for population, land clearance, and crop areas are shown in Annex Tables 1-4.

2. For each crop, production and consumption tables were prepared. These tables incorporate changes in total area, yields, on-farm losses (including production retained for seeds), on-farm human consumption, and other on-farm utilization (e.g., livestock feed), to calculate total quantities transported off the farm. A similar methodology was used to derive transported tonnages of timber and livestock. Urban consumption within the area was then deducted to calculate quantities available for export from the region. Representative working tables for some of the key commodities are presented as Annex Tables 5-7.

3. Finally, an attempt was made to value the projected production of the key traded commodities (coffee, cocoa, rubber, rice, and timber) for the years 1984 and 1989. The price assumptions were based on the most recent projections of the World Bank Economic Analysis and Projections Department, converted to Brazilian border prices and adjusted to take into account quality differences between the Brazilian commodities and those considered by the Bank. The adjustment factors were calculated by dividing a three-year average (1977-79) of Brazilian FOB export prices (CIF import price in the case of rubber) for the five commodities in question by a three-year average of world prices for the same (though not necessarily the identical quality) commodities. The Bank commodity prices projected for 1984 and 1989 were then multiplied by the adjustment factors derived as above to attain projected Brazilian border prices. The final step was to multiply the production forecasts for each selected commodity under each of the three scenarios by the respective projected border prices. The underlying price assumptions for the selected commodities are presented in Annex Table 10.

ANNEX 1
Table 1

POPULATION AND CONSUMPTION ASSUMPTIONS
Population ('000s), rural and urban

1979 (Baseline)

Rural	590
Urban	577
Total	1,167

	% Annual increase - - - years - - -			Total ('000s)		
	1-5	6-10	11-15	1984	1989	1994
Scenario I - Rural	11	10	8	997	1,605	2,360
- Urban	11	11	11	975	1,650	2,785
				1,972	3,255	5,145
Scenario II - Rural	12	13	8	1,038	1,910	2,808
- Urban	12	12	12	1,016	1,787	3,146
				2,054	3,697	5,954
Scenario III- Rural	12	12	10	1,038	1,827	2,942
- Urban	12	12	8	1,016	1,787	2,627
				2,054	3,614	5,569

Per capita annual consumption (kg.)

Rice (as paddy)	50
Beans	18
Corn (dry weight equivalent)	10
Meat (live weight equivalent)	40
Coffee	5
Manioc (wet root equivalent)	50
Bananas	10

ANNEX 1
Table 2

SCENARIO I: UNDERLYING ASSUMPTIONS FOR CULTIVATED CROP AREAS

Area ('000 ha)	Base (1979)	Scenario factors 0-5	6-10	11-15	1984	1989	1994
Land clearance/yr	200	11%	8%	6%	340	500	670
Seeded pasture	2,570	By difference			3,600	5,340	7,886
Coffee	53	+ 10,000 ha/yr			100	150	200
Cocoa	25	+ 5,000 ha/yr			50	75	100
Rubber	1	+ 2,000 ha/yr			11	21	31
Total	79				161	246	331
Rice	230	11%	8%	6%	390	570	760
Corn	86	11%	8%	6%	140	210	280
Beans	60	11%	8%	6%	100	150	200
Others	25	11%	8%	6%	40	60	80
Total	401				670	990	1,320
Grand total, crops	480				831	1,236	1,651
Banana (interplanted)	27	= cocoa			50	75	100

ANNEX 1
Table 3

SCENARIO II: UNDERLYING ASSUMPTIONS FOR CULTIVATED CROP AREAS

Area ('000 ha)	Base (1979)	Scenario factors 1-5	6-10	11-15	1984	1989	1994
Land clearance/yr	200	12%	14%	10%	350	680	1,100
Seeded pasture	2,570	By difference			3,580	5,570	9,390
Coffee	53	+ 12,000 ha/yr			110	170	230
Cocoa	25	+ 7,000 ha/yr			60	95	130
Rubber	1	+ 3,000 ha/yr			16	30	45
Total	79				186	295	405
Rice	230	12%	14%	10%	400	770	1,240
Corn	86	12%	10%	6%	150	240	320
Beans	60	12%	10%	6%	110	180	240
Others	25	12%	10%	6%	45	70	95
Total	401				705	1,260	1,895
Grand total, crops	480				891	1,555	2,300
Banana (interplanted)	27	= cocoa			60	95	130

