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Operations Evaluation Department

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ABBREVIATIONS AND ACRONYMS

AMZA	Amazonia Mineracaoes S.A. (Amazon Mining Inc.)
CETESB	Companhia de Tecnologia de Saneamento Ambiental (Environmental Sanitation Technology Company)
CHESF	Companhia Hidro-eletrica do Sao Francisco (Sao Francisco Hydroelectric Company)
CIDA	Canadian International Development Agency
CODEVASF	Companhia de Desenvolvimento do Vale do Sao Francisco (Sao Francisco Valley Development Company)
CONAMA	Conselho Nacional de Meio Ambiente (National Environmental Council)
CVRD	Companhia Vale do Rio Doce (Rio Doce Valley Company)
ELETRONBRAS	Centrais Eletricas Brasileiras S.A. (Brazilian Central Electrical Company Inc.)
ESMAP	Energy Management Assistance Program
ESW	Economic and Sector Work
FAO	Food and Agricultural Organization, United Nations
FUNAI	Fundacao Nacional do Indio (National Indian Foundation)
IBAMA	Instituto Brasileiro do Meio Ambiente e Recursos Naturais Renovaveis (Brazilian Institute for the Environment and Renewable Natural Resources)
IDB	Inter-American Development Bank
INCRA	Instituto Nacional de Colonizacao e Reforma Agraria (National Colonization and Agrarian Reform Institute)
INFES	Instituto Nacional de Pesquisas Economicas e Sociais, IPEA (National Economic and Social Research Institute, IPEA)
IPEA	Instituto de Pesquisa Economica Aplicada (Institute of Applied Economic Research)
NGO	Non-governmental Organization
OAS	Organization of American States
OD	Operational Directive, World Bank
OECD	Organization for Economic Co-operation and Development
OED	Operations Evaluation Department, World Bank
OMS	Operational Manual Statement, World Bank
PGC	Programa Grande Carajas (Greater Carajas Program)
PLANVASF	Plano de Desenvolvimento do Vale do Sao Francisco (Development Plan for the Sao Francisco Valley)
POLONOROESTE	Programa de Desenvolvimento Integrado do Noroeste do Brasil (Northwest Integrated Development Program)
POLOSINDICAL	(Rural labor union confederation, lower-middle Sao Francisco valley)
PROCOP	Programa de Controle de Poluicao, CETESB (Pollution Control Program, CETESB)
RIMA	Relatorio de Impacto sobre o Meio Ambiente (Environmental Impact Report)
SDR-PR	Secretaria de Desenvolvimento Regional, Presidencia da Republica (Secretariat of Regional Development, Presidency of the Republic)
SEAIN	Secretaria de Assuntos Internacionais, SEPLAN (International Affairs Secretariat, SEPLAN)
SEMA	Secretaria Especial do Meio Ambiente, Ministerio do Interior (Special Environmental Secretariat, Ministry of the Interior)
SEMAM	Secretaria do Meio Ambiente, Presidencia da Republica (Environmental Secretariat, Presidency of the Republic)
SEPLAN	Secretaria de Planejamento, Presidencia da Republica (Secretariat of Planning, Presidency of the Republic)
SISNAMA	Sistema Nacional do Meio Ambiente (National Environmental System)
SPMA	Sao Paulo Metropolitan Area
SUDECO	Superintendencia de Desenvolvimento do Centro-Oeste (Superintendency for the Development of the Center-West)
UNDP	United Nations Development Program

ABBREVIATIONS AND ACRONYMS

AI	Area Indigena (Indigenous Area)
ANPEC	Associacao Nacional das Escolas de Pos-graduacao em Economia (National Association of Post-graduate Schools of Economics)
ASTER	Associacao de Assistencia Tecnica e Extensao Rural - Rondonia (Technical Assistance and Rural Extension Association - Rondonia)
BASA	Banco da Amazonia S.A. (Bank of Amazonia Inc.)
BB	Banco do Brasil S.A. (Bank of Brazil)
BEC	Batalhao de Engenharia e Construcao (Engineering and Construction Battalion)
BNDES	Banco Nacional de Desenvolvimento Economico e Social (National Economic and Social Development Bank)
CASEMAT	Companhia de Armazens e Silos do Estado de Mato Grosso (Mato Grosso State Warehouse and Storage Company)
CDES	Conselho de Desenvolvimento Economico e Social, Mato Grosso (Economic and Social Development Council, Mato Grosso)
CEDEPLAR	Centro de Desenvolvimento e Planejamento Regional, Universidade Federal de Minas Gerais (Center of Regional Development and Planning, Federal University of Minas Gerais)
CEPLAC	Comissao Executiva do Plano da Lavoura do Cacau (Executive Commission for the Cocoa Development Plan)
CETEC	Centro de Tecnologia, Minas Gerais (Center of Technology, Minas Gerais)
CFP	Comissao de Financiamento da Producao (Commission for Production Financing)
CIBRAZEM	Companhia Brasileira de Armazenagem (Brazilian Storage Company)
CNPq	Conselho Nacional de Desenvolvimento Cientifico e Tecnologico (National Council for Scientific and Technological Development)
CODAGRI	Companhia de Desenvolvimento Agricola, Mato Grosso (Agricultural Development Company, Mato Grosso)

CODARON	Companhia de Desenvolvimento Agricola de Rondonia (Rondonia Agricultural Development Company)
CODEMAT	Companhia de Desenvolvimento de Mato Grosso (Mato Grosso Development Company)
CVRD	Companhia Vale do Rio Doce (Rio Doce Valley Company)
DERMAT	Departamento de Estradas de Rodagem do Estado de Mato Grosso (Mato Grosso State Highway Department)
DER-RO	Departamento de Estradas de Rodagem - Rondonia (Highway Department - Rondonia)
DNER	Departamento Nacional de Estradas de Rodagem (National Highway Department)
DNPM	Departamento Nacional de Producao Mineral (National Department of Mineral Production)
EMATER-MT	Empresa de Assistencia Tecnica e Extensao Rural - Mato Grosso (Technical Assistance and Rural Extension Enterprise - Mato Grosso)
EMBRAPA	Empresa Brasileira de Pesquisas Agropecuarias (Brazilian Enterprise for Agricultural and Livestock Research)
EMPA-MT	Empresa de Pesquisa Agropecuaria do Estado de Mato Grosso (Mato Grosso Agricultural Research Enterprise)
ESW	Economic and sector work
FAO	Food and Agricultural Organization, United Nations
FGV	Fundacao Getulio Vargas (Getulio Vargas Foundation)
FIPE	Fundacao Instituto de Pesquisas Economicas, Universidade de Sao Paulo (Institute of Economic Research Foundation, University of Sao Paulo)
FUNAI	Fundacao Nacional do Indio (National Indian Foundation)
GCU	General coordination unit, SUDECO
GEBAM	Grupo Executivo de Terras do Baixo Amazonas (Executive Group for Land in the Lower Amazon River Area)
GEIPOT	Grupo Executivo de Planejamento dos Transportes (Executive Group for Transport Planning)

GETAT	Grupo Executivo de Terras da Bacia Araguaia-Tocantins (Executive Group for Land in Araguaia-Tocantins Basin)
GPC	Gabinete de Planejamento e Coordenacao, Mato Grosso (Planning and Coordination Cabinet, Mato Grosso)
HYV	High yield variety
IBAMA	Instituto Brasileiro do Meio Ambiente e Recursos Naturais Renovaveis (Brazilian Institute of the Environment and Renewable Natural Resources)
IBC	Instituto Brasileiro do Cafe (Brazilian Coffee Institute)
IBDF	Instituto Brasileiro de Desenvolvimento Florestal (Brazilian Institute of Forestry Development)
IBGE	Instituto Brasileiro de Geografia e Estatistica (Brazilian Institute of Geography and Statistics)
IBRA	Instituto Brasileiro de Reforma Agraria (Brazilian Institute of Agrarian Reform)
IDB	Inter-American Development Bank
IEF	Instituto Estadual de Florestas, Rondonia (State Forestry Institute, Rondonia)
INCRA	Instituto Nacional de Colonizacao e Reforma Agraria (National Institute of Colonization and Agrarian Reform)
INPA	Instituto Nacional de Pesquisas da Amazonia (National Institute for Amazon Research)
INPES	Instituto Nacional de Pesquisas Economicas e Sociais, IPEA (National Institute of Economic and Social Research)
IPARDES	Instituto Paranaense de Desenvolvimento Economico e Social (Parana Institute of Economic and Social Development)
IPEA	Instituto de Pesquisa Economica Aplicada (Institute of Applied Economic Research)
IPLAN	Instituto de Planejamento, IPEA (Planning Institute, IPEA)
ITFA	Interdepartmental Task Force on the Amazon, FAO
MEFP	Ministerio de Economia, Financas e Planejamento (Ministry of Economy, Finance and Planning)

MINTER	Ministerio do Interior (Ministry of the Interior)
MIRAD	Ministerio de Reforma Agraria (Ministry of Agrarian Reform)
NAEA	Nucleo de Altos Estudos da Amazonia, Universidade Federal do Para (Nucleus of High Studies of Amazonia, Federal University of Para)
NGO	Non-governmental organization
NRDC	Natural Resources Defense Council
NUAR	Nucleo urbano de apoio rural (Urban nucleus of rural support)
OED	Operations Evaluation Department, World Bank
OMS	Operational Manual Statement, World Bank
PAD	Projeto de Assentamento Dirigido (Directed Settlement Project)
PCR	Project completion report
PIC	Projeto Integrado de Colonizacao (Integrated Colonization Project)
PIN	Programa de Integracao Nacional (National Integration Program)
PLANAFLORO	Plano Agropecuario e Florestal de Rondonia (Rondonia Agro-livestock and Forestry Plan)
PMU	Project management unit, Mato Grosso
PND	Plano Nacional de Desenvolvimento (National Development Plan)
PNMA	Programa Nacional do Meio Ambiente (National Environmental Program)
POLAMAZONIA	Programa de Polos Agricolas e Minerais da Amazonia (Amazonia Agricultural and Mineral Poles Program)
POLONOROESTE	Programa de Desenvolvimento Integrado to Noroeste do Brasil (Northwest Integrated Development Program)
PROBOR	Programa de Incentivos a Producao da Borracha Natural (Program of Incentives for Natural Rubber Production)

PRODEAGRO	Programa de Desenvolvimento Agrícola, Mato Grosso (Agricultural Development Program, Mato Grosso)
PROTERRA	Programa de Redistribuição de Terras e Estimulo a Agroindustria (Land Redistribution and Agro-industrial Incentive Program)
RADAMBRASIL	Radar Survey of Brazil
SANEMAT	Companhia de Saneamento do Estado de Mato Grosso (Mato Grosso State Sanitation Company)
SAR	Staff appraisal report
SAS	Secretaria de Acao Social, Rondonia (Secretariat for Social Action, Rondonia)
SCT-PR	Secretaria de Ciencia e Tecnologia, Presidencia da Republica (Secretariat of Science and Technology, Presidency of the Republic)
SDR-PR	Secretaria de Desenvolvimento Regional, Presidencia da Republica (Secretariat of Regional Development, Presidency of the Republic)
SEC	Secretaria de Educacao e Cultura, Mato Grosso (Secretariat of Education and Culture, Mato Grosso)
SEMA	Secretaria Especial do Meio Ambiente, MINTER (Special Secretariat for the Environment, MINTER)
SEMAM-PR	Secretaria do Meio Ambiente, Presidencia da Republica (Secretariat of the Environment, Presidency of the Republic)
SEMARO	Secretaria de Meio Ambiente de Rondonia (Rondonia Secretariat of the Environment)
SEPLAN-PR	Secretaria de Planejamento e Coordenacao, Presidencia da Republica (Secretariat of Planning and Coordination, Presidency of the Republic)
SEPLAN-RO	Secretaria de Planejamento de Rondonia (Rondonia Secretariat of Planning)
SES	Secretaria Estadual de Saude, Mato Grosso (State Secretariat of Health, Mato Grosso)
SIMI	Sistema de Informacoes sobre as Migracoes Internas, MINTER (Internal Migration Information System, MINTER)
SPVEA	Superintendencia para a Valorizacao Economica da Amazonia (Superintendency for the Economic Valorization of Amazonia)

STS **Secretaria Territorial de Saude, Rondonia**
 (Territorial Health Secretariat, Rondonia)

SUCAM **Superintendencia de Campanhas de Saude Publica**
 (Superintendency for Public Health Campaigns)

SUDAM **Superintendencia de Desenvolvimento da Amazonia**
 (Superintendency for the Development of Amazonia)

SUDECO **Superintendencia de Desenvolvimento do Centro Oeste**
 (Superintendency for the Development of the Center West)

SUDEPE **Superintendencia de Desenvolvimento da Pesca**
 (Superintendency for the Development of Fisheries)

SUDHEVEA **Superintendencia de Desenvolvimento da Borracha**
 (Superintendency for Rubber Development)

UEPAT **Unidade de Execucao da Pesquisa de Ambito Territorial, Rondonia**
 (Agricultural Research Unit at Territorial Level, Rondonia)

UNDP **United Nations Development Program**

WORLD BANK APPROACHES TO THE ENVIRONMENT IN BRAZIL:

A REVIEW OF SELECTED PROJECTS

THE POLONOROESTE PROGRAM

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Map: Northwest Region

WORLD BANK APPROACHES TO THE ENVIRONMENT IN BRAZIL: A REVIEW OF SELECTED PROJECTS

THE POLONOROESTE PROGRAM

PREFACE

1. This is a report on the last of four case studies undertaken by OED and the Brazilian federal Secretariat of Planning (SEPLAN) as part of a larger study entitled "The World Bank and the Environment in Brazil: A Review of Selected Projects." From the perspective of OED, the objective of the larger study is to determine how -- and how well -- the World Bank has perceived and dealt with environmental issues and problems in the context of several major infrastructure and regional development projects in one particular country. Brazil was selected both because it is one of the Bank's principal borrowers and because Bank operations have encountered a wide range of ecological conditions and environmental issues in the country. SEPLAN (as of March 1990 part of the newly created Ministry of the Economy, Finance and Planning - MEFP), in turn, has focused on how the federal government and its agencies have addressed environmental issues in the course of project preparation and implementation.

2. In addition to road, agricultural and health projects under the POLONOROESTE Program in Northwest Brazil (ie. the states of Rondonia and Mato Grosso in the western part of the Amazon region), the OED/SEPLAN exercise examines Bank-assisted operations in Eastern Amazonia (Carajas Iron Ore Project), the middle and lower Sao Francisco valley in the semi-arid Northeast (hydropower, irrigation and involuntary resettlement) and the highly urbanized and industrialized state of Sao Paulo (pollution control). In these distinct geographic settings, the study is concerned with the principal physical and human environmental impacts of Bank-supported investments. Where applicable, moreover, it also attempts to assess the adequacy, effectiveness and sustainability of specific project components or parallel programs designed to protect the natural environment and/or vulnerable social groups, including both Amerindian communities and populations that are forced to relocate on account of such interventions as dam and port construction.

3. The objective of the present case study is to determine how -- and how effectively -- the Bank and the Borrower anticipated and dealt with the principal environmental aspects and consequences of the major physical infrastructure (the BR-364, or Porto Velho-Cuiaba, highway and regional feeder road network) and productive (small-scale agricultural development and directed colonization) and social service (particularly public health) activities whose installation, expansion and/or improvement were co-financed by the Bank in Northwest Brazil. Since several of the operations examined below have closed relatively recently and no completion report has yet been submitted for the Rondonia New Settlements Project (Loan 2353-BR, unlike the other case studies in this series, the focus of the present report will be more on the environmental dimensions of the overall POLONOROESTE strategy, its underlying assumptions and information base than on the performance and results of individual projects, although the latter will also be discussed to the extent possible.

4. In addition to assessing the environmental dimensions and impacts of POLONOROESTE over the past decade, this report will attempt to address some of the more general issues surrounding the construction of transport infrastructure and promotion of agricultural settlement in tropical frontier regions in Brazil and elsewhere. These include prospects for introducing and/or consolidating sustainable agricultural development in areas which are both distant from major national and international markets and characterized by sensitive ecosystems having limited "carrying capacities" for many types of rural land use at prevailing technologies and production costs, as was the case with some of the areas where POLONOROESTE attempted to promote new agricultural settlements. Some of the considerations discussed in the earlier OED case study of the Carajas Iron Ore Project¹ in terms of the complexity and dynamics of the forces underlying recent frontier occupation in Amazonia are revisited in light of the nearly simultaneous experience in northwestern Mato Grosso and Rondonia.

5. The present case study is based on a detailed review of Staff Appraisal and President's Reports, Loan and Project Agreements, minutes of the Board meetings at which the various loans for POLONOROESTE were approved, identification, preparation, appraisal, supervision and mid-term review mission reports, project completion reports and other relevant documentation, including the published report of an inter-disciplinary Bank survey mission that visited the program area in late 1979. It is also based on interviews with Bank and FAO staff involved in project preparation, appraisal and supervision and the findings of a three week field mission to the Northwest region in September-October 1989 during which participating federal agencies in Brasilia and Manaus and state and federal entities in Porto Velho and Cuiaba were visited. Representatives of the recently dissolved Superintendency for the Development of the Center West (SUDECO), the federal coordinating agency for the program, accompanied the OED/SEPLAN team during its field visits in both Rondonia and Mato Grosso. SUDECO's invaluable provision of transportation and other logistical support to the OED/SEPLAN mission is gratefully acknowledged.

6. During the September-October 1989 mission, more specifically, OED and SEPLAN maintained contacts with project coordinating and executing agencies, the Amazonian Research Institute (INPA) in Manaus and a FAO technical cooperation team at SUDECO in Brasilia, as well as with program beneficiaries, local government officials, Amerindian communities and environmental, church and other non-governmental organizations. In Rondonia, field visits were made to agricultural colonization projects and rural service centers (NUARs) in Ouro Preto, Urupa and Machadinho, Amerindian areas (Uru-eu-wau-wau, Sete de Setembro), national parks and biological reserves (Parque Nacional dos Pica-paus and Reserva Biologica do Guapore), cassiterite mining and gold prospecting areas near Ariquemes (Bom Futuro) and on the Madeira and Mamore Rivers respectively and to the cities and towns of Porto Velho, Ariquemes, Ouro Preto, Ji-Parana, Costa Marques and Guajara-Mirim, among others.

¹ See OED, Environmental Aspects and Consequences of the Carajas Iron Ore Project, September 4, 1990.

7. Substantial parts of Rondonia were surveyed by helicopter including the Uru-eu-wau-wau Amerindian area, the Pacaas Novos National Park, the Guapore Biological Reserve, the BR-429 earth highway (not financed by Bank) connecting the town of Costa Marques on the Guapore River to the BR-364 highway south of Ji-Parana and the Madeira and Mamore Rivers. In Mato Grosso, in turn, meetings were held with state government agencies in Cuiaba and rural settlement areas around Caceres and Mirassol d'Oeste were visited. As in Rondonia, contacts were made with local officials, small farmers and other program beneficiaries, as well as with Amerindian communities and other local groups. The ecologically rich Pantanal wetlands near Pocone and the Chapada dos Guimaraes National Park on the southern and eastern edges of the program area were also visited. In addition, many of the members of the inter-disciplinary research team at the University of Sao Paulo that was responsible for the on-going evaluation of the POLONOROESTE Program until 1987, were consulted about the program during earlier OED visits to Sao Paulo in January and March 1990.

8. While all field visits made in connection with this and the other case studies undertaken as part of the larger exercise were carried out jointly, due to the differences in focus mentioned above, from the outset, OED and SEPLAN decided to prepare separate reports. During the field visit for the POLONOROESTE case study, SEPLAN was represented by an environmental economist from the Institute of Economic Research of the Institute of Social and Economic Planning (IPEA/INPES) and a geographer and an anthropologist from the (then) Environmental Analysis Unit of the Secretariat of Economic and Social Planning (SEPES/CAA) under the overall guidance of the then Secretariat (now Department) of International Affairs, SEAIN (now DEAIN). OED, in turn, was represented by one regular staff member during part of the field visit and specialized consultants, who possessed considerable prior knowledge of the program region, in the areas of physical and human environmental impact assessment respectively. A consultant anthropologist, also highly familiar with Northwest Brazil and its indigenous communities, assisted OED in evaluating the program's Amerindian Special Project. Helpful comments by the Secretariat of Regional Development in the Presidency of the Republic (SDR-PR), the National Department of Mineral Production (DNPM) of the Ministry of Infrastructure, and the National Indian Foundation (FUNAI) on an earlier draft have been incorporated in the present version of this report.

9. The report is divided into ten chapters and six annexes having the following organization. After a brief introduction, Chapter II and Annexes I and II describe the general macroeconomic, Bank strategy, ecological, demographic and socio-economic context in which POLONOROESTE was established. Chapter III and Annex III discuss the origins, objectives, basic strategy, principal components and other relevant aspects of the program and the projects which composed it including the non-Bank funded Amerindian Special Project. Chapter IV and Annex IV (Mato Grosso) examine the program's execution performance and general results, giving emphasis to the conclusions of the Bank's 1984 mid-term review and the four available project completion reports. Chapter V assesses POLONOROESTE's environmental and Amerindian protection components based on the results of the mid-term review, the PCR for the Phase I Northwest Agricultural Development and Environmental Protection Project and OED/SEPLAN (environment) and other Bank missions (Amerindians) undertaken in 1989. Chapters VI and VII and Annex V (Rondonia) survey the program's broader human and physical environmental impacts. The former gives particular attention to migration and

population growth, spontaneous settlement and rural development, expansion of extractive activities, urbanization and public health, while the latter focuses on deforestation and the principal causal factors associated with it, soil alterations, the loss of biodiversity, water quality and possible climate change.

10. Chapter VIII and Annex VI (Rondonia) look in further detail at the adequacy of program design in light of its subsequent environmental consequences and the unexpected difficulties encountered during execution. Consideration is given to: the adequacy of the regional development approach adopted by the program; the significant implementation imbalances between its transport and other components; the impacts of roadbuilding on migration, on the rapid expansion of ranching, logging and prospecting activities and on rural land distribution, values and tenure; and shortcomings in program planning with respect to the region's agricultural potential, especially in terms of soil quality and the crucial distance-to-market factor. The relationships between the predominantly extractive nature of the Northwest's economy at present, regional carrying capacity and prospects for the sustainability of regional productive activities are also addressed.

11. Chapters IX and X attempt to summarize the Bank's recent experience in Northwest Brazil and to highlight the principal lessons and legacies of POLONOROESTE from an environmental standpoint. Chapter IX assesses the adequacy of initial Bank perceptions of environmental risks in relation to the program and evaluates its effectiveness in dealing with environmental issues and problems. In addition, it explores the future economic and environmental prospects for the Northwest, describes several possible development paths for the region and indicates general alternatives to continuing occupation of tropical frontier areas. Chapter X, in turn, sketches the main institutional and policy impacts of POLONOROESTE to date, both in Brazil and the Bank, and briefly describes several actual or potential follow-on projects. The chapter recapitulates POLONOROESTE's main lessons for future Bank operations in terms of program planning and execution and reviews the principal implications of this experience for Bank activities and procedures. It likewise suggests general areas where additional research into tropical frontier region development and more detailed evaluation of program impact are necessary.

12. Finally, it should be stressed that this report does not represent an ex-post evaluation of POLONOROESTE, nor is it an impact study per se. It is a partial assessment which focuses on those aspects of the program and other significant regional development tendencies (eg. the proliferation of logging and mining activities and rapid urbanization), occurring at the same time as POLONOROESTE and, in part, related to it, which have had a tangible effect on the physical and/or human environments in Northwest Brazil. The report, therefore, does not generally assess non-environmental program components in terms of their specific objectives and targets, not does it elaborate on POLONOROESTE's often substantial non-environmental benefits. Furthermore, it is largely based on a visit to the region in September/October 1989 and the documentation available to OED at that time. For the most part, accordingly, it does not reflect more recent changes and events in the region. These limitations should be clearly kept in mind in reading the report, as well as the persisting need to undertake a more detailed and systematic evaluation of the program's direct and indirect economic, social and environmental consequences.

WORLD BANK APPROACHES TO THE ENVIRONMENT IN BRAZIL: A REVIEW OF SELECTED PROJECTS

THE POLONOROESTE PROGRAM

SUMMARY AND CONCLUSIONS

The Context

1. In the 1960's and 1970's, Brazil adopted ambitious measures aimed at integrating the vast Amazon region into its rapidly expanding economy. A highway network criss-crossing Amazonia was planned and mass settlement programs were drawn up, while growth pole strategies and fiscal incentives were expected to attract private investment to the region. Concomitantly, large numbers of small farmers and rural workers were being pushed off the land by agricultural modernization and the concentration of holdings in south-central Brazil and by demographic pressures, recurrent droughts and poverty in the less developed Northeast. The need to find gainful employment for these migrants lent added impetus to attempts at large-scale Amazonian settlement.

2. Colonization projects carried out along the Transamazon highway in the early 1970's, however, fell short of their targets as government settlement schemes proved incapable of overcoming the difficulties of implanting sustainable agriculture in a poorly known tropical environment. Meanwhile, infrastructure, especially road, construction combined with tax and credit incentives and a widespread speculative fever to produce a dramatic increase in land values in more accessible parts of the region. In many areas, this led to a rapid concentration of rural holdings and a de facto limitation on access by small farmers to available land.

3. The discovery of fertile lands under public domain in Rondonia in the western part of the region appeared to provide a more promising outlet for the increasing number of migrants drawn to Amazonia. While the official colonization institute, INCRA, was first directed to Rondonia in response to a localized land conflict, several factors coalesced to turn this area into the main focus of the agency's activity in the region. Government assistance soon expanded and news that land of good quality was being distributed prompted the first significant waves of migration to Rondonia in the mid-1970's, at about the same time as the Transamazon colonization projects were being deactivated.

4. Growing migration, increasing land disputes and occasional violent conflicts between settlers and Amerindian groups set the stage for the Northwest Region Development Program, or POLONOROESTE. Officially covering all of the present state of Rondonia and the northwestern part of neighboring Mato Grosso and involving a total area of more than 410,000 square kilometers, the program sought to consolidate small-farmer colonization in a humid tropical setting in the hope that this approach could be replicated elsewhere in Amazonia. It likewise sought to help transform the Northwest into a dynamic part of the national economy where social and environmental concerns would receive privileged attention.

Origins, Objectives and Principal Components of POLONOROESTE

5. The growing intensity of migration to Rondonia quickly increased local demand for roads, schools, health clinics and agricultural support services during the 1970's. Strong interests both inside and outside the region converged to channel these demands into a federal government proposal to reconstruct and pave the existing, but seasonally impassable, BR-364 highway between the capital cities of Cuiaba and Porto Velho. This was to be followed by other major infrastructure improvements including the Samuel dam and hydropower plant near Porto Velho. Lacking the resources to rapidly upgrade the highway and attend other investment priorities, the newly-inaugurated Figueiredo administration approached the Bank for financing in early 1979.

6. The proposed project, however, satisfied neither the Bank's policy for the transport sector in Brazil, which stressed road maintenance and rehabilitation over new highway construction, nor its broader mandate to support economic development cum poverty alleviation. Key Bank officials were, nevertheless, convinced of the region's development potential and argued that the Bank should assist the Government to improve production and living conditions in existing rural settlement projects. In response to these concerns and based on the findings of a multi-disciplinary Bank survey mission to the region, subsequent discussions led to formulation of a large, small-farmer oriented, area development effort, organized around a major transport improvement.

7. Subsequent Bank-Borrower discussions, more specifically, resulted in an ambitious program to promote the orderly human occupation and development of the Northwest region through economic and social infrastructure and what were considered to be environmentally sound smallholder activities. A complex institutional setup was designed to implement the operation under the coordination of a federal regional development agency, SUDECO. Potential benefits both for small-farm families already in the region and expected future arrivals in terms of greater productivity, better access to markets, increased employment and improved rural health and education services were thought to be substantial. The program also contained pioneering environmental and Amerindian protection components in an attempt to minimize the likely adverse effects of the anticipated acceleration of migration due to pavement of the BR-364 highway. Through these measures, the risks of encouraging further frontier occupation in what was acknowledged to be an environmentally sensitive area were judged to be controllable.

8. POLONOROESTE's basic objectives were to pave the BR-364 highway and provide the investments "necessary to achieve the harmonious socio-economic development of the region influenced by that road and the protection of the physical environment and Amerindian population of that region." It was argued that paving the highway would "increase the economic contribution of the underutilized physical resources of this region to the national economy, reducing substantially transport costs and thus improving the region's terms of trade with the more developed and populated areas lying to the south." It was also recognized, however, that "improving the BR-364 would...make its area of influence more accessible to potential immigrants and increase the pressure on the local physical and social environment. Hence, policies and corresponding

implementation structures [were to be] set up to help avoid a disorderly development of the region which could place in jeopardy those same resources that the highway would aim at developing."

9. The resulting investment program was formally created by the federal government in May 1981, having an estimated cost of nearly US\$ 1.6 billion. It was partially financed by six interlinked World Bank loans for a projected total of US\$ 434.4 million. As of January 1991, US\$ 329.1 million of this amount had been disbursed, while US\$ 92.3 million had been cancelled. The first three of these were approved in December 1981, less than a month before the Territory of Rondonia was elevated to statehood. In terms both of total investment and subsequent indirect environmental impact, POLONOROESTE's principal component involved improvement of the 1,500 kilometer Cuiaba-Porto Velho highway and expansion of the regional feeder road network. Also approved at this time were a loan for the consolidation of selected existing agricultural colonization areas in Rondonia and environmental protection in the region as a whole and a loan to improve rural health services and combat malaria in Rondonia. An Amerindian Special Project, not financed by the Bank, was likewise included as part of all three phases of POLONOROESTE. Satisfactory implementation of the Special Project was among the Brazilian Government's contractual obligations in connection with the Bank loans.

10. Phase II of the program, approved in March 1982, consisted of a rural development project in existing small-farmer areas in northwestern Mato Grosso. The third phase, in turn, approved in October 1983, was intended to support establishment of several new settlement projects in Rondonia. Execution of the program's three overlapping phases was expected to require roughly seven years. While a conscious effort was made to adapt POLONOROESTE's rural development components to the distinct ecological characteristics of the Northwest, for the most part these operations followed the model of "integrated" rural development pursued by the Bank in Northeast Brazil and elsewhere during much of the preceding decade.

Program Implementation and General Results

11. Even though reconstruction of the Cuiaba-Porto Velho highway had been subsumed under a broader regional development concept, implementation of POLONOROESTE's various subprograms was seriously imbalanced. On the one hand, the trunk road component and other physical infrastructure investments were executed with considerable success. While some irregularities were observed, most construction activity was implemented within the allotted budgets and in some cases, most notably the BR-364 highway itself, ahead of schedule. On the other hand, by late 1984 when a mid-term review of the program was undertaken, execution of its "software" components, especially agricultural support services, community facilities and environmental and Amerindian protection measures, was found to have lagged considerably and their results to have fallen short of initial expectations.

12. Imbalanced implementation, in turn, created several difficulties of a larger order. Not the least of these was that transport improvements to and within the region provided greatly enhanced physical access to its natural resources on the part of a variety of economic actors (ie. loggers, miners,

prospectors, ranchers, land speculators, etc.) in addition to the program's small-farmer target population in the virtual absence of effective environmental controls. Equally seriously, improved access to and within the Northwest, particularly Rondonia, by creating significant new employment opportunities in both agricultural and extractive activities, encouraged the acceleration of migration at a time when, despite the additional resources channeled through POLONOROESTE, the public sector was increasingly unable to respond to growing local demands for productive and community support services.

13. While part of the discrepancies between POLONOROESTE's objectives and achievements derives from shortcomings in its initial conception, planning and appraisal which will be further discussed below, flaws in the institutional arrangements established for program coordination and execution, together with the lack of appropriately timed and executed corrective measures, also played a major role. Perhaps the most important contributing factor, however, was the growing fiscal crisis in the Brazilian public sector more generally during the early and mid-1980's. A final element was the very different nature, execution requirements and underlying economic and political support for the program's main "hardware" and "software" components respectively.

14. In convincing the Brazilian Government to transform its original proposal for a road improvement project into a considerably broader and more complex regional development initiative, the Bank overestimated the Borrower's effective capacity to attain the program's social and environmental objectives which had been introduced largely at the Bank's insistence. In hindsight, it is also apparent that the institutional mechanisms established for POLONOROESTE's implementation were inadequate. A large part of the latter problem reflected serious disparities among the various agencies charged with program execution.

15. The coordinating agency, SUDECO, was institutionally, technically and administratively weak. Program monitoring and on-going evaluation activities, in turn, while essential for proper management of a large and multi-faceted operation such as POLONOROESTE, were denied necessary financial and logistical support by the coordinating agency on various occasions. More general financial problems, particularly the insufficient and/or untimely provision of counterpart funding and the failure to furnish parallel agricultural investment credit, in turn, were largely a product of the severe economic recession and associated fiscal crisis experienced in Brazil during much of the program implementation period.

16. In addition, since most of the Bank loan funds were allocated to POLONOROESTE's transport components whose implementation proceeded far more rapidly than other program interventions, these resources were largely disbursed before the full extent of the distortions in its execution became apparent. As a result, by the time the Bank became clearly aware of the program's deficient performance in terms of its agricultural objectives and cognizant of its increasingly adverse consequences on the physical environment and Amerindian populations, its leverage was smaller than it might otherwise have been. Nonetheless, following the comprehensive mid-term review of program implementation in late 1984, together with expressions of concern from supervision staff, external consultants, environmental organizations and at least one member country government, the Bank suspended disbursements on all of its

loans for POLONOROESTE in March 1985 just as a new civilian-led federal administration was taking office in Brazil. Presumably, this action was not taken even sooner after the mid-term review because of the imminent change in governments.

17. Bank funding was resumed in August 1985 after incoming Brazilian authorities took steps to improve the protection of several highly vulnerable Amerindian areas and agreed to a Bank-proposed agenda for redirection of the program. By this time, however, migration into Rondonia was already well over 150,000 people a year, while largely uncontrolled spontaneous settlement, together with logging, ranching and prospecting activities was spreading in parts of the region. Despite the persistence of many of these tendencies, reorientation of the program in mid-1985 and the significant decline in migration after 1986, permitted tangible improvements with respect to agricultural development, environmental control and Amerindian protection. Despite the lack of credit, institutional weaknesses and inadequate and delayed funding for support services, rural extension activities financed by POLONOROESTE did eventually play a catalytic role in the expansion of tree crops in Rondonia and, in recent years, have encouraged more viable mixed cropping and agroforestry systems including timber and fruit trees, the enrichment of fallow lands, improved silvipastoral systems and greater retention of forest reserves at the farm level through appropriate replanting and product extraction techniques.

Assessment of Program Environmental and Amerindian Protection Measures

18. POLONOROESTE's initial strategy to protect the natural environment contained three basic elements. The first was to direct new rural settlement toward areas considered to have good potential for agricultural development and away from those parts of the region having less fertile soils or whose agronomic possibilities were still poorly known. The second was to encourage a less environmentally damaging form of agricultural production in both existing and new small-farmer colonization areas through the promotion and support of tree crops. The third was to establish and/or maintain national park and forest reserves and ecological stations and carry out a regional ecological research program. These objectives, however, were only partially achieved.

19. Due to the accelerated in-flow of population and the expanding regional road network, the spontaneous settlement of rural areas, especially in Rondonia, quickly outran government efforts to increase the supply of new colonization plots. The uncontrolled occupation of rural lands was further encouraged by construction of penetration roads by logging interests and installation of a major new trunk highway (the BR-429) by the state government using non-program resources. The net result was encroachment by squatters, ranchers, loggers and prospectors in some areas possessing poor soils including parts of the Guapore River valley in Rondonia and in various ecological and Amerindian reserves.

20. Similarly, prior to its reorientation in 1985, the program was unable to consolidate the cultivation of perennial crops in official colonization and other small-farmer areas or to effectively discourage the expansion of annual crops and livestock production elsewhere in the region. This reflected a number of factors including the aforementioned lack of investment credit, declining

commodity prices, increasing transport costs, plant diseases and the need for settlers to produce annual crops and raise livestock in order to guarantee their own physical and economic survival. Agricultural census data reveal that both annual crop production and cattle, and hence pasture land, have expanded much more rapidly than tree crop production in Rondonia as a whole since 1980. These land use tendencies, in turn, have been responsible for much of the deforestation and associated environmental degradation observed in the region during the program execution period.

21. As originally designed, finally, POLONOROESTE contained ambitious forestry development, environmental protection and ecological research components. Attempts to "salvage" potentially valuable timber cleared from colonization plots and introduce rational forest management techniques were largely frustrated, while commercial loggers have progressively removed valuable species such as mahogany, in the process disturbing the surrounding forest and opening up additional areas for occupation by squatters and land speculators. National parks and ecological reserves, as well as smaller "block" reserve areas within official colonization schemes, have occasionally been invaded by loggers and squatters, while, at least until very recently, official efforts to limit such "invasions" and restrict illegal timber extraction from these areas were largely ineffective. Only the program's ecological research component was relatively problem-free, generating a variety of studies that can be used in connection with future natural resource management and environmental control, even though their immediate policy impact was limited.

22. On the more positive side, redirection of the program in 1985 has resulted in significant institutional changes and new initiatives which represent a necessary precondition for future environmental improvements in the Northwest. State environmental protection agencies were established and supported with program resources in both Mato Grosso and Rondonia. A major effort to improve protection of the Pantanal was also launched and measures were taken to step up the planting of tree crops in existing colonization areas in Rondonia. Despite the persisting need to improve management plans and maintenance activities, the various natural reserves and ecological stations implemented under the program are still in place and now cover more territory than originally anticipated as a result of the legal establishment of a second generation of conservation units over the past year. More generally, a large share of the undisbursed resources at the time POLONOROESTE was reoriented has been used to support environmental monitoring and protection activities including an "emergency" federal program to reduce burning of the Amazon forest which started in 1988. Rapidly declining migration after 1986 and atypical local rainfall patterns, however, have also played an important role in lowering the rate of forest burning in Rondonia in recent years.

23. On balance, POLONOROESTE's Amerindian Special Project has been more successful than its environmental protection subproject, at least in the short-run. Nonetheless, inadequate execution of the Special Project was the principal declared reason for the Bank's suspension of disbursements in early 1985. The Special Project was expected to focus primarily on the regularization of tribal lands, the provision of health and education services and the promotion of small economic development projects in Amerindian areas and secondarily on the institutional strengthening of the National Indian Foundation, FUNAI, which was

its executor. Early implementation, however, was slow and concentrated on building up FUNAI's infrastructure in the region, while giving insufficient attention to the establishment and protection Amerindian reserves. As a result, these areas became increasingly subject to illegal timber extraction and encroachment by non-Amerindian squatters and prospectors, occasionally with the complicity of FUNAI itself.

24. Following the suspension of disbursements, the situation with respect to the regularization of tribal lands and the removal of squatters improved. As a result of POLONOROESTE, around 80% of the Amerindian population, which has stabilized and once again appears to be on the rise, now live in legally demarcated reserves, compared with a much smaller percentage at the start of the program. Serious problems nevertheless remain with some reserve areas, particularly that for the Uru-eu-wau-wau Indians in central Rondonia, while health care and community development services, which were adequate at first, have reportedly declined in recent years. Among the factors contributing to the problems encountered by the Special Project were frequent changes in management and orientation at FUNAI and the agency's chronic underfunding and understaffing. These were further aggravated by the broader financial difficulties experienced by the federal government during much of the 1980's. Also important are the weak de facto status of Amerindians in Brazilian society and their particularly vulnerable situation in frontier areas, especially during periods of rapid occupation by economic actors whose primary interest is to attain physical access to natural resources, many of which are located on or under tribal lands.

25. Since many of these problems persist, the long-run sustainability of Amerindian protection efforts in the Northwest remains uncertain. Furthermore, since much of what was achieved under the Special Project reflects the Bank's insistence that the Borrower comply with its contractual obligations to protect Amerindian interests, continuing involvement on the part of external agencies may be necessary to ensure adequate future vigilance. Finally, measures should be taken to guarantee the constitutional rights of tribal populations, including the further strengthening of FUNAI, together with increased reliance on other agencies and relevant NGOs to provide specialized services to Amerindian communities. The prompt legal establishment of adequate reserve areas, their timely physical demarcation and the permanent control and protection of all reserve boundaries, together with increasing participation of tribal peoples in public sector decisions affecting their communities, should be among the priorities of future efforts to support Amerindian communities in the Northwest, as in Amazonia more generally.

Human Environmental Impacts

26. In retrospect, it is clear both that POLONOROESTE's design incorporated what were, at the time and in the Brazilian frontier context, progressive social and environmental concerns and that the Bank attempted to build safeguards into the program. However, it is equally evident that paving the BR-364 highway and expanding the regional feeder road network helped to accelerate migration to and the spread of settlement in the Northwest, in the process strongly, if indirectly, contributing to the significant human and physical environmental impacts associated with these processes. Much of the environmental degradation associated with recent occupation of the Northwest,

in short, is a reflection of the inability of POLONOROESTE and the state and federal governments more generally to control the spread of rural and urban settlement and the expansion of extractive activities and, thus, to keep the incoming population from attempting to exploit some of the areas that the program was originally designed to protect.

27. Intensive migration in response to roadbuilding and agricultural colonization was inevitable. The timing of POLONOROESTE, whose initial years coincided with one of the most acute economic crises in post-war Brazil, further stimulated these flows. Ill-conceived state government propaganda campaigns surrounding the program and the rapid increase in unemployment in the country's largest metropolitan areas, especially Sao Paulo, motivated large numbers of urban dwellers, together with a continuing flow of rural migrants, to head for the region during the early and mid-1980's. The attraction of Rondonia to non-rural migrants was enhanced by the rapid increase in gold prospecting, cassiterite mining and commercial timber extraction. The two latter activities were facilitated by the program-supported expansion of feeder roads in the state.

28. In the face of constantly growing spontaneous settlement, other problems and shortcomings of the region were heightened. Thus, the predominance of low fertility soils in much of the area, the difficulties of an unfamiliar, poorly understood and, in many cases, outright hostile physical environment, together with the very considerable distances to extra-regional markets, all reduced the feasibility of planned new settlement schemes. Despite the program's deliberate, but ultimately unsuccessful, attempts to deal with it, not the least of the hardships faced by small farmers and other migrants was the rising incidence of malaria which, after imposing severe financial and personal costs, has forced many families to leave the area altogether.

29. Towns and cities likewise expanded rapidly in response to accelerated migration, the significant multiplier effects associated with extractive activities and the decreasing absorptive capacity of rural areas, in the process magnifying urban social and environmental problems. As a result, well over half of the regional population is presently estimated to reside in urban centers of varying sizes. Urban water pollution due to poor sanitation and industrial effluent discharges, particularly by sawmills, is especially a problem. Most towns and the peripheries of larger cities lack adequate sanitation and other local public services, while municipal governments are poorly equipped to meet the rising demands upon them. This situation is further exacerbated by the proliferation of local government jurisdictions in the region over the past two decades. Despite this, except for the installation of a number of "rural support nuclei," some of which have subsequently become the seats of new municipalities, POLONOROESTE contained no provisions to support urban development or to deal with urban environmental problems, nor did it include any direct assistance to municipal governments.

Physical Environmental Impacts

30. While considerable uncertainty and controversy exists as to the precise level and rate of deforestation in the Northwest, satellite images confirm both that land clearing has proceeded very rapidly since 1975, particularly since 1985, and that there is a strong correlation between those

parts of the region which have undergone rapid rural settlement and areas experiencing rapid deforestation. The instrumental role of roadbuilding in this process is dramatically illustrated by these same remote sensing images which reveal the "fish-bone" pattern of land clearing along trunk, feeder and connector road networks, especially in Rondonia. Whatever the actual extent of the deforestation that has already taken place in Rondonia, most observers agree that, had the tendency that prevailed until very recent years persisted, the area available for land clearing would have soon reached the legal limit.

31. The clearing of tropical forests such as those which covered more than half of the Northwest region in the late 1970's inevitably results in the destruction of sensitive nutrient-cycling mechanisms, causing a loss of soil fertility and increasing erosion. Although the planting of perennial crops such as coffee, cocoa and rubber reduces these problems, in the specific case of Northwest Brazil, on account of falling output prices and the distance to market, tree crop production has, thus far, not proven to be profitable to the extent anticipated by POLONOROESTE's designers. Consequently, much of the forest which has been cleared over the past decade has been used either for annual crop cultivation, using traditional slash-and-burn techniques, or turned into pasture and eventually to second growth vegetation (known locally as capoeira), all of which are comparatively undesirable outcomes from an ecological standpoint.

32. The increasing transformation of tropical forests into farmland, pasture and second growth vegetation in the Northwest, to which POLONOROESTE has strongly, if unintentionally, contributed since 1980, has likewise resulted in some reduction in the variety of plant and animal species in the areas immediately affected and, thus, in some loss of biodiversity. Mining and urban sewage have increased pollution in various rivers, as well as along their margins, harming local ecosystems. Mercury contamination, which is a direct by-product of gold prospecting, is a particularly serious problem, representing a potential threat to human health.

33. Regional prospecting activities also destroy riverbanks, while increasing siltation and water turbidity. On the positive side, in turn, until recently, the Pantanal wetlands, located just to the south of the project area in Mato Grosso, and their abundant wildlife had become increasingly endangered by widespread but largely uncontrolled hunting and fishing practices, as well as by growing agricultural and agroindustrial run-off. Protection of this area, however, has been stepped up over the past several years, first under POLONOROESTE itself and now as part of the Bank-assisted National Environment Program for Brazil that was approved in early 1990. Finally, it is possible that the deforestation that has occurred in the Northwest, as in some other parts of Amazonia, over the past two decades may be influencing climate conditions at the regional and even global, as well as at the local, levels. Systematic future monitoring is necessary in order to overcome the present lack of empirical data in this regard.

Program Design and Unanticipated Developments

34. The obstacles encountered by POLONOROESTE ranged from an inhospitable natural environment to the intricacies of administering a complex multi-agency program in an area larger than Great Britain. In retrospect, it is evident that

some of the major risks associated with the program were substantially underestimated by both the Borrower and the Bank. On the positive side, in turn, it is unquestionable that the more encompassing regional development approach put forward by the Bank in response to the Government's initial road pavement proposal reveals the former's sensitivity to the social and environmental costs, as well as economic benefits, likely to result from major regional transport improvements. This provides a favorable contrast to the Bank and Borrower's considerably more narrow approach to the identification of the potential ecological and social effects of the Carajas Iron Ore Project in its area of influence in eastern Amazonia. In addition, the environmental and Amerindian protection components that the Bank attempted to build into the program were truly innovative both in relation to earlier area development operations in Brazil and its broader lending program more generally. Irrespective of the subsequent success or failure of these measures, their pioneering nature should be clearly recognized.

35. Nonetheless, the concept of "regional development" which underlay POLONOROESTE was a partial one, substituting a set of sectoral investments, many of which were targeted on one particular group of economic actors (i.e. small colonization farmers) in specific subareas of the larger Northwest region, for a more comprehensive and truly integrated approach to area development, natural resource management and environmental protection. The imbalanced execution of program components only exacerbated this initial design shortcoming. The extent and acceleration of migration during a period of national recession further hindered the program's ability to produce satisfactory social results and avoid significant ecological damage. In view of the strong demographic pressures on the natural environment and of the public sector's incipient capacity to respond to local demands and despite its considerable size and complexity, POLONOROESTE was simply too small and too impaired by its own implementation difficulties to achieve its stated general objective of promoting the "harmonious socio-economic development" of the Northwest region.