ANNEX 1
Table 4

SCENARIO III: UNDERLYING ASSUMPTIONS FOR CULTIVATED CROP AREAS

Area ('000 ha)	Base (1979)	Scenario factors 1-5	6-10	11-15	1984	1989	1994
Land clearance/yr	200	12%	10%	5%	352	567	726
Seeded pasture	2,570	By difference			3,581	5,259	7,778
Coffee	53	+ 15,000 ha/yr			130	200	280
Cocoa	25	+ 12,000 ha/yr			85	150	200
Rubber	1	+ 5,000 ha/yr			26	50	75
Total	79				241	400	555
Rice	230	12%	12%	8%	400	700	1,000
Corn	86	12%	12%	10%	150	260	420
Beans	60	12%	12%	10%	110	190	300
Others	25	12%	12%	10%	45	80	130
Total	401				705	1,230	1,850
Grand total, crops	480				946	1,630	2,405
Banana (interplanted)	27	= cocoa			85	150	200

COFFEE: CALCULATION OF TRANSPORTED AND EXPORTED OUTPUT

	Base 1979	SCENARIO (I) 1984	(I) 1989	(I) 1994	(II) 1984	(II) 1989	(II) 1994	(III) 1984	(III) 1989	(III) 1994
Population - rural	590	997	1605	2360	1038	1910	2808	1038	1827	2942
('000s) - urban	577	975	1650	2785	1016	1787	3146	1016	1787	2627
Per capita annual intake (kg)	5	5	5	5	5	5	5	5	5	
Total area ('000 ha)	53	100	150	200	110	170	230	130	200	280
Average yield (t/ha)1/	0.94	1.08	1.20	1.08	1.04	1.00	0,95	1.02	1.37	1.43
Total output ('000 t)	50	108	180	215	114	170	218	132	273	400
Not transported										
On-farm losses - %	15	20	20	20	15	13	11	13	11	10
- '000 t	8	22	36	43	17	22	24	17	30	40
Subsistence ('000 t)	3	5	8	12	5	10	14	5	9	15
On-farm use ('000 t)	0	0	0	0	0	0	0	0	0	0
Total not transported	11	27	44	55	22	32	38	22	39	55
Total transported ('000 t)	39	81	136	160	92	138	180	110	234	345
Local urban consumption ('000 t)	3	5	8	14	5	9	16	5	9	13
Balance exported ('000 t)	36	76	128	146	87	129	164	105	225	332

1/ Base yield calculated on assumption that coffee < 5 yrs yields average of 0.6t/ha and all older coffee averages 1.5t/ha.

COCOA: CALCULATION OF TRANSPORTED AND EXPORTED OUTPUT

	Base 1979	SCENARIO (I) 1984	(I) 1989	(I) 1994	(II) 1984	(II) 1989	(II) 1994	(III) 1984	(III) 1989	(III) 1994
Population - rural	590	997	1,605	2,360	1,038	1,910	2,808	1,038	1,827	2,942
('000s) - urban	577	975	1,650	2,785	1,016	1,787	3,146	1,016	1,787	2,627
Per capita annual intake (kg)	0	0	0	0	0	0	0	0	0	0
Total area ('000 ha)	25	50	75	100	60	95	130	85	150	200
Average yield (t/ha)1/	0.20	0.60	0.91	0.89	0.53	0.72	0.76	0.46	0.85	1.17
Total output ('000 t)	52/	30	68	89	32	68	99	39	127	233
Not transported										
On-farm losses - %	15	20	20	20	15	13	11	13	11	10
- '000 t	1	6	14	18	5	9	11	5	14	23
Subsistence ('000 t)	0	0	0	0	0	0	0	0	0	0
On-farm use ('000 t)	0	0	0	0	0	0	0	0	0	0
Total not transported	1	6	14	18	5	9	11	5	14	23
Total transported ('000 t)	4	24	54	71	27	59	88	34	113	210
Local urban consumption ('000 t)	0	0	0	0	0	0	0	0	0	0
Balance exported ('000 t)	4	24	54	71	27	59	88	34	113	210

1/ Base yield assumes that cocoa < 5 years old yields average of 0.2t/ha, 5-10 yields average of 1.0t/ha and > 15 years averages 1.5t/ha.

2/ Overestimate, since most cocoa was < 3 years in 1979.