36. Had more of the region's soils been of better quality and had more small farmers in newly-settled areas been able to plant tree crops and sell their output at higher prices in southern markets, perhaps the greater than expected inflow of migrants would not have generated such serious consequences in human and physical environmental terms. But, by the early and mid-1980's, most of the soils that remained to be exploited in the Northwest were either relatively poor or, as in other Brazilian frontier areas, small farmer access to them had been effectively blocked by larger landowners. Despite the program's intention of consolidating rural development in areas possessing good soils, many new and existing settlers were unable to produce competitively because natural soil fertility declined rapidly following deforestation and could not be economically restored due to the high costs of transporting fertilizers and/or because the distance to market added to land speculation, crop disease, malaria, poor road maintenance and other factors presented substantial obstacles to agricultural success.

37. Given the difficulties of establishing sustainable small-farm agriculture, the discovery of additional gold and cassiterite deposits, coupled with the enhanced profitability of commercial logging and the sizeable urban multiplier effects associated with these activities, provided an unexpected

source of employment and income for many recently-arrived migrants and existing settlers alike. Indeed, booming extractive activities, by directly or indirectly generating a large number of jobs and substantial local demand for food products, have contributed significantly to the region's recent economic prosperity, particularly in Rondonia. The importance of extractive activities as a major driving force in the regional economy and influence on the regional ecology, however, was largely unanticipated by POLONOROESTE's designers.

38. As a result of these factors, many small-farmers who might otherwise have been forced to remigrate have remained in the region on the basis of the sale of timber and foodstuffs, the use or rental of exhausted agricultural or previously uncleared forest land for ranching purposes, seasonal or part-time jobs in mining and prospecting activities or commercial and service sector employment in rapidly growing towns and cities. In the short run, this constitutes a significant indirect economic benefit of the transport investments made through POLONOROESTE. However, both the short and long-run environmental costs associated with logging, mining, prospecting, annual crop-intensive agriculture and livestock raising have also turned out to be much larger and more difficult to control than originally expected.

39. During the early years of program implementation, moreover, the limited political willingness to curb environmental damage from extractive and other primary activities, especially at the state and local levels, further aggravated the situation. Many such productive activities, in practice, "mine" potentially renewable (eg. soils and forest vegetation), as well as non-renewable (eg. minerals), resources in the pursuit of short-run private profit maximization, while public sector actions to limit or reduce the environmental costs associated with increasing exploitation of regional natural resources have, at least until very recently, been timid and ineffective. Both of these tendencies have important implications for the sustainability of the activities involved and, thus, for the medium and long-run economic and environmental prospects of the region more generally.

Future Prospects for the Northwest Region

40. One of the paradoxes of POLONOROESTE is that, despite its failure to achieve many of its declared objectives, recent occupation of the Northwest has generated considerably more economic activity and wealth in the short run than many inside or outside the Bank anticipated. This prosperity, however, has come about in largely unexpected ways and at considerable expense to both the natural environment and traditional, particularly Amerindian, populations. Especially in view of the latter, future prospects for achieving sustainable development in the Northwest should be briefly assessed.

41. As concerns agriculture, possibilities for future absorption of large numbers of additional small farmers in the region are slim. Given the peculiarities of local ecosystems, it is unlikely that broad, encompassing solutions will ever work. Rather, painstaking site-specific approaches suited to the particular ecological and socio-economic conditions of different subareas, necessarily including improved soil and forest management techniques, the recuperation of degraded pasture lands and the promotion of extractive reserves, should be implemented. Given the region's distant location in relation to major

domestic consumer markets, furthermore, it is likely that most future demand for agricultural produce will come from local sources and that commercial tree crop (eg. coffee and cocoa) production, while environmentally less harmful than that of annual crops, will remain at a competitive disadvantage vis-a-vis production of these commodities elsewhere in Brazil.

42. The rapid growth of both small and larger-scale cattle raising in Rondonia over the past decade, in turn, makes this activity a persisting issue in regional development. Available evidence suggests that ranching is a comparatively undesirable way of utilizing tropical forest areas from an ecological standpoint. From a social and economic perspective, however, small-scale livestock raising seems to play a crucial role in small-farmer survival strategies, while increasing local demand for meat and dairy products appears to have stimulated the formation of larger herds in some parts of the region. With more adequate pasture management techniques, socio-economic and environmental concerns can and should be reconciled in those areas already dedicated to cattle raising, while the extension of this activity to new areas should be carefully controlled.

43. The extraction of timber is also presently bringing considerable prosperity to the region, particularly Rondonia. As currently practiced in the Northwest, however, this is a temporary and largely predatory source of wealth that can be sustained only so long as the initial stock of commercial hardwoods is not depleted. Mining and prospecting activities, while not explicitly considered by POLONOROESTE, likewise represent a significant source of regional income at present. The backward and forward linkages of cassiterite and gold mining, as of logging, are extremely important for the regional economy, including its agricultural economy, but their future duration is hard to foresee. In any event, once these extractive activities move on to as yet unexploited areas elsewhere on the frontier, most of the processing industries and services associated with them will also leave, thus "pulling the rug" out from under much of the regional urban economy. In the meantime, pressures on official reserves areas are likely to continue and perhaps even intensify.

44. The flow of public revenues to the Northwest due to POLONOROESTE and other sources, finally, has been another important contributing factor to recent regional economic growth. The program helped to create, expand and/or support a number of federal and state, including environmental, agencies in the area, in the process generating considerable direct and indirect local employment. Future possibilities of maintaining federal investments and revenue transfers at the levels observed over the past decade, however, are limited. Given the nature of the activities involved, in synthesis, economic prospects for the Northwest over the longer run may be considerably less promising than the region's current prosperity might suggest.

Principal Lessons of POLONOROESTE

45. Although clearly not responsible for its onset, POLONOROESTE nevertheless contributed to the acceleration of environmental degradation in Northwest Brazil. Beyond this, the program has not fully succeeded in consolidating a model of sustainable small-farm development that can be replicated on a larger scale in a tropical frontier setting. At least part of

the discrepancy between POLONOROESTE's ambitious objectives and its more limited achievements stems from the distorting influence of powerful economic and political interests behind the program or which subsequently benefitted from it, together with the Bank's not having fully anticipated the potential impact of these influences. Despite dissenting views and cautionary advice in both the Bank and Brazil, POLONOROESTE was implemented because it generated considerable momentum in different sectors.

46. Inside the Bank, there was a sincere desire to improve the living and productive conditions of the rural population already residing in the Northwest and to help prepare the region for and protect its natural environment and tribal populations against the pressures of further migration and rural settlement that were considered certain to come whether the BR-364 highway was paved or not. There was also a desire to test an evolving approach to rural development and land settlement in a tropical environment and to increase lending to an important client country at a time when its foreign exchange requirements were rapidly increasing. The convergence of these diverse and legitimate interests, however, ultimately resulted both in an underestimation of the true social and environmental risks associated with the program and an equally serious overestimation of the Borrower's institutional capabilities and commitment to the goals of environmental and Amerindian protection. These interests, moreover, may have hindered a more adequate ex-ante assessment and understanding of the broader ecological, demographic, socio-economic and political-institutional characteristics and dynamics of the emerging Northwest frontier.

47. Two questions are critical for any evaluation of the Bank's role in POLONOROESTE: should the Bank have become involved in Northwest development in the first place and, if so, what could it have done differently in order to have avoided or more effectively reduced the program's adverse social and ecological consequences? The key point in relation to the first question would seem to be that, in the absence of the Bank's support which provided legitimacy as well as financial resources to the program, on account of the severe fiscal crisis in Brazil in the early 1980s, if for no other reason, it would probably have taken longer to transform the BR-364 highway into an all-weather thoroughfare and to expand the regional feeder road network. Thus, the migrants who arrived in Rondonia during the early and mid-1980's would probably not have materialized in such large numbers or as quickly as they did.

48. This time element was essential for the subsequent chain of events since the dominant characteristics of the region's occupation over the past decade have been the rapidity and largely uncontrolled nature of both rural and urban settlement and the closely related expansion of extractive activities, including, as currently practiced, much small-farmer agriculture itself. Had the program's road improvements been delayed and even though there is no guarantee that these actions would have actually taken place, valuable time might have been gained to undertake more detailed soil and other natural resource surveys, to perform more thorough assessments of regional agro-ecological, agronomic and socio-economic potentials and constraints, to rationalize existing settlement strategies and further improve colonization design, to better absorb the migrants who had already arrived and, perhaps most importantly, to establish and/or strengthen environmental protection legislation, institutions and enforcement mechanisms. In short, it might have permitted both a more realistic

ex-ante appraisal of longer-term settlement possibilities in the region and better management of existing, as well as likely future, demographic pressures in an area whose human carrying capacity was still largely unknown. Unfortunately, the pressure to proceed rapidly with improvement of the trunk highway did not permit these possibilities to occur.

49. Although the Bank did suspend loan disbursements for POLONOROESTE in 1985 in order to accelerate implementation of its "software" components, this occurred only after the program's principal investment (ie. pavement of the Cuiaba-Porto Velho highway) had already been largely completed. Thus, while the Bank did eventually react decisively to the Borrower's persisting failure during the early years of program implementation to comply with its contractual obligations regarding Amerindian and environmental protection, the former could have made more effective use of the instruments at hand to forestall unauthorized actions and correct harmful inactions. Namely, it could have suspended loan disbursements at an earlier stage than it did. Additionally, had more precise and specifically dated environmental and Amerindian protection covenants been included in the Loan Agreements and had the Bank carried out more forceful monitoring of Government compliance with these commitments, the Bank could have responded more quickly to uneven program execution by stopping disbursements for all of POLONOROESTE's components, including its road investments, at a time when its potential leverage over the Borrower was substantially greater.

50. Given the fact that pavement of the BR-364 highway did go ahead, there can be no doubt that most, if not all, of the environmental and Amerindian protection measures associated with the program, as well as many of its activities to support small-farm development, occurred as a result of the Bank's participation. Had the Bank not become involved and on the assumption that the Government would have proceeded sooner or later to improve the trunk road anyway, the situation in terms of ecological damage and settler conflicts with tribal populations would undoubtedly have been even worse. In this connection, the strong concern of Bank staff and consultants with the program's evolving human and physical environmental impacts and their efforts to prevent deforestation, encourage the use of perennial crops and protect indigenous areas should be clearly recognized even though these efforts were frequently frustrated because the Bank did not possess sufficient means to coerce POLONOROESTE's executors to take more vigorous and timely corrective actions.

51. At the same time, the unconscious role of Bank support for the program in providing legitimacy to the various internal interests behind POLONOROESTE and/or which took advantage of it in order to pursue their own agendas vis-a-vis the attainment of statehood for Rondonia, additional roadbuilding, the encroachment of reserves, the spread of rural settlement in inappropriate areas and even local and national political ambitions, should also not be overlooked. As a result, the Bank unwittingly became a party to actions which were to have unfortunate social and environmental consequences. One of the general lessons to be derived from POLONOROESTE for similar future situations, accordingly, is the need for the Bank to more carefully sort out the various economic and political actors and interests involved and to determine how they are likely to respond to proposed program actions in terms of natural resource use and possible misuse.

52. Even more importantly, in complex undertakings such as POLONOROESTE the Bank should attempt to gauge the real extent of Borrower commitment to different program objectives and components, as well as its institutional capability and political willingness to meet relevant contractual obligations. As a general rule, when a large multi-faceted investment project or program is designed to meet a variety of potentially conflicting objectives and/or is composed of a number of components, some of which (eg. road improvements in the present case) were proposed by the Borrower while others (eg. small-farmer development, Amerindian and environmental protection) were essentially introduced by the Bank, it should not be surprising if subsequent performance with respect to the former exceeds, and perhaps greatly exceeds, that in relation to the latter. Nor should it be surprising if there is a corresponding differentiation in terms of results.

53. Prior to defining specific interventions or deciding whether or not to finance them when proposed by a prospective borrower, furthermore, the Bank should evaluate the real carrying capacity of the particular areas in question and the potential social and environmental costs, as well as the economic and financial benefits, associated with its future development. When newly settled or about to be settled tropical frontier areas are involved, more specifically, the Bank should fully assess the nature of existing development tendencies in these regions or in areas ecologically similar to them where these processes have already occurred, as well as the likely impacts of these tendencies in terms of natural resource use and environmental quality. One of the options that should be seriously considered in such situations, moreover, is that of supporting alternative interventions which avoid the occupation of tropical areas, but instead permit achievement of many of the socio-economic objectives generally associated with frontier development (ie. the absorption of "surplus" population, the expansion of agricultural production, the promotion of small-farmer or poverty alleviation-oriented rural development, etc.) in other parts of the country and possibly other sectors (eg. urban employment generation) where both environmental and long-run economic costs may be considerably lower.

54. Consistent with this general orientation, any future Bank-supported efforts to deal with environmental degradation in Northwest Brazil should begin by attempting to better understand the economic and political forces underlying the recent expansion of extractive and agro-ranching activities in the region. In order to limit future environmental damage in the POLONOROESTE area, more concretely, recently initiated policing and control efforts should be reinforced and existing environmental protection institutions further strengthened. Above all, unequivocal political commitment to environmental objectives at all levels of public administration will be required. In order to avoid the further spread of ecologically damaging activities within the region, finally, future roadbuilding should be curtailed and other public sector incentives for the occupation of areas still in native forest should be eliminated.

55. In a dynamic extractive frontier region such as the Northwest, these measures will not be easy to implement and the Bank should be realistic about the possibilities of doing so. Attainment of these objectives, however, is likely to be largely impossible unless public awareness of the long-run social and ecological, as well as economic, implications of present land and other natural resource use tendencies is increased and greater accountability with

respect to potential adverse environmental impacts is built into public sector decision and resource allocation processes at the state and local as well as federal government levels. In addition to the substantial reinforcement of state natural resource management agencies and the need to undertake widespread public education campaigns, this may require more effective local community and NGO participation than existed in the region during the early 1980's.

56. Once road improvements were well advanced, migration was on the rise and extractive forces had been unleashed in parts of the Northwest, the Brazilian Government in general and POLONOROESTE in particular largely lost control over the occupation process. Part of the problem was that central administration of the latter was vested in a weak institution that was incapable of coordinating the various sectoral agencies involved and unwilling or unable to deal with the irregular allocation of resources at the state level. An obvious lesson for the future, therefore, is the need for the Bank to give greater attention to the selection of the coordinating agency and the design of inter-institutional and implementing arrangements in operations of similar complexity. More generally, this implies the need for the Bank to give greater attention to institutional analysis and risk assessment during project appraisal and to institutional development in project design and supervision.

57. In addition to institutionally strong and technically competent coordinating agencies, more balanced execution of complex programs such as POLONOROESTE requires an equally strong commitment on the Bank's part to the adequate monitoring and supervision of their principal components. More specifically, implementation of such programs requires intensive, multi-disciplinary supervision, together with continual monitoring and on-going evaluation, preferably involving responsible local NGOs together with public sector agencies that are not themselves directly involved in program implementation. In such cases, additionally, permanent Bank field supervision (ie. from the Bank office in Brasilia or the Northwest region itself in the present case) is also strongly indicated.

58. One of the clearest operational lessons that can be derived from observation of POLONOROESTE's uneven implementation is that those activities which are handled as physical engineering projects and/or straight business deals with private contractors, such as road construction, tend to be carried out rapidly and straightforwardly, while activities involving the protracted participation of government agencies and/or permanent dealings with target populations, such as rural extension, credit, administration, community development and the like, may be susceptible to considerable delays or encounter a broad range of financial, institutional and other problems. These difficulties are likely to be magnified when, as in rural settlement schemes in tropical areas, basic know-how on key issues simply does not exist. In the case of POLONOROESTE, roadbuilding was the centerpiece of the program and it was in the contractors' interest to fulfill their obligations as quickly as possible. As a result, pavement of the trunk highway was completed long before adequate support services and/or environmental protection could be provided.

59. In the execution of future multi-dimensional projects, whether these are situated in tropical areas or not, care should be taken to ensure that uneven execution of different components does not jeopardize the overall effectiveness

of the operation. More importantly, in any future undertaking like POLONOROESTE, implementation of "software" components, especially those involving environmental and/or tribal peoples protection and institutional strengthening more generally, should be well advanced prior to initiating any major new infrastructure or productive sector investments. In this connection, finally, the Bank must be willing to suspend loan or credit disbursements in order to induce needed institutional development, Borrower compliance with environmental protection covenants or reformulation of priorities and strategies as soon as there is evidence that implementation is not proceeding properly or that serious physical and/or human environmental damage may be occurring as the direct or indirect result of program or project investments.

Implications for Bank Activities and Procedures

60. Insofar as its environmental and social aspects and consequences are concerned, the POLONOROESTE experience has numerous implications for Bank practice, including country policy dialogue and economic and sector work (ESW) as well as project preparation, appraisal, implementation, supervision, monitoring and evaluation. While these lessons apply specifically to large, multi-faceted investment programs in tropical frontier areas, many are also of relevance to Bank operations elsewhere. The most important of these implications are the following:

- (i) Any attempt to promote roadbuilding and/or agricultural settlement, especially on a large scale, in tropical areas such as Amazonia should be approached cautiously and, in most instances, probably be discouraged rather than supported by the Bank. In any event, such investments should not be undertaken in the absence of prior assessments of regional and local carrying capacities, including a detailed evaluation of natural resource potentials and constraints and of existing institutional and enforcement capabilities in the fields of environmental management, protection and control.
- (ii) Any proposal to promote the occupation of tropical areas should first be assessed in terms of what may prove to be less costly alternatives in other regions and sectors from both an environmental and an economic standpoint. This requires development of a cross-sectoral and interregional policy framework which should include identification and analysis of the environmental impacts of macroeconomic and sectoral policies that act both directly and (by inducing labor and capital flows from elsewhere in the country) indirectly on the area in question. More generally, this implies the need for the Bank to encourage its borrowers to develop explicit policies and instruments for population distribution and natural resource management at the national level.

- (iii) There is a clear need to improve (ex-ante and ex-post) assessment of the social and environmental consequences of public investments, including road and rural development projects, and other public policies and interventions, such as credit and fiscal incentives, fuel pricing subsidies, land development regulations (or the lack thereof), etc., which will directly or indirectly affect natural resource use and environmental quality. The environmental implications of market forces (eg. the outwardly advancing livestock frontier in the case of Northwest Brazil) should likewise be analyzed at the regional level.
- (iv) Increasing emphasis should be given in Bank country policy dialogue, ESW and project development activity to the need to strengthen national and subnational environmental management capabilities. Similarly, greater attention should be given to developing the policy, legal, regulatory and institutional frameworks necessary to ensure adequate protection of the physical environment. The mobilization of public opinion and national and local political support for environmental goals should also be a conscious element in Bank development efforts.
- (v) Bank ESW should focus greater attention on natural resource management and environmental protection issues, capabilities and constraints at the national and subnational levels, particularly in countries possessing large areas of tropical forest and/or other sensitive ecosystems. More generally, there is a persisting need to better integrate Bank economic and environmental analysis at the country policy, sector and project levels.
- (vi) Especially in tropical frontier areas, project preparation and appraisal should be based on a better understanding of the ecological, socio-economic and political-institutional characteristics of and evolving natural resource use tendencies in the geographic areas where new investments are to be undertaken. This should be part of the detailed ex-ante environmental assessment of any such project that should necessarily include an evaluation of the likely indirect and longer-term, as well as direct and short-run, ecological and social consequences of these interventions. Particularly for operations involving active frontier regions, the Bank should also carry out a more extensive risk analysis than has traditionally been the case in the past.
- (viii) Future Bank-supported interventions in tropical forest areas, where clearly justified, should not be restricted

to the rural sector or, within the rural sector, to small farmers in directed settlement projects. Other small producers and non-predatory extractivist groups such as rubber tappers, nut, fruit and palm oil gatherers and subsistence fishermen, together with tribal populations, should also be assisted. Basic sanitation, public health and environmental education, protection and control measures, furthermore, should be extended to rural and urban populations alike.

- (ix) As occurred in the case of POLONOROESTE, complex investment projects in tropical frontier areas and elsewhere should be identified, prepared, appraised, supervised, monitored and evaluated by multi-disciplinary teams including environmental and institutional development specialists and social scientists from a variety of backgrounds, as well as agriculturalists, economists, financial analysts and engineers.
- (x) Monitoring, on-going and ex-post evaluation of project implementation and results are an essential part of project management. Such activities should directly involve beneficiary populations, responsible NGOs and public sector entities that are administratively independent of project coordinating and implementing agencies. In rapidly growing frontier areas, more specifically, broader regional development and natural resource use tendencies should be systematically monitored together with project interventions per se.
- (xi) In complex, risky and/or environmentally sensitive operations such as POLONOROESTE, in addition to performing a comprehensive mid-term review, the Bank should strongly consider establishing its own permanent monitoring and supervision capability in the field. In addition to facilitating contact with project agencies and beneficiaries, this would send a clear signal to the Borrower regarding the Bank's particular concern with any such operations and their potential physical and human environmental consequences.
- (xii) Finally, in projects considered likely to have significant ecological or social impacts and for which loan and/or credit covenants are used as one of the instruments to ensure that adequate precautions or protection (including institutional strengthening) measures are taken, such covenants should be unambiguous and contain explicit timetables for Borrower compliance. They should likewise be closely monitored and strictly enforced by the Bank. As POLONOROESTE clearly illustrates, however, loan covenants and other forms of Bank pressure cannot substitute for true borrower

commitment to the achievement of project social and environmental objectives.

Conclusion

61. Due largely to its environmental consequences and the public attention which they have attracted, POLONOROESTE has contributed, albeit largely unintentionally, to significant institutional and policy changes in both Brazil and the Bank over the past several years. Partially in response to internal concern and external pressures as a result of increasing deforestation and other problems associated with the program, the Brazilian Government has launched several major initiatives and created new natural resource management and environmental protection institutions over the past several years, most recently including an Environmental Secretariat in the Presidency of the Republic itself. In addition, due in part to POLONOROESTE and other recent developments in western Amazonia, public awareness of environmental and Amerindian issues in Brazil is presently much greater than at the time the program was prepared and appraised.

62. Partly in reaction to some of the same concerns and pressures, the Bank's 1987 reorganization included creation of a new central Environment Department and Environment Divisions in each of the regional Technical Departments. This process has also led to a significant increase in Bank environmental staff and training activities, considerable strengthening of its environmental assessment procedures and a notable increase in the preparation of country environmental strategies and action plans, free-standing environmental lending operations, project environmental components and environmental conditionalities. Together, the Brazilian Government and the Bank have recently prepared and appraised, or are in the process of preparing or appraising, a number of new operations involving natural resource management and environmental protection in the Northwest and elsewhere in the country that are, directly or indirectly, offspring of POLONOROESTE.

63. Much, accordingly, has already been learned from this experience by the Brazilian Government and the Bank that has influenced the way in which both parties presently view the potential consequences of large transport and rural development projects in tropical areas. As suggested in the preceding paragraphs, however, POLONOROESTE contains numerous lessons which need to be more fully integrated into Bank practice in Brazil and elsewhere. Likewise, many lessons can and should be drawn from POLONOROESTE by the Brazilian Government and other Bank borrowers who envision similar investments in the future.

WORLD BANK APPROACHES TO THE ENVIRONMENT IN BRAZIL: A REVIEW OF SELECTED PROJECTS

THE POLONOROESTE PROGRAM

I. INTRODUCTION

1.01 The Northwest Region Integrated Development Program (POLONOROESTE) was formally created through a decree signed by the President of Brazil on May 27, 1981. It was largely implemented through five interrelated projects financed by six interlinked World Bank loans involving a total of US\$ 434.4 million that were approved between December 1981 and December 1983. Total program cost was initially estimated at nearly US\$ 1.6 billion. General program objectives were to pave the existing BR-364 highway connecting the capital cities of Cuiaba (Mato Grosso) and Porto Velho (Rondonia) and to provide for the investments necessary to achieve the "harmonious socio-economic development" of the region influenced by this road and protect its physical environment and Amerindian populations. The program was to be implemented in three overlapping stages. The Borrower was the Federative Republic of Brazil and program execution was the responsibility of a large number of federal and state government agencies under the overall coordination of the Superintendency for the Development of the Center West (SUDECO).

1.02 The first three Bank loans for the program were approved on December 1, 1981, specifically: the Agricultural Development and Environmental Protection Project (Loan 2060-BR for US\$ 67.0 million); the Health Project (Loan 2061-BR in the amount of US\$ 13.0 million); and, the Highway Project (Loan 2062-BR for US\$ 240.0 million). These loans were intended to support the first phase of program activities and included the following major components:

- (i) paving of the BR-364 highway, strengthening of the Rondonia Highway Department (DER-RO) and implantation of feeder roads in Mato Grosso and Rondonia (Ln. 2062);
- (ii) construction, equipment and staffing of health centers, posts and referral centers, expansion of an existing malaria control program, training and supervision of rural health workers and research and evaluation of public health problems and issues in Rondonia (Ln. 2061); and,
- (iii) consolidation of rural settlement, through the installation and/or expansion of access roads, service centers (Rural Support Nuclei or NUARs), agricultural extension and research services, crop storage and drying facilities, farmer organization and rural education, and environmental protection, including the establishment and/or control of national forests, natural reserves and ecological stations and the undertaking of ecological research, together with land regularization studies in Mato Grosso, soil surveys for new settlements in Rondonia and general program coordination, monitoring and on-going evaluation activities (Ln. 2060).

1.03 The rural settlement component of the latter project had an initial target population of some 18,200 small farmers who had previously migrated to Rondonia in search of land in existing official colonization schemes. By expanding local infrastructure and production support services, this component in particular and the program more generally were expected to assist farmers to make better long-term use of their comparatively abundant land and relatively scarce labor resources, to increase their output and move toward commercial agriculture based on environmentally less harmful perennial crops and, through interplanting, to adopt continuous rather than shifting cultivation of annual crops. A supplementary loan (2060-1-BR) of US\$ 22.8 million was approved for this project on December 8, 1983, but most of this amount was later cancelled.

1.04 The second phase of the program involved integrated rural development in northwestern Mato Grosso and was supported by Loan 2116-BR for US\$ 26.4 million, approved on March 25, 1982. This project, which covered nine of the fourteen municipalities in the Mato Grosso part of the POLONOROESTE program region, consisted of the following main elements: (i) the strengthening and expansion of agro-ecological zoning, rural extension, agricultural research and input supply; (ii) the expansion of physical infrastructure, including crop storage and drying capacity and municipal roads, and improvement of road maintenance capability; (iii) the strengthening and expansion of education and health facilities and services and construction of rural water supply systems and community centers; and, (iv) project management and coordination including monitoring and on-going evaluation. The project was expected to raise the incomes and improve the living standards of roughly 17,500 small-farm families with holdings under 200 hectares.

1.05 Stage three, finally, entailed implementation of the New Settlements Project in Rondonia and was partially financed through Loan 2353-BR in the amount of US\$ 65.2 million, approved on October 25, 1983. As initially appraised by the Bank, this operation was expected to support the installation of six new colonization schemes in Rondonia and include investments for: (i) land use planning and new settlement design; (ii) rural roads and improvement of road maintenance capability; (iii) establishment of rural service centers (NUARs) and satellite centers; (iv) agricultural research, rural extension and input supply; (v) grain drying and storage facilities; (vi) pilot "salvage logging" and sawmilling facilities, together with strengthening of the state's capacity to protect natural parks and reserves; (vii) education and health facilities; (viii) studies to diversify regional agricultural options and prepare new projects in Mato Grosso and Rondonia; and, (ix) project management, coordination and monitoring. Some 15,000 immigrant farm families were expected to be settled as a result of the project by 1989. Due to poor soils, however, only three colonization schemes were implemented and some 5,000 farmers settled. For the same reason, the Bank and the Brazilian Government agreed to cancel part of the project and the associated loan.

1.06 POLONOROESTE also included a "Special Project" to protect the roughly 8,000 Amerindians estimated to reside in its immediate area of influence in Mato Grosso and Rondonia at the time of appraisal. The Amerindian Special Project was to be implemented by the National Indian Foundation (FUNAI) and financed exclusively with domestic resources. At the time the first three Bank loans were

approved, this component was estimated to involve a total cost of US\$ 26.6 million, or roughly 2.5% of total program costs. The principal elements of the Special Project were: (i) land demarcation and regularization; (ii) the provision of health and education services; (iii) small economic development projects; and, (iv) the strengthening and improvement of FUNAI's regional administration. Amerindian protection measures were to be carried out in parallel to all three stages of the larger regional development program.

1.07 As of January 31, 1991, the status of the various Bank loans for POLONOROESTE was as follows. Loans 2060 and 2060-1 (agricultural development and environmental protection) closed in March 1990; while the former was fully disbursed, US\$ 18.3 million was cancelled from the latter. Loan 2061 (health) closed in June 1988 and slightly over US\$ 1 million was cancelled. Loan 2062 (highways) closed in September 1988 and just over US\$ 42.0 million was cancelled. Loan 2116 (Mato Grosso rural development) closed in December 1988 and US\$ 3.7 million was cancelled. Finally, Loan 2353 is expected to close in March 1991, but a total of US\$ 27.2 million (41.7%) has already been cancelled and US\$ 12.95 million remained undisbursed. In short, of the more than US\$ 434 million in Bank funds originally approved for the program, US\$ 92.3 million (21%) has already been cancelled, while an additional US\$ 13 million (3%) remained undisbursed in January 1991.

1.08 Several follow-on operations directly involving the Northwest region have recently been approved or are presently in preparation for future Bank consideration. They include the Amazon Basin Malaria Control Project (Loan 3072-BR in the amount of US\$ 99.0 million), approved on May 25, 1989, and proposed natural resource management projects for Mato Grosso and Rondonia are in elaboration by the respective state governments and the National Environmental Project for Brazil (Loan 3173-BR for US\$ 117.0 million), approved on February 27, 1990, contains a specific component to protect the Pantanal wetlands in the southern part of the area of influence of the Cuiaba-Porto Velho highway. Furthermore, in January 1985, the Inter-American Development Bank (IDB) approved two loans for a total of US\$ 58.5 million to finance pavement of that part of the BR-364 highway linking Porto Velho to Rio Branco, capital of the neighboring state of Acre, and implementation of a parallel environmental and Amerindian protection program (known as PMACI). These on-going and prospective future operations are described somewhat further in Chapter X, but will not be specifically assessed in this report.

II. PROGRAM BACKGROUND

A. The Macroeconomic Context¹

2.01 Brazil enjoyed remarkable economic growth between 1967 and 1979 with GDP and per capita income rising at real average rates of about 9% and 6% per annum respectively. Growth and the reduction of inflation were achieved without significant deterioration of the external resource balance in the 1967-73 period, despite considerable trade liberalization. However, given the heavy dependence of the country's industry and transport system on imported petroleum, the quadrupling of oil prices in late 1973 caused a sharp deterioration in Brazil's terms of trade. Increased energy costs, together with excess aggregate demand and a succession of bad harvests, resulted in increasing balance of payments difficulties and the acceleration of inflation.

2.02 Throughout the second half of the 1970's, the main challenges faced by Brazilian economic policy makers were to sustain high rates of output and employment growth and to establish the basis for long-term structural adjustment, while at the same time coping with short-run constraints. Meanwhile, innovative efforts were launched to reduce energy consumption and substitute domestic energy sources for imported petroleum. Considerable success was achieved in maintaining rapid growth and limiting balance of payment pressures. Nonetheless, continued dependence on imported oil, rapid accumulation of external debt, the constriction of imports and intensification of domestic inflation increased the economy's vulnerability to external shocks such as the additional sharp increases in petroleum prices and international interest rates during the late 1970's and early 1980's.

2.03 In March 1979, a new federal administration headed by General Joao Figueiredo took office for a six-year term. Grappling with inflation and the balance of payments situation initially absorbed much of its attention. Largely as a result, the economic priorities of the new government were to promote agricultural growth, reduce dependence on imported petroleum and continue the expansion of manufactured exports initiated during the early 1970's. During 1979, aggregate demand continued to grow fueled by rapid monetary expansion, an increased public sector deficit, large wage settlements in the unionized sectors and the continued expansion of exports. High demand coupled with a poor harvest and increased fuel costs, however, resulted in the acceleration of inflation which reached an annual rate of 78%, the highest level since 1964. These factors, together with a sharp rise in external borrowing costs, contributed to further deterioration of the balance of payments. The merchandise trade balance

¹ This and the following section are largely based on the President's Report for the Northwest Region Agricultural Development and Environmental Protection Project, P-3137-BR, November 9, 1981, pp. 1-16. For a fuller account of the country's macroeconomic performance during the 1970's and early 1980's, see World Bank, Country Economic Memorandum - Brazil, Report No. 3275a-BR, May 29, 1981 and Country Economic Memorandum - Brazil, Report No. 4674-BR, August 22, 1983.

registered a US\$ 2.9 billion deficit in 1979 with the cost of fuel imports alone increasing by US\$ 2.2 billion. Interest payments likewise rose from US\$ 3.3 billion in 1978 to US\$ 5.3 billion in 1979, while the current account deficit grew from US\$ 6 billion to US\$ 10 billion.

2.04 The new administration introduced measures designed to slow inflation and reduce balance of payment pressures in 1979 and 1980. However, these met with only temporary success and inflation rose to more than 110% in 1980. Despite an excellent harvest and the continued expansion of manufactured exports, the trade deficit for the year totalled US\$ 2.8 billion. Conditions for new external financing became more stringent and Brazil's total outstanding medium and long-term foreign debt reached US\$ 56 billion by the end of 1980. A number of additional policy measures were introduced in 1981. Controls on public expenditure were tightened and monetary expansion was restricted. To encourage private savings and further stimulate exports, monetary correction was brought into line with actual inflation. Commercial banks were freed from some financial controls, interest rates on official credit were raised and price controls were progressively relaxed. The initial results of these measures were a short-term increase in inflation, greater restraint on aggregate demand and a slowdown of economic activity accompanied by reduced pressure on the balance of payments.

2.05 Meanwhile, efforts were also being made to relieve poverty. Along with general measures to increase employment and prevent the erosion of wages, special programs for the less developed Northeast region were maintained or expanded, while coverage of the social security system was increased in urban areas and extended to the rural population. Housing loans likewise expanded and primary health services were gradually extended to rural areas. High priority was likewise given to the expansion and improvement of urban water supply.

2.06 In synthesis, after a period of very dramatic economic progress during the late 1960's and early 1970's, sharp increases in the cost of imported petroleum forced Brazil to moderate its growth expectations and adapt its productive structure to the rapidly changing terms of trade. The resurgence of domestic inflation and rapid accumulation of foreign debt, however, left the economy increasingly vulnerable to external shocks. This forced a revision of demand management policies and a greater selectivity of public investments with an emphasis on export expansion, import substitution, employment generation and poverty alleviation.

B. Bank Strategy in Brazil

2.07 By September 30, 1981, the Bank had made 106 loans to Brazil, 52 of which were fully disbursed. Total lending as of that date amounted to nearly US\$ 6 billion net of cancellations and disbursements were expected to increase over the next several years. In FY81, eight loans totalling US\$ 844 million had been approved. Although Bank lending increased substantially to nearly US\$ 1.5 billion in FY83, during FY82, when the first four loans for POLONOROESTE were approved, total new Bank commitments were only on the order of US\$ 724 million. The four POLONOROESTE loans, nevertheless, accounted for 48% of new Bank lending to Brazil in FY82, while the Northwest highway loan alone represented 33%.

2.08 At the time POLONOROESTE was appraised, a number of interdependent and complementary objectives were being pursued by the Bank in its lending to Brazil. One major goal was to help identify and develop projects that would increase the productivity and incomes of the poorest segments of the population, broaden the economic opportunities open to low-income groups and improve their living conditions. Thus, loans for nutrition research and development, primary education, vocational training, agricultural research, agricultural extension, polder construction and irrigation in the lower Sao Francisco river valley and integrated rural development were designed to assist low-income groups in rural areas, particularly the Northeast. The proposed Northwest Region Development Program was seen as being consistent with this overall objective in that it was intended to improve the productivity, incomes, health and social welfare of the present and future populations in western Amazonia.

2.09 Another explicit objective of Bank lending to Brazil was to support institutional development and policy reform. Accordingly, loans were aimed at the development of rational policies and procedures, establishment of adequate coordination and control within the public sector and maximization of public savings through improved selection of investment projects. Such institution building aims were deemed especially important in the case of POLONOROESTE where Bank-assisted projects sought to build up the planning and administration capacity required to promote a more orderly occupation and development of the rapidly growing agricultural frontier. More specifically, the proposed operations for the Northwest were expected to help the then Territory of Rondonia develop its capabilities for planning, implementing and coordinating rural development, health and road construction and maintenance activities.

2.10 A third major Bank lending objective, which was of particular importance to the Brazilian Government at the time, was to ease the foreign exchange constraint on development by supporting projects designed to help the country increase its export capacity and promote domestic import substitution. The proposed projects for the Northwest were also seen as contributing to this goal by helping to develop an area judged to have considerable potential for agricultural production and by facilitating the more rapid and fuel-efficient flow of goods over the Cuiaba-Porto Velho highway.

2.11 Finally, all Bank lending to Brazil in the early 1980's aimed at providing part of the large volume of medium and long-term capital inflows needed by the country in order to sustain satisfactory growth and achieve its employment creation and regional development objectives. Active Bank lending was seen as being essential to maintain the confidence of the international financial community in the future prospects of the Brazilian economy and to encourage other lenders to contribute to the country's development. Bank participation reportedly had already helped Brazil to obtain resources in larger amounts and on more favorable terms from bilateral credit agencies and private financial institutions than would otherwise have been the case. However, unlike other major Bank-supported operations in Brazil during the 1970's and early 1980's, including the Paulo Afonso IV Hydropower and Carajas Iron Ore Projects examined in other parts of this study, POLONOROESTE did not attract co-financing from other external sources.

C. The Northwest Region: Ecological Characteristics ²

2.12 The Northwest Region is officially defined as the area of influence of the Cuiaba-Porto Velho highway in Mato Grosso and Rondonia. ³ This area includes all of the present state of Rondonia plus the northwestern part of the neighboring state of Mato Grosso (see map). The region covers approximately 410,000 square kilometers, an area roughly equal to that of Paraguay and three-quarters the size of France. Rondonia occupies 59% of the region, while the remaining 41% is divided among sixteen municipalities and part of a seventeenth (Aripuana) in Mato Grosso. It is important to point out at the outset that many of POLONOROESTE's interventions, especially in relation to rural development, occurred in relatively small parts of the larger program region. These latter subregions within the Northwest will be specifically referred to as the "project areas." The following section briefly describes the main ecological features of the program region as a whole.

1. Topography and Principal Rivers

2.13 The topography of the Northwest region is highly variable. Its dominant physical feature is the Serra dos Parecis, a ridge rising to about 600 meters. The Parecis highlands are oriented in a southeast-northwest direction starting in western Mato Grosso, north of the town of Pontes e Lacerda, and entering southern Rondonia where it is extended further northward by the Serra dos Pacaas Novos. Together, these highlands separate the Amazon basin to the north and the Rio de la Plata basin to the south. An ancient sandstone plateau is located to the north and east of the Serra dos Parecis. It undulates gently at around 500 meters above sea level forming the southern limit of the Amazon basin. The southern and western sections of the region, in turn, are situated at about 200 meters. This area merges into riverine swamplands which drain into the Amazon and Paraguay rivers to the north and south respectively. The eroded edge of the plateau varies from a distinct escarpment to broken terrain extending for as far as 200 kilometers in some areas.

² This section is largely based on Eneas Salati, POLONOROESTE: Problemas Ambientais, mimeo, OED, 1989; World Bank, Staff Appraisal Report (SAR), Brazil Northwest Development Program, First Phase, Agricultural Development and Environmental Protection Project, (Report No. 3512b-BR), October 30, 1981; and World Bank, Staff Appraisal Report (SAR), Brazil Northwest Region Development Program, Phase II, Mato Grosso Rural Development Project, (Report No. 3635-BR), March 4, 1982.

³ In fact, this area is even larger since the BR-364 highway extends from Rondonia to the capital city of the state of Acre (Rio Branco) and beyond and is also used by both vehicles and migrants as a means of overland access from south-central Brazil to the city of Manaus, in the state of Amazonas. Part of northwestern Mato Grosso (ie. the municipality of Aripuana) is also directly accessed through eastern Rondonia and, thus, initially by means of the Rondonia segment of the Cuiaba-Porto Velho road. POLONOROESTE, however, only involved actions in northwestern Mato Grosso and Rondonia.

2.14 The principal man-made feature of the region is the BR-364 highway which stretches nearly 1,500 kilometers between the capitals of Mato Grosso and Rondonia. In the former state, the Cuiaba-Porto Velho road runs along the Guapore River valley, south and west of the plateau, until it crosses into Rondonia at Vilhena which lies on the plateau. In central Rondonia, however, the edge of the plateau becomes indistinct and, after traversing rolling terrain, the highway descends into level country some 200 kilometers to the south of Porto Velho.

2.15 Rondonia occupies an area of 243,000 square kilometers in the northern part of the region and has a largely flat or gently undulating topography. Four main sub-regions can be distinguished: (i) the Amazon plain to the north which has an average altitude of less than 200 meters and declines gradually toward the Madeira River; (ii) the northern slope of the Brazilian plateau which is an intermediate area between the Rio Madeira and the northern crest of the Parecis-Pacaas Novos ridges; (iii) the Parecis-Pacaas Novos highlands which form the principal elevated area in the state; and (iv) the Guapore valley that extends from the crest of the Parecis-Pacaas Novos ridges outward into Bolivia and which has median altitudes between 100 and 200 meters.

2.16 The Mato Grosso or southern part of the region, in turn, includes an area of some 167,000 square kilometers and contains three ecologically distinct subregions characterized, respectively, by dense tropical rainforest in the central and western sections, savannah (or cerrado) vegetation in the far north near the Parecis escarpment and the Pantanal wetlands in the south. From the standpoint of physical features, the Mato Grosso portion of the program area also houses four main sub-regions: (i) the Parecis plateau which presents slight undulations and altitudes between 300 and 600 meters; (ii) the central subelevation having altitudes between 190 and 300 meters and extending southward into Bolivia; (iii) the Pantanal depression which during the rainy season forms a continuous swamp in the low areas of the Paraguay River basin; and (iv) the Araras ridge, located to the northeast of the town of Caceres, which attains an altitude of 600 meters at its highest point.

2.17 The region is cut by numerous rivers whose hydrographic basins are defined by relatively low ridges. All of the major water courses that drain Rondonia belong to the Madeira River system. Those originating to the south of the Pacaas Novos ridge and to the west of the Parecis plateau flow through the Guapore and Mamore Rivers and then into the Madeira. Rivers originating to the north of the ridge flow in a northerly direction until they reach the Madeira. Those which begin to the east of the Pacaas Novos ridge and the Parecis plateau form the sub-basin of the Ji-Parana River. The main river in the Mato Grosso segment is the Paraguay which originates south of the Parecis plateau and, together with its affluents, penetrates the Pantanal depression. The rivers which form on the northern side of the Serra dos Parecis in Mato Grosso flow into the Amazon basin through the Roosevelt River which joins the Aripuana River to the north and then the Madeira to the east.

2. Climate

2.18 Climate in the Northwest is also characterized by considerable variation. Most of Rondonia, however, possesses a humid tropical climate, with

mean temperatures ranging between 21 and 26 degrees Centigrade, annual rainfall varying between 1,800 and 2,200 mm and only three to four months with less than 50 mm of rainfall which coincide with the cooler parts of the year. In the Mato Grosso segment, in turn, temperatures vary between 12 and 34 degrees Centigrade, while precipitation is between 1,500 and 2,000 mm in the northwestern section and between 1,150 and 1,400 mm in the southern portion of the program area. Some 70% of annual precipitation is concentrated in the period between November and March. The three month period between June and August is very dry, normally registering only 2% of total annual rainfall. Overall, the rainy season lasts from five months (November to March) in parts of Mato Grosso to seven months (October to April) in Rondonia. This period opens and closes with a month of intermediate rainfall leaving a dry season of five months in southern Mato Grosso and only three months in Rondonia. ²

2.19 The water vapor which generates rainfall in the Northwest is produced partly by ocean vapor and partly by evapotranspiration occurring in the Amazon basin itself. It is estimated that the contribution of water vapor produced in the region is particularly important during the dry season. ³ This suggests that deforestation both within and outside the POLONOROESTE region could result in some reduction of rainfall in Amazonia more generally. Furthermore, since the use of annual crops and pasture lands alters the hydrological balance, changes in the thermal balance can also be expected as rural settlement and associated deforestation increase.

3. Vegetation

2.20 Prior to the accelerated occupation of the area over the past two decades, the natural landscape of Rondonia consisted of virtually uninterrupted tropical moist forest, giving way to savannah grasslands (or cerrados) and swamps on poorer soils in the southwest. The Mato Grosso part of the program area, in turn, includes the three types of vegetation which are also characteristic of the rest of the state: dense tropical rainforest, cerrado grasslands and the Pantanal complex. Altogether, six major types of vegetation, three forest and three grassland, are found in the Northwest. They differ greatly in extent and grade into one another in response to differences in local humidity, climate and soil conditions. The three types of Amazon forest, more specifically, are

² According to the Koppen classification, the Northwest presents both Am and Aw climate types. The former, which is found in the northern, central and southeastern sections of Rondonia and the central and northwestern parts of Mato Grosso, is characterized by a predominantly rainy tropical climate and a short dry season during which the continuity of the tropical forest is not threatened by low temperatures. The latter is typically found in tropical savannahs such as in southern and southwestern Rondonia and the central and southern portions of Mato Grosso and is characterized by a prolonged and well-defined dry season and soils which tend to present a permanent water deficit.

³ Eneas Salati and Jose Marques, "Climatology of the Amazon Region" in H. Sioli (ed.), The Amazon: Limnology and Landscape Ecology of a Mighty Tropical River and its Basin, W. Junk, Dordrecht, The Netherlands, 1984.

evergreen wet forest, semideciduous forest and humid floodplain (or varzea) forest. The latter is lowland, occasionally flooded forest, while the other two are upland forest varieties.

2.21 Numerous tree species, prime grade as well as lower quality, are distributed throughout the Northwest. Recent commercial exploitation, however, has increasingly depleted higher value species, especially in the Mato Grosso portion of the region and in the more accessible parts of Rondonia. Since they rarely occur in homogeneous stands, prior to the expansion of trunk and feeder road networks under POLONOROESTE, commercial timber extraction was generally very time-consuming and costly. The evergreen canopy has an average height of some 20 to 30 meters with taller trees reaching up to 50 meters, while the semideciduous forest is some 5 to 15 meters lower. The latter contains relatively larger quantities of Brazilnut and babacu palm trees whereas the varzea forest contains comparatively more rubber trees.

2.22 Non-forest vegetation includes the cerrado grasslands, campos or open grasslands, and sedge meadow. The cerrado covers the Parecis plateau and is found in patches throughout Rondonia. It is also the predominant form of vegetation in much of the Mato Grosso portion of the region. The cerrado assumes various forms, but is generally composed of relatively short, sparse and twisted shrubs and trees. Under natural conditions, such areas normally provide poor grazing and almost negligible timber value. Sedge meadows or inundated varzea grasslands, however, are appropriate for raising water buffalo and rice production. Open grasslands or campo limpo usually occur in upland areas and, like the cerrado, provide inferior grazing. The Pantanal complex, finally, is a 173,015 square kilometer mosaic of vegetation, nearly all of which is seasonally flooded. In contrast to the cerrado, the Pantanal supports a large cattle population and attracts a growing numbers of tourists and poachers as it teems with a wide variety of abundant wildlife.

2.23 In terms of their relative proportions, upland wet forest and wet varzea forest covered 79% and 7%, respectively, of the total area of Rondonia (or some 198,000 square kilometers) in the late 1970's, while 9% (20,700 km²) was in cerrado and 6% (14,400 km²) in campo grasslands. While precise figures were not available for the Mato Grosso part of the region, upland wet forest (41%) and cerrados (38%) accounted for nearly equal shares of the state as a whole. The Pantanal covered 14% of the total land area, in Mato Grosso, while the remaining areas were either in campo grasslands (3%) or semideciduous forest (3%).⁴ From these figures, the predominance of humid tropical forest, especially in Rondonia, followed by savannah brushlands, particularly in Mato Grosso, is clearly evident.

⁴ World Bank, Brazil: Integrated Development of the Northwest Frontier, Washington, second printing, November 1983, Table 8, pg. 40.

4. Soils and Agricultural Production Potential

2.24 At the time POLONOROESTE was prepared, Rondonia was reputed to have a relative abundance of promising soils for agricultural purposes.⁵ In comparison with the highly-leached, nutrient-poor soils that predominate in most of Amazonian terra firme this may be true. However, as will be discussed later in this report, subsequent events have demonstrated that this comparative advantage was insufficient to justify the frequent assumption that agricultural activity could be profitably and sustainably practiced in much of the region, especially considering that soil quality in many parts of the Northwest was still largely unknown at the time POLONOROESTE was appraised.

2.25 Some early Bank missions accepted the prevailing Brazilian view that soils in Rondonia were generally of high quality. The report prepared by an interdisciplinary regional survey mission, for example, affirmed that: "in contrast to most other parts of Amazonia where agroclimatic conditions are generally unfavorable, the Northwest has areas of soils suitable for some crops and a pronounced dry season which inhibits the propagation of plant diseases."⁶ The same document, nevertheless, also indicates that this was based at least partly on trust since exact data were still largely unavailable at the time of program formulation: "at present, the nature and extent of the various soils occurring in the Northwest is not precisely known. There are only two sources of data concerning land capability...The findings of these surveys...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 Because of these doubts, the Bank required that soil studies be undertaken before initiation of new colonization projects in Phase III of the program.

2.26 The statement concerning the uncertain extent of suitable regional soils for agricultural purposes later proved prophetic, not so much because of the results of more detailed surveys which were not always carried out, but due to the practical difficulties of achieving sustainable agricultural development in the area. More recent assessments are less optimistic about long-run commercial agricultural possibilities in the Northwest on account of the distance-to-market factor and the associated costs of transporting both inputs and outputs. Such difficulties, in practice, require a redefinition of the concepts of "good," "moderate" and "marginal" agricultural potential in reference to natural soil fertility.

2.27 Be that as it may, the predominant soils in the Northwest region (40% of the total) are low fertility, high aluminum content, red-yellow and yellow latosols. This soil type prevails in the Mamore-Guapore valleys in a

⁵ See Brent H. Millikan, The Dialectics of Devastation: Tropical Deforestation, Land Degradation, and Society in Rondonia, Brazil, Master's thesis, University of California, Berkeley, 1988, pp. 14-15.

⁶ World Bank, Brazil: Integrated Development..., op. cit., pg. 57.

⁷ Ibid., pg. 57.

wide swath southwest from the town of Guajara-Mirim and is found extensively in the municipalities of Porto Velho, Ariquemes, Jaru, Ji-Parana, Costa Marques and Cerejeiras, as well as in the Guapore River basin area in Mato Grosso. The second most important group of soils (33%) are red-yellow podzols formed by prolonged weathering of poor parent materials. These tend to have moderate to high fertility in the period immediately following deforestation and can, thus, support annual or perennial crops with moderate to good productivity for several years, after which time their natural fertility rapidly declines.

2.28 Areas of relatively good podzolic soils are found on both sides of the Cuiaba-Porto Velho highway in Rondonia between Ariquemes and Pimenta Bueno, as well as around Colorado d'Oeste where they are interspersed with very fertile terra roxa soils. These were precisely the areas where INCRA located its initial colonization projects in Rondonia and where settlement was to be consolidated under the first phase of POLONOROESTE, thus giving origin to the perceptions of high natural soil fertility in the region. In Mato Grosso, in turn, the better soils are found mainly in the western part of Aripuana, the southern Guapore valley and the Mirassol d'Oeste sub-region.

2.29 Altogether, it is now estimated that only 2% of the land in Rondonia is composed of exceptionally fertile soils, while another 8% is well-suited for agricultural production, whether of annual or perennial crops. An additional 60% can be utilized for annual crops with suitable cultivation techniques and chemical fertilization, but 7% are suited only for pasture and 23% are inappropriate for any sort of agricultural activity. In the Mato Grosso portion, it is estimated that only 3% of the soils are totally without restriction for either annual or perennial crops, 22% can be used with adequate cultivation methods for annual cropping, 38% (particularly in the Pantanal area) are best suited for pasture, while the remaining 37% present an aptitude only for forestry and should, thus, be kept in reserve.

2.30 In retrospect, the absence of definitive pedological surveys appears to have contributed to a tendency both in Brazil and the Bank to overestimate actual soil fertility in the Northwest. Furthermore, the agricultural potential of even fertile soils was occasionally limited by steep topography. As a result, considerable ecological heterogeneity, especially with regard to soils and topography, at both the sub-regional and the individual farm levels was later found to have posed a significant constraint on sustainable small-farmer settlement in many parts of the region.⁶

2.31 Perhaps the most serious oversight in the early assessments of agricultural development potential in the Northwest, however, was the aforementioned failure to adequately consider the distance factor. Several areas within the region did, in fact, possess moderate to good soils, requiring only appropriate inputs and cultivation methods to produce at the same level as areas having soils of similar quality in the south-central Brazil. Given the much greater distance to domestic and external markets from Rondonia, the cost of

⁶ See Millikan, op. cit., pg. 16 and Marc Dourojeanni, "An Example of the Complexity of Development in the Humid Tropics: the Northwest Region Development Program in Brazil," mimeo, Toronto, 1985, pp. 24-27.

transporting inputs and produce to and from the region nevertheless required that natural soil fertility, in fact, be much higher than that in less remote areas in order for agricultural production to be economically feasible on a commercial scale except to supply local demand. The initial absorption by the federal government of part of the costs of transporting farm output from the Northwest to markets outside the region through uniform fuel prices and other means masked this problem to some extent, but additional subsidies would have been necessary to reduce the cost of importing the inputs necessary to maintain the fertility of "good" or "moderate" soils in the area.

D. The Northwest Region: Demographic and Socio-Economic Characteristics

2.32 Despite important dissimilarities between its two component subregions, considered as a whole the Northwest experienced very high rates of demographic growth between 1960 and 1980. In the 1960's, the region's population increased at an average rate of 6.5%, largely on account of the rapid growth of Cuiaba, Caceres and Barra do Bugres in northwestern Mato Grosso. The two latter municipalities, moreover, received large contingents of rural, as well as urban, migrants during the decade. By comparison, Rondonia grew at an annual rate of 4.8%, resulting in a total increment of only 41,000 people, during the 1960's.

2.33 In the 1970's, however, the situation was reversed with Rondonia's population growing at an extraordinarily high average rate of 16.0% per year, as compared with the still very substantial 6.6% rate registered in Mato Grosso. Within the latter state, the areas of most rapid population growth in the 1970's were the Cuiaba-Varzea Grande urban agglomeration and rural areas to the north including Aripuana, Barra do Bugres, Caceres, Mirassol d'Oeste and Tangara da Serra. In Rondonia, demographic expansion during the decade was largely concentrated in or near the agricultural colonization areas along the Cuiaba-Porto Velho highway.

2.34 Table 1 presents data on population, land area and demographic density for each of the municipalities subsequently covered by POLONORCESTE with the exception of Aripuana for which specific data on the area included in program were unavailable. In addition to revealing the very low densities that were characteristic of much of the area, these figures indicate that the two capital cities, Cuiaba (whose urban area extends into Varzea Grande) and Porto Velho, account for much of the population in the region as a whole. Indeed, these three municipalities alone accounted for 40% of the Northwest's total population in 1980.

2.35 At the time of the 1970 census, urban areas held only 39% of the total population in the Mato Grosso part of the region, while urban population, at 54% of the total, predominated slightly over that in rural areas in Rondonia. This situation, however, was reversed in 1980 when Mato Grosso's urban population rose to nearly 58% of the total, while that in Rondonia declined to 47%. Such patterns reflect the differences in migration and settlement patterns experienced in the two areas during the decade.

Table 1

Northwest Region: Total Population, Land Area and Population Density, 1980

<u>State/Município</u>	<u>Population</u>	<u>Area</u> (km ²)	<u>Density</u> (Persons/km ²)
<u>Mato Grosso</u>			
Araputanga	17,153	2,086	8.2
Caceres	59,057	30,972	1.9
Jauru	16,701	1,842	9.2
Mirassol d'Oeste	18,595	1,113	16.7
Pontes e Lacerda	14,406	13,335	1.1
Quatro Marcos	18,204	1,085	16.8
Rio Branco	17,573	1,835	9.6
Salto do Ceu	11,191	1,443	7.8
Vila Bela da Sta. Trindade	8,943	47,298	0.2
Barra do Bugres	23,637	10,760	2.2
Tangara da Serra	31,303	12,536	2.5
Cuiaba	212,984	12,790	16.7
Nossa Sra. do Livramento	10,264	6,315	1.6
Pocone	23,359	16,691	1.4
Varzea Grande	76,676	682	112.4
Total	560,046	160,783	3.5
<u>Rondonia</u>			
Ariquemes	53,364	38,687	1.4
Cacoal	67,037	8,741	7.7
Guaajara-Mirim	34,755	63,935	0.5
Ji-Parana	121,711	22,027	5.5
Pimenta Bueno	30,019	17,904	1.7
Porto Velho	133,898	58,310	2.3
Vilhena	50,285	33,440	1.5
Total	491,069	243,044	2.0
TOTAL	1,051,115	403,827	2.6

Source: IBGE, Anuario Estatístico, 1984.

2.36 Migration was responsible for most of the dramatic demographic expansion that occurred in the Northwest during the 1970's.⁹ Even before this period, the growth of Caceres, Barra do Bugres and Cuiaba in central and western

⁹ See World Bank, Brazil: Integrated Development..., op. cit., pp. 14-19.

Mato Grosso was largely due to migration. However, while most of the migrants to Cuiaba originated in other parts of Mato Grosso, particularly from nearby rural areas, migrants to Caceres and Barra do Bugres came mainly from older agricultural settlement areas in Parana, Mato Grosso do Sul, Sao Paulo, Minas Gerais and Espirito Santo. Most of the latter were attracted to the region by the availability of relatively inexpensive land and many arrived with some capital from the sale of former landholdings in the South. Before 1970, in contrast, migration to Rondonia occurred on a much smaller scale.

2.37 On the basis of census data, it has been estimated that total net migration to Rondonia during the 1970's involved roughly 360,000 people. Of these, one-third came as children under 10 years of age, one-quarter were aged 10-19, an additional one-third were in the 20-59 age group, while the remainder were over 60 years of age.¹⁰ These figures suggest the preponderance of migration by families during the decade. Given the generally adverse living conditions in rural areas, this tendency greatly contributed to urban growth since it became commonplace for wives and younger children to remain in the towns along the BR-364 highway while older male family members initiated land clearing and the cultivation of food crops.¹¹

2.38 Data from the migrant information system (SIMI) established by INCRA in Rondonia in the early 1970's and later taken over by the Ministry of the Interior are practically useless for the measurement of migration prior to 1978. Nevertheless, these figures, coupled with information collected during field research, provide considerable insight into the origin and composition of migration flows to the Territory. Throughout the 1970's, most migrants to Rondonia were from the earlier frontier states of Parana and Mato Grosso (which then also included Mato Grosso do Sul), although significant numbers also came from Minas Gerais, Espirito Santo and Sao Paulo. A 1978-79 field study found, additionally, that most recent migrants to government colonization projects had previously resided in several states before coming to Rondonia. Even though a majority of the settlers proceeded from Parana or Mato Grosso, very few had actually been born in these states.¹² In terms of previous occupations, in turn, the majority had been small landholders, sharecroppers, tenant farmers or rural wage laborers.

2.39 INCRA data on plottolders in official colonization projects, additionally, reveal that migrants' previous agricultural experience generally included the cultivation of some perennial crops, particularly coffee. Few settlers had made use of rural credit or marketed their output through formal

¹⁰ Haroldo da Gama Torres, Migracao e Agricultura na Fronteira: o Caso da Amazonia Sul, Master's Thesis, CEDEPLAR/UFMG, Belo Horizonte, 1990, Annex 1.

¹¹ Millikan, op. cit., pg. 70.

¹² A. T. Calvente, Formacoes Neo-capitalistas no Movimento de Ocupacao da Amazonia: Colonizacao Agricola em Rondonia 1970-1980, Master's thesis, Instituto de Ciencias Humanas, Departamento de Economia, Universidade de Brasilia, 1980.

channels before coming to Rondonia.¹³ Overall therefore, it would appear that many migrants to the Territory during the 1970's came from market-oriented, albeit relatively low-income, agricultural backgrounds. Lack of experience with rural credit, marketing and cooperatives, however, suggested the need for strong extension services, which would also have to be sufficiently flexible to take the significant differences in agricultural experience among migrants into account.

2.40 Available data suggest, finally, that, while initial settlers tended to come mainly from rural areas, an increasing proportion of all migrants to Rondonia in the late 1970's had non-agricultural backgrounds. SIMI data, for example, reveal that 44% of all migrants entering the Territory during the first quarter of 1979 came from towns and cities, although it is uncertain how many of these may have had previous agricultural experience. As discussed later in this report, the participation of urban migrants increased even further in the early 1980's in response to the growing difficulties encountered by the Brazilian industrial economy during this period.

E. The Historical Context

2.41 As indicated in the previous section, the area of influence of the Cuiaba-Porto Velho highway, particularly in Rondonia, received an increasing influx of migrants in search of land and employment during the 1970's. This largely uncontrolled flow brought into prominence several concerns in terms of regional development. Among these was that the failure of earlier attempts to settle small farmers in Amazonia had demonstrated the need to provide migrants with a range of physical infrastructure, agricultural support and social services in order to productively establish them on the land. However, government efforts in this direction during the 1970's, especially along the Transamazon highway, were stymied by the size and intensity of migration, poor soils in many of the areas selected for directed colonization, the shortage of financial and other resources and the absence of a replicable rural settlement model. Additional concerns generated by advancing settlement in the Northwest in particular included the potential threat to Amerindian groups, some of which were still in the process of being contacted, together with increased pressures on the sensitive, but still relatively unknown, physical environment.

2.42 To better appreciate the circumstances under which POLONOROESTE was conceived and the challenges that it faced during implementation, it is necessary to place the program in its larger historical context. Of particular relevance is the experience of previous frontier occupation in Brazil, both in Amazonia and elsewhere, since the trajectory of such settlement helps to explain why the Northwest region suddenly became the preferred destination of many rural migrants. It is likewise important to examine the nature and consequences of the major transformations experienced in the Brazilian agricultural sector in the years preceding the establishment of POLONOROESTE in order to comprehend the origins and magnitude of the migrant flows that later streamed into the region. Finally, it is necessary to consider the evolution of government policy for the Northwest and Amazonia more generally. These elements will be briefly

¹³ World Bank, Brazil: Integrated Development..., op. cit., pp. 17-18.

described in the following paragraphs and are discussed more fully in Annex I. The more specific history of rural settlement in Rondonia and northwestern Mato Grosso prior to POLONOROESTE, in turn, is summarized in Annex II.

1. The Frontier, Agricultural Modernization and Regional Policy

2.43 Between 1940 and 1970, the land frontier in Brazil served as a partial "safety valve" for demographic pressures in older settlement areas. It also provided one of, if not, the principal means of increasing agricultural production both for internal consumption and export. As the frontier moved progressively farther northward and westward during the 1970's, official colonization schemes attempted to reproduce the earlier market-driven expansion of rural settlement in the Center-South. However, wholesale changes in the structure and relations of agricultural production, together with high rates of population growth, were creating an unprecedented exodus from rural areas in southern Brazil, particularly in the state of Parana, at this time. While part of this flow was channeled to Amazonia, the failure of directed settlement along the Transamazon highway and the associated shift from a small-farmer to a large enterprise-based occupation strategy in the eastern part of the region left tens of thousands of migrants stranded.

2.44 More generally, the capacity of the frontier to resolve basic social and economic problems elsewhere in Brazil was steadily declining. The best areas in terms of soils, climate and location had already been occupied by 1970. Even though the agricultural frontier was at first able to absorb considerable numbers of small farmers, increasingly during the 1970's and continuing throughout the 1980's, northwestern Parana, south-central Goias, Mato Grosso do Sul and even northwestern Mato Grosso themselves became the principal areas of rural outmigration in the country. By 1980, much of the demographic holding capacity of earlier frontier areas had essentially disappeared.

2.45 The failure of official colonization schemes in eastern Amazonia reflected the difficulties of installing and sustaining rural settlement in areas that were both considerably more distant from major domestic markets and less appropriate in terms of their underlying human carrying capacities than earlier frontier zones. Furthermore, the absolute size of the "surplus" population that needed to be absorbed in new frontier areas in order to effectively reduce tensions in other parts of the country increased substantially during the 1970's. Much of the transformation of rural areas occurring in south-central Brazil during this period, moreover, came in response to federal government policies which consciously promoted agricultural exports, especially soybeans, and sugar cane-based alcohol production to substitute imported petroleum as a vehicle fuel.

2.46 Even though Rondonia's peculiar characteristics, especially the fact that the federal government owned most of its land area and that the first colonization projects had been comparatively successful, appeared to favor its ability to absorb a substantial share of the migration channeled to Amazonia, as suggested above, initial assessments of the Territory's agricultural potential later proved to have been overly optimistic and an ex-post review of the principal ecological, socio-economic and political-institutional characteristics of the Northwest reveals several features that, individually and in combination, were inimical to the achievement of sustainable agricultural development and the

large-scale absorption of small farmers in the region. Indicative of this, even before the Bank's first three loans for the program were approved, parts of central and northern Mato Grosso outside the immediate Phase II project areas were losing substantial rural population through outmigration, mainly to Rondonia.

2.47 Regional development policy for Amazonia during the 1960's and 1970's, finally, stressed the need to achieve territorial and socio-economic "integration" and to exploit the region's vast natural resources including a variety of minerals (eg. iron, manganese, copper, gold, nickel, bauxite and cassiterite) and commercial hardwoods, together with its immense hydro-electric potential and, given the abundance of unsettled land, what were believed to be significant agricultural development possibilities. A range of instruments was used to pursue these objectives including public sector infrastructure, particularly road and hydropower, investments, the aforementioned directed colonization schemes and generous fiscal and credit incentives to attract private capital. The latter were used, often inefficiently and at a significant environmental cost, to promote industrial and agro-ranching activities, particularly in the eastern part of the region, but also, in the case of cattle raising, in portions of northwestern Mato Grosso outside the Phase II project area. Private colonization projects were likewise undertaken along the Cuiaba-Santarem highway in north-central Mato Grosso, to the east of the POLONOROESTE area.

2. Settlement in the Northwest Prior to POLONOROESTE

2.48 The Territory of Rondonia was created in 1945. Despite an inflow of population along the Amazon river system due to the "rubber boom" in the late 19th century and again during the Second World War, the area remained very sparsely populated until the 1950's when the discovery of large cassiterite deposits stimulated another surge of migration. Construction of a precarious dirt road at that time provided the Territory's first overland link with south-central Brazil. The road was rebuilt in the mid-1960's further improving access and helping to spur an increase in Rondonia's population from 70,000 to 110,000 during the decade, partly in response to the initiation of private agricultural settlement efforts in the late 1960's.

2.49 In 1970, the official colonization agency, INCRA, arrived in Rondonia in response to land conflicts and increasing social tensions in the private settlement scheme near the town of Ouro Preto on the Cuiaba-Porto Velho road. Despite the presence of INCRA, physical occupation of the Territory during the 1970's was largely spearheaded by private landgrabbers (*grileiros*) and speculators whose activities were fed by a growing number of migrants in search of reportedly fertile land. Initially, INCPA applied the same highly centralized and paternalistic colonization model that was being attempted (and later abandoned) along the Transamazon highway. However, in the face of rapidly increasing demographic pressures, starting in 1975 much of the agency's efforts were redirected to the "regularization" of rural settlement through the provision of land titles and minimal services in areas that had already been spontaneously occupied by migrants.

2.50 At the same time, measures were taken by the federal government to curtail the population inflow through disincentive campaigns in the migrants' areas of origin and the placement of barriers along the main road into the Territory. Migration data suggest that such measures, indeed, had an impact as flows decreased somewhat in 1977-78 relative to those registered in immediately preceding years. Government attempts to reduce migration to Rondonia, however, were later reversed when a new federal administration took office in early 1979 and the policy became one of encouraging population growth through the improvement of physical infrastructure and rural services and the expansion of agricultural settlement programs.

2.51 By 1980, nevertheless, there were already more than 48,000 rural establishments in Rondonia, most of which had received some form of assistance from INCRA, as compared with only slightly over 7,000 in 1970. Altogether, as noted above, on the order of 360,000 people came to the Territory during the 1970's, roughly 190,000 of whom went to rural areas, while the total area under cultivation increased from less than 45,000 hectares in 1970 to nearly 375,000 ha at the end of the decade. While INCRA's activity did have a positive impact on rural land distribution, finally, there was also a clear tendency for the proliferation of small (ie. less than 10 ha) farm units whose share rose from 8% to more than 25% of all rural establishments during the 1970's.

2.52 Present day Mato Grosso, in turn, was created in January 1979, when the state formerly having this name was divided into two parts. Although sharing recent frontier status with Rondonia at the time POLONOROESTE was prepared, Mato Grosso differed from the former Territory in several important respects. First, as mentioned in the previous section, rural population growth in northwestern Mato Grosso accelerated prior to that in Rondonia. Secondly, while much of the land in the latter was in federal government hands, in the former state, by 1980, most of the region between Cuiaba and Vilhena had already been claimed, if not physically occupied, by large ranchers or small spontaneous settlers. As a consequence, Mato Grosso possessed one of the highest indices of rural land concentration in Brazil in that year.

2.53 Also in contrast to Rondonia, colonization activities in Mato Grosso, as indicated above, had been undertaken almost exclusively by private interests. The only public settlement scheme was initiated by a state government agency in 1977, INCRA being largely absent from Mato Grosso altogether. Comparative studies indicate that farmers participating in private colonization schemes in the state normally had greater capital assets, and thus were generally wealthier, than those opting for government projects in Rondonia and elsewhere. As also suggested above, a number of the large ranching enterprises in the Mato Grosso part of the Cuiaba-Porto Velho corridor benefitted directly from federal government fiscal incentives, while virtually none of these tax favors were used in Rondonia.

2.54 As a result of these differences, migration patterns in Rondonia and Mato Grosso in the 1970's were also distinct. Being the location of relatively older settlement, much of the program's larger area of influence in the latter state, unlike Rondonia, was already expelling significant numbers of rural migrants during the decade, both to nearby urban areas and to newer frontier areas farther to the north, although this was not clearly perceived until the

1980 census results became available several years after POLONOROESTE was appraised. A final key difference between the two parts of the program region was that the Mato Grosso section was considerably closer to major domestic markets than Rondonia.

F. Conclusion

2.55 POLONOROESTE was negotiated at a time of increasing economic difficulties in Brazil. Rising inflation, a critical balance of payments situation and successive trade balance deficits forced the Government to adopt a series of energetic measures and controls, while at the same time attempting to expand poverty alleviation efforts. Under these circumstances, the program seemed attractive as an intervention simultaneously favoring export promotion and employment generation. From the Bank's perspective, POLONOROESTE appeared capable of achieving several broad and complementary objectives including an increase in the output and improvement in the incomes of the Northwest's existing and expected future populations, a strengthening of the institutional capacity required to promote orderly occupation of a new frontier area, development of the agricultural potential of a newly settled region and provision of part of the external capital required by the country in order to sustain its image and credit in the international financial community.

2.56 The strategy of turning to the agricultural frontier for the resolution of economic and social problems had a long-established tradition in Brazil. During much of the period between the 1920's and the 1970's, frontier expansion served both as a safety valve for social tensions and permitted a significant increase in agricultural production without altering prevailing forms of rural social organization and land tenure. Three major movements, in fact, occurred during this period: (i) the opening up of northwestern Parana and adjacent areas in the 1930's and 1940's; (ii) the occupation of a vast central strip from the present state of Mato Grosso do Sul to Maranhao in the 1950's and 1960's; and, (iii) more recently, the partial incorporation of the vast Amazon frontier.

2.57 The capacity of frontier expansion to resolve basic economic and social difficulties, however, clearly diminished over time. In retrospect, the logic of the chronological order which marks modern frontier expansion in Brazil has proven to be impeccable. The best areas, both in terms of location and natural (especially soil) resources, were occupied first and absorbed the largest number of migrants. While federal government intervention in support of frontier occupation increased progressively during the 1960's and 1970's, the largely frustrated attempts at colonization in eastern Amazonia revealed the serious difficulties facing efforts to promote settlement in more distant, ecologically less apt and climatically less hospitable areas. To compound these difficulties, the size of the "surplus" population that would have to be absorbed by more recent frontier areas in order to reduce social tensions elsewhere multiplied rapidly during the 1970's due to a combination of high population growth and rapid agricultural modernization associated with increasing rural land concentration in south-central Brazil, factors which together generated massive rural outmigration.

2.58 Several government initiatives during the first decade of the military regime (ie. 1964-1974) aimed at the physical incorporation of Amazonia and its effective integration into the national economy. The overall thrust of these actions ultimately favored occupation by large-scale enterprises that absorbed little manpower. The National Integration Program, launched in 1970, constituted somewhat of an exception to this trend in that it was partially designed to settle small farmers along the Transamazon highway. Several factors, however, contributed to the early abandonment of this socially-oriented policy and efforts aimed at attracting large-scale enterprises to the region were intensified after 1974. These are the main elements of the general context within which the Brazilian Government and the Bank began discussing POLONOROESTE in the late 1970's.

2.59 An ex-post review of the main physical features, historical settlement patterns and demographic and socio-economic characteristics of the Northwest region at the time POLONOROESTE was prepared reveals several aspects which limited its future prospects for sustainable agricultural development and the large-scale absorption of rural migrants. Even though the region's terrain, climate, vegetation and soils were considered by many observers at the time the program was appraised to be comparatively favorable to agricultural production, subsequent events were to demonstrate that this view was overly optimistic. Not only was pedological information sketchy but, more importantly, assessments of the region's productive potential failed to take the concrete circumstances under which agricultural activity would be carried out fully into account. Initial assumptions as to the extent to which the distance factor would affect the ability of small farmers to adopt adequate cultivation practices, including the use of fertilizers and other agro-chemical inputs which had to be brought in from outside the region, subsequently proved to be incorrect, as did those regarding the level of natural soil fertility required for the Northwest to compete successfully with areas located much closer to domestic and external markets. Such difficulties, in practice, transformed soils of "good" or "moderate" natural potential into "poor" or "marginal" soils.

2.60 On another plane, the characteristics of rural settlement in the region prior to POLONOROESTE would later also present an obstacle to the absorption of additional migrants. At the time the program was prepared, substantial areas in the general vicinity of the Phase II rural development project in northwestern Mato Grosso had already been claimed by large ranchers and/or were expelling increasing numbers of rural migrants, many of whom were going to Rondonia. Previous government interventions in Mato Grosso, in fact, had disproportionately benefitted large-scale private colonization and cattle raising interests, while small farmers were relegated to interstitial areas which became the principal focus of POLONOROESTE's intervention in the state. In Rondonia, in turn, even though official attention had favored smaller producers and agricultural colonists to a much greater extent than in Mato Grosso, the land occupation situation had already become increasingly chaotic prior to the program's appraisal. Indeed, as will be further described in the next chapter, this provided one of the main justifications within the Bank for supporting POLONOROESTE. As later chapters of this report indicate, however, the program's combination of major transport improvements and efforts to support rural settlement, together with other influences that were totally beyond its control, would, on balance, only further aggravate this situation.

III. THE NORTHWEST REGION DEVELOPMENT PROGRAM

A. Introduction

3.01 The Northwest Region Development Program, or POLONOROESTE, was a complex, ambitious and admittedly risky undertaking that represented the Bank's first attempt to support agricultural development in the Amazon region in a major way. By combining interventions in a number of sectors (road transport, rural development, public health), together with environmental and Amerindian protection, in an area of rapid frontier settlement, this was truly a pioneering venture both for the Brazilian Government and the Bank. Before turning to its implementation performance, results and environmental impacts, however, this chapter will describe the program in some detail.

3.02 The present chapter, more specifically, will examine the origins of POLONOROESTE, the Bank's role in its identification and preparation and the program's general strategy, institutional arrangements and perceived benefits and risks at the time of appraisal. The origins of its Amerindian component and the related genesis of the Bank's tribal peoples policy will also be briefly discussed. Annex III presents a more detailed description of the five Bank-supported projects and the Amerindian Special Project which comprised most of the larger program. In view of POLONOROESTE's subsequent implementation problems and environmental and social impacts, the ex-ante perceptions and assumptions underlying the Brazilian Government's general intervention strategy in the Northwest and the rationale for Bank involvement will be highlighted throughout this discussion.

B. Origins of POLONOROESTE¹

3.03 As indicated in the previous chapter, a large, multi-dimensional and multi-institutional program such as POLONOROESTE can not be fully understood without considering the historical context that prevailed at the time of its inception. What brought the project into being? Who were the principal actors involved and what were their motivating interests? How were such interests translated into objectives, subprograms and activities? How realistic were these original objectives and goals? To answer such questions, it is necessary to look both at the formal plans, reports and events connected with the undertaking and to situate them in their broader political-institutional context.

1. Local Considerations

3.04 Within the Territory of Rondonia and the northwestern part of Mato Grosso, the demand for improved roads and increased electric energy, agricultural research, extension, credit, warehouses, schools, health centers, recreational and other facilities was growing rapidly in the late 1970's as a result of the

¹ This section is largely based on George Martine, "A Economia Politica da Fronteira Recente," paper presented to an international seminar on Amazonia and the Environment at the University of Campinas, Sao Paulo, in October 1989.

demographic growth described in the previous chapter. Pavement of the Cuiaba-Porto Velho highway had, in fact, been initiated by the Army in 1976, but was later abandoned due to a lack of funds. Nevertheless, thousands of poor and adventurous migrants streamed into the region, particularly Rondonia, seeking access to cheap fertile land and productive employment.

3.05 The fact that the Government's most significant effort to promote small-farmer colonization during the 1970's had been undertaken precisely in Rondonia helped to fuel the expectations of the resident and migrant populations alike as to the future activities of federal agencies in the region. Independently of the relative success of such endeavors, increasing public intervention during the decade brought growing direct and indirect resource transfers to the Northwest. While on a visit to Porto Velho in May 1979, the recently inaugurated President, General Joao Figueiredo, promised to reconstruct and pave the BR-364 highway. Various interests of an economic and political nature outside the region merged with the understandable enthusiasm of the local population to support the road improvement project which was soon identified as a national priority by the federal government.

2. Extra-local Economic and Political Factors

3.06 In addition to growing local needs and aspirations, the gestation and formulation of what was later to become POLONOROESTE appears to have resulted from the convergence of several extra-local factors, not the least of which was the Bank's own decision to become involved in the program which will be reviewed in the following sections. Within Brazil, several extra-regional influences contributed to the emergence of the program. First, the development strategy of the newly-installed Figueiredo administration placed considerable emphasis on the expansion of agricultural production and, due to the increasing balance of payments problems briefly described in Chapter II, on the expansion of agricultural exports in particular. The in-coming federal government viewed the northwestern frontier as a potentially important source of future agricultural output both for external markets and domestic consumption. In this connection, pavement of the BR-364 highway was seen as a necessary precondition for effective exploitation of the region's agricultural possibilities.

3.07 Geopolitical considerations, meanwhile, provide the underlying framework within which the on-going development of Amazonia was conceived by the military government.² As indicated in Annex I, strategic occupation of the region had been intensely pursued by the previous Medici (1969-74) and Geisel (1974-79) administrations through a variety of measures including large-scale roadbuilding, small-farmer colonization, the promotion of agro-ranching and agro-mineral "growth poles" and the concession of fiscal, credit and other incentives to large business enterprises, even though the results of these interventions were often considerably less impressive than initially anticipated. The sparse settlement of Brazil's extensive border areas with its neighbors immediately to the north and west, in particular, constituted an enduring preoccupation.

² See, for example, the discussion on the Medici administration's policy for Amazonia in Thomas E. Skidmore, The Politics of Military Rule in Brazil, 1964-85, Oxford University Press, New York, 1988, pp. 144-49.

3.08 On the domestic front, in turn, massive migratory streams provoked by agricultural modernization cum land speculation in older areas of settlement in south-central Brazil, also briefly described in Annex I, were an increasing source of concern among federal policy makers during the 1970's. Urban growth was occurring rapidly, particularly on the peripheries of the largest cities, and the potential dangers of huge "poverty belts" around the main metropolitan areas and other state capitals were a growing preoccupation from the standpoint of political stability.³ Federal government attempts to implement internal migration and national urbanization policies in order to curb such problems, however, had either failed or were just getting underway and were later to prove largely unsuccessful.⁴ As in earlier decades, continuing occupation of the land frontier appeared to provide an outlet for some of these pressures.

3.09 Within the new Figueiredo Government, the appointment of several key Ministers who had been prominent in the earlier growth-oriented Medici period served to revitalize the strategy of developing large public works as a shortcut to transforming the country into a major power. Having fallen out of the limelight during the Geisel administration, these officials were once again in a position to pursue an economic growth strategy that gave a privileged role to large-scale construction activities. Another factor strongly affecting the future of the Northwest during the 1980's was the appointment of the dynamic former Mayor of Manaus as Governor of Rondonia. This nomination both reinforced the civil engineering approach to development and formed an integral part of the military's longer-term redemocratization strategy initiated under President Geisel and accelerated under President Figueiredo.⁵

³ On the politics of urban poverty in Brazil and in less developed countries more generally, see, Janice E. Perlman, The Myth of Marginality: Favelas and Politics in Rio de Janeiro, University of California Press, Berkeley and Los Angeles, 1977, and Joan M. Nelson, Access to Power: Politics and the Urban Poor in Developing Nations, Princeton University Press, Princeton, 1979.

⁴ The Ministry of the Interior attempted to define a national internal migration policy during the mid-1970's, but little came out of this in terms of concrete interventions. A national urbanization policy was delineated at roughly the same time (see, for example, Jorge G. Francisconi and Maria A. de Souza, Política Nacional de Desenvolvimento Urbano - Estudos e Proposicoes Alternativas, IPEA, Estudos de Planejamento No. 15, Brasilia, 1976) which emphasized "containing" the growth of the largest metropolitan areas and supporting that of secondary cities. This policy was explicitly reflected in the second and third National Development Plans (II and III PNDs) for the 1975-79 and 1980-85 periods, respectively, as well as in the establishment of a national intermediate cities program in 1976, which was subsequently supported by the Bank through the Medium-Sized Cities Project (Loan 1720-BR, approved in June 1979). See OED Report No. 8302, dated December 29, 1989, for further details.

⁵ For discussions of this process, see Skidmore, op. cit., Chapters VI and VII, and Alfred Stepan (ed.), Democratizing Brazil: Problems of Transition and Consolidation, Oxford University Press, New York, 1989, particularly Parts I and II.

3.10 In short, the interest of the Figueiredo administration in the Northwest region centered on reconstruction and pavement of the Cuiaba-Porto Velho highway. This was largely a response to the convergence of the interests of a rapidly growing local population, which felt largely cut off from the rest of the country, and strong economic forces outside the region, reinforced by a persisting geopolitical concern with the occupation and integration of the Amazonian frontier. Faced with a deteriorating macroeconomic situation, however, the new government lacked the financial resources necessary to rapidly implement such a large-scale undertaking and attend other priorities. This is what appears to have motivated its decision to seek external assistance for the project.

C. Early Bank Involvement

3.11 The first discussions between the Brazilian Government and the Bank in relation to development of the Northwest took place shortly after President Figueiredo promised to build an all-weather road from Porto Velho to the Center-South. In meetings held in late May 1979 with the new Minister of Transport and the in-coming President of the national transport planning agency, GEIPOT, Bank officials were presented with a request to finance two major highway projects. Of these, reconstruction and pavement of the Cuiaba-Porto Velho road was identified as the main priority.

3.12 Early meetings in June and July 1979, however, revealed diverging views between the Bank and Brazilian authorities as to the main focus of any future joint effort in the Northwest. Throughout these discussions, pavement of the BR-364 remained the focal point of the Government's interest, while the Bank replied that paving highways per se was inconsistent with its broader development and poverty alleviation mandate. The Government counterargued that, in order to get a sluggish economy moving again, it had decided to place heavy emphasis on reactivation of the primary sector, including continued expansion of the agricultural frontier, which, in turn, required more efficient road transportation. It was also argued that, by considerably shortening the journey between Porto Velho and Cuiaba, especially during the long rainy season, pavement of the road would contribute to a savings in gasoline and diesel fuel consumption and, thus, in increasingly expensive petroleum imports, thereby having a direct and favorable balance of payments impact.

3.13 Out of these initial discussions, a more encompassing project concept eventually evolved. Having analyzed earlier colonization experiences in Amazonia,⁶ furthermore, one Bank study concluded that small-farmer settlement was a feasible alternative in selected sub-areas and that, through careful planning, the errors that had plagued past directed settlement schemes could be avoided. Convinced that the Amazonia in general and Rondonia in particular possessed considerable long-term growth potential, but also concerned about the chaotic nature of the latter's settlement process to date, some Bank analysts

⁶ Particularly the Bank-supported Alto Turi Land Settlement Project in Maranhao (Loan 0853-BR, approved in July 1972) and INCRA's Ouro Preto project in Rondonia. See "A Comparative Study of the Administration of Two Amazon Colonization Projects: Alto Turi and Ouro Preto," mimeo, October 15, 1979.

concluded that future development prospects in the area were bright, as the following statement drawn from a research report clearly suggests:

In...the Territory of Rondonia, land settlement was proceeding spontaneously and at a rapid pace in a manner that the government had not expected and was not prepared to cope with....The situation was confused; there were serious land conflicts and hardships experienced by landless migrants created a serious problem. Gradually these problems are being resolved. By the end of 1978...a promising beginning had been made in creating a stable lower middle class community of small landowning farmers....Although no miracle solution...can be found in the Amazon, genuinely attractive opportunities for small-scale settlement exist and can be successfully realized if the lessons of past experience are incorporated into new projects. ⁷

3.14 Later in the same document, specific ways in which future Amazonian colonization projects could avoid past errors were suggested, including inter alia the observations that: (i) such schemes have the greatest chances for success when they are located on fertile soils and migrants are spontaneous rather than recruited; (ii) economically productive farming systems, as opposed to slash-and-burn agriculture, should be fomented; (iii) projects should be laid out carefully so as to minimize the need for infrastructure; (iv) some areas of good soil should be kept as biological reserves; (v) land-titling procedures should be effective and prompt; and, (vi) project organization should be coordinated by a single agency, while trained administrative and technical staff should be paid adequate salaries. ⁸ In short, key Bank staff were generally familiar with the earlier Amazonian colonization experience and were optimistic about its longer-run social and economic feasibility in Rondonia.

3.15 As noted above, however, when the Government first approached the Bank to obtain funding for pavement of the BR-364 highway, it was informed that the latter's policy for the Brazilian transport sector was to support road maintenance and rehabilitation rather than new construction. The subsequent decision to relax this constraint can be taken as further evidence of converging interests by different parties, including the Bank, in the undertaking. The Bank's decision to remove this objection appears to have turned precisely upon placement of the highway project in the context of a broader regional development program. ⁹ In all likelihood, one of the factors leading to this

⁷ Skillings, Robert and Tcheyan, Nils, Economic Development Prospects of the Amazon Region of Brazil, School of Advanced International Studies (SAIS), Johns Hopkins University, Washington, D.C., mimeo, 1979, pp. 72-73.

⁸ Ibid., pp. 80-83.

⁹ A meeting at the level of the Senior Vice President for Operations in July 1980, as reported in an internal memorandum dated August 7, 1980, at first confirmed the initial position that the Bank should not finance the proposed

convergence of interests was the Bank's desire to step up lending to Brazil at a time when the country was facing increasing balance of payments problems and when the continued flow of Bank resources was considered essential to maintain the confidence of other international lenders in the latter's medium and long-run development prospects.¹⁰

3.16 Ultimately, various local and extraregional interests, together with the desire for Rondonia's political emancipation, the interest of Bank staff in supporting agricultural colonization and regional development in the Northwest¹¹ and the Bank's institutional motivation to increase its lending to an important borrower at a time of growing economic difficulties, appear to have coalesced to produce POLONOROESTE. In retrospect, the attempt to weld subareas in Mato Grosso and Rondonia having diversified settlement histories, social structures and problems into a single regional development program appears somewhat incongruous. This becomes more comprehensible, however, when viewed in light of the fact that the Government's primary interest was to improve the road that was expected to better unite these subareas, while the Bank sought to transform a single sector investment project into an "integrated" regional development program despite the possible risks involved. These differing priorities on the part of the Borrower and the Bank also help to explain the imbalances in the program's subsequent implementation performance illustrated later in this report.

project "because highway construction did not conform to the Bank's major lending objectives in Brazil, namely institution building, poverty alleviation and easing of foreign exchange constraints." However, after representatives of the Brazil Division argued that improvement of the highway was part of an "integrated plan for development which was to include rural settlement and feeder roads components and that Bank participation gave it a greater role in the design and implementation of measures to be taken to ensure environmental and Indian protection," it was decided that the highway construction project could be supported, but only if it were "part of an acceptable regional development program whose outstanding issues (agriculture, environment, Indians, etc.) were properly appraised." (Emphasis OED)

¹⁰ Very similar considerations appear to have underlaid the Brazilian Government's request, at roughly the same time, for Bank financing of, and the latter's subsequent decision to support, the massive Carajas Iron Ore Project in eastern Amazonia (Loan 2193-BR, approved August 1982).

¹¹ As will be further discussed below and detailed in Annex III, the comparatively high concentration of low-income "small" farmers in Amazonian terms (i.e. possessing less than 200 ha) in Rondonia and parts of northwestern Mato Grosso also provided a concrete opportunity for the Bank to extend the poverty-oriented integrated rural development approach already being applied elsewhere in Brazil to the western Amazonian frontier.

D. Proposed Regional Development Strategy

1. Toward an "Integrated" Multi-sectoral Approach

3.17 Early Bank missions correctly reasoned that, in the absence of adequate measures in terms of land use, colonization, agricultural production and technology, rural extension, commercialization, agro-industrial processing, warehousing and the social and ecological aspects of regional development, pavement of the BR-364 road would only exacerbate the problems that had already emerged in the Northwest, and particularly in Rondonia, as a result of the largely uncontrolled flow of migrants to the area during the 1970's.¹² Consequently, the Bank proposed that improvement of the Cuiaba-Porto Velho highway be placed in the context of a broader multi-sector development program for northwestern Mato Grosso and Rondonia. According to one early Bank mission report, the Brazilian Government "appears to have accepted the idea of an integrated approach" to regional development based on pavement of BR-364, the construction of feeder roads and the provision of land titling, agricultural support and other services to farmers located in the area of influence of the road.¹³

3.18 The initial project brief for the "Northwest Development Project" stated even more emphatically that "the Government accepted the integrated approach suggested by the Bank and it was decided to distinguish three specific components: (i) the reconstruction and paving of the Cuiaba-Porto Velho highway; (ii) the implementation of an integrated rural development program to assist in the agricultural/rural development of the region; and, (iii) the construction and provision of a feeder road network to connect agricultural development areas to the main trunk highway."¹⁴ The first two components were to be supported by direct Bank loans for the program and the third through an existing Bank-assisted feeder roads operation through the National Economic Development Bank

¹² World Bank, Project Brief for the Brazil Northwest Development Project I, Cuiaba-Porto Velho Highway, October 12, 1979, pg. 3 (emphasis OED).

¹³ Report on a "Reconnaissance Mission" for the Mato Grosso and Rondonia Rural Development Projects, dated July 24, 1979 (emphasis OED). This report also affirmed that "the Government is preparing a preliminary plan for the integrated development of the Northwest region....The designs for the improvement and construction of the new BR-364 appear to be well advanced and it is likely that this aspect of the program would be ready for appraisal before the others. It is recommended that Bank participation in the construction and improvement of the new BR-364 be conditioned on assurances from the Government that the feeder roads and agricultural development programs would be ready for implementation within a reasonably short period of time."

¹⁴ Project brief, op. cit., emphasis OED.

(BNDE). The rural development component, in turn, would be defined largely on the basis of evolving Bank/FAO experience elsewhere in Brazil.^{15 16}

3.19 Differences of opinion, however, soon arose within the Bank between "developmentalists" and "environmentalists." This would be the first Bank-supported undertaking to actively promote frontier occupation in an Amazonian setting and some Bank staff members were wary about funding a major highway construction project in a largely unknown, but ecologically sensitive, area. While the former group saw this as a unique opportunity to generate a rural settlement model for tropical frontier areas, the latter emphasized the potential dangers associated of the proposed project in terms of ecological preservation and Amerindian welfare. The possibility of introducing sustainable agricultural production in much of the region, given its distance from Brazil's principal ports and domestic consumer markets and prevailing soil conditions, was also questioned. Staff environmental officers, in particular, argued in favor of pursuing innovative forest resource management measures and warned of the ecological problems and adverse impacts on tribal populations that were likely to occur due to the accelerated occupation likely to be provoked by pavement of the BR-364 road.¹⁷

3.20 The limited preoccupation of the federal government with ecological questions in the late 1970's, especially when compared with the intensity of its interest in the roadbuilding project and the seriousness of the socio-economic problems faced by the population already in Rondonia, provided the Bank's at that time very small and over-extended environmental staff with few and

¹⁵ The integrated rural development (ie. small-farmer oriented, multi-sector, area development) approach was already being followed in a number of Bank-supported projects in Brazil, primarily in the Northeast. Prior to the preparation of POLONOROESTE, such operations (and their Board approval years) included the aforementioned Alto Turi Land Settlement Project (1972) and the Lower Sao Francisco Polders Project (1975), together with integrated rural development projects in Rio Grande do Norte (1975), Minas Gerais and Ceara (1977), Paraiba and Bahia (1978), Sergipe and Pernambuco, as well as the Second Lower Sao Francisco Irrigation Project (1979).

¹⁶ For a general assessment of the Bank's experience in this area, see OED, Rural Development: World Bank Experience, 1965-86, Washington, 1988. On that in Northeast Brazil more specifically, see Judith Tendler, et. al. New Lessons from Old Projects: The Dynamics of Rural Development in Northeast Brazil, OED, draft, January 1991.

¹⁷ These observations were elaborated most thoroughly in a background document for the "environmental issues and policy" chapter of the report later published by the Bank as Brazil: Integrated Development of the Northwest Frontier, op. cit. This background report was dated March 3, 1980 and entitled "Brazil: Northwest Region Economic Review - Environmental Aspects." It covered such topics as forest potential, land use criteria, energy relations and human ecology. Among other conclusions, the report recommended that specialized environmental and Amerindian consultants participate in all future Bank missions concerned with program preparation.

comparatively uninfluential official interlocutors in Brazil.¹⁸ As a result, environmental concerns, in practice, became a secondary consideration in program preparation as highway engineers and agricultural specialists assumed the principal role in shaping the new operation both in Brazil and the Bank. In response to persisting concerns within the Bank that pavement of the BR-364 highway could provoke major environmental degradation and result in other serious problems, a frequent response was that the Government would proceed with its highway development plans with or without the Bank's involvement and that the latter should, therefore, use its leverage by participating in the effort to promote Amerindian and ecological protection in the context of a larger regional development program.