RICE: CALCULATION OF TRANSPORTED AND EXPORTED OUTPUT

	Base 1979	SCENARIO (I) 1984	(I) 1989	(I) 1994	(II) 1984	(II) 1989	(II) 1994	(III) 1984	(III) 1989	(III) 1994
Population - rural	590	997	1,605	2,360	1,038	1,910	2,808	1,038	1,827	2,942
('000s) - urban	577	975	1,650	2,785	1,016	1,787	3,146	1,016	1,787	2,627
Per capita annual intake (kg)	50	50	50	50	50	50	50	50	50	50
Total area ('000 ha)	230	390	570	760	400	770	1,240	400	700	1,000
Average yield (t/ha)	1.5	1.5	1.5	1.4	1.5	1.4	1.3	1.6	1.6	1.6
Total output ('000 t)	345	585	855	1,064	600	1,078	1,612	640	1,120	1,600
Not transported										
On-farm losses - %	20	25	25	25	20	18	16	18	16	14
- '000 t	69	146	214	266	120	194	258	115	179	224
Subsistence ('000 t)	30	50	80	118	52	96	140	52	91	147
On-farm use ('000 t)	0	0	0	0	0	0	0	0	0	0
Total not transported	99	196	294	384	172	290	398	167	270	371
Total transported ('000 t)	246	389	561	680	428	788	1,214	473	850	1,229
Local urban consumption ('000 t)	29	49	83	139	51	89	157	51	89	131
Balance exported ('000 t)	217	340	478	541	377	699	1,057	422	761	1,098

NORTHWEST REGION: FORECAST OF TOTAL PRODUCTION FOR 1984, 1989, and 1994
('000 metric tons)

	Base 1979	Scenario I 1984	Scenario I 1989	Scenario I 1994	Scenario II 1984	Scenario II 1989	Scenario II 1994	Scenario III 1984	Scenario III 1989	Scenario III 1994
Tree crops										
Coffee	50	108	180	215	114	170	218	132	273	400
Cocoa	5	30	68	89	32	68	99	39	127	233
Rubber	-	-	4	12	-	5	13	-	10	39
Annual crops										
Rice	345	585	855	1,064	600	1,078	1,612	640	1,120	1,600
Corn	155	252	378	476	270	408	512	285	546	882
Beans	30	50	75	90	55	81	96	61	114	180
Banana	216	400	600	800	480	760	1,040	680	1,200	1,600
Other[1/]	145	232	348	400	261	350	428	270	384	416
	946	1,657	2,508	3,146	1,812	2,920	4,018	2,107	3,774	5,350
Livestock										
Beef	54	57	64	71	57	66	74	61	72	85
Pigs & poultry	18	28	45	68	29	45	70	34	57	86
	72	85	109	139	86	111	144	95	129	171
Timber	221	375	550	628	426	713	963	618	1,119	1,602
Total	1,239	2,117	3,167	3,913	2,324	3,744	5,125	2,820	5,022	7,123

1/ Includes manioc, groundnuts, cotton, and soybeans.

NORTHWEST REGION: FORECAST OF EXPORTABLE AGRICULTURAL SURPLUSES FOR 1984, 1989, and 1994[1]/
('000 metric tons)

	Base 1979	Scenario I 1984	Scenario I 1989	Scenario I 1994	Scenario II 1984	Scenario II 1989	Scenario II 1994	Scenario III 1984	Scenario III 1989	Scenario III 1994
Tree crops										
Coffee	36	76	128	146	87	129	164	105	225	332
Cocoa	4	24	54	71	27	59	88	34	113	210
Rubber	-	-	3	10	-	4	12	-	9	35
Annual crops										
Rice	217	340	478	541	377	699	1,057	422	761	1,098
Corn	89	132	193	234	155	236	295	142	286	474
Beans	3	1	-	-	7	-	-	13	31	55
Banana	6	10	17	28	10	18	31	10	18	26
Other[2]/	59	77	99	17	109	101	33	108	106	6
	414	660	972	1,047	772	1,246	1,680	834	1,549	2,236
Livestock	19	5	-	-	2	-	-	9	-	-
Timber	177	300	440	502	341	570	770	494	895	1,282
Total	610	965	1,412	1,549	1,115	1,816	2,450	1,337	2,444	3,518

1/ Total production less on-farm consumption and losses, and urban consumption.
2/ Includes manioc, groundnuts, cotton, and soybeans.

Source: IBRD, Northwest Economic Survey mission.

ANNEX 1
Table 10

UNDERLYING PRICE ASSUMPTIONS FOR SELECTED COMMODITIES, 1977/79, 1984 AND 1989
(constant 1980 US$ per metric ton)

	1977/79	1984	1989
Coffee (FOB)	5,089	2,610	2,880
Cocoa (FOB)	3,857	2,850	1,980
Rubber (CIF)	1,821	1,810	1,970
Rice (FOB)	371	459	481
Timber (FOB)	260	271	313

Source: IBRD, Economic Analysis and Projections Department; mission estimates.