2. Program Preparation and the Northwest Region Survey

3.21 Other than basic information and engineering plans for the rerouting and pavement of the BR-364 highway, few studies were available at the time of the initial discussions between the Brazilian Government and the Bank regarding development of the Northwest. To prepare the detailed studies required for Bank appraisal of the proposed interventions, a "Northwest Working Group," composed of representatives of the Ministries of Interior, Planning, Transport and Agriculture and coordinated by the regional development agency for the Center-West, SUDECO, was formally established on August 13, 1979. The proposed investment program elaborated by this group was first reviewed by a multi-disciplinary "regional survey" mission sent by the Bank to the Northwest in October-November 1979.¹⁹ The results of this survey were published some two years later under the title Brazil: Integrated Development of the Northwest Frontier, although an unpublished version of the report was distributed internally within the Bank in December 1980.²⁰

3.22 This study represented a noteworthy response by the Bank to its own admitted relative unfamiliarity with Amazonia and the Northwest in particular. As mentioned in the previous chapter, the mission report subscribed to the view that a substantial portion of the Northwest, unlike most other parts of Amazonia, possessed climatic conditions and soils that were suitable for

¹⁸ The government agencies primarily concerned with environmental and Amerindian protection were the relatively weak Special Secretariat for the Environment (SEMA) and FUNAI, respectively, both of which were linked to the Ministry of the Interior. The similarly weak Brazilian Institute of Forestry Development (IBDF), attached to the Ministry of Agriculture, in turn, was responsible for the management of forest resources.

¹⁹ This mission, which was led by a Bank economist from the Brazil Division who had published extensively on Amazonian development, was composed of Bank and FAO staff agronomists, a Bank ecologist and Bank agricultural and transport economists, together with specialized consultants in the areas of agronomy, tree crops, agricultural settlement and regional planning.

²⁰ Report No. 3042a-BR, "The Integrated Development of Brazil's Northwest Frontier," dated December 23, 1980.

agriculture.²¹ It, nevertheless, acknowledged that the extent and types of soils present in the region were not fully known, particularly in those areas that were not yet occupied, but that detailed land use capability surveys were being undertaken and would be utilized to determine the appropriateness of these areas for proposed future settlement projects. The question of soil quality in Rondonia, however, persisted as a major source of disagreement among Bank agricultural and environmental staff and consultants throughout the period when POLONOROESTE was under preparation.²² For this reason, moreover, only areas with good soils were included under the Phase I agricultural consolidation component of the program.

3.23 The survey report likewise confirmed that INCRA had been unable to accommodate the increasing flow of migrants entering Rondonia during the 1970's and that a sense of insecurity and isolation pervaded much of the area. It further noted that the settlers who had not been absorbed in official settlement schemes probably constituted the majority of all migrants to the area and, in many cases, had simply established themselves as squatters on the fringes of official colonization areas or found temporary employment on the farms of those already settled or in the rapidly growing towns in the region. It also pointed out that difficulties of physical access to markets were resulting in high crop losses among local farmers. In the Mato Grosso portion of the region, in turn, even though there were no federal colonization projects and INCRA's role had been essentially limited to land tenure regularization, the mission reported that good potential existed for small-farmer development in older settlement areas north of Caceres. However, as in Rondonia, inadequate infrastructure and support services presented a serious constraint on future development possibilities.

²¹ This position, however, was, by no means universal. The draft report prepared by the Bank staff ecologist who participated in the survey mission, for example, affirms (pg. 2), in reference to the Northwest, that: "[clearcutting of the forest] should be avoided...because subsequent agricultural activities are probably not sustainable on the poorer soils which constitute much of the available part of the region. After approximately three harvests, practically all non-tree forest replacement crops on all but the most fertile sites will fail without continual use of inputs which...may not prove to be financially justified under prevailing accounting procedures." Elsewhere (pg. 22), the same report observes that "most of the soils of the area to be settled are so exceptionally infertile that annual crops will fail as soon as the ash from the burnt forest is gone." On the other hand, the report notes (pg. 23) that "most of the... region is suited to a wide array of tree crops."

²² The project files refer to opposing opinions by two consultant tropical soil experts as to the possibilities of introducing sustainable agricultural production and of obtaining significant increases in crop yields through the introduction of fertilizers in the area given its ecological characteristics and location. The files also suggest that the soil studies referred to in the regional survey mission report were proceeding more slowly than originally expected, leading one Bank agricultural advisor to conclude in July 1981 that "the investigation of lands is presently inadequate to justify the program."

3.24 The regional survey mission similarly identified many of the major ecological risks and other challenges likely to be encountered in attempting simultaneously to improve regional transport infrastructure and rationalize agricultural settlement in the area. Particular concern was expressed as to the probable impact of induced economic development on the natural environment and Amerindian communities. Aware that the humid 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," the mission's report explicitly endorsed the ecologists' preference for tree crops and forestry development rather than annual crops. The report also affirmed that this view was "by and large shared by government authorities" as demonstrated by the recent initiation of programs to promote coffee, cocoa and rubber production in various parts of the region.

3.25 With respect to tribal populations, in turn, the report indicated that, even though the size of these communities was "not reliably known," there were estimated to be as many as 8,000 Amerindians in the area. The report noted, however, that "the recent swell of migration to the region has intensified pressures on Indian lands and increased the transmission of diseases...to which the indigenous population has little or no immunity." It was further observed that, even though Indian rights were protected "in principle" under the Brazilian Constitution, due to insufficient staff and financial resources, FUNAI had been unable to prevent the invasion of Amerindian lands or to provide adequate medical care when epidemics erupted. Finally, the report anticipated that, with continued development, contacts between settlers and Indians would inevitably increase, requiring FUNAI and the Brazilian Government more generally to greatly improve their capacity to ameliorate the potentially devastating effects of such contacts. Given the sensitivity of the specific issues raised in the formulation of POLONOROESTE'S Amerindian component, as well as its pivotal role in the definition of the Bank's own guidelines for the protection of tribal peoples, the origins of these measures will be examined in somewhat further detail.

E. Origins of the Amerindian Special Project

1. The Situation Prior to POLONOROESTE

3.26 The indigenous population in the area of influence of the BR-364 highway is presently estimated at approximately 10,000, the largest groups being the Pacaas Novos (1,260) and Uru-eu-wau-wau (700) in Rondonia and the Nambikwara (1,110) and Pareci (720) in Mato Grosso. This figure includes all of the people living as Amerindians on Indian reservations plus other groups considered by the Brazilian Government as indigenous populations. This total, however, does not include Indian groups in southern and eastern Mato Grosso who are considered to be outside the area of influence of the Cuiaba-Porto Velho road. Nor does it include assimilated Indians who live intermingled with the general population and no longer speak tribal languages or practice tribal customs.

3.27 The Amerindians of the Northwest are organized at a tribal level with no political institutions above the village. Thus, while two nearby populations may be culturally and linguistically similar, they often regard themselves as separate peoples and common languages and customs do not

necessarily imply unity or the ability to cooperate. Traditionally, the Indians of the Northwest subsisted by slash-and-burn agriculture, growing manioc, corn, beans and other crops. The main protein sources derived from hunting, fishing and gathering and some groups became involved in rubber tapping as a source of cash income. Many communities have adopted rice and other non-native crops that were introduced over time as the result of contact with Brazilian rural society. A few groups harvest coffee, mostly from trees planted by non-Indians prior to the legalization of reserve boundaries. More recently, some Amerindians have turned to the sale of handicrafts and occasional agricultural wage labor.

3.28 Many of the tribal communities in the vicinity of the BR-364 highway have been contacted only within the last decade or two and some have still not entered into permanent contact with Brazilian national society. Consequently, a majority of the Indians of northern Mato Grosso, Rondonia and Acre speak little or no Portuguese, possess neither literacy nor numeracy and have little or no familiarity with Brazilian institutions. Prior to contact with rural settlers, Amerindian populations in the Northwest typically lived in autonomous villages structured by kinship and ceremonial organizations. Leadership was not strong, being usually vested in a headman who had the confidence of the principal kinship group or political faction in the village.²³

3.29 The largest communities, located generally along major streams, probably contained no more than 500 people. More typically, tribal populations lived in large thatched communal houses or malocas with up to 100 persons in a village. Their economy, with its dependence on extensive agriculture, hunting and gathering, made them highly itinerant. Villages were also often in a state of belligerency with neighboring communities, a fact that contributed to frequent moves. As Brazilian settlers and rubber tappers pushed into their territory, many Indian groups retreated into more isolated areas. Even now, there are confirmed reports of uncontacted Indians in parts of the POLONOROESTE region.

3.30 Prior to POLONOROESTE, the Northwest Amerindians were biologically at risk to diseases introduced through contact with Brazilian society, particularly influenza, the common cold, measles, syphilis, gonorrhea, tuberculosis and resistant strains of malaria. During the 1970's, Indians in the area were exposed to a much higher rate of disease as the result of increasing rural settlement. Indian communities practiced medicine using herbs and other forms of therapy. However, traditional practices were of limited effectiveness in dealing with introduced diseases.

3.31 The influx of outsiders during the 1970's also disrupted Amerindian subsistence systems. Areas formerly hunted and fished by Indians were progressively taken over by farmers, loggers and prospectors. Roadbuilding, forest clearing and other activities frightened away game, while placer mining

²³ For a recent description of the social organization of the major tribal populations affected by POLONOROESTE, see David Price, Before the Bulldozer: The Nambiquara Indians and the World Bank, Seven Locks Press, Cabin John, Maryland, 1989. For an earlier classic study of the Nambikwara, see Claude Levi-Strauss, Tristes Tropiques, Atheneum, New York, 1967, pp. 235-310.

(garimpagem) polluted streams once abundant with fish. In some cases, settlers invaded fertile lands previously farmed by Amerindians. Acting together, these disruptions to tribal subsistence systems had a negative impact on diet and the synergistic effect of nutritional deficits with introduced diseases led to increasing levels of morbidity and mortality.

3.32 The combination of disease, nutritional deficits and general social stress also resulted in a precipitous decline in fertility. This is a common occurrence among tribal peoples in South America although the precise biological pathway is not well understood. At some point during the 1960's, in any event, the birth rate among many Amerindian populations in the Northwest dropped to near zero, even though they have rebounded more recently, largely in response to interventions made in connection with POLONOROESTE, such that, at present, the crude birth rate among many regional tribal populations ranges between 4% and 6% a year. This figure is considerably higher than that for the Brazilian population more generally.

3.33 These conditions are not unusual in the history of frontier expansion in Brazil. A similar situation has also characterized the process of frontier occupation in the area of influence of the Carajas Iron Ore Project in eastern Amazonia.²⁴ What may be unusual in the present case, however, is the rhythm of events. The speed of migration and the somewhat greater technological capacity of many of the migrants to the Northwest made their presence more devastating than previous migration to the Amazon. Regional Amerindian groups, in turn, had little in their individual or collective backgrounds on which they could rely in confronting the rapidly expanding agricultural frontier. As a result, tribal social, economic and medical traditions were not well adapted to the increasingly close interactions with Brazilian rural society and its institutions.

2. The Bank's Response

3.34 When the Bank first began to consider financing pavement of the BR-364 highway, the massive migratory flows to the Northwest had already begun. Migrants pushed out of the southern states of Parana and Rio Grande do Sul by the expansion of mechanized agriculture came to the Northwest, and Rondonia in particular, attracted by the promise of plentiful land and good soils. Later, prospectors also began to flock to certain subareas in the region in search of gold and cassiterite. During the 1970's, furthermore, vast sections of Rondonia were surveyed and laid out by INCRA for in-coming agricultural colonists, while squatters, in many instances, occupied adjoining areas. As a result, pressures on tribal lands rapidly increased, occasionally leading to violent conflicts and the encroachment of areas such as the Sete de Setembro reserve in Rondonia.

3.35 Recognizing the urgency of this situation, the Bank insisted that Amerindian protection be an explicit component of the POLONOROESTE Program. As noted above, the Bank's regional survey mission clearly identified the adverse effect that the proposed highway improvement and associated expansion of rural

²⁴ See OED, Environmental Aspects and Consequences of the Carajas Iron Ore Project, mimeo, September 1990, especially Chapters V and VII.

development activities was likely to have on Amerindian communities as one of the key issues to be resolved in connection with POLONOROESTE.²⁵ Despite initial resistance by the Brazilian Government,²⁶ consultant anthropologists were subsequently hired by the Bank to assess FUNAI's proposals to protect regional Amerindian populations and identify the needs of specific tribal populations including the Nambikwara.²⁷

3.36 The Nambikwara were expected to be particularly affected by improvement of the BR-364 highway since this involved rerouting the former dirt road through the center of the Guapore valley in northwestern Mato Grosso which was the area traditionally occupied by this group. Bank project files reveal that the proposed "variant" of the BR-364 road in close proximity to Nambikwara areas generated both considerable concern among and reaction from Indian rights groups inside and outside Brazil²⁸ and led to heated internal discussions within the Bank.²⁹ Many of these discussions revolved around the question of

²⁵ Prophetically, however, the report of this mission also observed that "even the most imaginative program for protecting Amerindian interests in the Northwest will be doomed to failure, if it is not given strong support by the highest levels of government. Such support could be manifested in many ways including the promotion of administrative reforms for FUNAI and the provision of adequate and timely [Special Project] funding. Most of all, however, strong political support would mean a firm commitment to enforcing the provisions of the Indian Statute, even in the face of economic pressures to the contrary." World Bank, Brazil: Integrated Development..., op. cit., para. 4.51.

²⁶ One early (March 1980) mission report observed that the Government "has refused Bank collaboration on issues pertaining to the Amerindian population of the area." Mention is also made in the project files of an April 1980 telex from the (then) International Affairs Secretariat (SUBIN) of the Planning Ministry which "seems to want to restrict Bank hiring of consultants concerning the protection of Amerindian interests in connection with the Cuiaba-Porto Velho highway project."

²⁷ See Price, op. cit., for details.

²⁸ One letter, dated July 10, 1980, addressed to Bank President McNamara from a group of pro-Indian organizations in Brazil, for instance, characterized the proposed rerouting of the highway as "amounting to an intentional and systematic act of genocide for which the Bank and the Brazilian Government should be held responsible." In response to this and similar letters, the Bank replied that it had requested information from the Brazilian Government about measures taken to protect the Indians and that this information would be "considered very carefully in determining whether the Bank will help finance the highway project." Copies of this letter, were sent to Ministries of Transport, Interior and Planning, as well as to the President of FUNAI.

²⁹ The report of a special Bank mission to examine Amerindian questions in the Northwest, dated July 7, 1980, registered, among other conclusions, that "FUNAI is too weak an organization for the Bank to work with productively" and that "a deep division exists between the anthropologists and the administrative

FUNAI's effective capacity to provide adequate protection and support to the affected tribal communities.³⁰

3.37 In response to these and related concerns, the Bank later required the Brazilian Government to take specific measures in relation to Amerindian protection as preconditions for negotiation of the first three loans for POLONOROESTE. Among these was that the Bank be satisfied that adequate progress was being made with respect to the demarcation of key Amerindian areas in the region, that an additional mobile health unit be established to attend tribal populations and that the eviction of illegal squatters in the Sete de Setembro reserve be substantially completed prior to loan negotiation.³¹ However, these conditions appear to have been only partially met prior to negotiations which took place in late September 1981.³²

3.38 During negotiations, furthermore, even though the Government agreed to formally recognize the need to provide special support to tribal populations in the Northwest, according to one Bank account of these discussions, it "strongly objected" to the inclusion of detailed covenants on the protection of Amerindian populations in the corresponding Loan Agreements due to the "political sensitivity" surrounding the issue.³³ As a result, the wording of

staff at FUNAI over the presently proposed route [with the former believing] unanimously that such a route would mean the end of the Nambikwara."

³⁰ An issues paper prepared in June 1980 specifically addressed this question, observing that "the monitoring of measures for protection of Indian rights raises a particular problem. The past deficiencies of FUNAI are a matter of acute concern for certain segments of public opinion in Brazil. It is evident that in the best of circumstances FUNAI may not be able to completely avoid infringement on Indian rights and may fall behind on some aspects of its agreed work program. There is thus a risk that public opinion groups distrustful of FUNAI could perceive such shortcomings as a dilution of earlier commitments and may question the Bank's effectiveness in monitoring FUNAI's program."

³¹ These conditions were first specified in an internal memorandum dated June 18, 1981 that accompanied distribution of the yellow cover Staff Appraisal Report for the Agricultural Development and Environmental Protection Project.

³² A July 30, 1981 memo providing an "update" on the progress made by the Government in meeting these conditions indicates that FUNAI had been given a special advance of 50 million cruzeiros to start its activities under POLONOROESTE and that eviction of squatters from Sete de Setembro had been initiated in mid-July, but that demarcation of the reserve areas would be delayed at least until October and that, rather than establishing a new mobile health unit in Vilhena, FUNAI had proposed to strengthen existing units in Cuiaba and Porto Velho.

³³ Internal memorandum dated October 7, 1981 summarizing the minutes of Bank negotiations with the Brazilian Government on the first three loans for the program. This memorandum also observes that "the Brazilian delegation strongly objected to the paragraph requiring them to employ experts with suitable

the Loan Agreement for the Northwest Agricultural Development and Environmental Protection Project, which also covered the other Bank loans in support of POLONOROESTE, was changed and more specific provisions were indicated in a "supplemental letter" by the Borrower.³⁴ In addition, since the Government considered it inappropriate for the Bank to directly finance the program's tribal protection component, the two parties had previously agreed that the Amerindian Special Project would be funded exclusively with domestic resources.

3.39 Finally, it should be observed that, at the time POLONOROESTE was initially appraised (January-February 1981) and approved (December 1981), the Bank did not yet possess a formal policy with respect to the protection of indigenous populations. A policy statement entitled "Tribal Peoples in Bank-Financed Projects," in fact, was not included in the Bank's Operational Manual until February 1982.³⁵ The background work for this Operational Manual Statement (OMS) was carried out by consultant anthropologists in parallel to the Bank's assessment of POLONOROESTE's Amerindian Special Project and was a concrete response to the Bank's lack of explicit guidelines in this area at the time it had to negotiate the initial loans for the program. Among other determinations, the resulting OMS requires that, whenever tribal populations are affected by Bank-supported operations, project design "should include measures or components necessary to safeguard their interests and, wherever feasible, to enhance their well-being."³⁶

qualifications to assist them in evaluations, [claiming] that these experts are usually at odds with the groups that they are supposed to be assisting and that, therefore, the conditions should specify that FUNAI ought to be strengthened and that experts could help in that strengthening process."

³⁴ Pursuant to these negotiations, Section 4.05 of the Loan Agreement for the Agricultural Development and Environmental Protection Project (Loan 2060-BR), signed by the Brazilian Government on December 15, 1981, was thus worded as follows: "The Borrower and the Bank agree that the strengthening of the measures to protect the indigenous Amerindian population in the Program Area is essential to the successful carrying out of the Project. To this end, the Borrower shall take all necessary measures to put into effect promptly the Special Project for protecting the interests of the Amerindians and the Amerindian communities located in the Program Area."

³⁵ OMS No. 2.34. This statement drew on a background report which was published in May 1982 under the title Tribal Peoples and Economic Development: Human Ecologic Considerations. An unpublished version of this document, however, was circulated internally within the Bank in July 1981.

³⁶ OMS No. 2.34, para. 4. For purposes of this statement, tribal peoples are defined (para. 2) as "ethnic groups typically with stable, low-energy, sustained-yield economic systems, as exemplified by hunter-gatherers, shifting or semipermanent farmers, herders or fishermen." One of the first, if not the first, concrete applications of this policy was in connection with another large operation in Brazil, the Carajás Iron Ore Project (see OED, Environmental Aspects..., op. cit.).

F. The POLONOROESTE Program

1. Objectives and Basic Intervention Strategy

3.40 The Bank, with the assistance of the United Nations Food and Agricultural Organization (FAO), fielded more than thirty identification, preparation, pre-appraisal and appraisal missions between mid-1979 and late 1981 when the first loans for POLONOROESTE were approved. The program's primary objective was to promote the orderly human occupation and development of the Northwest region through government support of productive activities and the expansion of economic and social infrastructure. According to the Government decree (Exposicao de Motivos) which officially established the program on May 27, 1981, POLONOROESTE's principal interventions were to consist of six interrelated activities: (i) reconstruction and pavement of the BR-364; (ii) construction and consolidation of the secondary and feeder roads network; (iii) implantation and consolidation of agricultural settlement projects; (iv) execution of land tenure regularization services; (v) support of agricultural, forestry and agro-industrial activities and the provision of social services and infrastructure to small rural communities; and, (vi) environmental protection and the support of indigenous communities.

3.41 POLONOROESTE's anticipated investment budget for 1981-85 totalled approximately US\$ 1.1 billion. More than half of this amount, however, was to be allocated to the transport sector, principally for improvement of the Cuiaba-Porto Velho highway. Program funding was expected to come from the regular budgets of the executing agencies, allocations from PIN and domestic and foreign -- including one or more World Bank -- loans. At the time of the program's inception, it was affirmed that, even though preparation of its components was still incomplete, POLONOROESTE's integrated nature, 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 represented a vast improvement over previous roadbuilding programs in Amazonia in which such elements had generally been absent.

3.42 The Bank's appraisal report for the Phase I Northwest Agricultural Development and Environmental Protection Project (Loan 2060-BR) provides an overview of the objectives, strategy and major components of the program which this and subsequent Bank loans were intended to support. Since this provides the general context for the individual Bank-supported operations described in Annex III and sets out the basic rationale for public intervention in the region, the SAR's description of the program merits reproducing in some detail. The following paragraphs will highlight those aspects and assumptions underlying POLONOROESTE which, in retrospect, have proven to have been of relevance for understanding the subsequent extent and nature of program environmental impacts.

3.43 According to the aforementioned SAR, POLONOROESTE originated with the general objectives of paving the Cuiaba-Porto Velho road and "concomitantly providing for the investments necessary to achieve the harmonious socio-economic development of the region influenced by that road and the protection of the physical environment and Amerindian population of the region." It was observed that, having originally been built in the 1960's, the BR-364 highway provided the first overland access to most of the region, but was "now in very

poor condition." Sections of the road were closed for periods of several weeks at a time during the rainy season and, even when passable, entailed high transportation costs.³⁷

3.44 In light of this situation, the basic economic justification for improving the road and the major risks involved in doing so were summarized as follows:

Paving of the BR-364 highway will increase the economic contribution of the underutilized physical resources of [the Northwest] region to the national economy, reducing substantially transport costs and thus improving the region's terms of trade with the more developed and populated areas lying to the south. The improving of BR-364 would, however, make its area of influence more accessible to potential immigrants and increase the pressure on the local physical and social environment. Hence, policies and corresponding implementation structures are being set up to help avoid a disorderly development of the region which could irreversibly place in jeopardy those same resources that paving of the BR-364 highway would aim at developing. There is little doubt that, whether BR-364 is paved or not, continuing immigration would, without adequate administration, result in long-term damage to the environment and society through occupation of poorer soils with ill-adapted agricultural practices, loss of valuable timber, encroachment onto Amerindian and natural reserves, agglomeration of land in the hands of relatively few, and a possible agglomeration of migrants in urban areas ill-equipped to receive them.³⁸

3.45 To avoid these dangers, "the program strategy of seeking reasonable social and environmental balances in the Northwest region as the BR-364 highway is paved combines measures of dissuasion to keep immigrants away from areas not yet sufficiently studied (or those proven to be inadequate) with measures to attract rural settlers to areas of proven agricultural or forestry potential and to introduce appropriate cultivation techniques."³⁹ The resulting program would be implemented in three overlapping stages, each requiring about five years to be completed. The first and most extensive phase would include: (i) the paving of BR-364; (ii) the strengthening of malaria control and establishment of a network of rural health posts and urban health referral centers in Rondonia, together with health related research; and (iii) agricultural development in Rondonia and region-wide environmental protection.

³⁷ Report No. 3512b-BR, para. 2.01 (emphasis OED).

³⁸ Ibid., para. 2.02 (emphasis OED).

³⁹ Ibid., para. 2.03 (emphasis OED).

3.46 Rural development activities would be extended to the Mato Grosso portion of the region during a second phase to provide assistance to an estimated 17,500 families, while the third phase would "aim at gradually developing new planned settlement schemes in unoccupied areas...identified as having adequate potential, both in Rondonia and Mato Grosso, and which clearly fit into the long-term land use development plans being generated under the POLONOROESTE Program." It was observed, however, that even though the new settlement phase of the program was expected to "help place some 30,000 families on 3 million ha in Rondonia and Mato Grosso during the next five to six years, accessibility of suitable lands, execution capacity constraints and delays or complications in the development of appropriate production recommendations where cultivable soils of relatively lower quality are to be used, may well limit the number of farmers and the total new area settled or may also extend the execution period for these new settlements." ⁴⁰

3.47 In addition to these components, the SAR affirmed that an "important program to reinforce protection of and support for the Amerindian population in the region to be executed with POLONOROESTE funding has been initiated and would be implemented in parallel to all three program phases." Furthermore, selective feeder roads to existing and planned settlements in both Rondonia and Mato Grosso would be financed in connection with the program either through the Northwest Highway Project (Loan 2062-BR) or existing and future feeder road credit lines of the National Economic Development Bank (now BNDES), also partly funded by the Bank.

2. Program Costs and Financing

3.48 POLONOROESTE's total cost, as estimated at the time the first three Bank projects were appraised and including physical and price contingencies, was expected to be on the order of US\$ 1.55 billion, excluding an anticipated US\$ 100 million in agricultural credit to be provided through existing channels. Table 2 reproduces the expected costs and cost shares for the major components of the program as presented in the SAR for the Agricultural Development and Environmental Protection Project. Financing was expected to come from executing agency budgets (43%), PIN and PROTERRA (23%) and the Bank (34%) and to be channeled to the various implementing agencies following approval by the Planning Ministry (SEPLAN).

3. Institutional Aspects ⁴¹

3.49 Administration and coordination of the program was situated within the legal and organizational framework of the Brazilian Government's special regional development programs and, thus, came under the direct responsibility

⁴⁰ Ibid., para. 2.04 (emphasis OED). It was also noted that "since most of the larger blocks of quite uniformly better quality soils are occupied by existing settlements, efforts are planned under the first phase project to increase the settler absorption capacity in these areas and to better protect areas of poorer soils and reserves."

⁴¹ This section is based on Report 3512b-BR, op. cit., pp. 30-36.

of the Ministry of the Interior, but the Secretariat of Planning (SEPLAN) retained a major role in the definition of financing levels of all special programs including POLONOROESTE. The federal and state agencies responsible for individual program components are indicated in Annex III. The basic division of labor in program execution, however, can be summarized as follows.

Table 2

Estimated Northwest Program Costs
(January 1981 US\$)

<u>Component</u>	<u>(million US\$)</u>	<u>% of Total</u>
A. <u>Transport</u>		
Cuiaba-Porto Velho Highway	448.6	41.6
Strengthening of Rondonia Roads Dept.	30.7	2.8
Feeder Roads	91.3	8.5
B. <u>Settlement of New Areas</u>	261.5	24.2
C. <u>Land Tenure Services</u>	8.6	0.8
D. <u>Rural Development</u>		
Rondonia	104.0	9.6
Mato Grosso	56.8	5.3
E. <u>Environmental Components</u>		
Forestry and Reserves	8.9	0.8
Ecological Research	7.0	0.6
F. <u>Rondonia Health Project</u>	24.7	2.3
G. <u>Protection of Amerindian Communities</u>	26.6	2.5
H. <u>Administration</u>	<u>10.1</u>	<u>1.0</u>
TOTAL BASELINE COST	1,078.8	100.0
Physical Contingencies	136.4	
Price Contingencies	<u>332.8</u>	
TOTAL	1,548.0	

Source: Report No. 3512b-BR, Table 1.

3.50 Within the Ministry of the Interior, responsibility for POLONOROESTE was entrusted to SUDECO.⁴² An Interministerial Coordination Group (Planning, Finance, Interior, Transport, Agriculture and Industry and Commerce) was established to facilitate articulation among the various federal agencies involved and to help resolve implementation problems. SUDECO set up a General Coordination Unit (GCU) for the program which was divided into two sections, one to establish liaison with federal and state agencies responsible for execution of specific components and the other to carry out planning, monitoring and on-going evaluation of program progress and impacts. While monitoring was largely carried out by the monitoring section of GCU/SUDECO and program executing agencies, evaluation was contracted out to the Economic Research Institute Foundation (FIPE) of the University of Sao Paulo.

3.51 The National Highway Department (DNER) was the executing agency for improvement of the BR-364 road, primarily through its Directorate of Works. The Rondonia Secretariat of Public Works and Services, through the Rondonia Highway Department (DER-RO), in turn, would be responsible for execution of the institutional strengthening subproject under the Northwest Highway Project (Loan 2062-BR). BNDE (now BNDES) would be the apex executing agency for the feeder roads subproject, whose physical implementation would be carried out by the road departments in Rondonia (DER-RO) and Mato Grosso (DERMAT) respectively.

3.52 Under the Health Project (Loan 2061-BR), malaria control would be managed by the Rondonia regional directorate of the federal Superintendency for Public Health Campaigns (SUCAM) with assistance from SUCAM's national headquarters in Brasilia. Implementation of new health care facilities in Rondonia would be the responsibility of the (then) Territorial (and later state) Secretariat of Health (STS), with specific construction work to be contracted by CODARON (see the next paragraph), and subsequent operation and maintenance to be undertaken by municipal governments with state technical support and supervision. Finally, the health research and evaluation subproject would be administered by the National Scientific Research Council (CNPq) and carried out by local research institutions.

3.53 The Government of Rondonia was to have overall responsibility for execution of the Settlement Consolidation subproject of the Agricultural Development and Environmental Protection Project (Loan 2060-BR). Federal funds for territorial (subsequently state) secretariats and agencies were to be channelled through the Planning Secretariat, SEPLAN/RO, which would coordinate the participation of local agencies. Implementation of this subproject was largely entrusted to the newly-established Agricultural Development Company of Rondonia, CODARON, whose creation was closely associated with POLONOROESTE.

⁴² SUDECO was one of four regional development superintendencies directly subordinated to the Ministry of the Interior. The other three such agencies were for the Northeast (SUDENE), Amazonia (SUDAM) and South (SUDESUL). Since the northern part of Mato Grosso and Rondonia were included in "Legal Amazonia," they came under the jurisdiction of both SUDECO and, for fiscal incentive purposes, SUDAM.

3.54 Actual physical execution and coordination of rural development activities, however, was to be carried out by regional units to be set up in each of the six municipalities to be benefitted under the subproject. CODARON-appointed managers of the thirty-nine project NUARs (rural support nuclei) would respond directly to these regional units. The regional CODARON units and NUAR managers were to provide on-site technical supervision of contractors, organize community labor and coordinate the local activities of INCRA, as well as of territorial (later state) extension, warehousing and other agencies dealing with agricultural production and marketing at the farm level. The principal implementing agencies for the New Settlements Project (Loan 2353-BR), in turn, would be INCRA, the National Rubber Superintendency (SUDHEVEA), the Brazilian Forestry Development Institute (IBDF) and specific sectoral agencies of the (by then) state of Rondonia

3.55 Under the Environmental Protection subproject of the Phase I Agricultural Development and Environmental Projection Project (Loan 2060-BR), IBDF was given responsibility for the establishment, protection and operation of the National Park of Pacaas Novos and the Biological Reserves of Guapore and Jaru on the basis of procedures established for other parks and reserves in Brazil. Given the fact that the Pacaas Novos Park was located in a area where still uncontacted Uru-eu-wau-wau Amerindian tribe resided, IBDF was expected to maintain permanent liaison with FUNAI throughout project execution. INCRA would also be involved in order to ensure coordination of the establishment of national forests with that of future settlement sites. Two existing ecological stations administered by the Special Secretariat for the Environment (SEMA) of the Ministry of the Interior were to be improved, while two additional such facilities would be established. CNPq, in turn, would contract various ecological research projects based on the evaluation of specific proposals submitted by interested institutions.

3.56 In Mato Grosso, since the areas to be regularized under the first phase project (Loan 2060-BR) fell within 100 km on either side of a federal highway (ie. BR-364) and/or within 150 km of a national boundary, INCRA was the only institution legally authorized to establish or confirm ownership rights and issue land titles. With respect to proposed new colonization areas in Rondonia, soil surveys for the initial settlements in INCRA's future program were contracted to EMBRAPA's soils survey section for the Machadinho area near Ariquemes and to the Technological Center Foundation of Minas Gerais (CETEC) for the Urupa area near Ouro Preto and Ji-Parana.

3.57 Under the Mato Grosso Rural Development Project (Loan 2116-BR), even though most components were to be carried out by existing state agencies (including the rural extension service, EMATER-MT, the state development company, CODEMAT, and the Secretariats of Health and Education), overall coordination and management would be the responsibility of a specially created Project Management Unit (PMU) in the state Cabinet of Planning and Coordination (GPC). State level policy decisions would be made by the existing Economic and Social Development Council (CDES), chaired by the Governor and including all of the state Secretaries. The coordinator of the PMU would report directly to the state Secretary of Planning who was also head of the GPC.

3.58 As concerns the Amerindian Special Project, finally, as indicated above, the Brazilian Government committed itself to strengthen its capacity to protect the indigenous populations in the Northwest. In this connection, FUNAI's operations in the region were to be reinforced by upgrading its local administrative infrastructure, establishing and equipping new Amerindian posts and expanding and training field staff. As further described in Annex III, the agency's operations under the Special Project were to involve a variety of activities in the region, ranging from the patrolling of reserves and eviction of squatters to the direct provision of health care to indigenous populations.

4. Expected Benefits and Risks ⁴³

(a) Benefits

3.59 The economic rate of return for the directly productive components of the Rondonia Settlement Consolidation subproject was estimated at about 22%, while that of the Mato Grosso Rural Development Project was estimated at 24%, and that of the New Settlements operation at 26%. In addition, most of the off-farm investments and services to be provided under these three projects were expected to generate significant benefits over and above the incremental output of the 18,200 participants to receive direct and intensive assistance in connection with the Rondonia Settlement Consolidation Project or the 10,000 such participants in the Mato Grosso Rural Development Project and the 15,000 anticipated direct beneficiaries of the New Settlements Project. Rural extension, crop drying, marketing, input supply and other services were expected, in practice, to become available to a larger clientele within each operation's respective area of influence.

3.60 Program feeder roads were likewise expected to have a substantial beneficial impact on all who lived in the different project areas by increasing access to services, facilitating the outflow of production and, it was assumed, improving the likelihood that more productive farming techniques would be adopted. It was similarly anticipated that improvements in health, education and rural water supply under POLONOROESTE would make these services more widely available to the regional population. The Northwest Health Project (Loan 2061-BR) was specifically justified because it was expected to satisfy the basic health needs of a large and growing population by reducing mortality and morbidity and providing essential rural health care. The value of incremental labor days saved due to improved malaria control alone was estimated to reach US\$ 1.3 million by the end of 1986 and to gradually increase thereafter.

3.61 As concerns the Northwest Highway Project (Loan 2062-BR), the Bank's appraisal considered its benefits to be indistinguishable from those of the larger regional development program which were expected to accrue to the road's entire area of influence and indirectly to the Brazilian economy as a whole. Thus, the benefits of the program's major component were not isolated. However, it was believed that feeder roads, other physical infrastructure and overall institutional strengthening would benefit most of the 75,000 families expected

⁴³ This section is based on the staff appraisal reports for each of the five projects supported by the Bank.

to live in the areas covered by the Settlement Consolidation subproject (Loan 2060-BR) by 1985, while its education component would directly attend some 67,000 primary school students.

3.62 Similarly, over the long run it was anticipated that the New Settlements Project (Loan 2353-BR) would indirectly benefit an additional number of families at least equivalent to that directly contemplated under the operation. It was further envisioned that the development of perennial crops in Rondonia would generate seasonal employment for large quantities of semi-skilled agricultural labor. New work opportunities would also be provided at the farm level for women and children, thereby improving family income. In the Mato Grosso project (Loan 2116-BR), by contrast, the indirect employment effects were not expected to be as large given the area's more settled characteristics, but, as in the other agricultural subprojects, the economic activity generated by incremental agricultural production was expected to create numerous jobs in the intermediation, packaging and processing industries.

3.63 With respect to the program's anticipated environmental benefits, preparation of the three agricultural projects (ie. Loans 2060-BR, 2116-BR and 2353-BR) reportedly gave particular attention to the improvement of settlement planning techniques with the objective of reducing the risks of soil erosion and retaining areas with low agricultural potential under forest cover. It was hoped that the promotion of tree crops and farmer training in continuous annual cropping with fallow periods would avoid environmentally damaging shifting cultivation. Commercial timber removal from agricultural areas, furthermore, was to be maximized and techniques for the rational and sustained use of legal reserve areas found to possess forestry potential were to be developed. Ecological research and monitoring, coupled with the establishment of natural reserves, were expected to enhance environmental knowledge and values. Finally, the parallel Amerindian Special Project was expected to reach most of the 4,600 tribal people living in official reserves in the program region.

(b) Risks

3.64 Bank staff were well aware that the highway project and the three agricultural projects were situated in an environmentally sensitive tropical frontier area. Extreme climatic conditions, fragile soils and lack of knowledge about the region's ecology presented well-documented risks. However, the main challenges identified by those appraising the program in this connection were to establish and maintain fairly intensive agricultural production and to consolidate existing small-farm operations, while preventing ecological damage and loss of long-run productive potential and avoiding possible climate alteration.

3.65 The principal direct risk associated with agricultural settlement, as perceived at the time, was the potential ecological damage that could result from deforestation on poor soils. In order to avoid spontaneous settlement in unsuitable areas, excessive exploitation of farm and fish resources, the clearing of steep slopes or river banks and improper management of forest reserves, a number of measures were to be incorporated into the program. The Phase III agricultural project (Rondonia New Settlements) was intended to add a range of precautionary measures, described in greater detail in Annex III,

such as improved selection of settlement areas, promotion of a wider variety of perennial crops, smaller individual plots, block reserves, salvage logging operations and the strengthening of environmental protection measures. Despite these improvements, the risk of negative environmental impacts was judged to be significant.

3.66 At the institutional level, the fact that the projects involved a large number of federal, state (or territorial) and local institutions, many of which were strained in terms of human and financial resources, was also seen as a major risk. Delays in the transfer of program funds, loose coordination, inappropriate allocation of personnel, inadequate monitoring and evaluation procedures and poor staff training were all seen as factors which might jeopardize POLONOROESTE's performance, especially in view of the difficult frontier conditions in which the institutions would be operating.

3.67 The patchy nature of existing knowledge about soil characteristics and quality in the Northwest, together with the lack of information as to how rapidly migrant farmers would (or could) adopt technologies appropriate to Amazonian soils of moderate to marginal fertility created doubts as to the actual extent of production risks under the program. Although perennial cropping was unanimously recommended, conclusive evidence based on concrete experience as to which types of tree crops should be promoted was generally lacking. Furthermore, risks due to potential crop infirmities had to be considered, although the initial impression was that eventual disease outbreaks could be successfully controlled. Finally, due to the long maturation period of perennial crops, there was also a danger that some farmers would sell their plots before these crops began to produce. The possibility of credit and/or labor shortages further enhanced such risks. Lastly, world market prospects for perennial crops, particularly coffee and cocoa, had evolved unfavorably between the time when the Phase I and Phase III projects were appraised.

G. Conclusion

3.68 POLONOROESTE was a response to a concrete demand for roads and services from the fastest growing region in Brazil in the late 1970's. Because this demand coincided with a variety of geopolitical, economic and other interests at a given point in time, considerable momentum was generated within the Brazilian Government and pavement of the road between Cuiaba and Porto Velho was declared a national priority. The need for resources led the Government to approach the Bank in connection with this undertaking, but roadbuilding alone did not satisfy the Bank's broader mandate to help alleviate poverty and support institutional development among its borrowing member countries.

3.69 Nonetheless, key Bank officials were convinced that: (i) the Government intended to go ahead with road improvements with or without the Bank's support; and (ii) setting the road-building project within a broader regional development program would permit more rational settlement of a potentially rich agricultural area, while reducing environmental damage. It would also permit improvement of the precarious living conditions faced by the migrant population already residing in the region. In subsequent discussions, accordingly, it was agreed that pavement of the BR-364 would be but one, although clearly the most important from a financial standpoint, component of

a multi-sectoral area development effort organized around a major transport improvement.

3.70 Substantial additional research, field visits, project preparation, institutional reorganization and negotiations between the Brazilian Government and the Bank took place before POLONOROESTE was officially created by the former in May 1981 and the first loans in its support were approved by the Bank some six months later. The program's primary declared objective was to promote the orderly human occupation and development of the Northwest through government support of productive activities and the expansion or improvement of its economic and social infrastructure. Complex institutional arrangements involving a multitude of federal, state and local agencies were established to implement this venture under the overall coordination of a relatively weak federal regional development superintendency, SUDECO.

3.71 The expected benefits for small-scale farmers already settled in the region, as well as for recent, but still unsettled, and expected future migrants, in terms of increased productivity, better access to markets, rural credit, employment, health, education and other community services were projected to be significant. Specific and innovative environmental and Amerindian protection and public health components, in turn, were designed in anticipation of the potentially significant impacts of the increased migration and rural settlement expected to be induced by pavement of the BR-364 highway and expansion of official colonization activities in the region. At the time the first Bank-assisted projects for the Northwest were appraised, however, the foreseeable risks associated with the acceleration of development in the region were felt to be controllable.

3.72 POLONOROESTE, as designed, was, nevertheless, a complex, multi-faceted program involving a large number of institutions, risks and uncertainties. As will be discussed in the balance of this report, despite the Bank's general awareness of the risks involved in undertaking the program, the precarious situation of many of its executing and coordinating agencies and the limited knowledge of the region's ecological characteristics and carrying capacity in terms of sustainable agricultural development, in retrospect, the importance of these factors was clearly underestimated. The full complexity and dynamics of the frontier settlement process were also insufficiently understood, while the Government's willingness and ability to manage this process were overestimated by the Bank.

3.73 What is important to emphasize at this juncture, however, is the fact that, despite its focus on a specific geographic area and its multi-sectoral and multi-institutional nature, POLONOROESTE was not a "regional development" program in the sense of being a truly comprehensive effort to promote and rationalize the productive occupation of and human settlement in the Northwest during the early 1980's. The area development components of the program (ie. Loans 2060, 2116 and 2353) dealt with only parts of the larger program region, more specifically six earlier colonization areas covering some 30,000 km² in Rondonia, a number of previously settled areas in nine municipalities involving some 61,500 km² in Mato Grosso and new settlement schemes in an expected 11,000 km² in Rondonia. Activities under the feeder roads component of the Highway Project (Loan 2062) in both Rondonia and Mato

Grosso and under the Health Project (Loan 2061) in Rondonia were for the most part targeted on the same areas. Collectively, therefore, the program's rural development components were expected to cover slightly over 100,000 km².

3.74 Two points are of relevance here. One is that integrated small-farmer rural development activities, including both the consolidation of existing settlements and the promotion of new ones, during the first three phases of POLONOROESTE were to be undertaken in roughly only one-fourth of the total area of the program region and only about one-sixth of the total area of Rondonia. Parts of the BR-364's larger region of influence, including some of the areas possessing better soils, were already occupied by larger farmers (Rondonia) or ranchers (Mato Grosso), while much of the Northwest was still inaccessible or suspected to have inadequate soils, as in the Rondonia section of the Guapore valley, or was officially placed or expected to be placed in Amerindian, biological or forest reserves. Small areas were also being exploited by corporate mining, especially cassiterite, interests in north central Rondonia near Ariquemes or by small gold prospectors as along the Madeira River in Rondonia and in various parts of northwestern Mato Grosso.

3.75 More important, however, is the fact that the areas which the program did intend to cover with some form of rural development activities were still very large. One hundred thousand square kilometers is not only considerably larger than the area occupied by many of the smaller states in Brazil, it is larger than that of many individual countries (such as El Salvador, Costa Rica and Panama in Central America) and is only slightly smaller than those of others (eg. Guatemala, Honduras and Nicaragua). Furthermore, it was considerably larger than the areas covered in most of the Bank's first generation of rural development projects in Northeast Brazil and elsewhere.

3.76 In addition to their comparatively greater size, the areas included under or directly affected by POLONOROESTE's road and rural development components were distinctly different from those involved in earlier Bank-supported rural development operations in northeastern and southeastern Brazil in several key respects. First of all, the Northwest was distinct both in terms of its predominantly humid tropical and savannah ecosystems and, as already suggested, because of the much poorer initial information base possessed by the Borrower and the Bank in relation to the longer-run agronomic potentials and restrictions of these ecosystems. Secondly, the areas where earlier Bank-assisted rural development projects in Brazil were situated were several thousand kilometers closer to major ports and domestic consumption centers, as well as being located in regions generally having larger, if less rapidly growing, initial populations and, hence, local markets.

3.77 A third difference between the Northwest and the areas where the Bank had previously promoted rural development in Brazil, with the exception of the very first such operation in western Maranhao (ie. the Alto Turi Land Settlement Project), was the dynamic frontier nature of the former, as compared with the much more settled, traditional small-farmer character of the latter. Despite the Bank's efforts to assess the on-going development process in the Northwest, as evidenced by the regional survey mission and the large number of project preparation missions undertaken by the Bank and/or the FAO, in retrospect it is clear that neither the full complexity, nor the evolving

dynamics of this process were well understood. As will be discussed below, this was due both to the changing nature of frontier settlement in the Northwest over the past decade and to the Bank's insufficient ex-ante comprehension of the factors underlying these changes. ⁴⁴

3.78 POLONOROESTE, furthermore, directly contemplated only certain groups in the regional population, particularly small farmers and their families, and probably as a result considered only certain economic actors in the on-going frontier occupation process. Non-small farmer occupants of rural areas, including rubber tappers and other traditional non-tribal populations, were essentially overlooked. Despite existing and growing small (gold) and larger-scale (cassiterite) mining and prospecting activities and an incipient commercial logging industry, the program contained little or nothing to promote or, more importantly, to rationalize the expansion of these activities. The same was true with respect to rapidly growing local industrial and service sector endeavors. While POLONOROESTE's "small-farmer orientation" is understandable given the Bank's prevailing rural poverty focus during the 1970's, what is more difficult to understand is the program's comparative lack of attention to non-Amerindian and, for the most part, non-recent migrant rural populations in the region, particularly rubber tappers and earlier subsistence settlers (caboclos) not situated in INCRA's colonization schemes.

3.79 Even more notable for its absence from the program as a whole was explicit consideration of and greater support for the region's rapidly growing towns and cities with the exception of selected NUAAs and satellite villages in existing and proposed new rural settlement areas. This occurred despite the fact that the region's population was already evenly divided between urban and rural areas in 1970, while growth rates of the cities at either end of the Cuiaba-Porto Velho highway, as well as of key towns situated at strategic locations in between (eg. Caceres, Vilhena, Ji-Parana and Ariquemes), were as elevated, if not more so, than those in the region's rural areas. These urban centers were characterized by serious and rapidly increasing deficits of infrastructure and services, as well as associated environmental sanitation and public health problems. Despite this situation and the multiple linkages between rural settlement and urbanization, regional towns and cities were largely ignored by the program.

3.80 In summary, POLONOROESTE involved major road improvements and small-farmer rural development projects with important rural health and environmental and Amerindian protection components. Despite its focus on a very large, heterogeneous, complex and dynamic frontier area, it was not a full regional

⁴⁴ The Bank's ex-ante awareness of development patterns, tendencies and constraints in the program region at the time the first loans for POLONOROESTE were appraised, nevertheless, was substantially superior to that in the case of the area of influence of the Carajás Iron Ore Project in eastern Amazonia, appraised in October-November 1981. The latter area had many features similar to those of the Northwest including a very large, ecologically heterogeneous and relatively unknown territory, a predominantly humid tropical forest environment and a complex and dynamic frontier development situation. See OED, Environmental Aspects..., op. cit., for details).

development program. Despite its stated objective of promoting the "orderly human occupation and development of the region," in fact, it attempted to deal with only part, albeit a critical part, of this process.

3.81 However, by focusing almost exclusively on small farmers and their role in the productive occupation and settlement of the Northwest, the program essentially overlooked the evolving contribution of other important actors (eg. larger farmers, ranchers, land speculators, loggers, rubber tappers, miners, prospectors and a wide variety of urban-based migrants) and occupational categories, including public officials and employees themselves, to this process and the nature of the interdependencies among these groups that would ultimately determine the real prospects for achieving an "orderly human occupation and development of the region." In hindsight, the origins of many of the problems encountered during program implementation, together with many of its less desirable consequences, can be traced to the insufficient understanding on the part of POLONOROESTE's designers, including the Bank, of the socio-economic and political-institutional complexities of the frontier development process which they were hoping to rationalize.

IV. PROGRAM IMPLEMENTATION AND RESULTS

A. Introduction

4.01 A full assessment of POLONOROESTE is not yet possible since one of the completion reports (PCRs) for the five interconnected Bank operations in the Northwest is still not available.¹ Accordingly, definitive statistical information on project achievements cannot be presented for some components. Furthermore, as indicated in the earlier FIPE evaluation, it has always been difficult to obtain reliable data on the performance and effectiveness of the program's non-highway infrastructure components.² Nevertheless, the information contained in internal Bank reports, FIPE and FAO evaluation documents, the mid-term review, the four available PCRs, academic studies and other sources makes it possible to provide a generally coherent assessment of program execution and overall results to date.

B. General Program Implementation Experience

4.02 As described in some detail in the previous chapter and Annex III, POLONOROESTE was implemented through five separate, but interrelated, projects, three of which were approved simultaneously in late 1981. Table 3 summarizes the principal benchmarks of program implementation by indicating the Board approval, effectiveness, projected completion and actual closing dates of the six Bank loans for POLONOROESTE. In addition to these key dates, a mid-term review of program execution through March 1984 was carried out by the evaluation team at FIPE/USP and the Bank in mid and late 1984 respectively. Subsequent to this review, for reasons which will be explored more fully below, Bank disbursements on all POLONOROESTE loans were suspended between March and August 1985.

4.03 As the projected completion and actual closing dates suggest, considerable delays occurred in project execution, especially for the Phase I Agricultural Development and Environmental Protection Project (Loans 2060 and 2060-1-BR). Execution delays also occurred for the other Phase I and II loans, with the Health (Loan 2061) and Highway (Loan 2062) operations closing in June and September 1988 and the Mato Grosso Rural Development Project (Loan 2116) in December 1988 respectively. As will be further illustrated below, shortages in local counterpart funding, chronic institutional weaknesses and differing implementation requirements for and levels of political commitment to different program components were the main factors responsible for these delays. In addition to inadequate support for several program components at the federal or state levels, the counterpart funding and institutional problems experienced by

¹ Specifically, the New Settlements Project (Ln. 2353-BR), which is expected to close at the end of March 1992.

² FIPE, Avaliacao Conjuntural do POLONOROESTE, Vol. 1, Sao Paulo, July 1987, pp. 41-42. As indicated in the previous chapter, FIPE (ie. the Economic Research Institute Foundation of the University of Sao Paulo) was hired by SUDECO to carry out the on-going evaluation of the program.

POLONOROESTE reflected the significant deterioration of Brazil's macroeconomic situation more generally during the early 1980's.

Table 3

POLONOROESTE - Implementation of Bank Loans

<u>Phase/Loan</u>	<u>Approval</u>	<u>Effectiveness</u>	<u>Projected Completion</u>	<u>Actual Closing</u>
<u>Phase I</u>				
Ln. 2060	Dec. 1981	April 1982	June 1986	March 1990
Ln. 2060-1	Dec. 1983	May 1984	June 1986	March 1990
Ln. 2061	Dec. 1981	April 1982	Dec. 1986	June 1988
Ln. 2062	Dec. 1981	April 1982	Dec. 1985	Sept. 1988
<u>Phase II</u>				
Ln. 2116	March 1982	August 1982	June 1986	Dec. 1988
<u>Phase III</u>				
Ln. 2353	Oct. 1983	Feb. 1984	June 1989	March 1992

Sources: Loan Agreements; IBRD, Statement of Loans, September 30, 1990

4.04 As a result of the second petroleum price shock and other factors adversely affecting the Brazilian economy in the late 1970's and early 1980's, GDP growth fell sharply, to an average of -1.3% a year between 1981 and 1983, as compared with a very impressive 9% per annum between 1966 and 1980. The falling growth rate which particularly hurt the industrial sector³ was accompanied by renewed balance of payments problems and a significant increase in the inflation rate which rose from on the order of 40% in 1977-78 to roughly 100% in 1980-82 and more than 200% in 1983. Even though GDP growth again picked up to over 7% per year in 1984-86, it continued to be accompanied by inflation rates exceeding 200% until 1986.⁴ These factors directly contributed to the Government's inability to provide adequate levels of domestic resources for POLONOROESTE and as to the Bank's related decision to increase the relative share of its financing for the program under a Special Action Program for Brazil, first in 1983 and again in 1986.

³ Output in the industrial sector in Brazil as a whole declined by an average of -3.9% a year between 1980 and 1982, while manufacturing employment in the Sao Paulo metropolitan area fell by roughly 25% between mid-1980 and the end of 1983.

⁴ For a more detailed discussion of the evolving economic situation in Brazil during the early and mid-1980's, see, World Bank, Brazil: Recent Economic Performance and Prospects, Report No. 4674-BR, dated August 22, 1983 and Brazil - A Macroeconomic Evaluation of the Cruzado Plan, World Bank Country Study, 1987.

4.05 The principal conclusion to be drawn from an initial overview of POLONOROESTE's implementation performance, however, is that, for a combination of economic, financial, institutional and political reasons, program execution was severely imbalanced. While roadbuilding and physical infrastructure construction more generally were carried out largely within or even ahead of established deadlines, implementation of other program components suffered considerable delays. In addition, the very efficiency of the execution of the transport components proved to be detrimental to the timely completion of other subprojects and, thus, to the attainment of the program's broader development and environmental protection objectives. The implementation experience and principal results of each major element of the program will be examined in the following sections. Particular attention will be given to the findings and recommendations of the mid-term review.

C. Transport Components

4.06 POLONOROESTE's road components (i.e. pavement of the BR-364 highway and the construction of feeder roads) were expected to be carried out between 1981 and 1985. Responsibility for road construction and maintenance in the Northwest, as elsewhere in Brazil, is divided by administrative jurisdiction. The National Highway Department (DNER), subordinated to the Ministry of Transport, is responsible for the federal highway network, while state roads in the region are administered by the Rondonia and Mato Grosso Highway Departments (DERs) and local roads are the responsibility of the respective municipal governments at least for maintenance purposes. The dividing lines between jurisdictions, however, are sometimes blurred in practice, thereby requiring agreements among the different parties involved.

4.07 From the outset of the Figueiredo government (March 1979), attempts were made to increase central control over DNER's expenditures. This agency, moreover, faced a difficult financial situation in 1980 and even stricter controls were introduced in 1981 to achieve greater consistency between its physical planning and financial programming.⁵ Despite these measures, the strategy of initiating highway construction before resources had been formally allocated in order to exert pressure on federal government budget decisions was commonplace. This approach was apparently followed in the case of BR-364, thus constituting one of the major pressures behind POLONOROESTE's roadbuilding component.

4.08 Given its comparatively straightforward technical characteristics, together with the strong interest of both government authorities and private contractors in its rapid implementation, the road component proved to be, by far, the most effective part of POLONOROESTE in terms of meeting initial execution objectives. In distinct contrast to most other program components, planned improvements to the Cuiaba-Porto Velho highway were completed ahead of schedule. Thus, by the time the Bank carried out its mid-term review of the program in late 1984, except for a 50 km detour around the Samuel dam near Porto Velho which was under construction at the time, the BR-364 road had already been totally rebuilt and paved.

⁵ IBRD, Report No. 3532b-BR, op. cit., pp. 4-5.

4.09 With the exception of the DER-RO institutional strengthening measures, all of the elements of the Phase I Highway Project were largely finished by December 31, 1984.⁶ As a result, by mid-1985 the Bank was able to declare paving of the BR-364 highway fully complete, as was the feeder road component in Rondonia, while close to 90% of the feeder road subproject for Mato Grosso had also been finished. The only sour notes in this connection were observations by the Bank's resident engineer that mistakes and misinformation had repeatedly appeared in the road cost and other accounting figures presented by the Government in relation to the project⁷ and the PCR's finding that road maintenance, including that of the BR-364 highway itself, has been inadequate.⁸

4.10 Despite suspicions of possible irregularities in the administration of the road component, the overall efficiency of its execution was clearly evident. Such efficiency causes little surprise since there was never any doubt about the capacity of Brazilian firms to implement a construction project on this scale or their interest in the undertaking. With respect to the latter, the SAR for the Highway Project reported that fifty-nine Brazilian firms, fifty-two of which were later qualified, submitted prequalifying documentation to DNER in response to its initial tendering announcement for the Caceres-Ariquemes segment of the highway, while 310 tenders were received from forty-five different firms by the May 1981 deadline for bidding on the actual contracts.⁹ With financial gains being tied to the ability to meet deadlines and implementation difficulties essentially limited to overcoming physical obstacles, as compared with the intricacies of meeting the often ill-defined social and production support needs of an ever-increasing population through other program components, it was largely a foregone conclusion that road construction would be finished on schedule,

⁶ As indicated in the respective PCR dated December 27, 1990, part of the Bank loan funds under this loan were redirected in mid-1985 to support the rehabilitation of federal roads and urban works damaged by severe flooding in Northeast Brazil. This non-POLONOROESTE component is not assessed here.

⁷ Correspondence from the IBRD resident engineer to officials at DNER on several occasions between 1983 and 1985.

⁸ According to this document (para. 5.07), a June 1990 project completion mission found that only 26% of the highway was in good condition, 41% was in average condition and 33% was in bad condition.

⁹ Report No. 3532b-BR, op. cit., para. 4.26. The Caceres-Ariquemes segment was divided into a total of seventeen lots for construction purposes and one additional lot was tendered for the installation of four bridges along the Cuiaba-Caceres section of the road. Contracts for individual road sections ranged in value from US\$ 15 to US\$ 35 million. According to discussions on this subject during the Bank Board meeting at which the first three loans for POLONOROESTE were approved, the strong interest in the road improvement contracts on the part of domestic construction firms reflected the very sluggish situation of the Brazilian economy at the time.

especially considering that physical works began several months before Bank resources were formally approved for the operation.¹⁰

4.11 On the less positive side, the very efficiency of the roadbuilding activities, together with the significant delays experienced by other program components, served to disrupt the coordinated evolution of POLONOROESTE as a whole. One of the main problems that INCRA and other agencies had previously encountered in their efforts to organize the settlement process prior to POLONOROESTE had been precisely the accelerated rate of migration to the region. As indicated in Chapter II above, the growing intensity of population displacement in the late 1970's, at a time when the condition of the road was clearly precarious, had led the Geisel administration to attempt to discourage migration to Rondonia in order to gain "breathing room" for colonization activities, although this policy was soon reversed by the Figueiredo government.

4.12 In synthesis, while completion of roadbuilding activities before substantial progress had been achieved on other program components may, indeed, have demonstrated the efficiency of the national construction industry, at the same time by facilitating physical access to and, through the feeder roads component, within the Northwest, together with government propaganda campaigns (discussed below) and the "push" factors associated with agricultural modernization and later the economic crisis in south-central Brazil, it also contributed to the increased flow of migrants to and their frequently uncontrolled settlement within the region, particularly Rondonia, during the early and mid-1980's.¹¹ As will be shown more fully below, this, in turn, helped to undermine the program's ability to achieve its broader objectives of promoting the "harmonious socio-economic development of the region" and protecting its physical environment and Amerindian population.

¹⁰ Even though Bank financing for the Highway and other Phase I POLONOROESTE projects was not approved until December 1981, construction work on all but some 47 kilometers of the new BR-364 had been tendered by the Brazilian Government in April 1981. DNER's contract award recommendations were reviewed by the Bank in mid-July and the corresponding contracts were signed in September 1981 with physical implementation expected to start the following month. As indicated in Table 10 above, however, the Bank loans for the first three POLONOROESTE projects did not become effective until late April 1982, some seven months after physical reconstruction of the road was initiated.

¹¹ Much of the increased migration flow into Rondonia, although physically facilitated by pavement of the BR-364 highway, was ultimately a response to the expectation of increased economic opportunities, especially greater access to land, other natural resources and associated direct and indirect employment, made possible by program transport improvements and other components in the region. Thus, while road investments per se did not "cause" much of the ensuing migration to the region (except to the extent that road construction brought workers to the area who might not otherwise have come), in their absence, the prospective income generating opportunities which did attract large numbers of migrants to the Northwest would have been considerably smaller.

D. Health Care and Malaria Control

4.13 As detailed in Annex III, POLONOROESTE's Phase I Health Project had three basic objectives: to strengthen malaria control, to establish a network of primary rural health care facilities in Rondonia and to support health research in the region. At the time the program was appraised, malaria had already been identified as the most serious health problem in the Northwest, especially Rondonia. The extensive forests in the region, together with its heavy rainfall, significant surface water accumulation, substantial humidity during much of the year and high temperatures, provided a favorable habitat for the malaria carrying anopheles mosquito. New rural settlements, such as the INCRA colonization projects, were particularly susceptible to malaria outbreaks since, as one study puts it, they were "optimal for transmission and difficult for control because of high vector density, high exposure to vectors, shelters inappropriate for residual spraying, logistic problems and deficient treatment and health care."¹² In addition to malaria, inadequate water supply, sewage disposal and drainage, together with makeshift living quarters for much of the rural population, caused gastro-intestinal and respiratory diseases to proliferate. Prior to the program, in contrast, primary health care was available for only a fraction of the population.

4.14 In view of this situation, the Health Project was designed to focus on basic rural health problems in Rondonia following the territorial government's official policy which emphasized the regionalization and decentralization of health services and recognizing the admittedly limited local absorptive capacity. These goals were to be attained by: (i) intensifying malaria control activities; (ii) strengthening and expanding primary and secondary health care facilities for the rural population living in the vicinity of the NUARs to be established under the Agricultural Development and Environmental Protection Project; (iii) strengthening health research and evaluation capability; and (iv) institution building.

4.15 By the time of the mid-term review in 1984, however, performance of the project's main components had been found to be "irregular" and progress was generally characterized as "slow."¹³ Malaria control and the training of health personnel, in particular, were experiencing "managerial and operational difficulties,"¹⁴ while construction and equipment targets were reportedly

¹² Donald and Diana Sawyer, Malaria on the Amazon Frontier: Economic and Social Aspects of Transmission and Control, Research Report, CEDEPLAR, Federal University of Minas Gerais, Belo Horizonte, March, 1987, pg. 9.

¹³ Internal memorandum entitled "Brazil - Northwest Region Development Program Mid-Term Review," February 25, 1985, para. 22.

¹⁴ The mid-term review report (*ibid.*, para. 23) observed, more specifically, that SUCAM had been slow to hire consultants to help develop alternative approaches to malaria control and had been inefficient in obtaining government import licenses and procuring anti-malaria drugs and DDT. SUCAM's regional directorate in Porto Velho (SUCAM-RO) was characterized as being "extremely weak," in part because of the agency's insufficient efforts to attract

behind schedule because of "administrative problems." Execution of the research component was allegedly less problematic, although here too some initial delays were experienced.

4.16 The Bank's PCR reveals that many of these problems continued to affect project performance despite its reformulation following the mid-term review.¹⁵ Its conclusion that project implementation was, for the most part, "satisfactory" notwithstanding, the PCR also observes that:

The malaria control program, which was designed according to SUCAM's traditional strategy of house spraying, case detection and treatment, proved to be a narrow approach because of the enormous size and complexity of the malaria problem in the region.¹⁶ The health service development component was well designed except for the fact that provision for maintenance of facilities and equipment was not included. Training and supervision activities, which were clearly spelled out in project design, were hindered by the weak institutional capability of the state of Rondonia and the State Health Secretariat (SES-RO), a factor which was identified as a risk during project preparation.... The roles and responsibilities of the...agencies in charge of project implementation were clearly defined and understood at the time of project appraisal and in the loan agreement. However, mechanisms to promote inter-agency coordination were lacking.¹⁷

capable managers to Rondonia.

¹⁵ Specific changes introduced as a result of the mid-term review included: (i) a reduction in the number of larger health posts from the thirty-nine originally proposed to twenty due primarily to the elimination of ten of the NUARs initially expected to be installed in connection with Phase I of the program; (ii) an increase in the number of referral health centers from three to four; and (iii) an increase in the number of smaller health posts from 50 to 80, together with the upgrading of eighteen existing health posts to health centers, in part through the introduction of some three to five beds for in-patient treatment.

¹⁶ In addition, SUCAM reportedly lacked the required flexibility to change its strategy when needed. According to the PCR (para. 5.03), "Bank supervision missions repeatedly recommended the introduction of sanitation works, ultra low volume spraying and the use of ecologically suited larvivorous fish to improve vector control, but SUCAM did so only at the end of the project."

¹⁷ OED Report No. 8469, dated March 19, 1990, Evaluation Summary, para. 2 (emphasis OED). The PCR (para. 5.05) affirms, more specifically, that, despite adequate financing, training and supervision were the "Achilles heel" of project implementation. It further observes (para. 8.01) that "the scarcity of health professionals (nurses and doctors), the very limited training and supervision

4.17 According to the PCR, the project nevertheless achieved its objective of improving access to basic health services for about one half of the unserved population in Rondonia and contributed to "ensuring greater productivity, income and social welfare of the population by reducing infant and maternal deaths, immunopreventable diseases and malaria incidence." ¹⁸ In support of this claim, the PCR indicates that infant mortality in the state fell from 128 per thousand in 1980 to 72 per thousand in 1988, while the number of malaria cases detected during the first quarter of 1989 (some 76,000) was fewer than during the same period in 1988 (89,000), a fact which is attributed to the "multiple intervention strategy adopted by SUCAM in the last two years of the program." ¹⁹ Despite this alleged improvement and the fact that SUCAM substantially increased its spraying and surveillance activities under the project, the PCR admits that "malaria has become an intractable problem." ²⁰

4.18 Empirical data on the evolution of the incidence of malaria in Rondonia over the past two decades lend considerable support to this latter affirmation, while at the same time casting doubt as to the effectiveness of the Health Project in combatting the disease. Even though the indicators for 1980 to 1982 suggest a slight improvement in the malaria situation in the state at the beginning of the decade, the figures for subsequent years reveal a significant increase in the overall incidence of the disease. Table 4 illustrates the evolution of reported malaria cases in Rondonia since 1970, separating out the period prior to and during which the Health Project was under implementation.

of auxiliaries, and the lack of maintenance of facilities and equipment pose a serious risk of a substantial waste of the investment made with Bank support through the Rondonia Health Project."

¹⁸ Ibid., para. 6.01.

¹⁹ Ibid., Part III, Table 8. Comparative data are also presented on the number of persons per health center (13,674 in 1988 as compared with 15,838 in 1980) and health post (3,590 in 1988 relative to 7,919 in 1980) before and after the project, while the percentage of the population under one year of age that had been vaccinated in 1988 (which ranged from 46% to 92% depending on the type of vaccine) is likewise indicated. With respect to malaria, more specifically, the PCR affirms that, even though incidence of the disease "soared during the period, the health system's capacity for detecting and treating cases improved significantly. In addition, the number of households sprayed with DDT increased from less than 50% of the targeted households to an average of 72% in 1988."

²⁰ Ibid., para. 6.02 (emphasis OED). The PCR notes, however, that "the malaria situation in Rondonia would have been worse without the project," illustrating this with reference to a six month suspension of DDT spraying in 1983 because of "transport difficulties" which reportedly resulted in a "70% increase in the annual parasite incidence from about 100 per 1,000 to 170 per 1,000 by the middle of 1984."

4.19 The incidence of malaria in Rondonia grew as a result both of the area's rapidly expanding population and rural settlement and the increasing proportion of its residents that contracted the disease. The principal factors contributing to the growing incidence of malaria in the state during the early and mid-1980's were identified by the mid-term review as:

- (i) the uncontrolled in-migration of people with no previous knowledge of, or immunity to, malaria;
- (ii) the increased density of the mosquito population in the state due to the growing number of breeding places in newly opened colonization areas;
- (iii) increased indoor exposure to the vector due to a lack of protection (such as DDT-sprayed walls, mosquito nets, etc.), together with increased outdoor exposure, especially in the course of agricultural and placer mining activities;
- (iv) an enhanced reservoir of malaria due to a high number of inadequately treated cases and growing parasite resistance to preventive treatment; and
- (v) managerial and operational problems in relation to malaria control activities.²¹

4.20 Whatever the exact causes, it is evident from the figures presented below that the absolute number of malaria cases in Rondonia increased dramatically during the 1980's. To put this in further perspective, it should be observed that Rondonia alone accounted for more than 45% of all reported malaria cases in Brazil in 1987 as compared with 27% of this total five years earlier. In addition, seven of the ten municipalities having the highest number of reported malaria cases in the country in 1986 were located in Rondonia with Ariquemes (44,200) and Porto Velho (37,100) topping the list.²² According to

²¹ Internal Memorandum dated February 25, 1983, op. cit., pg. 7 (emphasis OED). The PCR (op. cit., para. 6.02) presents a similar list of "unforeseen" causes: (i) the unexpected and dramatic population increase in Rondonia from close to 620,000 in 1982 to about 1.6 million in 1988; (ii) rapid expansion of human settlements around vast, difficult-to-control forest and agricultural areas; (iii) fast-growing numbers of garimpos (mining camps) in malarial areas which contributed to the spreading of the disease; (iv) increasing resistance of falciparum malaria to routine treatment; (v) enhanced reservoir of malaria resulting from the high mobility of infected persons and parasite resistance to treatment; and (vi) managerial and operational problems in malaria control activities.

²² World Bank, Staff Appraisal Report (No. 7535-BR), Amazon Basin Malaria Control Project, Washington, April 21, 1989, Annex 3. The other Rondonian municipalities among the top ten were: Costa Marques (21,300), Jaru (14,100), Ji-Parana (13,500), Rolim de Moura (12,300) and Presidente Medici (12,100). For additional information on this subject, see Agostino Cruz Marques, "Main Malaria

the SAR for the Amazon Basin Malaria Control Project (Loan 3072-BR, approved in May 1989), the number of reported malaria cases in Ariquemes, which has four INCRA colonization schemes including the Bank-supported Machadinho project, reached some 75,000 in 1987. Furthermore, due to the "backward flow of migrants," Ariquemes was found to be responsible for at least 1,200 cases of malaria "exported" to 204 municipalities in eighteen states including Parana, Sao Paulo, Bahia, Minas Gerais and Mato Grosso.²³

Table 4

Evolution of Malaria in Rondonia, 1970-81, 1982-88

<u>Year</u>	<u>Slides Examined</u>	<u>Positive Cases</u>	<u>% Positive</u>
1970	22,960	5,790	25.2
1971	26,862	5,650	21.0
1972	30,413	5,617	18.4
1973	34,540	7,323	21.2
1974	37,311	8,187	21.9
1975	54,981	16,705	30.3
1976	58,706	16,157	27.5
1977	83,729	23,488	28.0
1978	96,034	27,989	29.1
1979	130,756	45,356	34.6
1980	179,943	59,145	32.8
1981	203,298	59,595	29.3
1982	213,463	58,936	27.6
1983	245,545	80,703	32.8
1984	433,323	151,095	34.8
1985	502,350	168,302	33.5
1986	539,000	189,986	35.2
1987	621,401	228,866	36.8
1988	828,322	278,268	33.6

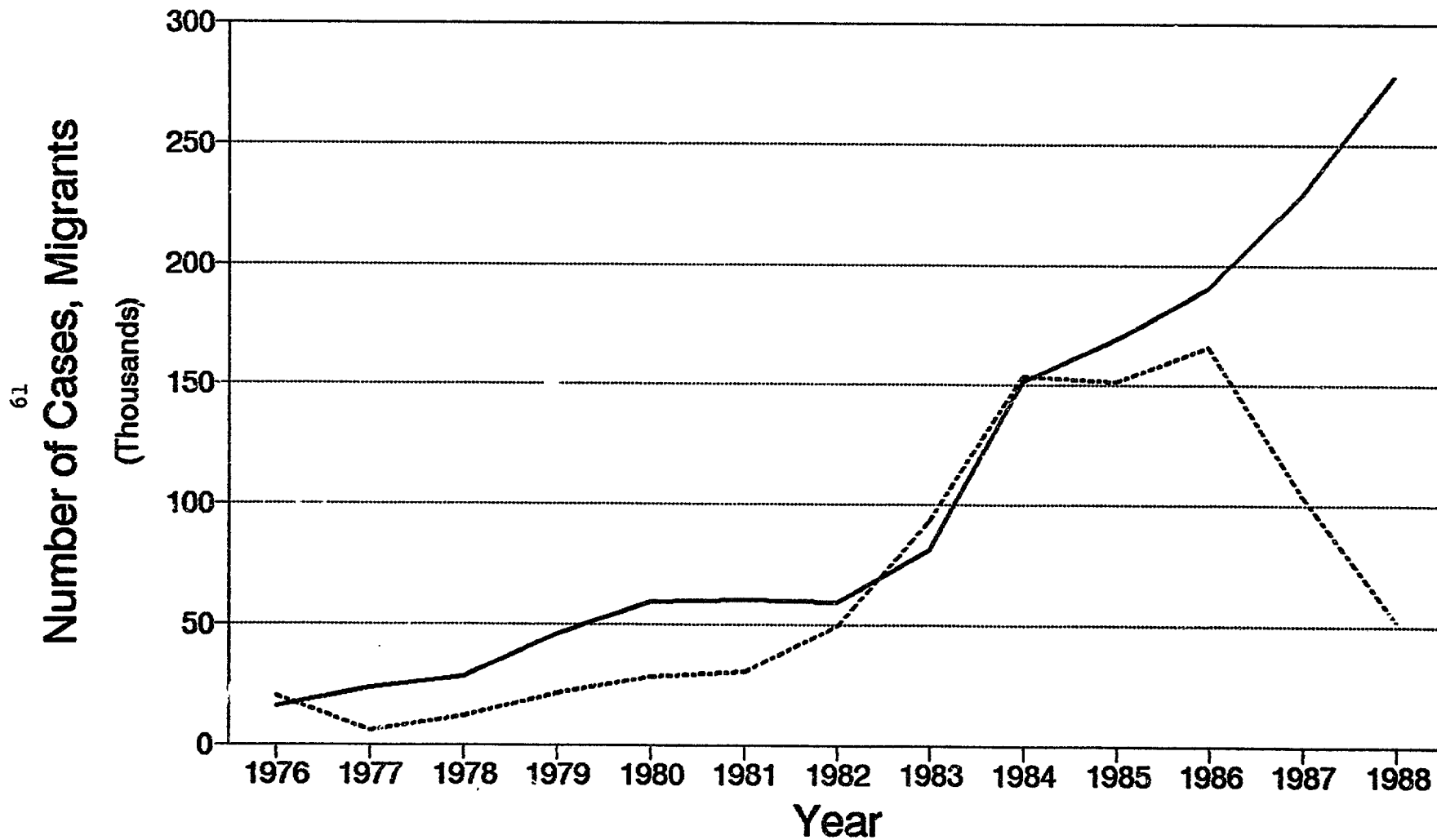
Source: SUCAM-PC

4.21 Empirical evidence suggests, additionally, that the pervasiveness of malaria has been a serious deterrent to sustainable agricultural settlement

Situation in the Brazilian Amazon Region," paper presented at a World Health Organization meeting on malaria control in Amazonia held in Brasilia in April 1988, and John F. Wilson, "Human Issues in Malaria Control: Population, Community Mobilization and Indigenous Peoples," World Bank, Brazil Department, Human Resources Division, August 1987.

²³ Ibid., para. 2.9. Not surprisingly, nor incorrectly, Ariquemes was commonly referred to in Brazil as "the malaria capital of the world" during the late 1980's.

Reported Cases of Malaria in Rondonia Compared with Incoming Migration



— Cases of Malaria - - - - Migrants

in Rondonia. While the number of settlers who have been forced to give up their plots as a result of the disease and the medical costs associated with it has not been determined, this occurrence is mentioned in practically all field studies in colonization areas in the state and can be presumed to be significant. Even though malaria incidence tends to decrease with the age of a given settlement, families in colonization areas throughout Rondonia continue to experience the illness.²⁴ The relative decline in the incidence of malaria with the age of the settlement, moreover, is of little consolation to new migrants whose ability to survive in colonization projects is often undermined by the disease. One recent study concludes that:

high malaria prevalence may contribute to 'negative' selectivity with regard to both the attraction and fixation of settlers who have more resources and skills....Malaria is a particularly serious problem for family farmers because they cannot easily substitute for disabled labor and because they must bear the direct and indirect costs of malaria on the entire family.... Turnover of settlers, to which malaria contributes, leads to reconcentration of property, defeating the social purposes of colonization.²⁵

4.22 Despite reported improvements, finally, prospects for the immediate future do not appear to be very promising. Even though particular care was taken to forestall the spread of malaria in the New Settlements Project, the worst known case of malaria transmission in a new colonization area to date has been that of Machadinho which was installed under this operation.²⁶ Furthermore, as one recent assessment has found: "malaria control in Rondonia has been particularly difficult. Shortages of personnel, vehicles, insecticides and drugs have plagued the program. Logistics are extremely difficult in remote rural areas where roads are often impassible in the rainy season, if they exist. The strategy based on use of parasiticides and insecticides faces new difficulties in Rondonia. There are serious problems of drug resistance.

²⁴ John Wilson and A. P. Alicbusan, "Development Policies and Health: Farmers, Goldminers and Slums in the Brazilian Amazon," mimeo, World Bank, 1990, pg. 11.

²⁵ Sawyer and Sawyer, op. cit., pg. 66.

²⁶ Wilson and Alicbusan, op. cit., pg. 12. One evaluation observed, for example, that more than 90% of the initial settlers on rural lots in Machadinho came down with malaria, that 75% of all in-patients (roughly 6,000) treated in the health center in the project's urban nucleus during the second semester of 1987 were afflicted with the illness and that a typical colonist in the scheme lost an average of 57 work days per year as a result of the disease, a fact which was exacerbated by the coincidence of the period of greatest malaria incidence (ie. the dry season) and that when the use of labor on the lots (for clearing, burning, planting, etc) was greatest. See Marie Madeleine Sant'Anna, "Estudo de Caso: Projeto Machadinho," SUDECO/UNDP/World Bank Training Program, Brasilia, February 1988.

Although there is no evidence of insecticide resistance, there may be insecticide avoidance." ²⁷

4.23 From the above discussion, it can be concluded that, independently of the operation's possible "success" in terms of installing the targeted number of rural health care facilities and providing support to SUCAM, the battle against malaria in Rondonia has clearly not been won. In short, even though the project's impact, viewed in a narrow sense, may have been positive, the actions taken under POLONOROESTE to combat malaria have clearly been insufficient, while the accelerated migration and settlement induced by the program have strongly contributed to the increased incidence of this disease, as well as to other public health problems, in the region. One very positive outcome of the Health Project which should be emphasized, however, is the substantially improved knowledge concerning the local causes and characteristics of malaria that has resulted from its research component. Numerous useful studies were sponsored under this component, many of which have contributed directly to the formulation of the aforementioned region-wide malaria control program for Amazonia. ²⁸

E. Existing Settlements in Rondonia

1. Project Background

4.24 From the Bank's perspective, the objective of promoting "orderly" and "harmonious" small-farmer development constituted the backbone of a program aimed at achieving the "productive and permanent settlement" of large numbers of migrants who had recently arrived in Rondonia and were precariously settled in or near existing colonization projects. As indicated in Annex III, the area specifically included under POLONOROESTE's Settlement Consolidation subproject covered substantial parts of the municipalities of Ariquemes, Ji-Parana, Cacoal, Presidente Medici, Ouro Preto d' Oeste and Jaru. Five INCRA settlement projects, where most of the subproject infrastructure and services were to be concentrated, straddled the BR-364 highway in areas of comparatively good soils over a length of some 350 kilometers in these municipalities. Some 37,000 families were estimated to be residing in or near these projects at the time the program was appraised.

4.25 Taken together, the interventions proposed under the Settlement Consolidation subproject (and described in section C of Annex III) appear to add up to an impressive program of assistance to these earlier settlement schemes. However, at the time of the mid-term review, there was a general consensus that

²⁷ Wilson and Alicbusan, op. cit., pg. 13.

²⁸ These studies are listed in Part III, Table 9 of the PCR. They include, among others, the paper by Donald and Diana Sawyer on the economic and social aspects of malaria transmission and control cited in footnote 10 above and several published articles by Wanderli Tadei and his colleagues at INPA in Manaus on the biology of the anopheles mosquito and malaria control in Ariquemes (see, for example, Acta Amazonica, Vol. 16/17, 1986/87, pp. 151-167, and Revista do Instituto de Medicina Tropical de Sao Paulo, Vol. 20, No. 3, May-June 1988, pp. 221-251).

the productive impact of these measures had been considerably smaller than initially expected. The PCR confirms that many of the program's original targets and objectives in terms of guiding settlement and enhancing small-farmer agricultural productivity, incomes and employment were not fully met.

4.26 In any event, it is evident that POLONOROESTE was insufficient to cover the large number of farm families already in Rondonia, let alone the subsequent massive inflow of migrants which the program helped to generate. According to the agricultural census, farm establishments in Rondonia increased dramatically from 7,100 in 1970 to 48,000 in 1980 (see Table II-2 in Annex II above) and were to further expand to 82,000 by 1985. As a result, the package of agricultural and social services extended under the Settlement Consolidation subproject would at best have been able to directly benefit only some 22% of all the farmers estimated to be present in the state in 1985, assuming one farm family per establishment (which, given the large number of sharecroppers, may be a substantial underestimate). Considering that the number of families, in fact, benefitted in this way, according to the PCR, was only 11,300, the actual share falls to 14%.²⁹ Despite the SAR's affirmation that a larger number of farm families would be indirectly assisted by the subproject, moreover, such selective treatment may have been conducive to the promotion of further inequalities in the region.³⁰

2. Findings of the Mid-term Review

4.27 With respect to the early implementation of the Settlement Consolidation subproject and of POLONOROESTE more generally, the Bank's mid-term review identified the principal problems experienced during the first three years of program execution. Given its importance for the subsequent course of the program, as well as for the Bank's reaction to the difficulties initially faced by it, it is useful to reproduce the main findings of this review in some detail. According to the review, first of all, the basis upon which the Bank originally decided to support POLONOROESTE was the following:

Aware of the host of hazards and unknowns involved in agricultural development in the Amazon, the Bank undertook a comprehensive multidisciplinary study of the region and...reviewed the performance of colonization schemes elsewhere in the Amazon. Its report ...laid out

²⁹ PCR, dated December 26, 1990, para. 5.07. The PCR notes, more specifically, that 11,300 (62% of the original target) were individually assisted at the farm level and another 3,300 were contacted under a group assistance scheme. Specific training courses in subjects such as perennial crop planting and cultural practices, farm administration and soil conservation were offered to some 13,500 participants.

³⁰ For a discussion of existing inequalities in part of the area covered by the subproject at the time of its implementation, see John F. Wilson, Ariquemes: Settlement and Class in a Brazilian Frontier Town, Ph.D. dissertation, Department of Anthropology, University of Florida, Gainesville, 1985, especially Chapter III.

a development strategy and the basic objective to attain sustainable and socially beneficial agricultural development, as opposed to the human suffering, irreversible environmental destruction and economic waste associated with frontier occupation processes elsewhere in Brazil....[T]he study called for the promotion of perennial crops and other measures conducive to sustained agriculture and for a strict confinement of any agricultural development to areas with high soil potential. Other areas were to remain untouched as biological, ecological or Amerindian reserves or to be managed as forest reserves or National Forests.

The inevitability of occupation of this high potential area was an important consideration when the Bank weighed the odds prior to its decision in 1981 to fund the Northwest projects. There was, it seemed, no option "to develop or not to develop," but only one of "how to." The forces were already at work, and sooner or later the highway would be paved. Against this backdrop it seemed that Bank involvement could make the critical difference between a destructive "free-for-all" occupation process and one that would secure opportunities for small farmers, protect Amerindian communities and preserve environmental riches.

There were no illusions that the process of securing a balanced development of the region would not be a difficult one and, by definition, an uphill battle against the tide of frontier fortune seekers, landless peasants, larger interest groups attracted by wood-logging and mining opportunities or petty politicians, who would not be likely to share the program's long-term vision. Nevertheless, it was felt that the Government was determined and able to marshal the resources to manage this complex and difficult program.³¹

4.28 This latter assumption, however, soon proved to be incorrect and the review acknowledged that "while the program has reached many of its infrastructure construction targets, its performance has been disappointing against its essential broader...objectives of balanced and controlled regional development."³² More specifically, even though POLONOROESTE had succeeded in paving the BR-364, which had contributed to increased (and "much higher than originally projected") migration to Rondonia, its "mitigating" measures had been "stunted by weak program coordination, institutional inefficiencies and an undisguised lack of political support for environmental and Amerindian

³¹ Internal memorandum dated February 25, 1985, paras. 2-4 (emphasis OED).

³² Ibid., para. 5 (emphasis OED).

protection." In addition, the program's agricultural strategy "remained largely unimplemented" because the Government had failed to comply with its contractual obligation to provide credit to small farmers in the region. More generally, the federal government's "primacy" as the "leading force in directing regional development [was] waning as large private interest groups stake[d] out their claims and as the Rondonia state government [took] a course in clear violation of the spirit of the Northwest loan agreements by allowing settlement in low potential areas."³³

4.29 Despite these setbacks, the review argued that the Bank's original assumption that things would be worse in the absence of its involvement remained correct. The Amerindian Special Project, which "in spite of its shortfalls and crises" was viewed as having "essentially been very effective in protecting the lands and the physical survival of the Indians and in raising the quality of assistance provided to them to levels unrivaled elsewhere in Brazil," was specifically cited in this regard.³⁴ Nonetheless, the review concluded that the program had "arrived at a crucial juncture" and that if it were "to stem [the] adverse and growing trend towards transgressions into reserve lands and failures in small-farmer colonization," it needed to be strengthened with "far more effective coordination and implementation instruments."

4.30 The review's findings with respect to the execution of the program in Rondonia in particular stressed that it had been "implemented to date in an unbalanced and sometimes defective manner with emphasis on infrastructure rather than on institutional development, services to farmers or protection of the environment." Paving of all but 50 kilometers of the BR-364, together with "publicity about the planned infrastructure and services and further propaganda implying that all newcomers would be given a substantial plot of their own," had stimulated migration that had "reached a level which cannot be managed with the limited institutional and financial resources of Rondonia."³⁵ Increased immigration "entailed widespread deforestation (often in expectation of services which did not follow) and...resulted in increased social tensions, greater incidence of diseases, squatting on areas which should be preserved and little apparent lasting economic improvement."

³³ Ibid., para. 5. (emphasis OED). This latter reference was to efforts by the state government to develop colonization projects in the Guapore valley where low fertility soils predominated. This, in fact, was in violation of the letter, as well as the spirit, of the legal agreements for the Agricultural Development and Environmental Protection Project which, as indicated in Annex III, explicitly required the state government to "take all necessary measures to discourage the agricultural exploitation of areas recognized as unsuitable for agricultural development" (emphasis OED).

³⁴ Ibid., para. 6.

³⁵ Ibid. para. 14 (emphasis OED). According to the review, some 120,000 migrants had arrived in the state during the first nine months of 1984 (ie. prior to completion of the BR-364 highway) and this flux had "accelerated greatly since then."

4.31 Among the distortions identified by the review were the opening up of new roads "into areas inadequate for settlement" on account of "political interests diverging from the objectives of the program" and the failure to undertake an agreed study of the redistribution of larger plots previously distributed by INCRA to settlers (100 ha) and private companies (3,000 ha) in parts of the state having better soils, both of which had "led to further deforestation in areas of poor soils and a lack of labor in settled areas." These shortcomings were also in contravention to specific sections of the Loan Agreement for the Agricultural Development and Environmental Protection Project. The failure to intensify the occupation of previously distributed lots, furthermore, was resulting in the underutilization of higher quality lands and existing infrastructure, as well as contributing directly to slower progress than expected in the cultivation of perennial crops. "Covert selective logging" practices and private mining interests, in turn, were putting additional pressures on forest areas and hampering road maintenance "already made difficult by the poor quality of construction...and a general lack of maintenance stemming from the considerable delay in the upgrading of DER-RO." ³⁶

4.32 The review also revealed that only twenty of the proposed thirty-nine NUARs under the Settlement Consolidation subproject had been installed and, somewhat obliquely, that the spatial distribution of the some 2,500 km (out of an anticipated 3,900 km) of program-built access roads had been "unequal" for political reasons. In many instances, the utility of these roads had been reduced due to "poor planning" of the connecting segments between them. Even though construction of schools and health posts had proceeded in parallel to that of the NUARs, the recruitment and training of staff had "suffered delays and been hampered by poor road planning." Planned crop storage facilities, additionally, had not been built "in the absence of designs for small units meeting the requirements of tropical areas," while existing storage space had not been used by small farmers due to the executing agency's reluctance to modify "inappropriate regulations." ³⁷

4.33 Another key finding was that no agricultural investment credit had been made available to settlers in Rondonia, while extension agencies, "trained mainly to assist farmers in obtaining credit and the subsequent cultivation of coffee," had been unable "to develop a useful message for small farmers deprived of credit." ³⁸ More generally, the proposed adoption of "sustainable cropping

³⁶ Ibid., para. 15. Furthermore, some "higher-standard" feeder roads constructed under the program were reported as "already very difficult to pass during the rainy season."

³⁷ Ibid., paras. 16-17.)

³⁸ More recently, however, the PCR (op. cit., para. 5.08) points out that "overall, extension performance under the project was good despite such constraints as: (a) lack of adequate coordination with, or poor performance by, other agencies responsible for complementary services (eg. community organization, marketing, land regularization and rural credit); (b) scarce and often untimely arrival of operating funds; and (c) the limited prior experience of extensionists with the climate and agronomic conditions of the project area."

systems" had not taken place for a number of reasons including: (i) delays in the establishment of credit for the installation of rubber plantations; (ii) improperly trained extension staff and limited Bank supervision of agricultural activities; (iii) extensive attacks of leaf blight disease in "once-promising" areas of cocoa production after "phyto-sanitary treatments were considerably reduced by farmers in view of the low world prices for cocoa;" (iv) a late focus of agricultural research into alternative regional crops; (v) health problems of farmers and a lack of hired labor; (vi) oversized (i.e. 100 ha) plots in existing colonization areas which were found not to be conducive to intensive farming; (vii) the dissolution of CODARON³⁹ which, among other consequences, hindered the supply of planting material; (viii) poor coordination between INCRA and SUDHEVEA with respect to the zoning of rubber areas; and (ix) rivalries between federal and state agencies in connection with the provision of technical assistance to farmers.⁴⁰

4.34 On the institutional side, in turn, the review concluded that "a pervasive lack of political commitment at both the federal and state levels (but mainly the latter) to most program components, but more particularly to the social and environmental ones, has resulted in considerable institutional, financial and managerial deficiencies."⁴¹ Coordination was especially weak at the state level, while attempts to strengthen executing agencies were frustrated by their incapacity to recruit better qualified personnel, improve salary scales and develop needed training programs. Funding shortages and delays were among the principal factors responsible for these problems in spite of the Bank's Special Action Program. More concretely, according to the review:

while paving of BR-364 was achieved faster than originally estimated, all other project components, which enjoyed lower political priority or had been more favored by the Bank than by the Government, notwithstanding the incapacity (extension, storage, road maintenance), indifference (forestry, research, health, marketing) or even hostility (Amerindian reserves, zoning studies, monitoring and evaluation) of local administrators, received late and insufficient financing....

Managerial deficiencies can be observed at various levels. A division of financial and technical coordination responsibilities between SEPLAN and SUDECO, the large number of agencies involved in program implementation and the weak staffing and hierarchical

³⁹ This allegedly occurred at least in part because of a serious political falling out between the state Governor and the President of CODARON who had been one of the former's principal collaborators in the design of the settlement consolidation strategy (eg. NUARs, etc.) for Rondonia.

⁴⁰ Internal memorandum dated February 25, 1985, op. cit., paras. 18 and 20.

⁴¹ Ibid., para. 31.

position of the [program] coordination unit within SUDECO are in great part responsible for delayed transfers of funds to executing agencies, weak monitoring and planning and inadequate documentation of project expenditures and progress. Similar weaknesses in SEPLAN-RO (and CODARON [prior to its] abolishment) entailed a poor definition of NUAR administration responsibilities; inadequate planning of infrastructure; no coordination of services to be provided out of the NUARs; and an incapacity of state authorities to plan a proper transition of administrative responsibilities from INCRA to the state of Rondonia in the new settlement areas. Program management at the state level became particularly inadequate during the period of election of state and federal level representatives, in the second half of 1982, when pressure to divert program resources and equipment for different purposes reached a peak.⁴²

4.35 Finally, "with the benefit of hindsight" and despite the fact that "there were no indications that the originally proposed strategy was not sound," the mid-term review indicates several key failings on the Bank's part in connection with the appraisal and early implementation of POLONOROESTE. These observations and the lessons drawn from them remain valid:

- (i) The program's political environment was not fully appreciated at the time of appraisal, nor were its structural weaknesses. The intervention strategy needed to be fully accepted and respected by all major parties in the development of the region. Insofar as this was not the case, and some program components had more support from the Bank than from the Government, stricter conditionality (eg. more use of dated covenants) should have been imposed and the Bank should have reacted more firmly and more rapidly in those instances where conditions were not fully met.
- (ii) More attention should have been given very early in the program to the proper strengthening of all agencies participating in program activities. The initiation of the main infrastructural components should have been delayed until such strengthening had been achieved. However, at the time the program was appraised, such a strategy seemed difficult to compatibilize with the perceived urgency of opening the

⁴² Ibid., paras. 32-33. The latter is a specific reference to the election of Rondonia's federal and state Senators and Deputies following the former Territory's elevation to statehood in December 1981. No mention of these distortions, however, was made at the time the Phase III New Settlements Project was presented to the Board in October 1983 when it was simply observed that implementation of Phases I and II were in line with forecast project plans and that the paving of the BR-364 highway was on schedule.

region's production to external markets and establishing the centers from which future services would be provided.

- (iii) The coordinated approach required from the Brazilian Government should have been accompanied by a corollary coordination of Bank supervision. Although good coordination occurred at the time of appraisal, it did not persist. Closer coordination between divisions of the Bank could have avoided some of the imbalances later observed in the program.⁴³

3. Proposed Modifications and Remedial Actions

4.36 Immediately following the mid-term review, the Bank made several attempts to introduce what were felt to be necessary corrections in program orientation. As will be further detailed in the next chapter, the principal, but by no means only, area of concern was the Government's handling of Amerindian and environmental protection in connection with the program. The strongest manifestation of Bank dissatisfaction, however, was the informal suspension of disbursements on all POLONOROESTE loans in March 1985, just as Brazil's first civilian government in more than twenty years was taking office and until such time as a "Corrective Action Program" could be agreed upon and certain specific measures were taken in relation to Amerindian protection.⁴⁴ Suspension of disbursements, which continued through August 1985, was justified on the basis of the Government's persisting non-compliance with various key loan covenants, particularly that under which it had committed itself to undertake adequate Amerindian protection measures.⁴⁵ The principal elements of the corrective action program, as first suggested in the memorandum which summarized the findings of the mid-term review and later formally transmitted to the incoming government of President Jose Sarney,⁴⁶ in a letter dated March 15, 1985, will be briefly summarized in the following paragraphs.

⁴³ Internal memorandum dated February 25, 1985, op. cit., para. 34 (emphasis OED).

⁴⁴ Disbursements, in fact, were suspended informally from March 12 to May 15, 1985 in order to give the new government an opportunity to respond to the Bank's concerns with respect to Amerindian protection, first indicated in a Telex to the out-going federal administration on March 1, 1985, and other problems identified during the mid-term review.

⁴⁵ Prior to the Bank's mid-term review mission, which took place between November 19 and December 5, 1984, a letter from the Bank's Vice President for Latin America and the Caribbean to the Brazilian Minister of Finance with copies to the Ministers of Planning and Interior, dated October 30, 1984, had already indicated the Bank's principal concerns in this area, stressing "the immediate need to resolve the issues related to the [Amerindian] Special Project."

⁴⁶ Mr. Sarney was, in fact, the Vice President-elect who was forced to assume the presidency when an illness which subsequently proved to be fatal impeded President-elect Tancredo Neves from being inaugurated on March 15, 1985.

4.37 Cognizant that Bank leverage was less than it might otherwise have been "because paving of BR-364, which absorbed most of the loan amount, has been achieved,"⁴⁷ but hopeful that the new civilian administration would be "more sensitive to environmental and social issues and to the criticism they have generated both inside Brazil and abroad,"⁴⁸ Bank staff responsible for the mid-term review proposed a series of short, medium and longer-term measures to deal with the problems associated with POLONOROESTE. The proposals concerning the program in general and rural development in existing settlements in Rondonia in particular will be described in the following paragraphs, while those referring to other program components (eg. Rondonia new settlements, Mato Grosso rural development and environmental and Amerindian protection) will be discussed in the corresponding sections later in this and the next chapter.

4.38 The Bank's proposal for reorientation of the program, as formally communicated to the new Brazilian Government, involved four essential elements:

- (i) a major reallocation of program funds to provide a greater share of resources for protective activities including forestry, environmental and Amerindian services and a smaller share for physical infrastructure and other activities which encourage further immigration to the region;

⁴⁷ At the time disbursements were suspended, the outstanding balance of the various Bank loans for POLONOROESTE was estimated to be on the order of US\$ 206.5 million, of which some US\$ 70 million from the Highway Project was expected to be cancelled due to the early completion of the BR-364 reconstruction component. In addition to the undisbursed loan funds, the other areas where the Bank felt it continued to possess some leverage in relation to the program were pending decisions as to whether to respond favorably to Government requests for a further increase in the Bank's share of project local cost financing (from 50% to 67.5%) under the Special Action Program and to provide support for possible future operations of a similar nature in the neighboring state of Acre.

⁴⁸ Among the most serious external criticisms regarding the perceived adverse environmental and social impacts of POLONOROESTE were those presented by Brazilian ecologist Jose Lutzenberger, now Secretary of the Environment, and others during hearings on "Tropical Forest Development Projects" held by the Subcommittee on Natural Resources, Agriculture Research and Environment of the United States House of Representatives' Committee on Science and Technology in September 1984. A summary of these discussions was first formally transmitted to then US Treasury Secretary Donald Regan by the Subcommittee Chairman on October 15, 1984 and later, via the Treasury Department, to the US Executive Director at the World Bank on October 29, 1984. At roughly the same time (October 12, 1984), then Bank President Clausen received a letter from the Natural Resources Defense Council (NRDC) signed by a large number of Brazilian, American, European and other international NGOs expressing "grave concern over disturbing evidence of the consequences of the continued neglect of sound management of natural resources and protection of indigenous peoples in the design and implementation of World Bank projects," in particular POLONOROESTE.

- (ii) a moratorium on all further new construction not related to protective activities under the program until the existing situation is consolidated, existing facilities properly utilized and further construction plans revised to better serve those areas needing protection;
- (iii) much greater emphasis on improving conditions in existing settled areas including more planting of perennial crops and much less emphasis on new settlement, most of which is occurring on poor soils with little hope of lasting benefits to the settlers in the absence of credit and technical assistance to establish the perennial crops; and
- (iv) a strengthening of the institutional structure to provide more effective decision making, coordination and control and an improved mechanism for allocating the human and financial resources needed to implement the program.⁴⁹

4.39 Within this general framework, the proposed action program included measures to reinforce POLONOROESTE's coordination at both the federal and state (ie. Rondonia) levels, reallocate program funding, reduce immigration, improve forestry and environmental protection and strengthen Amerindian protection. With respect to the overall administration of POLONOROESTE, the federal government was requested to "substantially strengthen and reorganize" program coordination by regrouping planning, budgeting and financing powers under a single entity and to cause participating federal agencies (IBDF, SUCAM, SEMA, FUNAI, CIBRAZEM, INCRA, EMBRATER, EMBRAPA and SUDHEVEA) to prepare assessments of their staffing, training and internal reorganization needs as related to their implementation responsibilities.⁵⁰ It was similarly proposed that all relevant federal agencies (ie. IBDF, SEMA, CNPq, etc.) expedite implementation

⁴⁹ Attachment III to a letter, dated March 15, 1985, from the Acting World Bank Vice President for Latin America and the Caribbean to the new Brazilian Minister of Finance transmitting the conclusions and recommendations of the Bank's mid-term review of POLONOROESTE (emphasis OED). Copies of the letter were also sent to the in-coming Ministers of Planning and Interior, the Superintendent of SUDECO and other high government officials in the Ministries of Planning and Finance.

⁵⁰ The mid-term review (internal memorandum of February 25, 1985, op. cit., para. 41) observed in this connection that "high caliber staff, with both political and technical clout, who would not require start-up training, should be appointed to key positions in the unit as a first step towards the overall upgrading of staff and salaries of the coordination unit; evaluation should continue as an outside, independent activity, and much more stringent financial audit provisions should be enforced." It was likewise proposed that "management and technical assistance consultant teams" be recruited for all key agencies in order "to prepare detailed plans to achieve program objectives and assist in early implementation." This latter recommendation was partially met through the subsequent placement of FAO technical advisers in the federal and state program coordination units at SUDECO and in Rondonia and Mato Grosso respectively.

of environmental protection measures and the monitoring of environmental quality in the region, possibly through establishment of a unit "modelled to some extent on the Carajas Project's environmental council."^{51 52} In the case of Rondonia, it was affirmed that the state government should define new project coordinating and executing arrangements to replace CODARON, that administrative procedures for project-supported NUARs should be finalized and that a renewable natural resources institute for the planning and execution of forestry development and environmental protection projects should be created by August 31, 1985.

4.40 With regard to program funding, in turn, in addition to the moratorium on all construction not specifically related to environmental (including forest) or Amerindian protection, malaria control⁵³ and the consolidation of earlier infrastructure investments,⁵⁴ it was proposed that program financial planning be reoriented to fully reflect the priorities listed in para 4.38 above and that arrangements be made by May 31, 1985 to ensure the "timely availability" of the resources required to meet future expenditures in accordance with schedules previously agreed with the Bank. The Government was likewise requested to make investment credit available for the promotion of perennial crops as had been agreed in the original Bank loan contracts for the program.

4.41 The specific measures proposed by the Bank to reduce the heavy migration which had "overwhelmed the capacity of nearly all program executing agencies and, in particular, those providing services to the settlers," in turn, were:

⁵¹ This referred specifically to a blue ribbon panel of scientists and Amazon development specialists established in December 1980 to advise the President of the Rio Doce Valley Company (CVRD) with respect to environmental aspects of its operations, especially the Carajas Iron Ore Project whose implementation was partially financed by Bank Loan 2196-BR, approved in August 1982 (See OED, Environmental Aspects..., op. cit., for further details).

⁵² The mid-term review also proposed that all field activities of the program should be transferred to state level agencies, with the exception of the installation of new settlements and the provision of technical assistance to rubber farmers which were to remain under the responsibility of INCRA and SUDHEVEA respectively.

⁵³ In this connection, the review indicated that the short-term action program should include development of new methods for health services, increased preventive and curative treatments in malaria areas, construction of infrastructure to reduce the proliferation of malaria vectors and education of migrants at the time of their administrative processing at border points (particularly Vilhena) into Rondonia.

⁵⁴ The review specifically mentioned the need to complete some 105 km of "short transversal connections" between existing NUARs and parallel access roads.

- (1) the federal and state (ie. Rondonia) governments should immediately stop all publicity encouraging landless farmers in other regions of Brazil to migrate to the Northwest; ⁵⁵
- (ii) the Government of Rondonia should identify all squatters, and remove a substantial portion of them, from all block forest reserves by August 31, 1985 and prepare a detailed plan to remove all remaining squatters by May 1986; it should also prepare a statement by April 1, 1985 on all additional on-going or scheduled access roads and topographical work in new areas as well as plans for or the results of studies regarding the agricultural potential of such areas; finally, by June 30, 1985, it should initiate "systematic surveillance and patrol activities" to minimize the negative impact, including the invasion of reserve lands and illegal squatting, of construction of the non-program funded BR-429 road between the BR-364 highway and Costa Marques in the Guapore valley; ⁵⁶ and,
- (iii) INCRA should prepare the study of land tenure reorganization of earlier settlement areas in Rondonia "for eventual redistribution in smaller plots through properly compensated expropriations and the promotion of direct sales of fractions of the original 100 ha lots to eligible buyers by August 31, 1985; ⁵⁷ INCRA should likewise carry out a study by September 31, 1985 to identify the larger 3,000 ha plots in the Pimenta Bueno area on which development had not been initiated within the five year legal time limit and propose alternative government action for their use. ⁵⁸

⁵⁵ The report summarizing the results of the mid-term review was even more emphatic in this regard, proposing that "counter-publicity" measures be launched through newspapers, radio and television "explaining the physical limitations, health problems and marketing difficulties awaiting potential settlers" as well as recommending that construction of all access roads to areas of poor or unknown agricultural potential be stopped.

⁵⁶ The mid-term review recommended, more specifically, that "a remote-sensing and surveillance program to detect unauthorized squatting, deforestation and mining activities" should be established and that forest police units should be strengthened.

⁵⁷ This study was expected to include proposals for a "subsequent pilot program under which INCRA would initiate by April 1986 the acquisition and redistribution of the land, together with technical assistance and credit to beneficiaries."

⁵⁸ Attachment IV ("Proposed Action Program") to the Bank letter dated March 15, 1985 to the in-coming Minister of Finance in connection with POLONOROESTE.

4.42 These conditions, plus others specifically related to environmental and Amerindian protection discussed in the next chapter, constituted much of the Bank's short and medium-term action program for the reorientation of POLONOROESTE. Once the proposed actions had been taken by the Government, the mid-term review report recommended that the Bank "resume financing all economic and social services to farmers, research activities, national forest development, road maintenance, special studies and preparation of new projects." On the other hand, it also recommended that Bank financing of additional physical infrastructure, new settlements at Cujubim and Capitaio Silvio and any future projects in the region (eg. Acre) be made contingent upon another set of Government actions including: (i) completion of all Amerindian land demarcation and registration; (ii) removal of all squatters identified through surveillance programs; (iii) initiation and satisfactory progress with respect to land redistribution in earlier settlement areas; (iv) completion of national forest management plans that take mining interests into account; and (v) the ready availability of investment credit, supplies and basic services to most area farmers.⁵⁹ Finally, the mid-term review concluded with the following affirmation:

The above proposals...are made with the firm belief that past Bank involvement in the Northwest program has, overall, helped to prevent even worse outcomes, and that, however unrewarding and thankless the defense of the small farmers, Indians and environment of the region may be, and however great the risks of failure may be, the Bank should do its utmost to help overcome the present difficulties and remain involved in the orderly development of the Amazon.⁶⁰

4. The Situation after 1985

4.43 Even with the subsequent strengthening of program administration as a result of the new government's positive response to the measures proposed under the Bank's corrective action program, implementation of POLONOROESTE remained problematic from an environmental standpoint due to persisting high rates of in-migration until 1987, the rapid penetration and expansion of logging and mining activities, the continued use of inappropriate cropping systems, insufficient rural credit, the above mentioned proliferation of malaria and other problems. Perhaps most damaging with respect to the achievement of POLONOROESTE's original objectives in terms of consolidating sustainable rural settlement in Rondonia, however, was that agricultural production failed to

⁵⁹ It was likewise recommended that "Bank financing should be made available for all expenditures related to the above proposals including farm investment credit (which was not provided under the first project because of the unacceptable interest rate levels existing at the time) and the protection of Amerindians."

⁶⁰ Internal memorandum dated February 25, 1985, op. cit., para. 44 (emphasis OED).

continue to grow at the dramatic rates that had been registered during the 1970's.

4.44 While the area planted in both annual and perennial crops grew significantly between 1970 and 1985, increases in agricultural output in the state began to level off shortly after program implementation initiated. Even the impressive growth of cocoa, reflecting the push toward perennial crops initially on the part of CEPLAC and later on that of the Bank as well, tapered off after 1985.⁶¹ Indeed, more recent reports suggest that farmers in Rondonia are increasingly transforming tracts of land that formerly produced cocoa into pasture.⁶² Falling export prices, the inability to deal economically with the "vassoura de bruxas" (or "witches' broom") blight, the impossibility of competing with Bahia's superior product and the reduction of transport subsidies appear to be the main reasons for cocoa's recent downfall in the state. In general, increasing attempts to cultivate inferior soils coupled with the distance to markets, and not implementation problems per se, are largely responsible for this negative outcome, as is discussed further detail in Chapter VI below. Whatever the reasons, the inability to promote the growth of small-farmer agricultural output is a significant shortcoming in a program aimed primarily at achieving sustainable rural development.

4.45 POLONOROESTE's difficulties in fully attaining the objectives of the rural settlement consolidation subproject, furthermore, contributed directly to the execution problems experienced by its environmental protection component since failure of the former has stimulated the even more rapid growth of pasture land. As discussed more fully in Chapters VII and VIII below, the formation of pasture and the expansion of cattle raising becomes a rational response of rural settlers when crop prices and/or soil fertility are low. In this context, it is relevant to note that, while the area in annual crops in Rondonia grew at 9.2% and that in perennial crops at 5.6% per year between 1980 and 1985, the cattle population grew at a rate of 25% per year over the same period! Although 1985 data on the amount of land in pasture in Rondonia are still unavailable, growth of the cattle population is generally directly associated with the creation of pasture land which is regarded by many ecologists as the most damaging form of land use in the Amazon region from an environmental standpoint.⁶³

⁶¹ According to IBGE's Annual Statistical Yearbook for Brazil, cocoa production in Rondonia expanded by less than 11% between 1985 and 1988, as compared with an increase of more than 1100% between 1980 and 1985.

⁶² Rubens Coutinho, "Rondonia Acaba aos Poucos com Plantacoes de Cacau," Jornal de Brasilia, December 28, 1989, pg. 8.

⁶³ See, for example, Robert Goodland, "Environmental Ranking of Amazonian Development Projects in Brazil," Environmental Conservation, Vol. 7, No. 1, spring 1980. According to this article (pp. 18-19), "conversion of tropical rainforest ecosystems into pastures for cattle rates the worst, environmentally, of all conceivable alternatives...[because] the area of the biome lost is large in relation to the short-term benefits and low employment creation."

4.46 Although back-to-office reports by Bank and/or FAO supervision missions in the years following the mid-term review showed optimism in terms of the possibility of resolving shortcomings encountered during the early years of program implementation, many of these appear to have persisted. In some instances, for example, the construction of infrastructure, except for roads, has not been completed, while existing facilities have become run-down and/or underutilized. Given the problems experienced by many settlers with respect to the production of perennial crops such as cocoa and coffee (ie. lack of credit, low prices, blights, etc.), in the absence of the generally unanticipated employment and prosperity brought to the region by prospecting, mining and logging activities, it is likely that local demand for agricultural output would be considerably lower and poverty levels and living conditions worse than those presently observed in the area.

4.47 The PCR provides more precise information on project production results and other attainments.⁶⁴ In addition to the smaller number of direct beneficiaries than initially expected, the PCR affirms that incomes of project beneficiaries improved, but not as much as anticipated at appraisal with actual average family income reaching only 56% of the appraisal estimate, or US\$ 6600. While total incremental crop area was reported to be close to that projected at appraisal, except for beans and cocoa, actual yield increases were some 5 to 50% below appraisal estimates due to shortages of investment and production credit, higher than expected fertilizer prices, lower product prices⁶⁵ and less technical assistance. Cocoa yields, in particular, were below appraisal expectations. As a result of these factors, the value of incremental project output at full development was estimated at about US\$ 62 million, as opposed to the appraisal target of US\$ 144 million. Furthermore, as compared with the anticipated 20,700 fully employed labor years expected to be generated by the project, the PCR found that only about 14,800 incremental labor years were actually created.⁶⁶

4.48 With respect to land tenure, the PCR indicates that INCRA provided land titles to some 19,800 farmers occupying about two million ha, but only a third of the families living in the vicinity of the colonization schemes. This activity is, nevertheless, credited with helping to establish "a core of family-owned farms in central Rondonia and reducing the incidence of squatters and extensive ranching which has characterized the occupation of much of the rest

⁶⁴ PCR, op. cit., paras. 6.06-6.11.

⁶⁵ Prices for cocoa and coffee at project completion, for example, were 57% and 63% lower than anticipated at appraisal.

⁶⁶ Ibid., para. 6.11. According to the PCR, "although there was a larger than expected increase in the area planted to coffee and cocoa, the lack of financing for fertilizer and herbicides and for other cultural practices reduced labor demand per ha cultivated." Increasing employment opportunities in mining, prospecting, logging and associated urban industrial and service activities, however, probably also help to explain the project's lower than expected labor absorption impact.

of the Brazilian agricultural frontier." ⁶⁷ Despite this, land turnover is high as only about one-third of the original settlers in the older INCRA schemes were still cultivating the same plots at the time of project completion. ⁶⁸

4.49 Cattle production increased dramatically in the project area, as elsewhere in Rondonia, from about 126,000 head in 1981 to 780,000 in 1987. Most of this growth, however, reportedly occurred prior to 1986 when the mixed farming model promoted by the program began to take hold. According to the PCR, furthermore, "while outside the project, cattle production is generally pursued as an extensive single production-line enterprise with emphasis on beef and breeding, cattle in the project area are complementary to other farm activities, comprising part of a mixed and rotational farming system with emphasis on beef and milk production." ⁶⁹ Finally, the PCR observes that "while farmers with adequate financial resources and technical assistance did introduce perennial crops and progressed well, most were not able to make this transition and continued shifting cultivation and deforestation." ⁷⁰

4.50 The PCR concludes by indicating the main lessons learned in the course of implementing the project. ⁷¹ These merit citing in some detail:

- (i) Public investments in frontier areas characterized by a fragile natural environment should be based on better technical knowledge of the sustainable development potential than that which was available at the beginning of this project. Agro-ecological zoning to guide public investment to suitable locations should be a condition sine qua non of future projects in such areas....The policy and regulatory framework governing land occupation and development patterns

⁶⁷ Ibid., para. 6.12.

⁶⁸ The PCR points out, however, that the situation in the project area compares favorably with that elsewhere in the state where only 10% of current occupants are original settlers.

⁶⁹ Ibid., para. 6.08. The PCR also observes (para. 6.12) that, while the number of rural establishments larger than 100 ha producing almost exclusively livestock declined from 36% to 16% of all farms within the project area, elsewhere in the state the proportion of such units increased from 30% to 46% between 1980 and 1985.

⁷⁰ Ibid., "Evaluation Summary," para. 6 and para. 6.02. The latter further affirms that "continued widespread shifting cultivation, both within settlement areas on assigned plots and elsewhere in the state, resulted in severe deforestation throughout much of the 1980's. In retrospect, the scope of the project was too limited to effectively improve production and income of the large and rapidly increasing rural population in the area."

⁷¹ Ibid., "Executive Summary," para. 9 and para. 13.01 (emphasis OED). Additional lessons drawn by the PCR regarding the program's environmental and Amerindian components will be indicated in the next chapter.

in the project area should be made consistent with the recommendations of the agro-ecological zoning. Otherwise, direct investments to protect the environment may be undermined by stronger incentives to exploit it in an unsustainable manner.

- (ii) The economic and political conditions outside the project area which affected to level of migration to it should have been better analyzed....The project was designed to benefit 18,200 families during a period when Rondonia grew by more than one million people. Such a massive influx of migrants created demands on infrastructure and on the environment which were clearly beyond the project's ability to address.
- (iii) Project organization and management arrangements, with many agencies and excessively centralized decision making at the federal government level, hampered project implementation. Decentralization in favor of the states and municipalities... would have resulted in greater accountability of project management to the community....Also, an increased role for NGOs and private organizations in project implementation could have enhanced accountability to the ultimate beneficiaries and improved the responsiveness of project executing agencies.
- (iv) When agriculture requires long-term financing, a careful analysis should be made of the availability of credit for the farmer beneficiaries....If suitable sources of credit are not available and where the failure of the agricultural development strategy could result in widespread environmental degradation, the Bank should either make special provision for credit in the project itself or should not support the project at all.
- (v) For innovative projects with above-average risks, it is essential that monitoring and evaluation systems be oriented to generate early warnings about project impact and implementation problems and that project design provide considerable flexibility to allow for the timely introduction of adequate corrective measures. At the same time, the Bank should be prepared to take sufficiently strong actions early on (ie. the suspension of disbursements) to remedy such problems.

F. New Settlements in Rondonia

4.51 In addition to consolidating existing rural settlements located in areas with relatively fertile soils in Rondonia and Mato Grosso, POLONOROESTE also intended to create new colonization projects that program planners hoped would be capable of partially alleviating the pressure on land and public services generated by migrants who continued to arrive in the region. Accordingly, as described in greater detail in Annex III, the third phase of the program attempted both to settle a large, although considerably smaller than

initially intended, number of colonists, and to create a model that could be replicated elsewhere in Rondonia and other Amazonian frontier areas. As stated in the corresponding SAR, "the project seeks an answer both to Rondonia's need to provide adequate land, facilities and assistance to its immigrants and to Brazil's more general need to evolve comprehensive and cost-effective settlement and environmental protection methods for the development of its vast, presently unoccupied and fragile Amazon region." ⁷²

4.52 Originally, the New Settlements Project was expected to cover some 1.7 million ha, consisting mainly of publicly-owned undeveloped and uninhabited lands. As described in Annex III, INCRA initially proposed the settlement of some 60,000 families, while the Bank set a target of 30,000. Later, in view of the poor soils encountered in some of the areas where new colonization was to take place, this target was scaled down even further. Even though the Bank attempted to lower the initial new settlement target to 9,000 families, after much discussion with INCRA, the goal was finally fixed at 15,000. Prospective new settlement sites were located either adjacent to earlier settlements (Urupa and Machadinho) or along unpaved sections of the BR-364 highway to the west of Porto Velho (Capitao Silvio and Marmelo).

4.53 The 15,000 farm families projected to be benefited under the operation were each to receive between 25 (in areas of better soils) and 40 ha (in areas of more patchy soils) of agricultural land, plus an equal amount of forest area within agglomerated "block reserves." ⁷³ These settlers were expected to engage in the production of both subsistence and commercial food crops including rice, maize, beans and cassava, but would also grow cash crops such as rubber, tropical fruits and, to a lesser extent and with private financing, coffee. Through administrative and operational arrangements that were still undefined at the time of appraisal, each settler would also be able to exploit forestry resources in his section of the block reserves.

4.54 Unlike earlier INCRA colonization schemes, land use planning and road construction in the New Settlements Project were to be adapted to the specific topographical and ecological conditions in the immediate areas to be settled. For this purpose, a preliminary zoning of the proposed settlement sites was to be carried out. Roads were to be laid out following natural crest lines wherever possible. After opening up simple paths along these preliminary lines, field evaluation would confirm and correct boundaries and detailed design of settlement plots and reserves would be undertaken. Such procedures, in addition to fomenting the proper use of soils, were expected to benefit malaria control efforts since settlers' residences could be located on higher ground away from mosquito-infested lowlands that were subject to flooding.

⁷² Report No. 4424-BR., op. cit., pg. 1.

⁷³ As noted in Annex V, this project introduced the practice of establishing collective "block reserves" in portions of colonization areas less suitable for agricultural activity to substitute of the individual on-plot reserves attempted, often with reduced effectiveness, in earlier INCRA schemes.

4.55 The SAR for the New Settlements Project reported that much of the preliminary land surveying and demarcation work had already been completed by 1982, particularly in the Urupa area. In retrospect, however, this appears to have been an overly hasty affirmation since subsequent evaluations repeatedly observe that the project's agro-zoning component was never carried out. Whether or not the Urupa site did, in fact, benefit from prior surveys, it is clear that other prospective settlement sites lacked adequate soil assessments. As a result, several sites originally chosen for new colonization projects such as Capitaó Silvio and Marmelo were never utilized due to the poor quality of their soils, while other localities such as Cujubim and Machadinho were only partially and precariously settled for much the same reason.⁷⁴

4.56 Furthermore, and at least in part as a result of low soil fertility, a significant share of all settlers who were allocated lots in new settlement areas, especially Machadinho, reportedly moved on shortly thereafter or have not taken up residence on their land.⁷⁵ In addition to poor soil conditions and incomplete or inadequate rural services, another key reason for high settler turnover rates and low lot occupancy in new colonization areas is malaria. One internal Bank memorandum concluded, for example, that "the incidence of malaria in places like Machadinho is alarming" and that the disease had resulted both in high rates of lot abandonment by their initial occupants and severely hindered "the ability of project staff to stay healthy."⁷⁶ As a consequence, only Urupa, among the proposed new settlement schemes under POLONOROESTE,

⁷⁴ In the case of Machadinho, specifically, while road and plot layouts did respect local topography and hydrographic conditions, they were not based on detailed soil aptitude studies. As a result, many settlers received lots characterized by predominantly fragile soils possessing very limited natural fertility. See Sant'anna, op. cit., pg. 16 for further details.

⁷⁵ Some 24% of all settlers interviewed in Machadinho during July of 1985, for example, had moved on by July 1986. Those who stayed appear to have done so largely because they had nowhere else to go. See Haroldo da Gama Torres, "Desistencia e Substituicao de Colonos em Projetos de Colonizacao na Amazonia e o Caso Machadinho", mimeo, no date, pp. 15-22. Sant'Anna (op. cit., pp. 35-36) reports that, of the 2,900 rural lots allocated in the Machadinho scheme as of February 1988, only 862 were effectively occupied, while some 830 settlers were living in the project's urban nucleus and periodically commuted to their lots and more than 1,200 proprietors resided outside the project's jurisdiction altogether.

⁷⁶ Internal memorandum dated November 5, 1985. It was observed, more specifically, that some 47% of all bloodsmears examined for malaria at Machadinho were found to be positive. Sant'Anna (op. cit., pg. 29), in turn, notes that roadbuilding in the area was "paralysed" on several occasions because of the high incidence of malaria among the members of the Army's Engineering Battalion which was responsible for the construction works. She affirms, furthermore, that it was probably the road workers and the first wave of rural settlers who introduced malaria into the area around Machadinho since the disease did not previously exist among the small number of rubber tappers already residing in the region.

appears to have actually been occupied more or less along the lines originally envisioned.

4.57 Given this situation, the goals of the New Settlements Project quickly proved to be unrealistic. An evaluation by FIPE in 1986 revealed that less than a third of the 15,000 projected families had effectively been settled, while more recent SUDECO data confirm that, as of early 1988, only 4,600 families had been allocated lots in Urupa, Machadinho and Cujubim (see Table 5 below). As was predictable on the basis of the experience in other phases of the program, the activity that has apparently come closest to achieving its initial targets is the construction of physical infrastructure. Due to the support of strong local economic and political interests, together with its relative technical straightforwardness, performance of the access road component again appears to have outrun that of other project segments.

Table 5

Status of New Settlement Projects as of March 1988

<u>Site</u>	<u>Projected Number of Families to Be Settled</u>	<u>Actual Number of Plots Allocated*</u>	<u>Number of Lots Effectively Occupied</u>
Urupa I & II**	2,074	1,205	1,089
Machadinho I & II***	6,707	2,900	862
Marmelo	2,500	-	-
Capitao Silvio	3,750	-	-
Cujubim	-	509	170
TOTAL	15,041	4,609	2,212

* Refers to the number of occupation licenses granted.

** Urupa I - 1,156 families; Urupa II - 918 families

*** Machadinho I - 1,707 families; Machadinho II - 5,000 families

Source: World Bank Report No. 4424-BR; MIRAD/SEASC, "Relatorio de Monitoria - POLONOROESTE: Outubro de 1987 a Marco de 1988"

4.58 Considering the disappointing results of the New Settlements Project, recent Bank documents, not surprisingly, tend to reiterate the initial divergences with INCRA concerning the number of settlers that could be accommodated in new colonization schemes. The long-standing debate, in brief, was largely one of quantity versus quality. Having already attracted large numbers of families to the region, the Brazilian Government, through INCRA, sought to pursue a solution largely akin to the previous Rapid Settlement Program described briefly in Annex II. The Bank, in turn, being aware of the problems experienced in previous colonization efforts, preferred a more carefully-prepared model capable of affording settlers a better opportunity to achieve sustainable agricultural production, while, at the same time, representing an ecologically more appropriate approach to Amazonian colonization. When the New Settlements Project failed to attain either goal,

the Bank reportedly attempted to convince a new administration at INCRA to undertake a different approach involving smaller settlements on good soils, even though this meant that suitable private lands would have to be acquired or expropriated for this purpose. There is little indication in the project files, however, that such recommendations have, in fact, had much of an impact on recent rural settlement in Rondonia.

4.59 Instead, the available data accentuate the limited impact of the New Settlements Project. As indicated in Table 5, as compared with the 15,041 families expected to be settled on rural lots in 1989, by March 1988, only 2,212 actually resided and worked on their land. An additional 1,805 families were reported to be exploiting their lots without residing on them in the Machado project. Although no reliable figures on production and commercialization are currently available, field visits underscore the difficulties faced by colonists with regard to crop production and distribution, as well as the hardships of their living, especially health, conditions.

4.60 In synthesis, the Phase III New Settlements Project appears not to have attained either the objective of settling large numbers of migrant families, which the state government and federal agencies, particularly INCRA, had proposed, or that of establishing an agricultural colonization model adequate for Amazonian conditions in accordance with the Bank's own aspirations. Even in Urupa, where the proposed model was carried out largely according to the original design and where soil conditions are comparatively more favorable, doubt exists as to the longer-term fate of the region's farmers. Here, the problems of distance to market and declining productivity, discussed in Chapter VIII below, appear to be the main obstacles to achieving "comprehensive and cost-effective settlement" over the longer run.

G. Rural Development in Mato Grosso

4.61 As in the Phase I Settlement Consolidation subproject in Rondonia, the main thrust of the Phase II Mato Grosso Rural Development Project was to increase sustainable agricultural production in a previously occupied region, especially in those areas where the predominant soils and land tenure situation were considered to be appropriate for this type of exploitation. This was to be achieved through the provision of additional support to small-farmer production systems. By providing such assistance, it was hoped that additional rural employment opportunities would be created, thereby absorbing part of the increasing flow of migrants toward Rondonia.⁷⁷

⁷⁷ The PCR, dated June 8, 1990, in describing the operation specifically states (para. 2.02) that "within the framework of the POLONOROESTE Program, this project was designed to increase agricultural production in an area of relatively good soils in southwestern Mato Grosso....It was expected that the project would not only improve the output and incomes of the existing population in the area, but would also absorb small farmers displaced from other regions of the country, thereby helping to decrease the pressure of migration into ecologically more fragile areas of Rondonia, Mato Grosso and other states of the Amazon basin."

4.62 Evaluation of the second phase component in Mato Grosso is complicated by the past and present heterogeneity of the region. As shown in Chapter II and Annex II, prior to POLONOROESTE land in the municipalities to be assisted by the project had already been occupied by a wide diversity of farm and ranch sizes and types. The area, moreover, presented a high incidence of land tenure problems. In some subareas, however, existing infrastructure and services were already at a level considerably superior to those in many parts of Rondonia.

4.63 Government intervention in the area prior to the program had also assumed varying forms, some of which were clearly at odds with the proposed objectives of the present project. Thus, as indicated in Annex II, for instance, one of the principal programs implemented by the federal government, through INCRA, in the region involved the so-called "Projetos Fundiarios." Theoretically, such projects were intended to clear up the confused land tenure situation, but overlapping claims continued to be common. Furthermore, new colonization projects, whether promoted by private companies through the Projetos Fundiarios or located on public lands by the state development company (CODEMAT), frequently added to the confusion by not granting legal title to settlers. In still other areas, land disputes were settled, as late as 1987 in the Jauru area, for example, only after considerable violence, despite the presence and intermediation of INCRA.

4.64 Lastly, even though much of the POLONOROESTE portion of Mato Grosso was still an area of rural net in-migration at the time the project was prepared, Annex Table II-4 revealed considerable diversity of migration tendencies in the state as a whole during the 1970's, reflecting the fact that frontier occupation was already proceeding rapidly northward. The northwestern part of Mato Grosso, in fact, had already been identified as one of the principal sources of migration to Rondonia. Unlike Rondonia, in short, the Mato Grosso part of the POLONOROESTE region was experiencing both considerable in and out-migration at the time the program was appraised, attesting to the heterogeneous and changing demographic and socio-economic conditions in the area.

4.65 Even before the PCR was undertaken, on-going evaluation work by FIPE and the Bank's 1984 mid-term review suggested that some project goals were being substantially under-attained. Agro-ecological zoning, for example, was supposed to have been undertaken prior to any kind of settlement, but the studies were carried out only in areas already occupied, probably as a result of the relatively advanced stage of settlement of much of the Mato Grosso portion of the region.⁷⁸ While rural extension services seem to have been dedicated and effective in some areas, they appear to have been almost non-existent in others.

⁷⁸ The PCR (para. 5.04) observes in this connection that "detailed studies of areas representative of special ecological conditions were not carried out; instead some studies were made of soils within the areas of experimental stations which were not representative of the overall area. The partial and delayed implementation of this component undermined its objectives. To date, none of the information generated has been used by the extension service for improving land use management."

The construction of access roads, in turn, was completed about two years behind schedule due to counterpart funding delays and maintenance is reported to be uneven. The health component was not fully implemented and some facilities were deteriorating rapidly due to poor upkeep, while social objectives were observed by Bank supervision staff to have suffered considerable political manipulation.

4.66 While the mid-term review dedicated considerably less attention to Mato Grosso than to Rondonia, it did note that in many parts of the former subregion "production of basic foodcrops is falling, as is the production of mechanized cash crops and livestock is spreading rapidly." In addition, it stated that "the main wave of migration has already passed through and is now moving northwards and westwards to neighboring states, leaving large areas deforested and depleted of fertility." ⁷⁹ The review likewise indicated that, "although, as in the case of Rondonia, the construction components have generally advanced faster than provision of the corresponding services," progress in relation to the access road component had been poor and the bulk of expenditures in this respect had involved the purchase of equipment by CODEMAT that was subsequently loaned to participating municipalities "who execute the works with little overall planning or coordination and subject to local political pressure, which works against the interests of the project's small farmer target population." ⁸⁰

4.67 The construction of schools, health centers, water supply systems and storage facilities, in turn, was found by the mid-term review to be "making some progress in terms of physical achievement," but that this had not been "matched" by the necessary recruitment and training of personnel, provision of needed supplies and actual delivery of services to the intended beneficiary population. The location of these facilities, additionally, was determined to have often been subject to "political pressures, making them relatively inaccessible to the clustered pockets of small farmers." ⁸¹ The mid-term review concludes that "lack of credit, insecurity of land tenure and the inadequacy and inaccessibility of supporting services and inputs still remain the chief constraints to small farmer development, and the project has so far done very little to remove these constraints, in spite of its objectives." ⁸²

⁷⁹ Internal memorandum dated February 25, 1985, op. cit., para. 26 (emphasis OED).

⁸⁰ Ibid., para. 28. The PCR (para. 5.14) characterizes the general performance of the road construction component as having been good, but also observes that "the achievements in strengthening municipal capacity to maintain the road network were disappointing, with the result that many of the roads constructed under the project are rapidly deteriorating."

⁸¹ Ibid., para. 29. The PCR (para. 5.16) also affirms that "a chronic problem faced by all of the social component facilities was the shortage of recurrent operating expenditures after completion of construction."

⁸² Ibid., para. 30 (emphasis OED).

4.68 The PCR confirms that project implementation did not progress as anticipated during its early years for reasons which included: (i) counterpart funding delays and shortfalls, compounded by inflation rates of 200-400% per year; (ii) institutional weaknesses and manpower shortages in the executing agencies; and (iii) delays in procurement for infrastructure construction.⁸³ Due to these delays and, to a lesser extent, the suspension of Bank disbursements in mid-1985, the loan closing date was extended twice from December 1986 to December 1988, by which time the operation had reportedly "achieved performance levels rates ranging from fair to good and attained many of its physical objectives, exceeding targets in some areas of production and service delivery."⁸⁴

4.69 As concerns the provision of rural extension services, however, the project was not successful in meeting its initial targets. According to the PCR, roughly 6,500 farmers (or 65% of the original target) were directly assisted by EMATER-MT, while a larger total of some 15,000 farmers (88% of the appraisal target) were reached with "agricultural orientation messages" through a group assistance arrangement. Training programs, in turn, benefited 4,130 farmers (54% of the appraisal target) and 210 extensionists (108% of the target). Although various problems were detected with the content and quality of extension activities in the region, the PCR attributes most of the responsibility for the "limited agricultural progress" achieved through the project to the lack of rural investment credit.⁸⁵

4.70 Project results, as reported in the PCR, were mixed. On the one hand, the operation "achieved the objectives of improving agricultural and social services and expanding and improving physical and social infrastructure in the project area, although on a more limited scale than expected."⁸⁶ On the other, the results with respect to raising incomes and standards of living of target farmers were "more modest," while the project was only "marginally successful in fostering a more sustainable development strategy based on increasing the area planted with perennial crops."⁸⁷ On the more positive side,

⁸³ PCR, op. cit., para. 5.01.

⁸⁴ Ibid., para. 5.03.

⁸⁵ Ibid., paras. 5.05-5.06.

⁸⁶ Ibid., para. 6.02. More specifically, according to the PCR, the operation "significantly improved the road network in already populated parts of the project area, facilitating the marketing of farm products; constructed (underutilized) storage and crop drying facilities; and introduced schools and health posts into previously unattended rural communities."

⁸⁷ Ibid., para. 6.03 (emphasis OED). The PCR adds that "the project was partially successful in retaining rural population in the area....[but] in retrospect, it was probably unrealistic to expect that a relatively small area development project would significantly alter migration rates or patterns."

the project is credited with helping to strengthen the implementation capabilities of key state agencies "which may ultimately have a wider impact."⁸⁸

4.71 With respect to agricultural production, more concretely, the PCR concludes that the project's impact on crop yields was "not significant" except for semi-mechanized cotton and corn "which used more inputs and official technical assistance than expected."⁸⁹ In general, however, a comparison of actual yield increases with those anticipated at appraisal reveals that the former were only on the order of 30% of the latter. The increase in the area expected to be planted in crops under the operation, in turn, was only about 76% (132,000 ha as opposed to 174,000 ha) of the appraisal projection. More seriously, "the expected movement towards perennials and more sustainable cash crops did not materialize, mainly because of the shortage of agricultural credit and weak extension and research."⁹⁰ Finally, only 3,100 incremental "laborer years" were estimated to have been created by the project as compared with the 6,500 projected at appraisal.

4.72 As a result of these shortfalls, the project's reestimated economic rate of return was only on the order of 7%, as opposed to an appraisal estimate of 24%. The principal reasons for this difference were the smaller than anticipated number of project beneficiaries, the lower than expected productivity levels and real price decreases for various key crops in the area over the 1982-89 period.⁹¹ From the individual farmer standpoint, however, the project outcome was more favorable since incremental financial gains reportedly exceeded incremental investment and operational costs even though actual "with project" farm incomes were still substantially lower (US\$ 2,400) on average than those projected at appraisal (US\$ 6,500).

4.73 In retrospect, the PCR judges the principal project risks, including "the ecological risk of increased deforestation of poor soils" and the risk that "new settlements induced by the project could stimulate encroachment on Amerindian reserves," to have been correctly identified prior to Bank approval of the operation. It observes, however, that "the magnitude and rate of spontaneous migration into the Northwest region and the full extent of Brazil's fiscal crisis were not foreseen at appraisal."⁹² The PCR likewise alerts that, while an effort is being made to maintain the investments made under the

⁸⁸ Ibid., para. 6.04.

⁸⁹ Ibid., para. 6.06.

⁹⁰ Ibid., para. 6.07. The PCR affirms, more specifically, that "virtually no credit was made available to target farmers; extension agents did not have technological packages readily usable by small farmers; and the agricultural research efforts into Amazonian crops and production systems started too late to generate quantifiable results under the project."

⁹¹ Real prices for coffee, corn, cotton and rubber in the region reportedly fell by 29%, 31%, 36% and 17% respectively over this period.

⁹² Ibid., para. 7.01 (emphasis OED).

project, "existing fiscal constraints raise doubts about their long-run sustainability." ⁹³

4.74 In relation to Bank performance, the PCR observes that some of the issues and problems identified by supervision missions (eg. the insufficient availability of credit and of storage and drying capacity) did not receive adequate follow-up, while, in other instances (eg. the recruitment of personnel for institutional strengthening and the timely availability of counterpart funding), the Bank should have "pressed for stricter adherence to the agreed covenants." ⁹⁴ The Borrower, in turn, while not giving "the required counterpart funding priority, partly because of the prolonged period of economic crisis and fiscal constraints," was credited with performing "as well as could be expected given the organization and management structure of the POLONOROESTE Program which were weak in terms of interagency coordination and decision making." ⁹⁵ The principal lessons derived from the project by the PCR, finally, are essentially the same as those drawn from the parallel experience in Rondonia (see para. 4.50 above) and will, thus, not be repeated here.

4.75 To complement the project-specific findings of the PCR, a more general empirical examination of rural development tendencies leaves little doubt as to the overall trends with respect to agricultural activity in the Mato Grosso portion of the POLONOROESTE region in the early 1980's. The direction of these tendencies trends, moreover, appears to be diametrically opposed to the basic objectives of the program. The results of this analysis are presented in some detail in Annex IV and briefly summarized in the following paragraphs.

4.76 Agricultural census data for 1980-85 reveal that the number of rural establishments suffered a sizeable decrease in eight of the nine municipalities in the project region, while average farm/ranch sizes rose throughout the area as a result of the increasing concentration of land holdings. In the area as a whole, the number of farm units declined by nearly 15%, while the average size per rural establishments increased by roughly 20%. In addition, the number of people engaged in agricultural activity fell in absolute terms in all but one of the municipalities in the project region. While the total area planted in perennial crops decreased between 1980 and 1985, furthermore, that in annual crops, particularly soybeans, and devoted to cattle raising increased. Finally, agricultural mechanization, probably also related to the expansion of soybean production, likewise increased in the area.

⁹³ Ibid., para. 8.01.

⁹⁴ Ibid., para. 9.01 (emphasis OED). On the other hand, the PCR states that the Bank's decision to increase the percentage of total costs financed by the loan and to extend the project implementation period "proved to be correct" because it "enabled the agencies involved to use the experience gained in the first years to execute the remaining part of the project components in a more efficient way."

⁹⁵ Ibid., para. 10.01.

4.77 In short, agricultural census figures complement the PCR in painting a fairly somber picture with respect to POLONOROESTE's achievements in Mato Grosso. On the basis of the information currently available, it can be concluded that the early 1980's constituted a period of heavy rural outmigration in the municipalities covered by the Mato Grosso project despite the program's efforts on the behalf of small farmers. One hypothesis which merits further consideration in this connection is that the amount of resources destined by POLONOROESTE to small-farmer consolidation in Mato Grosso was comparatively small in relation to that invested in roadbuilding, especially improvement of the Cuiaba-Porto Velho highway itself, which, by stimulating higher land values and associated speculation, in practice worked at cross purposes to the program's rural development objectives.

H. Principal Causes of Observed Implementation Problems

4.78 The preceding discussion highlights a recurring pattern with respect to the design and implementation of the various components of the Northwest Region Development Program. With the exception of the highway subproject whose planning was already well advanced before the Bank was approached in connection with the program, POLONOROESTE's various components were designed or redesigned with considerable Bank and/or FAO intervention. Furthermore, the Bank's desires to favor small farmers and protect the natural environment were unequivocally stated and several innovative features were introduced in an attempt to guarantee the success of the program's social and environment components. Yet, with the exception of the road component, whose administrative and technical problems seem minor by comparison, and other infrastructure construction, each of the remaining program elements (ie. agricultural production support and social services, environmental and Amerindian protection) encountered serious implementation difficulties. Indeed, it is fair to say not only that these non-infrastructure components seem to have achieved only part of their objectives, but that the settlement-related subprojects appear to have contributed to the aggravation of other problems including malaria, deforestation, encroachment of tribal areas, etc. What accounts for these recurring gaps between stated goals objectives and subsequent reality?

4.79 In this section, the main question of interest is the extent to which implementation problems per se can be held responsible for the observed discrepancies between program intentions and its social and environmental results. From the outset, it should be observed that considerations related to program implementation were clearly a contributing factor to, but not the only cause of, this gap. In order to fully understand the discrepancy between program goals and outcomes, it is also necessary to analyze the impacts of roadbuilding and other forms of public intervention on migration flows in an active frontier area, the difficulties of achieving sustainable agricultural production in the region in light of its soil constraints and the distance to market, as well as to view the environmental consequences of the program and parallel influences in light of these factors. This analysis will be largely undertaken in Chapter VIII below. The following paragraphs will address the contribution of implementation problems to the more encompassing difficulties affecting POLONOROESTE's performance and environmental impacts.

1. Institutional Arrangements and Program Coordination

4.80 One of the major shortcomings of POLONOROESTE's design and appraisal was the Bank's serious overestimation of the commitment and capacity of many of the public sector institutions connected with the program, particularly in relation to its social and environmental objectives. At the Government's request, coordination of POLONOROESTE was centralized in SUDECO, the Superintendency for the Development of the Center-West. SUDECO, however, was a weak agency within a politically sensitive Ministry (Interior) and its deficiencies were readily apparent at both the technical and the administrative levels. SUDECO, for example, was both unaccustomed to handling a large volume of resources and incapable of coordinating a wide variety of institutions at different levels of public administration, especially much stronger federal agencies such as DNER and INCRA.⁹⁶

4.81 Many of the executing agencies involved in POLONOROESTE were also weak, although some, notably SEPLAN, INCRA and DNER, wielded considerable power. SEPLAN was acutely concerned with the balance of payments crisis at the time the program was prepared and appraised (ie. 1979-83) and tended to judge externally-funded projects primarily in terms of their ability to generate infusions of hard currency. Furthermore, since SEPLAN, together with the Finance Ministry, simultaneously had the task of administering the foreign debt, incoming funds were routinely retained for considerable periods, often delaying transfers to executing agencies, thereby adversely affecting project implementation. INCRA, in turn, had acquired considerable experience in the design and execution of colonization schemes and was accustomed to undertaking by itself all phases of directed settlement projects from initial land demarcation to the provision of health and education services.⁹⁷ Decentralization of these multiple roles did not come easy, nor was it accompanied by the required improvement in the administrative and technical capabilities of other agencies.

4.82 The influx of comparatively large and relatively flexible resources from POLONOROESTE through SUDECO appears to have caused additional disequilibria at various levels. SUDECO was regularly accused of disregarding the funding requirements of the executing agencies which rarely received the expected amounts at the right time. In addition, suspicions of shadowy dealings and references to political interference in program resource allocation are present in Bank and other reports concerning POLONOROESTE's administration. As already noted, for instance, the mid-term review explicitly mentions "political interests diverging from the objectives of the program" that led to the opening up of roads in areas inappropriate for settlement. The review likewise observed that program management at the state level became "particularly inadequate"

⁹⁶ SUDECO's weakness in relation to the other federal agencies that participated in POLONOROESTE was further exacerbated by the subordinate position of the program coordination unit within the regional superintendency itself (see Sant'Anna, op. cit., pg. 40).

⁹⁷ INCRA's President at the time, moreover, was a direct appointee and former colleague of the powerful Planning Minister, Delfim Neto, and, thus, possessed considerable personal influence within the Figueiredo government.

during the pre-electoral period in 1982 "when the pressure to divert program resources" reached its peak.⁹⁸

4.83 At the state and local levels, government agencies tended to be even weaker. In Rondonia, a state development company (CODARON) was created for the specific purpose of coordinating the program. This agency was apparently doing a reasonable job when it was abruptly abolished by the state Governor. Alleged motives for the demise of CODARON run the gamut from corruption to conflicting political aspirations, but the net result as far as POLONOROESTE was concerned was a further decline in the already limited level of technical and coordinating capability in the state. More generally, the fact that the present state of Mato Grosso became a separate unit of the federation in January 1979,⁹⁹ while the Territory of Rondonia was elevated to statehood in December 1981, and that, in both parts of the program region, numerous new municipalities were created in the late 1970's and early 1980's, suggest the very high degree of political-administrative flux and associated institutional indefiniteness that characterized the area at the time POLONOROESTE was prepared, appraised and initially implemented.

4.84 The poor performance of most of the planned institution building activities under the program, furthermore, resulted in part from the lack of authority of practically all of the agencies involved to recruit better qualified staff and upgrade their salary scales. Necessary adjustments in response to the severe economic crisis in the early 1980's fostered a prolonged period of fiscal austerity during which public agencies were legally prohibited from hiring new personnel or introducing real increases in existing salaries. Rampant inflation as a result of the crisis, in turn, made public sector salaries even less attractive, as well as quickly eroding the real value of all domestic resources transferred from SEPLAN or SUDECO to program executing agencies. The lack of institutional strengthening, however, was also partly due to the agencies' inability to clearly define their specific roles and functions within the program and to develop the corresponding training programs.

4.85 In sum, one serious set of obstacles to the more balanced implementation of POLONOROESTE stemmed from the very complexity and fragility of the institutional framework set up for its execution. A weak coordinating agency was unprepared to handle large quantities of resources or to articulate the activities of a wide number of organizations involving several different levels of government. As a result, attempts to train human resources or create

⁹⁸ Internal memorandum dated February 25, 1985, op. cit., paras. 15 and 33.

⁹⁹ The creation of present-day Mato Grosso as a result of the division of the former state having the same name meant that the northern part (ie. the new Mato Grosso) was left with two-thirds of the land area, but only one-third of the population, economic activity and revenue base of the previous Mato Grosso, in addition to its former capital city, Cuiaba. This resulted in considerable initial financial difficulties since the new state was required by existing civil service laws to maintain the payroll and other current expenditures of the former state, but received a much smaller share of its revenues, thus also increasing its dependence on the federal government.

efficient local executing agencies in connection with the program were largely frustrated. Inadequate central government supervision and control of resource flows, additionally, left room for the creation of interest groups among and within program executing agencies and generated recurring suspicions that part of its funds were improperly used.¹⁰⁰

2. The Adequacy of Program Monitoring and Evaluation

4.86 Monitoring and evaluation appear not to have been given uniform treatment during different stages of program implementation. Only the SARs for the Agricultural Development and Environmental Protection Project and the Mato Grosso Rural Development Project make explicit reference to these aspects of program management. The former states that: "funds would be made available for monitoring overall program progress, mid-term and final evaluation surveys, ad hoc studies on issues arising during and affecting project implementation, and general studies, including studies oriented to the identification of future projects relevant to the development of the program area."¹⁰¹ This report also indicated that a six-man Monitoring and Evaluation Section would be established within SUDECO made up of a coordinator, an economist, an agronomist, a civil engineer, a sociologist and an ecologist. This section, assisted by Bank-approved consultants, would be largely responsible for the on-going evaluation of the program on the basis of monitoring data provided by the individual implementing agencies. In addition, it would monitor program activities within SUDECO, contract out ad hoc, mid-term and final impact studies and supervise their execution. Monitoring results were to be consolidated into quarterly reports.

4.87 As concerns the various subprojects in Rondonia, for the most part monitoring was to be handled locally. More generally, project performance

¹⁰⁰ In its comments on the preliminary version of this report, the Secretariat of Regional Development (SDR) observed that: "the difficulties encountered by POLONOROESTE were not limited to those of a single administration. There were structural/institutional problems, the majority of which inherited from previous governments, when public sector agencies began to overlap with one another in terms of their responsibilities. This became one of the most serious challenges to be faced by all those charged with managing the execution of government programs. Added to this was the fact that [these agencies] did not have sufficient numbers of qualified and trained professionals to carry out specific functions. The crisis of planning at the regional, state and municipal levels, due to the process of centralization of decisions at the federal level, should also be highlighted. POLONOROESTE, created in 1981 in the midst of this excessive centralization of the public sector, could not be immune from this process or the consequences of its growing difficulty to sustain and administer programs with efficacy and effectiveness. The basic question of POLONOROESTE not only passes through the identification of planning, management and execution deficiencies, but also through the adoption of administrative measures and the resolution of existing problems through projects compatible with reality, technical cooperation and, above all, institutional strengthening."

¹⁰¹ Report No. 3512b-BR, op. cit., para. 4.27.

indicators were to be monitored through information gathering procedures established as part of an existing computerized data system (SAPE-GRAFF) previously developed by the Planning Ministry. Such monitoring activities would be complemented by qualitative and quantitative impact studies and a project evaluation methodology to be developed by an independent consultant firm or university. SUDECO was to provide the Bank with quarterly monitoring results, research and evaluation reports to be prepared in parallel to program execution, a mid-term evaluation by June 1984 and a completion report within six months of project closing. The SAR for the Mato Grosso project provided more detailed information as to how monitoring and evaluation were to be carried out, but without altering the basic arrangements described above.

4.88 The extent to which and how well such instructions were carried out is difficult to reconstruct from the information presently available. With respect to program monitoring, however, it appears that the elaboration of quarterly reports which were to consolidate different types of field data produced irregular and uneven results. As concerns evaluation, the major initiative, as already noted, was to hire FIPE (the Economic Research Institute of the University of Sao Paulo) on the basis of public bidding procedures for the purpose of elaborating annual evaluation reports, to carry out specific studies on previously agreed topics and to prepare mid-term and final evaluation reports.

4.89 After considerable delays, caused mainly by bureaucratic impediments at SUDECO, FIPE initiated its research activities. It soon became apparent that the promised data, including the information to be provided through the SAPE-GRAFF monitoring system, would be of little use for evaluation purposes and that independent field research and verification was necessary. Annual discussions concerning the content, format and costs of the evaluation activities to be undertaken, however, tended to be drawn out, involving considerable loss of time, while stalemates between FIPE and SUDECO on several occasions were only resolved after intervention by the Bank.

4.90 Despite such difficulties, the field research carried out by FIPE in 1983 and 1984 provided much of the information which led to and/or supported Bank efforts to reformulate the program following the mid-term review. Through FIPE's work, the first realistic evaluation, capable of penetrating the rhetoric, euphoria and propaganda that had surrounded POLONOROESTE during its early years, was produced. Although weak on environmental aspects, FIPE's reports presented a critical, and, thus, sobering, picture of project achievements and limitations, together with a first-hand account of rapidly evolving demographic and socio-economic conditions in the program area.

4.91 Given this assessment, the relationship between the outside evaluators and SUDECO, predictably, continued to deteriorate and only energetic action on the Bank's part was able to maintain FIPE's involvement in the program. Rather than attempting to translate more of FIPE's critical observations and recommendations into guidelines for program changes, however, evaluation activities were eventually phased out through a combination of payment delays, claims of incompetence and similar tactics. As a result, no systematic final program evaluation was undertaken by an independent Brazilian institution.

3. Bank Supervision and Response to Implementation Problems

4.92 Overall, despite its earlier (and correct) assessment of the very substantial risks facing POLONOROESTE, in practice the Bank appears to have been slow to perceive the various distortions associated with the early execution of the program. Furthermore, at least until disbursements were suspended in early 1985, the Bank appears to have been largely ineffective in dealing with or correcting these problems. Indeed, the extensive participation of Bank staff from various divisions and departments, in addition to FAO personnel, in the planning and design of POLONOROESTE, once the Government's initial request for a roadbuilding project had been transformed into a multi-sector regional development program stands in sharp contrast to its more limited and, apparently, poorly coordinated role in the supervision of program execution between 1982 and 1984.

4.93 There appears to be a consensus among those interviewed by OED and SEPLAN in connection with POLONOROESTE, both inside the Bank and in Brazil, that Bank/FAO participation tended to diminish somewhat as each of the successive component projects was approved and ultimately became subject to the degree of personal commitment and the specific concerns of individual project officers in the various sectors covered by the program. While there is at least one notable case of a Bank staff member whose dedication to POLONOROESTE's social and environmental goals left a lasting impression on all involved and who was instrumental in removing numerous obstacles to its implementation over a period of several years, the overall extent of Bank involvement appears to have been insufficient in light of the program's size and complexity and the extremely intricate and dynamic nature of the regional development processes it was attempting to orient or control.¹⁰² As a result, the Bank's ability to alter the program's trajectory, short of the suspension of disbursements, was similarly constrained.

4.94 By the time the suspension of disbursements did occur, furthermore, the Bank had already lost part of its potential leverage with the Government, since the latter's principal objective, paving of the BR-364 highway, had already been largely met.¹⁰³ More importantly, the Bank appears to have lost

¹⁰² The PCR for the Agricultural Development and Environmental Protection Project affirms (para. 9.01) that "Bank involvement measured in terms of staff inputs throughout the life of the project has exceeded by far the average for Bank agricultural projects." This included 18 multi-person supervision missions over nine years and a total of some 340 staff weeks. The PCR neglects to mention, however, that field supervision in the critical period prior to the mid-term review entailed four missions involving 31 staff weeks in 1982, eight missions totalling 28.3 staff weeks in 1983 and a single mission for a total of 12.5 staff weeks in 1984. Of these 13 missions, five (including half of those in 1983) were carried out by a single staff member.

¹⁰³ Regional staff point out in this connection, however, that substantial reformulation of the two rural development projects for Rondonia (ie. Loans 2060 and 2353) did, in fact, take place after the mid-term review despite the near

time in terms of attempting to induce the Borrower to implement measures that might have given the program a better chance of achieving its broader objectives of promoting orderly rural settlement and protecting the natural environment in the region. Why the Bank did not take stronger action earlier to try to stem the main problems associated with program implementation remains unclear, although part of the reason undoubtedly was that it believed that its efforts were likely to be more effective once a new federal government took office in mid-March 1985.¹⁰⁴ In any event, it is surely no coincidence that the Bank's letter to the Government proposing a "Corrective Action Program" for the program was sent on the same day that the new civilian administration was inaugurated.

4.95 While the decision to wait until after the mid-term review was concluded and the new federal government was in place before attempting to undertake a major reformulation of the program is understandable, it is also clear that many of the problems that led to the need for this action could have been perceived and dealt with sooner had a more systematic, better coordinated, and, above all, more "hands-on" approach to project monitoring and supervision been followed by the Bank. Given both the program's dimension and complexity and the magnitude and diversity of the (previously identified) risks associated with its implementation, a more intensive Bank supervision presence during its critical initial stages of execution would have been highly recommendable, if, for no other reason, than to unequivocally signal to the Borrower and its agencies the Bank's commitment to the achievement of the program's non-roadbuilding objectives. The physical presence of one or more Bank staff members and/or permanent consultants in the program area or in or near the program coordinating agency would have permitted a more effective "early warning system" with regard to the problems and distortions experienced by POLONOROESTE and, perhaps, have prevented some of them from occurring in the first place.¹⁰⁵ Earlier and more systematic Bank contact with local and national NGOs would also have contributed to this end.

I. Conclusion

4.96 The implementation of the various projects and subprojects which comprised POLONOROESTE was notably imbalanced. The road component and other activities involving the construction of physical infrastructure and facilities were executed with considerable, although by no means universal, success. Minor

completion of the major road component.

¹⁰⁴ Some participants in program supervision suggest that administrative changes and shifting priorities in the operational divisions that dealt with the program between 1981 and 1984, together with insufficient cross-sectoral coordination, help to explain why the increasingly serious problems encountered in connection with POLONOROESTE's implementation did not receive greater attention within the Bank at an earlier date.

¹⁰⁵ Similar arrangements for overseeing the Bank's rural development activities in Northeast Brazil, in fact, already existed at the time in the form of a small Bank office at SUDENE in Recife that was established in the early 1970's and continues to this day.

irregularities and administrative inconsistencies, as well as exceptions such as the feeder roads component in Mato Grosso, do not deter from the general fact that most major construction activities were executed roughly on or even ahead of schedule and within or below projected budgets in US dollar terms. The same is not true, however, of other program components whose achievements, in many instances, fell far short of initial targets, in addition to creating several un- or poorly anticipated problems of a larger order. Responsibility for a major share of these discrepancies stems from basic errors in conception, planning and judgement, as will be discussed more fully in Chapter VIII below.

4.97 But part of the problems encountered by POLONOROESTE were also clearly related to flaws in the institutional framework established for the program and to the lack of, and/or delays in taking, appropriate corrective measures. In transforming a road project into a complex, multi-faceted regional development program, the Bank appears to have misread the Brazilian Government's actual commitment to this broader undertaking, particularly as concerns its social and environmental aspects. Be that as it may, it is also evident that the institutional arrangements set up for the administration of POLONOROESTE were inadequate. The coordinating agency was technically, administratively and politically weak. Furthermore, it was overshadowed by both the entity that controlled the program's financial arrangements (SEPLAN) and the sectoral agencies responsible for its trunk road (DNER) and rural settlement (INCRA) components. In hindsight, it is likewise evident that, during the early years of program implementation, procedures for the monitoring, evaluation and eventual reorientation of its activities were often ineffective and that Bank supervision was insufficient.

4.98 The largely unforeseen magnitude of the economic crisis and the of associated deterioration of the Government's financial situation in the early and mid-1980's clearly exacerbated POLONOROESTE's execution problems which ultimately reflected the institutional weaknesses and lack of commitment to the program's non-infrastructure objectives described above. The fact remains, however, that, by the time the principal shortcomings in the program's initial implementation were fully apparent to the Bank, the possibility of taking effective corrective action was limited since the program's most important component from a political and economic standpoint had been essentially completed. In retrospect, this experience suggests that pavement of the BR-364 highway and most other program-related transport improvements should have followed rather than preceded effective implementation of its institutional strengthening, environmental protection and other "software" components.

4.99 From an environmental perspective, finally, it should be observed that those corrective measures which could still be, and to a large extent were, in fact taken after the mid-term review, while clearly necessary and important, have been largely palliative in nature. This is especially true when these measures are considered in light of the much stronger demographic and economic pressures on the region's natural resource base that were set off in part by the highly uneven early implementation of POLONOROESTE itself. This can be illustrated through a more specific examination of the execution performance and results of the program's environmental and Amerindian protection components.

V. EVALUATION OF ENVIRONMENTAL AND AMERINDIAN PROTECTION COMPONENTS

A. Introduction

5.01 As indicated in Chapter III and described in Annex III, POLONOROESTE contained specific forestry development, environmental preservation, ecological research and Amerindian protection components. In many respects, these were innovative initiatives that preceded Bank guidelines on environmental and tribal peoples protection and contributed to the subsequent formulation and/or formalization of such measures. As a result, the implementation performance and consequences of these components -- one of which (ie. forestry development/environmental protection/ecological research) was partially financed by the Bank and the other (Amerindian protection) was not, but, nevertheless, received Bank supervision and later became a principal factor in its decision to suspend loan disbursements for the program -- merit a direct evaluation. This assessment will be largely based on the results of the Bank's mid-term review in 1984-85, the findings of an OED/SEPLAN visit to the program region in September-October 1989 and the recently (December 1990) submitted PCR for the Northwest Agricultural Development and Environmental Protection Project (Loans 2060 and 2060-1-BR). It also entails an evaluation of the Northwest Amerindian Special Project specifically prepared for the present report. ¹

B. Forestry and Environmental Protection Components

1. General Natural Resource Management Concerns ²

5.02 The objective of protecting forests and the physical environment more generally under POLONOROESTE not only gave rise to a specific subproject in the Phase I Agricultural Development and Environmental Protection Project, but was intended to permeate other program components as well, especially those concerned with agricultural development. The program's three agricultural projects, furthermore, differed from earlier Bank-supported settlement efforts in that they explicitly aimed at promoting the conservation of renewable natural resources at both the farm and the regional levels. The respective staff appraisal reports, accordingly, emphasized both the need to undertake agro-ecological zoning, soil capability surveys and other land use planning measures and to improve rural settlement design and on-farm resource management techniques.

¹ Daniel R. Gross, "The Amerindians of the Northwest Region of Brazil," mimeo, December 11, 1989.

² This and the following sections are largely based on Marc Dourojeanni, "An Example of the Complexity of Development in the Humid Tropics: The Northwest Region Development Program in Brazil," op. cit., as well as on supervision and mid-term review reports prepared by the same author between 1983 and 1986 as a consultant to the Bank on POLONOROESTE's forestry and environmental protection components.

5.03 Even though, in practice, rural land use planning information was either not generated at all, was greatly delayed in its preparation or was insufficiently utilized during program implementation, the idea of zoning agricultural, ranching and other primary sector activities (including forest, biological and Amerindian reserves) on the basis of soil aptitudes and other natural resource characteristics and constraints was at least recommended by the Bank in connection with the design of POLONOROESTE.³ In accordance with existing IBDF and INCRA regulations, moreover, 50% of each settlement plot or, under the Phase III Rondonia New Settlements Project its equivalent in block reserves, was to be permanently maintained in native forest. Commercially valuable or otherwise useful tree and palm species, in turn, were to be exploited more rationally than had been the case in the past.⁴ The promotion of "salvage" logging operations in the areas to be cleared, in short, was to be another innovative natural resource utilization measure under the program.

5.04 In recognition of the significant soil restrictions in much of the Northwest, priority was given to the installation of perennial crops. Tree crops, such as rubber, coffee and cocoa, were considered to be far more likely to preserve soil nutrients than annual crops that were traditionally grown using land extensive, slash-and-burn, shifting cultivation techniques. Finally, since it was expected that small farmer production of perennials would largely avoid, or at least substantially reduce, environmental degradation associated with excessive deforestation and the resulting loss of soil fertility through erosion and nutrient depletion, the program was designed to provide a broad array of physical infrastructure and agricultural support services to these producers.

5.05 POLONOROESTE, as appraised by the Bank, also took pains to ensure the protection of representative samples of prevailing ecosystems, and thus of genetic diversity, in the region, while at the same time attempting to make proper use of forest reserves and protect the central highlands (ie. the Parecis-

³ A general review of the experience with land use zoning in developing countries by Richard Barrows and Martha Newman ("A Review of Experience with Land Use Zoning," mimeo, University of Wisconsin, February 1990) suggests, however, that, even if the required studies had been carried out in Northwest Brazil, this per se would not have guaranteed their successful application. According to this review (pp. 19-20), "zoning can be an effective policy for maintaining land in less intensive uses if zoning is supported by other government policies that create economic incentives that are consistent with the zoning or reduce incentives that cause the land use behavior the zoning seeks to change. Consistent economic incentives are particularly important for agricultural and forestry zoning because lower-intensity uses frequently have no strong political constituency within the governmental jurisdiction in which the zoning is enforced....The key to successful zoning policy is to recognize that zoning, by its nature, is an attempt to change the behavior of individuals in their use of land. Unless the economic incentives that drive individual behavior are changed, zoning is likely to fail." (Emphasis OED)

⁴ Prior to the program, the prevailing practice in most new colonization areas in Rondonia, especially those characterized by poorer access, was to clear and burn all forest vegetation including trees of commercial value.

Pacaas Novos ranges) where most of its watersheds originated. Specific funding was likewise allocated for an environmental research program to be carried out by Brazilian scientific institutions and universities under the coordination of the National Science Council, CNPq. The equipment, staff and activities of the forestry development agency (IBDF) were to be strengthened, while a Military Police Forestry Battalion was to be created and equipped in order to reinforce the control of ecologically sensitive areas, regional water resources and protect endangered species.

5.06 A key element in the program's environmental protection subproject was the expansion and consolidation of a partially-existing network of protected areas. In this connection, POLONOROESTE was expected to establish and/or support some ten conservation units, covering a total of roughly 2.4 million hectares.⁵ Perhaps most importantly, the Bank broached the issue of environmental preservation in Amazonia at a time when the Brazilian Government's own concern in this regard was still incipient. As discussed in Annex III, the Bank sought assurances from the Government that all necessary means would be used to discourage the exploitation of unsuitable areas and to guarantee the immunity of protected subregions from encroachment by grileiros and spontaneous settlers. Altogether, it was estimated that at least 10% of all program funds initially allocated to Rondonia were intended for the management or conservation of its natural resources.⁶

5.07 In synthesis, the strategy that underlay the program's environmental and forestry components was described by one specialized consultant as one that attempted to pave the way for "truly integrated and sustained rural development, with minimum waste of natural resources and the certainty of being able to rely on a network of protected areas for the conservation of biological diversity."⁷ In this context, POLONOROESTE included measures at both the individual settlement and the regional levels. The former consisted basically of the selection of areas with fertile soils, the introduction of "appropriate agriculture" with a high percentage of perennial crops, the avoidance of extensive livestock activities, the rational exploitation of timber felled in the land clearing process, the establishment and protection of block reserves and the prevention of soil erosion, together with the discouragement of settlement in areas of inadequate soils, while the latter involved setting up and/or protecting the Pacaas Novos National Park, the Guapore and Jaru Biological Reserves, four ecological stations and two or more national forests. The parallel protection of Amerindian reserves, discussed later in this chapter, was also expected to contribute to achievement of the program's environmental conservation goals.

⁵ Eneas Salati, "POLONOROESTE: Problemas Ambientais," op. cit., pg. 72 and Table V.

⁶ Dourojeanni, op. cit., pg. 22.

⁷ Marc Dourojeanni, "Northwest Region Development Program - Phases I, II and III - Mid-term Review: Report on Environmental Component," mimeo, January 7, 1985, para. i.

2. Overall Results of Program Environmental Initiatives

5.08 Despite this impressive battery of proposed measures, POLONOROESTE has often been accused of contributing both directly and indirectly to extensive deforestation, the loss of biodiversity, erosion, soil degradation, pollution and other environmental problems in the region.⁸ As suggested in the previous chapter, part of the discrepancy between intended objectives and actual program results had to do with inadequate implementation of the proposed environmental protection measures. Whether or not it was realistic to assume that such measures could be properly implemented is another matter which will be discussed in a later chapter. The following points, however, are germane to the question immediately at hand.

5.09 First, as pointed out in Chapter II, soil resources in much of the region are limited.⁹ As indicated in the previous chapter, furthermore, the consolidation of existing settlements, especially in Mato Grosso, and the initiation of new colonization projects in Rondonia under POLONOROESTE, contrary to the assurances of the respective SARs, were not preceded by adequate pedological analyses. Not only were several of the new settlements promoted by the program not located in areas possessing good soils, but any assistance to either existing or new colonization areas tended to stimulate an additional rush of "spontaneous" migrants into adjacent lands which often turned out to be of even poorer quality. The layouts of the earlier INCRA colonization schemes in Rondonia, in turn, generally failed to consider topographical features, natural drainage systems, water availability or soil conditions. Even though the Phase III New Settlements Project consciously attempted to improve design procedures in this respect, in fact it attained only modest success.

5.10 Secondly, although some clearing of the forest is an inevitable consequence of rural settlement in tropical areas, deforestation in the Northwest region, particularly Rondonia, is considered by many observers to have been excessive and to have occurred in the wrong places. Thirdly, there is little unequivocal evidence that agricultural development will be sustained over the long run in many of the areas that have already been cleared. After the first few years of cultivation, the productivity of tilled crops is low in much of the region, while landholdings are becoming increasingly concentrated, soil erosion is occurring and a substantial percentage of the land is left fallow. Given the poor prospects for farming in large parts of the Northwest, the area of pasture land has multiplied, further contributing to environmental degradation.

⁸ The more vociferous accusations have come from NGOs such as the Natural Resources Defense Council and the Sierra Club, but the same position has been taken by a number of ecologists and other scientists inside and outside Brazil, among whom Philip Fearnside of the National Institute for Amazon Research (INPA) in Manaus has probably been the most prolific.

⁹ For detailed information on the soils in Rondonia, see SEMA, Programa POLONOROESTE - Diretrizes Ambientais: la Etapa - Estado de Rondonia, Brasilia, 1986, Chapter V.

5.11 Fourthly, although forestry programs are operating, thus far they appear to have produced few positive results. At present, control over commercial logging activities and forest management are still insufficient, making forestry development one of the most disappointing components of the program. Fifthly, the longer term scenario for the physical environment in the region is not very optimistic. In addition to extensive deforestation and soil erosion, river pollution due to urban-industrial growth is significant, while that caused by the proliferation of mining and prospecting activities, especially mercury contamination, although largely unforeseen, remains potentially serious despite recent program-sponsored efforts to increase control over mercury use. Furthermore, until relatively recently, program expenditures aimed at bolstering government agencies responsible for the management of renewable resources, preserving biological diversity, monitoring deforestation, promoting environmental research and protecting reserve areas were largely ineffective.

5.12 In short, even though POLONOROESTE was environmentally "aware" and its design incorporated a variety of promising safeguards, in practice, until fairly recently, few of the measures initially proposed had a significant impact in terms of protecting the natural environment. As will be further illustrated in the next two chapters, the overall thrust of the program has produced a significantly different outcome than that originally intended. The following sections, however, will focus on the performance of the program's specific environmental and forestry components.

3. Findings of the Mid-term Review ¹⁰

5.13 The Bank's mid-term review of POLONOROESTE, carried out in late 1984, concluded that progress in relation to the program's forestry and environmental activities had been "weak" due mainly to the "inadequate resources of IBDF and the absence of any implementing capacity at the state level."¹¹ It was observed, for example, that plans for a national forest to be established under the program had been "developed without due consideration to mining operations underway in the same area," while a second national forest had yet to be officially created or inventoried. Although forestry control posts were, in fact, set up in accordance with the original plans, they had "failed in providing the corresponding services." In addition, IBDF had not complied with its contractual obligations to complete salvage logging and forestry development studies by December 31, 1982 and June 30, 1983, respectively.¹²

¹⁰ These observations are largely drawn from Dourojeanni, "Northwest Region...", op. cit.

¹¹ These and the other direct citations in this and the next paragraph are drawn from the internal memorandum dated February 25, 1985 which reported the results of the Bank's mid-term review of the program (op. cit., para. 24).

¹² These conditions were contained in Sections 4.03 and 3.06 of the Loan Agreement between the Bank and the Brazilian Government for the Northwest I Agricultural Development and Environmental Protection Project.

5.14 Even though the planned biological reserves had been officially established, measures to ensure their proper management were being taken only "very slowly." A contractually required agreement between FUNAI and IBDF regarding administration of the Pacaas Novos National Park and the overlapping Uru-eu-wau-wau Amerindian Reserve, in turn, "was still in the making."¹³ In addition, while the four ecological stations to be operated by SEMA had been built and equipped, measures to enhance their use by universities and other researchers had not yet been fully developed. Finally, although findings were being generated from the studies carried out under the program's ecological research component, "other agencies involved with field activities [had] not become acquainted with these results and [thus had] not used them for monitoring and planning purposes."

5.15 In short, by the time of the mid-term review, it was already evident that many of POLONOROESTE's environmental objectives had been only partially attained at best. According to one participant in the review, "rapid, heavy migration, the gap between execution of infrastructure components (BR-364 and other highways, in particular) and progress with other elements of the program, the lack of awareness of environmental problems, the weakness as institutions of several of the agencies responsible for program execution, over-optimistic goals and time targets, the malaria rate, the effects of the economic crisis and other factors combined to upset all the original projections."¹⁴ The program's results in settlement areas, more specifically, were found to be "frankly adverse" from an environmental standpoint and included: "poor soil selection and disregard of [soil] classification; waste of forest resources and [air] pollution through burning; acceleration of erosion processes; shortages and high cost of processed timber; high proportion of unused land; cattle-farming of the extensive type and concentration of landholdings; block destruction of forests and reserves; excessive hunting and fishing, etc."¹⁵

5.16 At the regional level, in turn, the establishment and, especially, the protection of reserve areas were found to have been so slow that, "with the relative exception of the ecology stations, such areas have benefitted from no real protection and are in fact being invaded."¹⁶ In addition, it was reported that decisions still pending on account of the presence of Amerindians in two of the key protected areas in the region, together with the inadequate size of others and the inappropriate use that was being made of "the only national forest created so far," had "put the advances achieved in this sphere in serious jeopardy." Finally, the ecological research carried out under the program had

¹³ This was specifically mandated by Section 3.08(b) of the Loan Agreement for the Phase I Agricultural Development and Environmental Protection Project.

¹⁴ Ibid., para. iii.

¹⁵ Ibid., para. iv. The report observes (para. 2), moreover, that, during the period between January 1983 and December 1984, the situation had grown worse, both in terms of the Government's performance and with respect to the program's increasingly adverse environmental impact throughout the region.

¹⁶ Ibid., para. v.

"failed to provide feedback for the rural development process or to push ahead substantially with the collection, description and cataloguing of the very diverse biological life in the area of influence of BR-364 before the forests which shelter it are eliminated entirely." ¹⁷ Progress on the environmental components of the program at the time of the mid-term review can be further described as follows.

(a) National Forests

5.17 By late 1984, IBDF had succeeded only in establishing the Jamari National Forest, which, it was subsequently discovered, was intended in part to provide protection for [cassiterite] mining companies owning concessions inside it. In addition, it was observed that the mining companies were obtaining protection against prospectors and settlers with government assistance, while their own activities also had a negative impact on the forest. Plans for the establishment of a second (Goncalves Dias) national forest, in turn, had not moved forward and it was known that at least 20% of the initially proposed area was in conflict due to the presence of Karitana Indians. ¹⁸

(b) Block Reserves

5.18 At the time of the mid-term review, INCRA's two block reserves in the Urupa new settlement project had already been "abandoned in an administrative sense" and were reportedly being invaded by landless settlers and loggers, while it was surmised that those at Machajinho were in the same situation. This was occurring despite the fact that some of these reserves had been established in areas that were unsuitable for either agricultural or forestry activities. Under the circumstances, IBDF refused to take over the reserves from INCRA for purposes of on-going management. Furthermore, it was anticipated that, as a consequence of increasing pressures on land in the new settlement areas and in the absence of stronger control measures, other block reserves might be similarly affected in the future. ¹⁹

(c) Timber Utilization and Forest Resource Management

5.19 According to the environmental consultant who participated in the mid-term review, "the destruction by fire of hundreds of thousands of cubic meters of timber annually is still an unsolved problem." ²⁰ This not only represented a waste of a valuable natural resource that might otherwise have provided settlers with an additional source of income, but, due to increasing amounts of smoke during the annual dry season, also generated a serious, if

¹⁷ Ibid., para. vi (emphasis OED).

¹⁸ Ibid., para. 18 and Dourojeanni, "An Example...", op. cit., pg. 47.

¹⁹ Dourojeanni, "An Example...", op. cit., pg. 48. In this connection, it was also observed that "the destruction of forests on very steep slopes in the older settlement areas is already noticeable."

²⁰ Dourojeanni, "Northwest Region...", op. cit., para. 21.

seasonally concentrated, air pollution problem in much of the region, to the point that even commercial air traffic to Porto Velho was often affected. In response to this situation, IBDF had done virtually nothing to control forest burning, while the Military Police's Forestry Battalion had not yet begun to operate effectively. In addition, there had been no action in the field of forestry extension services, while only one of the two planned tree nurseries in the Northwest was in full operation.²¹ More generally, it was found that the forestry posts were operating, but were ineffective even to collect wood taxes, while there was virtually no control over areas that were being logged.

(d) Pacaas Novos National Park

5.20 In relation to the Pacaas Novos National Park,²² the mid-term review characterized execution delays as "enormous" and reported that park boundaries were not being policed. The installation of park infrastructure had been hampered from the outset by the still undefined division of administrative responsibilities between FUNAI and IBDF which also meant that the latter agency possessed virtually no control over the area. As a result, some fifty families were reportedly occupying sections of the park, while park officials had taken no action to prevent squatting or remove encroachers.²³

(e) Biological Reserves

5.21 The situation of the biological reserves at the time of the mid-term review was largely similar. Implementation of protective measures in the Guapore Reserve, whose area was reduced in 1982 from nearly 1.8 million ha to 600,000 ha, was delayed, leading the review mission to affirm that there was

²¹ Ibid., paras. 22-24. Located in Cuiaba, this latter facility was situated at a considerable distance from much of the program region and, thus, was of little or no use to most program beneficiaries.

²² This park, formally established in 1979, covered some 765,000 ha of the Serra dos Pacaas Novos in central Rondonia. According to Dourojeanni, ("An Example...", op. cit., pg. 43), its principal justifications were to protect an untouched representative sample of some of the regional ecosystems, including the transition area between the cerrados and humid Amazonian forest, and to safeguard the origins of the three main watersheds of the state (ie. the Madeira, Mamore and Guapore Rivers).

²³ Dourojeanni, "Northwest Region...", op. cit., para. 4. The situation on other perimeters of the park was unknown, but it was surmised that "there must obviously be other instances of invasion." Dourojeanni ("An Example...", op. cit., pg. 44) further observes that "it is probable that some gold digging is also in progress in the park, but, in general, the presence of 'dangerous' Indians discourages settlers, gold diggers and other intruders, who limit themselves to safer places." Due to inherent legal and institutional difficulties in defining the precise boundaries between the park and the proposed Uru-eu-wau-wau Amerindian Reserve ("a national park or an Indian reserve, as well as an Indian park, can not be superimposed on the other"), he concludes (pg. 45) that "the future of the Pacaas Novos National Park...is presently in question."

"still nothing in place at all." ²⁴ Although much of the reserve was susceptible to seasonal flooding, during the dry period it was used for grazing activities and "two cattle ranches, two villages, as well as several squatters" were allegedly located within its boundaries. In addition, its future was threatened by on-going construction of the BR-429 highway (not financed by the program) between the BR-364 road and Costa Marques which, it was feared, would "allow squatter and logging activity in the entire northern range of the reserve." ²⁵

5.22 The Jarú Reserve had also been reduced in size from some 680,000 ha to less than 270,000 ha when it was officially transformed from a forest reserve into a biological reserve in 1979. The rest of the area occupied by the original forest reserve was transferred to an INCRA colonization project (Machadinho) and to a large private estate on the Ji-Paraná (or Machado) River on the western border of the present biological reserve, such that the division between the two was formed by a straight line inside the forest instead of having the river as a natural boundary. ²⁶ Even though the Jarú Reserve had not been significantly affected by encroachment as of late 1984, some squatter pressure was reported along its eastern periphery and future problems were anticipated due to the difficulty and high cost of controlling the straight western boundary.

(f) Ecological Reserves

5.23 Despite some delays, SEMA's activities in relation to the Cunia, Serra das Araras, Taima and Ique ecological stations were found to be generally satisfactory by the mid-term review. More specifically, SEMA was credited both with being "physically present" and as having "instituted reasonably effective inspection arrangements." On the less positive side, however, the usefulness of the stations from a scientific standpoint was characterized as being "almost negligible." In addition, the Ique station in northern Mato Grosso was found to be in a situation similar to that of the Pácaas Novas National Park, as FUNAI had recently discovered that the Saluma Indians possessed rights to the entire area that it occupied even though major public infrastructure investments had already been made there. ²⁷

²⁴ Dourojeanni, "An Example...", op. cit., pp. 41-42. This area was specifically characterized as a "good sample of the union point of Amazonia, cerrado and Pantanal eco-geographical provinces."

²⁵ Ibid., pg. 42.

²⁶ Ibid., pg. 42. Because of the nature of this boundary which extended some 82 km into the forest, Dourojeanni's mid-term review report ("Northwest Brazil ...," op. cit., para. 8) concluded that "speculative subdivision of this property would create tremendous, almost insoluble, inspection problems where the Reserve is concerned."

²⁷ Dourojeanni, "Northwest Brazil...", op. cit., paras. 10-11. The "legal problem" in relation to the Ique facility was characterized as being "very complex" and it was affirmed that over the medium and long-term "there are major incompatibilities between the interest of the Indians and the objectives of the station."

(g) Ecological Research

5.24 The ecological research subproject, finally, also experienced difficulties during the initial years of program execution, but for the most part was considered to be proceeding along potentially productive lines. Studies in the areas of meteorology and hydrology were reported to be well advanced, as were those on plant and animal ecology.²⁸ In contrast, one important project on the ecology of smallholder production systems -- more specifically on the carrying capacity of Amazonian agro-ecosystems -- had reportedly encountered serious problems. In general, all of the research projects were experiencing implementation delays due in part to funding shortages. Preliminary findings were not being adequately disseminated and, thus, were not performing their intended role of providing feedback for the development process in Rondonia.

4. Recommendations of the Mid-term Review

5.25 In light of the problems summarized above, the mid-term review mission proposed a number of measures to correct the "misjudgments and distortions" that had characterized implementation of POLONOROESTE's physical environmental components through the end of 1984. These included the need to review and improve the regional system of protected areas based on a study to be undertaken by a consultant and the principal government agencies involved. It was hoped that such a study would result in a broader and more representative system of protected areas "in which boundaries are easier to identify and conserve, in which use is made of buffer zones (eg. national forests) to reinforce the protection afforded the major Indian reserves and natural assets and which incorporate extensive tracts of the country's mountain ranges so that preservation of its hydrological resources can be assured."²⁹

5.26 It was likewise recommended that special attention be given to the Pacaas Novos National Park and the Ique ecological station whose future protection depended on the rapid definition and execution of inter-institutional agreements between FUNAI and IBDF and the former agency and SEMA respectively. Furthermore, it was considered "absolutely essential" that the Government of Rondonia participate directly in the management of the state's natural resources and, therefore, that it should proceed as quickly as possible to establish a

²⁸ More precisely, these included: (i) research on ecological changes accompanying intensive settlement; (ii) an evaluation of the hydrometeorological system; (iii) a study of an experimental watershed on the Jaci-Parana River; (iv) botanical studies in the area of influence of BR-364; and, (v) studies on the ecology of natural environments. The results of most of this research have subsequently been published by CNPq or other participating institutions.

²⁹ Ibid., para. vii(a). More concretely, it was recommended that an expert in the development of protected areas be hired to advise IBDF, SEMA and relevant state agencies in Rondonia with respect to the management of forest and ecological reserve areas under POLONOROESTE.

specific agency for this purpose.³⁰ At the federal government level, in turn, it was recommended that SEMA prepare environmental guidelines for Rondonia, which would constitute the "basic tool" of the new state environmental management agency.

5.27 In addition, as part of the Bank's proposed "Action Program" for the reorientation of POLONOROESTE, most of whose elements were described in the previous chapter, the Brazilian Government was requested to "expedite implementation by all relevant agencies (IBDF, SEMA, CNPq, etc.) of environmental measures and to monitor overall environmental quality" of the actions taken in connection with the program.³¹ The following specific measures were to be taken by participating federal agencies with respect to the program's forestry and environmental components:³²

- (i) by May 31, 1985, IBDF and RADAMBRASIL were to establish and fully operationalize a remote sensing program to detect unauthorized squatting, deforestation and mining activities in the region;
- (ii) by the same date, the Military Police were to fully staff forest police units in Rondonia to levels agreed during the mid-term review mission;
- (iii) by June 30, 1985, IBDF and INCRA were to jointly establish criteria for creating and protecting block forest reserves in new settlement areas and prepare a plan satisfactory to the Bank defining the tenure and administrative arrangements for these reserves;³³
- (iv) by the same date, IBDF would prepare forest management plans for the Jamari National Forest and existing block reserves in Urupa and Machadinho, with implementation of the plan for Jamari to begin shortly thereafter, while those for the block reserves were to be implemented as soon as squatters are removed, but no later than December 31, 1985; and
- (v) by June 30, 1985, IBDF would hire consultants for salvage logging, wood industry and marketing studies, which were to

³⁰ Ibid., para. vii(e). It was likewise recommended that the program finance the incremental start-up costs for this agency.

³¹ Annex 4 of the letter to the Brazilian Finance Minister dated March 15, 1985, op. cit., para. 1.01(a) and (b).

³² Ibid., paras. 1.04-1.08.

³³ In the case of Machadinho in particular, this plan was to be implemented by October 31, 1985 through the identification of new block reserves "to compensate for the selection by INCRA of inadequate 'reserves' in that area."

be completed by December 31, 1985, in accordance with appraisal provisions.

5. Findings of the OED/SEPLAN Mission

5.28 The visit of the OED/SEPLAN mission to the Northwest region suggested that, despite the Government's formal compliance with most of the recommendations made by the Bank at the time of the mid-term review, in general the situation in September-October 1989 was not very different from that encountered in late 1984. The basic conclusion of the mission, accordingly, was that POLONOROESTE appears to have been largely unable to implement and/or sustain many of its environmental protection measures or to avoid the continuing invasion of reserve areas by loggers, prospectors and spontaneous settlers. The essential findings of the OED/SEPLAN mission³⁴ are briefly summarized below:

- (i) Pacaas Novos National Park. This park did not appear to benefit from any kind of effective environmental control. Since it is inside the Uru-eu-wau-wau Amerindian area, state and federal environmental agencies are not permitted to operate in much of the area without prior permission from FUNAI. As a result, the boundaries of the park are only partially demarcated and it has been invaded by loggers and settlers both to the south in the area near the BR-429 highway and to the north. The control station previously operated by the federal forestry agency (IBDF, which is now part of the national environmental protection agency, IBAMA),³⁵ was abandoned and practically destroyed in a physical sense.
- (ii) Guapore Biological Reserve. This area is bounded by the BR-429 highway and a large number of farms and logging operations to the north. The helicopter overflight revealed that numerous areas within the reserve have been invaded by settlers. A small town (Isidolandia) containing some 50 families, at least one two-story building, a school, sawmills and a gasoline station, furthermore, is located near the eastern boundary of the reserve and has apparently been there for several years (see para. 5.21 above).³⁶ From Isidolandia, it was reported that settlers had penetrated some 40 to 50 kilometers within

³⁴ These findings were originally reported in an internal memorandum dated October 30, 1989.

³⁵ IBAMA, or the Brazilian Institute for the Environment and Renewable Natural Resources, was formally established in January 1989 as a result of the fusion of SEMA, IBDF, SUDHEVEA and SUDEPE, the former Superintendency for the Development of Fisheries.

³⁶ There is some uncertainty as to whether this township is actually located inside or outside the Reserve since it is unclear which of two water courses in the area forms the Reserve's legal boundary. In any event, it is situated in close proximity to the Reserve.

the reserve following roads built by loggers, who, in some cases, were reported to have been in the area for more than five years.³⁷ Even though much of the area remains well-preserved, some clearing and burning of the forest within the reserve was seen from the air. FUNAI has also reported the presence of uncontacted Amerindian groups in the region.

- (iii) Jaru Biological Reserve. This reserve was not visited by the OED/SEPLAN mission, but contacts with representatives of the State Forestry Institute (IEF)³⁸ in Ji-Parana revealed that the area is subject to illegal logging activities, as is the Igarape Lourdes Amerindian area which borders on the reserve immediately to the south.³⁹ The mission was also informed of the reported entrance of prospectors in the northern part of the reserve.
- (iv) Jamari National Forest. This forest was created in an area possessing important cassiterite reserves which are potentially exploitable in more than 60% of its extension. At the time of the OED/SEPLAN mission, mining operations were being carried out by large companies that maintained a private security force to keep out loggers, settlers and independent prospectors.⁴⁰ Although this area was not visited by the OED/SEPLAN mission, it was reported to be in a good state of conservation except for those subareas that were being mined, allegedly including some 1,700 ha which had been deforested.
- (v) Cunia Ecological Station. As of late 1989, this station had not been officially established or demarcated. The OED/SEPLAN

³⁷ A visit to the park by a representative of a European NGO in August-September 1989 confirmed the presence of several penetration roads and sawmills, together with large and small logging enterprises, settlers and at least one rancher, inside the reserve. These encroachments reportedly took place with the full knowledge and, in at least one case, the active encouragement of local politicians, while official agencies such as IBAMA (ie. the former IBDF) looked the other way. See Ulf Rasmussen, "Travel Report from Visits to the State of Rondonia," Friends of the Earth, Sweden, September 26, 1989, for details.

³⁸ IEF was created subsequent to the mid-term review of POLONOROESTE, partially in response to the Bank's request that a state forestry and environmental agency be established in Rondonia.

³⁹ Interestingly, the recently (ie. as of September 1989) appointed IEF representative in Ji-Parana had previously worked for both INCRA and FUNAI in the same municipality. This same source told the OED/SEPLAN mission that control over illegal logging activities in much of the area was virtually impossible in the absence of a continuous large-scale police effort.

⁴⁰ As of this writing (May 1991), LAI reports that this activity has been stopped.

mission was told by local informants that squatters had lived in the area for some time and that, even though at one point they were reportedly removed and compensated by SEMA (now IBAMA), at least some of them apparently returned.

5.29 The OED/SEPLAN mission also visited the Forestry Battalion of the Military Police and the IBAMA (formerly IBDF) office in the town of Costa Marques on the Guapore River and followed the BR-429 highway along its entire length between Costa Marques and BR-364. The members of the Forestry Battalion appeared to be dedicated in their attempts to control burning of the forest by detecting and fining violators, but were hampered by limited manpower, material resources and logistical support. The IBAMA office, in turn, was staffed by a single middle-level technician in comparatively lavish and well-equipped installations, but with no effective means of transportation and a mandate to authorize a large number of logging activities in an extensive area that included part of the Guapore Biological Reserve. Under internal norms, logging licenses were being granted automatically since the IBAMA office literally did not possess the technical or logistical capability necessary to analyze the required forest management plans (planos de manejo), let alone to verify their implementation. Inspection of lumbering operations in the area as a result was essentially non-existent.

5.30 The flight along the route of the BR-429 highway revealed an earth road in excellent condition that was being further improved by bulldozers and other road maintenance equipment in several stretches (presumably in preparation for the coming rainy season). Spontaneous settlement had occurred along both sides of the road, including areas close to Costa Marques possessing sandy soils generally known to be of poor quality for agricultural purposes. A large number of sawmills was seen from the air, with one small town (Alvorado d'Oeste) containing nineteen such facilities. Areas along either side of the highway had been cleared, in some cases extending for considerable distances outward from the road, while more than 100 fires, the largest of which extended for several kilometers, were spotted both in forest areas and existing pasture lands despite an active government campaign to curtail burning activities. Both the density of human occupation and the extent of deforestation along the route grew with increasing proximity to Ji-Parana, reflecting better soils, older areas of settlement and more direct access to the Cuiaba-Porto Velho highway, and, thus, to both local and extra-regional markets.

5.31 As described in Annex III, several ecological stations and other reserves were also supported by POLONOROESTE in the Mato Grosso portion of the program region. While the OED/SEPLAN mission was unable to visit these areas, local informants affirmed that they had been subject to the same problems of "invasion" by loggers, prospectors and spontaneous settlers that were observed in Rondonia. These areas, furthermore, had been only partially demarcated and, as in Rondonia, there appeared to be little control on the part of the federal environmental protection agency, IBAMA.⁴¹ The PCR for the Phase II Mato Grosso

⁴¹ Symptomatic of this situation, an attempt by the mission to visit the Serra das Araras ecological station was frustrated when the IBAMA official responsible for the area (but who lived in Cuiaba) took the wrong road and was

Rural Development Project reported, additionally, that, even though all the programmed infrastructure for forestry control, including four control posts and the strengthening of IBDF (now IBAMA) regional offices, had been installed, while the physical targets for all but one (Taima) of the ecological stations had been achieved, deforestation in the area had accelerated during the project implementation period because of continued migration and the further spread of slash and burn agriculture. ⁴²

5.32 The overall impression of the OED/SEPLAN mission concerning environmental protection measures in POLONOROESTE's immediate area of influence, in short, was that, at least until recently, they had been largely ineffective. Despite abundant road signs in Rondonia encouraging settlers not to burn the forest, the manpower and other resources actually available to state authorities to police clearing and burning activities in rural areas remained limited. In general, there appeared to be little fiscal or environmental control over the profitable logging, mining and prospecting industries. Loaded logging trucks, described locally as "ants" ("formigas") because there were so many of them, circulated mainly (and deliberately) at night after state inspection posts had closed. According to local informants, inspection officers, who earn very low wages, were frequently subject to bribery or threatened with physical violence if they attempted to restrict the extraction of timber from Amerindian, biological or other reserves.

5.33 As a result, these areas were becoming increasingly pressured by what are commonly referred to in Rondonia as "the economic interests" ("os interesses economicos"). In this connection, one program-sponsored study of the environmental impacts of human occupation in Rondonia, published in 1989, has described many such reserves as effectively "unprotected." ⁴³ This characterization can be applied as well to many of the individual farm and "block" reserves in INCRA colonization areas which have been invaded and partially cleared by successive waves of illegal occupants. This at least was reported to be the case by local residents in the three program-supported settlement schemes (ie. Ouro Preto, Urupa and Machadinho) visited by the OED/SEPLAN mission.

5.34 Given the large territorial dimensions of the areas involved, the scale, apparent profitability and resulting dynamism of extractive activities, especially prospecting and logging (about which more will be said in the next chapter), together with the limited institutional resources for, and, it can be surmised, the lack of political commitment at the local level for the restriction of, these often environmentally damaging activities, it can legitimately be

unable to locate the station.

⁴² PCR, op. cit., para. 6.10.

⁴³ Philip Fearnside, A Ocupacao Humana de Rondonia: Impactos, Limites e Planejamento, CNPq, Brasilia, 1989, pp. 59-62. In addition to the problems of encroachment in forest and biological reserves briefly described above, Fearnside observes that several of the Amerindian reserves in Rondonia have already been, or are projected in the future to be, cut by roads.

questioned whether this process is likely to, or even can, be adequately controlled in the future. Further complicating the situation is the fact that land clearing and, hence, further deforestation, is likely to continue to be both necessary and economically rational from the standpoint of the rural settler in order to maintain, if only temporarily, both agricultural and cattle raising activities even in the absence of any additional rural settlement in the Northwest.

6. Findings of the PCR

5.35 The recent completion report for the Agricultural Development and Environmental Protection Project also provides an assessment of POLONOROESTE's efforts to preserve the natural environment. According to this source, even though

most of the physical targets of the environmental protection were... attained,...the broader objective of establishing effective environmental safeguards under the POLONOROESTE Program was not met. Environmental protection and ecological research were too limited in scope. Also, the project did not include any mechanisms to introduce environmental considerations into public investment planning in the state, nor did it address the policies and regulations that would continue to undermine the project's environmental protection objectives. On the other hand, in spite of its obvious shortcomings, the project was instrumental in establishing an institutional framework and capability which will be extremely useful for environmental protection in the future. It also helped to increase the debate, awareness and political commitment to protection of the environment in the Amazon Basin, and, as a reflection of this, a substantial share of project funds originally intended for other purposes was redirected to environmental protection during the latter years of project execution.⁴⁴

5.36 With respect to implementation of the program's environmental protection components, more specifically, the PCR indicates among other findings that:

- (i) while a management plan for the administration and development of the Jamari National Forest was prepared and the needed infrastructure and equipment was put in place, the plan was not implemented because of inadequate staffing and resources and the overall weaknesses of the executing agency (IBDF);

⁴⁴ PCR, dated December 26, 1990, op. cit. "Executive Summary," para. 6 (emphasis OED).

- (ii) while six new forestry control posts had been constructed in Rondonia and Mato Grosso, the effectiveness of forestry control efforts was limited both by IBDF's managerial weaknesses and inability to hire and retain adequate numbers of qualified staff and by the rapid development of local wood industries; as a result, throughout much of the project period, deforestation went virtually unchecked in the program area, particularly Rondonia;
- (iii) by project completion, the boundaries of all natural reserves and ecological stations had been demarcated and most of the planned investments in infrastructure and equipment had been made; however, the institutional weaknesses of IBDF and SEMA, lack of adequate staffing of the reserves/stations and financial constraints, particularly during the early project years, resulted in poor functioning of the facilities and an apparent inability to avoid sporadic invasions into most of the areas;
- (iv) about 200 scientific papers and articles, directly attributable to the ecological research program, were published; despite the very good diagnostic capabilities of many of the researchers, however, the lack of policy focus and clear linkage with project implementation reduced the direct impact of this component on project results.⁴⁵

5.37 On a more positive note, the PCR also observes that a series of corrective measures were taken during the latter years of the project.⁴⁶ These included increases in the level and incidence of taxes for forest exploration and of fines against violators which have apparently contributed to a reduction in the rate of deforestation and whose revenues were used to help strengthen the capacity of state agencies to implement forestry control and enforcement. Of particular importance were the establishment of the State Forestry Institute (IEF) and the State Forestry Military Police in Rondonia. During the last project year (ie. 1989), furthermore, the initial phase of an "Emergency Program" by IBAMA to reduce forest burning in the region was financed with POLONOROESTE resources and, together with decreasing migration rates and favorable local rainfall patterns, appears to have curbed new deforestation over the past several years. In addition, a State Secretariat for the Environment (SEMARO) and a State Environmental Council were created in Rondonia with project support. SEMARO has reportedly initiated the regulation and control of polluting industries such as cassiterite and gold mining and is promoting environmental education. In Mato Grosso, in turn, the project funded the activities of a Forestry Battalion to enforce legislation against hunting and degradation of unique flora and fauna in the Pantanal National Park and supported the creation of a State Secretariat of the Environment which is giving priority to pollution control in the Pantanal area.

⁴⁵ Ibid., paras. 5.17-5.22.

⁴⁶ Ibid., paras. 6.14 and 6.16-6.17.

5.38 The increasing importance of environmental protection activities in the project is reflected in the allocation of its resources. As compared with an estimated US\$ 15.0 million, or 7% of the total, at appraisal, actual expenditures for environmental protection measures, according to the PCR, were US\$ 36.7 million, or 23% of project costs. US\$ 25 million of this total, furthermore, were utilized during the last three years of project execution, with much of the increment apparently being used to support environmental protection activities in the Pantanal. Finally, in terms of lessons learned, the PCR affirms that "the physical demarcation of environmental conservation units and Amerindian reserves is a necessary, but not sufficient, condition for their protection. Financial disincentives, such as the absence of public physical and social infrastructure in the surrounding areas and strong enforcement capacity to prevent and punish invasions are also required for ensuring the protection of such areas." ⁴⁷

C. The Amerindian Special Project

1. General Characteristics

5.39 During implementation, the Amerindian Special Project underwent a number of changes in scope and direction. This has caused some confusion in ex-post evaluations of the undertaking. To clarify the matter, the Project as agreed between the Borrower and the Bank will be described and analyzed apart from the Project as it subsequently evolved.

5.40 POLONOROESTE's Amerindian protection component was, in fact, partially specified in several different documents which, together, may be taken as constituting the Special Project as actually agreed to by the Borrower and the Bank. These documents included:

- (i) Section 4.05 of the Agreement for Loan 2060-BR which simply stated that a Special Project would be implemented "to strengthen the measures to protect the indigenous population of the Program Area."
- (ii) A side letter dated December 15, 1981 citing relevant passages in the Brazilian Constitution and legislation and agreeing to take certain measures as set forth in a FUNAI document entitled "Project to Support the Indigenous Communities in the Area of Influence of the Cuiaba-Porto Velho Highway, 1980-85." This document specified five components: (a) strengthening FUNAI as an institution; (b) demarcation, delimitation and interdiction of Amerindian land; (c) protection of Amerindian interests and lands against outsiders through the preservation of boundaries and eviction of illegal occupants; (d) medical assistance, economic development and educational services for indigenous populations; and (e) regulation of relations between Amerindian communities and

⁴⁷ Ibid., "Executive Summary," para. 9 (emphasis OED).

highway construction workers. The Borrower further agreed to allow the Bank to supervise the Project and to provide such information and access as might be necessary for this purpose.

- (iii) Letters from FUNAI to the Bank dated January 20 and February 2, 1981. The first of these presents a detailed response to a report submitted by a Bank mission and pledges FUNAI to carry out a number of specific actions primarily concerning the Nambikwara Indians in Mato Grosso.
- (iv) Minutes of Understanding between the Bank and FUNAI dated February 12, 1981.
- (v) The aforementioned Special Project document elaborated by FUNAI and consisting primarily of a budget of US\$ 26.6 million allocated among five basic categories: (i) land regularization - US\$ 3.2 million (or 15% net of contingencies); (ii) health - US\$ 6.2 million (29%); (iii) education - US\$ 750,000 (4%); (iv) economic development - US\$ 5.1 million (24%); and (v) administration - US\$ 5.97 million (28%). An additional US\$ 5.38 million (or 20% of the Special Project total) was reserved in a contingency fund.

5.41 The broad objective of the Special Project was to protect indigenous communities in the area of influence of the BR-364 highway from the detrimental effects of rapid development in the region. Protection of indigenous lands was seen by the Bank as the cornerstone of the Project. The general procedure can be briefly characterized as follows. The first step toward creation of an indigenous reserve is interdiction by FUNAI, an instrument affording a measure of legal protection of the areas involved from outside incursions. The process of regularization, in turn, begins with the formal identification of an area with an indigenous population. FUNAI then carries out a set of studies aimed at the delimitation of the specific boundaries of the potential reserve. If the proposed boundaries are approved by the Interministerial Group specifically established for this purpose in 1983,⁴⁸ FUNAI moves ahead to demarcation of the reserve. The final steps for full regularization are confirmation (homologacao) by presidential decree and registration in the appropriate municipal land registry office (cartorio) or offices and the Federal Property Register (Servico de Patrimonio da Uniao). For practical purposes, demarcation is the single most important step, but an area can only be considered fully regularized when it has been demarcated with full Presidential ratification and registered at both the local and national levels.

5.42 Demarcation of an Amerindian area requires an accurate survey of the boundaries of the proposed reserve which are then indicated with topographical

⁴⁸ Until reorganization of the federal government in March 1990, this Group was composed of representatives of FUNAI, the Ministry of the Interior, the National Defense Advisory Council (formerly the National Security Council) and pertinent regional and local authorities. Until it was abolished, the former Ministry of Agrarian Reform (MIRAD) also participated in the group.

markers and signs. Artificial boundaries (ie. those that do not correspond to natural features such as streams or ridgelines) are marked by clearing a six-meter wide swath along the boundary line. All boundaries require periodic patrols and maintenance, especially artificial ones. At present, FUNAI does not have a program of active boundary maintenance, nor does it encourage people of a particular reserve to help maintain their own boundaries. As a result, interlopers have occasionally invaded Amerindian reserves, claiming that they did not know where the boundaries lay.

5.43 There has been some confusion over the extent of the obligations assumed by the Borrower in the Loan Agreement with respect to the demarcation of Amerindian reserves. A careful review of the documents listed in para. 5.40 reveals that the Loan Agreement required the Borrower to demarcate seven indigenous reserves in the states of Mato Grosso and Rondonia involving a total area of roughly 3.1 million hectares and 3,941 kilometers of boundaries.⁴⁹ Of these seven reserves, five were fully regularized as of August 1990 with a total area of 2.9 million ha (or 91% of the original target). One area (the Saluma Indigenous Area) has been approved by the Interministerial Group for demarcation since 1987, but the order to demarcate this area has not been issued. The Karipuna Indigenous Area, in turn, has been identified, but not delimited, apparently because some officials feel that the size of the proposed reserve is not warranted by the small population of Karipuna still living in the area.

2. Situation at the Time of the Mid-term Review

5.44 Before considering the main results of and the principal problems encountered by the Amerindian Special Project, given its essential role in the suspension of Bank loan disbursements for POLONOROESTE as a whole in early 1985, it is instructive to briefly consider the status of its execution at the time of the mid-term review. On the positive side, the review found that, despite "continued and growing land and funding problems," progress had been achieved in some important areas under the Project by mid-1984. It was observed, for example, that a total of nineteen Amerindian areas had been demarcated in the region. FUNAI assistance to the Nambikwara Indians in the Guapore valley had been "substantially upgraded" through the creation of additional Indian Posts and mobile health units.⁵⁰ At least partially as a result of these measures, it was affirmed that the Nambikwara population had increased by roughly 50% during the initial three and a half years of program implementation.

5.45 On the other hand, the scope of the original FUNAI project had "gradually evolved in accordance with increasing knowledge about the Indians of the region" whose numbers at the time of the review were estimated to be on the

⁴⁹ More specifically, these reserves (and their respective areas), as indicated in the SAR, were: Area Indigena (AI) Pareci (600,000 ha), AI Nambikwara (912,000 ha), AI Vale do Guapore (324,000 ha), AI Saluma (460,000 ha) and AI Karipuna (205,000 ha) in Mato Grosso and AI Zoro (440,000 ha) and AI Tubarao-Latunde (200,000 ha) in Rondonia.

⁵⁰ Internal memorandum dated February 25, 1985, op. cit., para. 25.

order of 11,000,⁵¹ as compared with some 5,700 at the outset of the program.⁵² As a consequence, land demarcation requirements later proved to considerably exceed those initially expected, while several recently identified Amerindian groups had not yet been assisted by FUNAI at all. This situation was exacerbated by "sharp shortfalls" in funding and a lack of qualified staff due in part to a general federal hiring freeze during the early 1980's in response to the economic recession.

5.46 Even before the mid-term review mission, the Bank had formally communicated to the Government its concern with persisting execution delays and other problems associated with the Special Project.⁵³ Foremost among these was the still undefined legal status of the Amerindian reserves in the Guapore valley. This issue had previously been the subject of Bank-Borrower discussions in May-June 1983, at which time the latter had agreed to a revised timetable for the demarcation of these areas and to complete needed staffing at FUNAI. As of October 1984, however, the Government still had not complied with these commitments and "substantial delays" continued to affect demarcation of the Guapore reserves.⁵⁴

5.47 The Bank was also increasingly preoccupied with the growing presence of illegal settlers in several Amerindian areas, especially the Igarape Lourdes Reserve in Rondonia. In this particular case, the Bank had first become aware of the problem in late 1982 and repeatedly requested the Government to remove the squatters. By late 1984, however, no action had apparently been taken and, instead, the number of squatters was "now in the hundreds."⁵⁵ The still undefined and, hence, undemarcated reserve areas for the Uru-eu-wau-wau and Zoro Indians were similarly threatened with encroachment by rural settlers.

5.48 As a result, the Bank formally communicated to the Government that, unless "every step [were] taken to ensure prompt completion of the various

⁵¹ A later Bank estimate (1988) put the actual number at on the order of 9,500-10,000 people.

⁵² The SAR (Annex 8), however, refers to a figure of about 4,200.

⁵³ These concerns were discussed with federal authorities during the course of visits by the Bank's Vice President for Latin America and the Caribbean Region to Brasilia and of the Brazilian Minister of the Interior to the Bank in mid-1984 and summarized in a letter from the Bank's regional Vice President to the Minister of Finance, with copies to the Ministers of Planning and Interior, dated October 30, 1984.

⁵⁴ More precisely, even though the physical demarcation of these areas had reportedly occurred, the Presidential Decree formally establishing them as Amerindian reserves had not been issued, nor had they been officially registered at the National Property Registry, despite further discussions to this effect with the Bank in April and June 1984.

⁵⁵ Letter to the Minister of Finance dated October 30, 1984, op. cit. An "igarape" is a stream or other narrow waterway.

actions described in the Special Project," it might be forced to discontinue its association with the program. The Bank requested, more specifically, that the Government take several concrete actions by March 1985: (i) complete legal establishment of the Sarare and Vale do Guapore reserves in the Guapore valley; (ii) final definition of the areas to be demarcated for the Zoro and Uru-eu-wau-wau Amerindian groups, together with definition of a firm implementation schedule; and (iii) eviction of illegal settlers from the Igarape Lourdes Reserve. The Bank also alerted that, if implementation of these measures within the indicated time horizon proved "impossible," it would "have no other option" than to suspend disbursements on all of the POLONOROESTE loans.⁵⁶ The original February 28th deadline for the completion or formalization of these measures was later extended to March 6, 1985.⁵⁷

3. Suspension of Disbursements and Subsequent Actions

5.49 The requested actions were not finalized prior to the change of federal administrations which occurred on March 15, 1985. As a result, disbursement of all POLONOROESTE loans was informally suspended on March 12, 1985.⁵⁸ As one of the two major conditions for the resumption of disbursements, the Bank stipulated that the Government would have to complete by April 1985 the Amerindian protection measures listed in the March 1, 1985 telex described

⁵⁶ Ibid. The Bank's parallel concern with the need to improve the execution of the program's non-infrastructure components, especially in the areas of environmental protection and agricultural development, was also raised in the same letter, but was not specified in detail pending the findings of the mid-term review mission.

⁵⁷ Telex from the Bank's Vice President for Latin America and the Caribbean Region to the Brazilian Minister of Finance dated March 1, 1985. More precisely, this extension was granted for: (i) official publication of the Presidential Decree establishing the Nambikwara Reserve; (ii) final definition of the Uru-eu-wau-wau Reserve; (iii) completion of a satisfactory revised schedule for the removal of squatters from the Igarape Lourdes Reserve by the end of March 1985; (iv) court notification to all squatters who were scheduled to be removed over the next two weeks; and, (v) final definition of the Zoro Reserve and of the corresponding plans for its demarcation.

⁵⁸ Letter from the Acting Vice President for Latin America and the Caribbean Region to the Brazilian Minister of Finance dated March 15, 1985 (op. cit.). Under the "informal suspension" of disbursements, which was initially expected to last until May 15, 1985 and with certain clearly specified exceptions, the Government was asked to "refrain from presenting withdrawal applications to the Bank on account of eligible expenditures under the loans or requesting the Bank to enter into new or unqualified agreements to reimburse after that date." The Government was also requested to refrain from submitting claims for the replenishment of any of the Special Accounts established under the POLONOROESTE loans.

in the previous paragraph.⁵⁹ As part of the Bank's "Proposed Action Program" for the reorientation of POLONOROESTE, in turn, it was specifically requested that FUNAI:

- (i) form a working group with IBDF by April 15, 1985 to prepare and begin to implement by July 1, 1985 a joint protection program for the Uru-eu-wau-wau Reserve and the overlapping Pacaas Novos National Park (see also para. 5.20 above);⁶⁰
- (ii) hire at least another forty staff members to administer Special Project health care activities and man additional Indian Posts by May 31, 1985;
- (iii) by the same date, contract services for the protection of Amerindian lands, surveillance and border upgrading works previously scheduled in the agency's work program for fiscal year 1985-86;
- (iv) also by the same date, submit all demarcated reserves which had not yet been ratified by presidential decree for consideration by the Interministerial Group that had been established to handle such matters;
- (v) initiate by May 1, 1985 all demarcation works that had already been scheduled for the 1985 dry season; and
- (vi) include under the Special Project the fourteen additional Amerindian groups that had not yet been attended by October 31, 1985.⁶¹

5.50 The Government's failure to comply with all of the above requirements by the end of May 1985⁶² led the Bank to extend the suspension of

⁵⁹ Given the largely negative findings of the mid-term review mission, as described more fully in the previous chapter, the second major condition for the resumption of loan disbursements was that the Government and the Bank agree by May 15, 1985 on "a comprehensive and detailed action program" to improve program implementation.

⁶⁰ In addition, FUNAI and IBDF were to reach an agreement to extend the existing one year convênio to jointly administer these areas, as well as to develop future joint administration and protection plans on an annual basis.

⁶¹ Letter dated March 15, 1985, op. cit., Annex IV, para. 1.09.

⁶² An internal Bank memorandum dated May 28, 1985 indicated, for example, that, as of that date, two conditions for the resumption of disbursements had not yet been met, specifically: (i) the removal of all squatters from the Igarape Lourdes Reserve (as ten of the original fifty-four illegal settler families still remained in the area); and (ii) the final definition of the Uru-eu-wau-wau Reserve which was "being slowed by the need to verify land claims." The same

disbursements for the POLONOROESTE loans through August 1985. As of early August, however, a Bank supervision mission was able to report that the "major outstanding Amerindian issues" had been "satisfactorily resolved."⁶³ It was observed, more specifically, that decrees for two Nambikwara Reserves and the Uru-eu-wau-wau Reserve had been signed and that an earlier decree for the Zoro Reserve had been confirmed, while all squatters had been removed from the Igarape Lourdes Indigenous Park. Satisfactory progress was also registered in relation to implementation of the broader Action Program despite "general delays due to government transition" which had adversely affected the allocation of funds and slowed down improvements in program coordination. In response to these improvements, Bank loan disbursements were resumed shortly thereafter.

5.51 Judging from the project files, the subsequent execution of the Amerindian Special Project, as well as of other POLONOROESTE components, continued to experience problems similar to or even more serious than those observed in the course of the mid-term review. An October 1985 supervision mission report affirms, for instance, that "the late allocation of funds and the lack of staff have again resulted in an alarming failure in environmental and Amerindian protection" and that "implementation of the Amerindian Special Project has been negatively affected by successive changes in FUNAI's administration."⁶⁴ A more recent (June 1987) Bank/FUNAI/SUDECO supervision mission, in turn, was "threatened at gunpoint" by Indians instigated by goldminers who had installed themselves illegally in the Aripuana Indigenous Area.⁶⁵ Other problems occurring after the mid-term review, together with the principal positive results of the Special Project, are described more fully in the next two sections.

4. Results of the Special Project

(a) Land Regularization

5.52 The original Special Project was designed to cover a total of twenty-eight distinct Amerindian areas. In the SAR and other documents indicated in para. 5.40, thirty-five different Amerindian areas are listed with

memorandum alerted more generally that a 25% cut in PIN/PROTERRA funds and "the continued high rate of immigration into Rondonia could jeopardize the effective carrying out of the Action Plan."

⁶³ Supervision mission report dated August 9, 1985.

⁶⁴ Supervision mission report dated October 21, 1985. This report also related that "due to the predominantly poor quality of its soils, development of the Cujubim [new] settlement site will be discontinued [and] the proposed Urupa II site will also be substituted by a more appropriate area." It likewise noted that "a malaria emergency program has improved the health situation in Machadinho to some extent; however, the situation continues to be serious."

⁶⁵ Telex from the Bank to the Minister of the Interior dated June 23, 1987. According to this communication, the miners entered the area with the help of the Indians, FUNAI's chief of the Aripuana Park and local FUNAI post personnel.

a total area of 5.5 million ha. The indigenous population in these areas was estimated at close to 4,250 at the time of appraisal. Several of the original areas were subsequently consolidated into a single Amerindian reserve, leaving a total of twenty-eight. Since it was designed in 1981, numerous additional indigenous groups or areas were identified and have benefitted from services and infrastructure provided through the Special Project.

5.53 Sixteen areas of the original twenty-eight were listed in the SAR as demarcated with some 1.65 million ha, or about 30% of the total area.⁶⁶ Of the areas in the original project, twenty-three (82%) have been demarcated, of which fourteen have been fully regularized. Four of the original 28 areas have been identified, but not yet demarcated. In terms of land area demarcated, as indicated in Table 6 below, 81% of the original target of 5.5 million hectares was met. One of the original areas, the Uru-eu-wau-wau Indigenous Area was demarcated in 1985-86. However, in January 1990, a Presidential Decree was issued revoking the founding decree of 1985. This area has been interdicted and is awaiting reidentification and demarcation (see paras. 7.61-7.68 for additional details).

5.54 The population of the twenty-eight areas in the original Special Project was estimated at approximately 6,470 in 1988. This is 50% larger than the population estimated at the time of appraisal in these areas. The observed increase can be attributed to various factors including migration, natural population growth and more accurate censuses. About 82% of the population residing in the 28 areas originally covered by the Special Project live in demarcated reserves.

5.55 Since appraisal, thirty-nine additional areas and/or indigenous groups have been added to the Special Project. These were primarily small groups found to be living within the program region, usually without any assistance from FUNAI. The addition of these groups to the Project raised the total number of potential indigenous areas in the POLONOROESTE region to sixty-seven. Eleven of the areas in the expansion group have been demarcated.

5.56 The estimated Amerindian population in all 67 tribal areas in the POLONOROESTE region in mid-1988 was about 9,600, of which more than 7,450 (78%) live on demarcated reserves. The current estimated land area occupied by indigenous groups in the region, in turn, is 11.9 million ha, of which about 7 million ha (59%) are demarcated. The incremental area demarcated since Project implementation began is about 5.4 million ha. Even though another seventeen areas have been formally identified as Amerindian areas involving a total of 2.9 million ha, action is still pending on them.

5.57 In assessing the results presented above, it should not be assumed that all of the areas listed in the expansion group will eventually become Amerindian reserves. Some of the areas awaiting identification contain groups which, because of the dislocations of recent years, have become separated from their current land base. In some of these cases, it may be appropriate to

⁶⁶ This, in fact, proved incorrect as several of the areas listed in the SAR as "demarcated" subsequently required delimitation and demarcation.

identify an area of land to resettle the affected population. In others, the indigenous groups may have decreased to such a small number or become so acculturated that creation of a reserve is not necessary. In several of the latter cases, small remnant groups can be resettled onto existing reserves. In other instances, even though Amerindian communities may be living in their traditional habitats, no determination has been made as to how large an area they would require in the form of a reserve under Brazilian law. A few groups, finally, remain entirely uncontacted such that their population and structure are still unknown, while yet others, previously identified, may now no longer exist.

Table 6

Status of Amerindian Areas under POLONOROESTE (June 1990)

<u>Legal Status of Area</u>	<u>Date Incorporated in Special Project</u>		<u>Total</u>
	<u>Original Project</u>	<u>After 1982</u>	
A. <u>Number of Amerindian Areas</u>			
Fully Regularized	14	6	20
Demarcated, Unregistered	9	5	14
Identified	4	13	17
No Action Taken	1	15	16
TOTAL	28	39	67
B. <u>Area (in ha)</u>			
Fully Regularized	3,171,494	2,268,064	5,349,558
Demarcated, Unregistered	1,313,758	293,347	1,607,105
Identified	867,136	2,019,072	2,886,208
No Action Taken	1,867,117	63,900	1,931,017
TOTAL	7,219,505	4,644,383	11,863,888
C. <u>Population*</u>			
Fully Regularized	3,538	1,584	5,122
Demarcated, Unregistered	1,767	568	2,335
Identified	462	742	1,204
No Action Taken	700	217	917
TOTAL	6,467	3,111	9,578

* The data are based on censuses and estimates made at different times with different methodologies. They refer to approximately mid-1988.

Source: FUNAI.

5.58 Despite these uncertainties, the Special Project appears to have greatly accelerated the pace of demarcation of indigenous reserves in the POLONOROESTE region. Of the sixty-seven total areas and groups, only seven had been demarcated before the Project began. Twelve more areas were demarcated after implementation initiated prior to the mid-term review. After this review and the subsequent suspension of disbursements, the pace of demarcation picked up as fourteen additional areas were demarcated between 1985 and 1988.⁶⁷ However, for a number of areas or groups action still needs to be taken. In some cases (eg. the Mequens and Saluma Indigenous Areas), demarcation has been authorized, but not carried out, apparently in response to political and economic interests opposed to demarcation. In other situations, such as the Rio Guapore Indigenous Area, the proximity of a national border seems to have played a role in delaying demarcation.

5.59 One notable success in this respect was demarcation of the Sete de Setembro Reserve which is the traditional habitat of the Surui Indians. This area had already been occupied by settlers under an INCRA colonization scheme when POLONOROESTE was initiated in 1981 and coffee planting was well advanced in the area. As a result, resettlement of these farmers was made a condition of Bank loan effectiveness for Phase I of the program and the non-Amerindians living in the area were peacefully relocated in 1982.

5.60 A second significant benchmark of the Special Project in this regard was resettlement of squatters who occupied parts of the Igarape Lourdes Indigenous Reserve and began planting coffee and other crops in 1983-84. These settlers, who had the support of some local leaders, were evicted by the Military Police in two operations that nearly created major confrontations between Amerindians and non-Amerindians in the area. The resolution of this problem was largely instigated by the Bank in connection with the suspension of disbursements described in paras. 5.48-5.52 above. It should, nevertheless, be observed that the unfavorable political climate which led to the initial invasion of this reserve still exists and that the recent political liberalization and decentralization in Brazil, which forces leaders to be more accountable to local electorates, may act as a significant brake on the ability of state and federal governments to use police power in similar situations in the future.

(b) The Uru-eu-wau-wau Reserve

5.61 Perhaps the single most contentious issue involving Amerindians in the Northwest, however, has concerned the creation and protection of the Uru-eu-wau-wau Reserve. This area, located in the north-central part of Rondonia

⁶⁷ In its comments on the draft of this report, FUNAI affirms: "despite the fact that the negative balance [of the Special Project] can be computed as greater than the positive, we cannot neglect the advances in the program to demarcate indigenous areas in the 1984/85 period and the inclusion of tribal areas in the south of Amazonas [state] that were suffering the indirect impact of POLONOROESTE. The pressure exerted by FIPE's evaluations on the Brazilian Government and the World Bank played a fundamental role in this respect."

encompasses the highlands where important tributaries of the Guapore and Roosevelt Rivers have their origins. As its name suggests, it is also the native habitat of a large number of, until very recently, uncontacted or only intermittently contacted Amerindians known as the Uru-eu-wau-wau.⁶⁶ Demarcation of the Uru-eu-wau-wau Reserve was, thus, seen as an important step both in the protection of highly vulnerable indigenous communities and in the preservation of important watersheds that are likely to contain botanical species and forest types that may be unique in Brazil.

5.62 At the time of appraisal, both the Bank and the Brazilian Government presumed that the Uru-eu-wau-wau Amerindian Area largely coincided with the Pacaas Novos National Park that had been created by decree in 1978. This understanding is reflected in Annex 8 of the SAR for the Agricultural Development and Environmental Protection Project in which the size of the anticipated reserve was set at 878,000 ha, or about 113,000 ha larger than the Pacaas Novos National Park. It was only after the mid-term review and the subsequent suspension of disbursements in 1984-85, however, that the Government took formal steps to delimit and demarcate the Uru-eu-wau-wau Reserve. A technical work group formed in 1985 determined that the actual territory used by the various Uru-eu-wau-wau groups was on the order of 1.87 million ha including the entire existing Pacaas Novos National Park plus substantial additional areas to the north and south of this park.

5.63 The delimited reserve partly coincided with an area under development by INCRA as a colonization scheme, Projeto Burareiro in the município of Ariquemes. Settlement plots averaging 800 ha were demarcated and assigned in this project, but the access roads planned for the overlapping area were not built. INCRA claims that it informed FUNAI of the coincidence of the delimited area and its colonization project. FUNAI, in turn, claims to have informed INCRA while Burareiro was still in the planning stage that the site was occupied by Indians. There can be little doubt that Indians indeed occupied the area which lies at the confluence of the Jamari and Nova Floresta Rivers since, as late as 1983, Uru-eu-wau-wau attacked the homes of pioneer rubber tapper families in the vicinity, killing and kidnapping several people. The largest contingent of Uru-eu-wau-wau in intermittent contact, in fact, is located in this area. In recognition of this, FUNAI concentrated its resources in the area, later building five outposts (Postos de Vigilância) to monitor and provide services to these groups.

⁶⁶ Uru-eu-wau-wau is a Pacaas Novos term meaning "people who bark like dogs." The Uru-eu-wau-wau speak a Tupian language related to Parintintin and may comprise more than one ethnic group. Estimates of their population range from 350 to 1,200. Some communities are as yet uncontacted by FUNAI, although they may have been in contact with local rubber tappers and prospectors over the years. For one recent description of this group, see the article entitled "Last Days of Eden: Rondonia's Uru-eu-wau-wau Indians," National Geographic Magazine, Vol. 174, No. 6, December 1988, pp. 800-817. A larger companion piece entitled "Rondonia's Settlers Invade Brazil's Imperiled Rain Forest" in the same issue (pp. 772-799) describes the human and physical environmental problems associated with recent developments in the state more generally.

5.64 Bank supervision missions placed special emphasis on the demarcation of the Uru-eu-wau-wau Reserve because of the vulnerability of the indigenous populations and the intense activity of settlers on the fringes of the area. There was, however, no specific basis in the Loan Agreement for demanding demarcation of the reserve because it was not one of the seven areas specifically designated in the documents defining the Amerindian Special Project referred to in para. 5.40 above. Nonetheless, more than two years after Project execution began with no action having been taken in relation to the Uru-eu-wau-wau, as indicated in paras. 5.48-5.49, the Bank made the demarcation of this reserve a major issue in the mid-term review and the subsequent suspension of disbursements for the program as a whole.

5.65 After the suspension of disbursements in early 1985, the Brazilian Government did move to delimit the area. After delimitation, the Uru-eu-wau-wau Amerindian Reserve was considered and approved by the Interministerial Group (see para. 5.41 above) and President Jose Sarney signed a decree on July 9, 1985 confirming the area as an Indigenous Reserve. The decree specifically included the boundaries proposed by the FUNAI working group and later approved by the Interministerial Group. The area of some 1.87 million ha was then demarcated by the Army Geographic Service and registered in the Federal Property Register and in all but one of the relevant municipal land registry offices.

5.66 Since 1985, there has been considerable local opposition to the dimensions of both the Uru-eu-wau-wau Reserve and the Pacaas Novos National Forest in Rondonia. Several groups have specifically lobbied for a reduction in the size of the Amerindian reserve in order to gain access to minerals, timber and agricultural land now included in the combination Park/Reserve. The state of Rondonia itself petitioned FUNAI to revise the boundaries of the Reserve on behalf of the deeded landowners in that portion of Projeto Burareiro which overlapped with the Amerindian area. The land registrar in Ariquemes, in turn, refused to register the Uru-eu-wau-wau Reserve because of the coinciding deeds issued in connection with the INCRA project.

5.67 On January 30, 1990, shortly before leaving office, finally, President Sarney signed a measure revoking the original 1985 decree delimiting the Uru-eu-wau-wau Reserve and calling for a restudy of its boundaries. This action was apparently taken to benefit a particular political faction, but it was repudiated by the state government of Rondonia. The federal Attorney General filed a court motion to strike down the new Presidential Decree on the grounds of unconstitutionality. In April 1990, FUNAI issued a formal interdiction of the entire original area of the reserve, but the restudy called for in the January 1990 decree was not carried out.

5.68 In the meantime, the state of Rondonia, together with federal agencies, has endeavored to protect the area from squatters, loggers, prospectors and others. However, resources are limited and powerful interests continue to support opening up the Uru-eu-wau-wau Reserve to mining, logging and colonization. Unless the January 1990 Presidential Decree is revoked, it would be necessary to repeat the entire regularization process for the Uru-eu-wau-wau Indigenous Area in order to formally reestablish the reserve. In the interim, there is a serious risk of invasion by landless farmers and speculators already located on the eastern boundary of the area and there are reports that

illegal logging activities are taking place at various points inside the reserve.

(c) Other Components

5.69 The health component of the Amerindian Special Project was aimed at the prevention of contagious diseases and the improvement of the medical services provided to tribal communities in the region. Among its achievements were the construction of thirty-eight new health posts on Amerindian reserves, improvements in medical facilities in Cuiaba, the training of FUNAI employees in basic health care and a successful immunization campaign. The principal physical accomplishment of the Amerindian health care system, however, was the provision of a significant number of new facilities, thereby improving the delivery of essential health services. Several of these facilities provide a combination of infirmary, ambulatory and residential services. The residential facilities were important because they provided an incentive for FUNAI health care personnel to live at the Indian Posts. Under its health component, finally, the Special Project supported construction of fifty-one basic water supply systems, consisting primarily of dug wells and limited piped water installations.

5.70 The educational component of the Special Project included the construction of thirty-two schoolhouses, the acquisition of equipment and supplies and the establishment of a school lunch program. Teachers were hired to provide primary education to both children and adults on many of the reserves in the region. The Project likewise supported a variety of economic development activities. For the most part, these took the form of the installation of communal gardens, the purchase of agricultural equipment and implements, the acquisition of small numbers of cattle and the establishment of trading posts. Lastly, under its administration component, the Amerindian Project supported the construction of sixty-three Indian Posts which were provided with administrative and residential facilities and radio communications equipment. Special Project resources were also used to finance FUNAI salaries, in some areas supporting large segments of the agency's total payroll. As of late 1989, however, FUNAI was paying all salaries in the region out of its own budgetary funds.

5. Principal Problem Areas

(a) Economic Development

5.71 One of the most controversial aspects of the Special Project was the above mentioned support for the "economic development" of Indian areas. This took essentially two forms: (i) the establishment of communal plantations; and (ii) the creation of community trading posts ("cantinas reembolsaveis"). The communal plantations were generally introduced without much prior planning and preparation. Often, a FUNAI worker would simply decide that a group of Amerindians should clear land for communal gardens for either subsistence or commercial purposes or both. Some agency officials, moreover, were under the mistaken impression that communal gardens were traditional among the tribal populations in the region, when, in fact, the norm was for each family to cultivate its own garden. As a result, friction frequently developed between FUNAI employees and Indians, as well as among the Amerindians themselves, since

many Indians avoided working on the gardens, but later insisted in partaking in the harvest. Most of these gardens were abandoned after only a year or two and the experiment was not repeated. Very little produce was actually sold and nearly all of the agricultural equipment purchased in connection with the Special Project now lies rusted or ruined.

5.72 FUNAI also initiated community trading posts with the idea of providing a means for Amerindians to sell their output and buy needed goods at affordable prices. Each community received a lump sum as seed capital for this purpose. With these funds, each post was to acquire Indian products such as rubber, Brazilnuts and garden produce for bulking and resale. In turn, they were to sell such necessities as toothpaste, sugar, kerosene, gunpowder (for shotgun shells), matches, etc. Many Indians purchased merchandise on credit and were later unable to pay their debts. The cost of storing and transporting goods to market, furthermore, was subsidized by FUNAI, while there were numerous accusations of improper dealings by agency staff and Indians who managed the posts. Largely as a result, only one of the several dozen trading posts that were started under the Special Project was still functioning by 1986.

(b) Education

5.73 The education component was similarly ill-fated. As indicated above, numerous schools were built and teachers hired by FUNAI to work at the Indian Posts. However, the teachers received little or no training for their tasks and few materials to work with. Partly as a consequence, they were largely unsuccessful in interesting potential students to attend classes, while the annual round of subsistence activities interfered with school schedules. Many teachers, furthermore, soon found life at the Indian Posts isolated and unrewarding, leading them to abandon their positions after only a few months. As a result, practically the only Indian Posts in the region where teaching presently takes place on a regular basis are those served by private religious missions. The very few literate Indians in the area were mostly raised outside their villages in seminaries or as adoptees. These people often later experienced considerable difficulty in reintegrating themselves into village life, if they returned to their native communities at all.

(c) Health Care

5.74 For a time at least, the Special Project did provide the tribal populations of the Northwest region with greatly improved access to health services. With vehicles and equipment purchased under the Project, doctors and nurses visited Amerindian communities on a reasonably regular basis to immunize people, examine and treat the sick and supervise sanitation works. At the same time, FUNAI built up its basic health infrastructure at each regional headquarters, largely through the installation of so-called "Indian houses" ("Casas do Indio") which simultaneously served as hostels, ambulatory clinics and hospitals.

5.75 For a time also, FUNAI succeeded in finding people to live and work in Indian villages since its salaries were generally higher than those paid by state government agencies for similar work. But gradually, as inflation began to erode FUNAI salaries, conditions in the communities worsened, supervision

suffered and equipment and facilities began to deteriorate due to a lack of maintenance. On many posts, health workers simply left and were replaced, if at all, by untrained persons. As a result, local health workers began to refer an increasing number of cases to the Casas do Indio rather than attempting to treat them in their own villages. Even simple problems such as worms, diarrhea and colds were increasingly referred to external health facilities, often forcing Indians to make arduous trips that frequently exposed them to more serious illnesses.

5.76 Low salaries and poor working conditions eventually led most of the physicians and nurses on FUNAI's staff to convert (legally or otherwise) to part-time contracts, thereby making it virtually impossible for them to visit communities in the field. Vehicles intended for health use were increasingly preempted for administrative purposes and the ferrying of Amerindians between the Casas do Indio and local hospitals. As a result, community visits by health teams became more sporadic, while those serious health problems that did emerge were frequently dealt with by improvised and/or palliative measures.⁶⁹

5.77 More generally, FUNAI's health and administrative personnel had little access to external expertise and information in the area of public health. As a consequence, lay persons such as regional administrators often made critical medical decisions such as the selection of drugs to send to a community experiencing an epidemic. Even though Brazil possesses numerous excellent agencies that are capable of providing high quality health services, FUNAI never took recourse to these potential sources of assistance, preferring instead to muddle through on its own. In addition, preventive and other health care skills were rarely passed on to the Amerindians themselves either by formal or informal means. In the villages where piped water was installed, for instance, all work was done by outside contractors. When problems arose with these systems, the usual outcome was their abandonment due to the lack of simple maintenance. This was often also the case with the schools and health posts built under the Special Project.

(d) Administration

5.78 The centralizing tendencies of the health system were replicated in other areas as well. Over time, FUNAI's staff became increasingly concentrated at subregional offices and regional headquarters. This reflected both low salaries and the harshness of field conditions, together with a lack of rigorous control on the part of FUNAI. By late 1989, the situation had reached the point where 71% of the agency's total staff in Mato Grosso were located in urban centers, while only 29% were in the field. In addition, the level of training of FUNAI's remaining field staff was low. This situation was further exacerbated by a general hiring freeze in 1989 which, once again, made it formally impossible for federal agencies to contract new personnel.

⁶⁹ For example, one FUNAI administrator responded to serious health problems identified by a Bank supervision mission in a particular area by bringing in an Air Force field hospital for one week to treat sick Indians.

5.79 Many FUNAI employees who were initially assigned to the field, furthermore, were later able to have themselves reassigned to urban posts through political influence or medical pretexts. The consequence was that Indian Posts became increasingly staffed by people originally hired as drivers or manual laborers, while agency administrative offices were jammed with employees who may have been well qualified and experienced, but frequently had little to do. After the new federal administration took office in March 1990, finally, there has been a cross-the-board reduction in public sector employment in Brazil, in the process further aggravating an already bad situation as far as FUNAI is concerned.

(e) Land Regularization

5.80 In spite of the progress made in regularizing many Amerindian reserves in the Northwest, a rising threat to the security and, thus, the sustainability of these areas remains. As indicated in the discussion of the difficulties surrounding the regularization and protection of the Uru-eu-wau-wau Reserve in Rondonia in paras. 5.61-5.68 above, the principal problem continues to be the invasion of Indian lands by loggers, prospectors, squatters and other groups. On a somewhat more positive note, however, even though no precise data concerning the actual extent of such encroachments presently exists, it is unlikely that the area so affected exceeds 5% of the total in Amerindian reserves in the region.

5.81 On the other hand, various legal problems continue to impede the full regularization of some Amerindian areas in the POLONOROESTE region. In Mato Grosso, for example, land sales conducted by the state government in the past resulted in the titling of nearly all the areas now in Indian reservations to private parties. The value of these titles is virtually nil because the great majority of titleholders do not physically occupy their parcels, nor are they likely to attempt to do so under current conditions. Nonetheless, these titles can create legal difficulties, as, for example, when titled landowners attempt to sell or mortgage property located on Indian lands. Furthermore, the demarcation and full registration of some areas has been held up by legal claims on parts of the reserves. In some cases, finally, landholders have what they consider to be legitimate claims to compensation for the loss of land for which they possess legal titles.

6. Causes of Problems Encountered

5.82 Some observers suggest that the primary causes of many of the problems described in the previous section have been malfeasance and corruption on the part of FUNAI.⁷⁰ The situation, however, is considerably more complex with the major factor underlying the distortions and difficulties experienced by the Amerindian Special Project, as well as other program components, being the extraordinarily rapid pace of migration to and demographic growth in the Northwest region over the past decade and a half. As will be illustrated in further detail in the next chapter, the population of Rondonia nearly tripled in just fifteen years. As the experience with many of POLONOROESTE's other

⁷⁰ See, for example, David Price, Before the Bulldozer, op. cit.

components amply demonstrates, no government agency has been able to maintain effective control over the rapidly changing conditions brought on by such growth. As already noted, the increase in malaria made Rondonia the world leader in terms of the number of reported cases of this disease despite the efforts of one of the most efficient public agencies in Brazil, SUCAM. As also indicated above, IBDF (now part of IBAMA) has been virtually helpless in the face of the ubiquitous sawmills which have sent increasing numbers of logging teams into the forested areas of Mato Grosso and Rondonia. Even the relatively powerful Ministry of Mines and Energy has been unable to stem the tide of tens of thousands of prospectors and small-scale miners who have invaded nearly every part of the region, often using environmentally destructive means to extract, process and/or purify gold, cassiterite and other minerals.

(a) Internal Financial and Administrative Factors

5.83 One important extenuating circumstance has been the extreme limitations on FUNAI's budget which has decreased in real terms during every year since 1981. In 1986, FUNAI adopted a package of policies designed, among other things, to reward employees for service in the field. For budgetary reasons, however, the plan was never implemented. FUNAI salaries, as already mentioned, declined in comparison to those paid by other agencies which frequently demanded much less of their employees. Many of FUNAI's employees, not surprisingly, became increasingly demoralized during the 1980's, while even very devoted and hard working staff became largely ineffective in the face of low salaries and other obstacles affecting job performance. In spite of its comparative shortage of skilled managers and technical personnel, additionally, at least until very recently, FUNAI has refused to call on other government agencies or NGOs to assist it in carrying out its mission.

5.84 Between 1980 and 1990, FUNAI underwent a total of eleven changes in its top leadership that echoed down to the level of regional administrators. While some of its executives were experienced indigenists, most, including both former military officers and civil servants from other sectors, were recruited from outside the agency and rarely had a background that prepared them to work with Amerindians. Against this financial and institutional backdrop, however, it should be recalled that FUNAI, due at least in part to the Bank's insistence, demarcated more Indian land after 1985 than had previously occurred in the entire history of Brazil!

5.85 One of the most intractable problems faced by FUNAI, as well as other program executing agencies, was the constant delay in the flow of resources from the federal government to those responsible for the actual implementation of specific components and subcomponents. The process of transferring program funds from the federal Treasury to the Ministry of the Interior, then from MINTER to SUDECO and from the latter to FUNAI and, finally, to the regional and field levels within the Amerindian agency rarely took less than six months. In addition, the high rate of inflation made it necessary to rebudget at every step. Once the resources did eventually reach their final destinations, they were seldom sufficient to carry out the investments for which they were initially intended and funds for construction and other (eg. agricultural) activities dependent on the seasons often arrived too late to be applied as originally programmed. FUNAI, in particular, engaged in a great deal

of reallocation of resources, often using funds supposedly destined for new expenditures to liquidate previously acquired debts which, on occasion, had no connection with the Special Project per se.⁷¹

(b) External Factors: Loggers, Prospectors and Settlers

5.86 The most serious and aggressive long-term threat to the security of Indian reserves in the Northwest, however, comes from the powerful logging industry and small-scale prospectors or placer miners. These parties have repeatedly invaded Amerindian reserves in total disrespect both of federal laws and the Indians themselves. In some cases, collusion has occurred between loggers and Amerindian leaders or between prospectors and Indians, with or without the tacit acceptance of FUNAI staff. While conditions have never deteriorated to the much publicized level of the Yanomani Indians in Roraima,⁷² the general situation is much the same.

5.87 In certain instances, FUNAI actively and openly made concessions to logging firms. Although they were later declared illegal and revoked by the Government, in 1986 and 1987, FUNAI signed contracts with sawmills for the extraction of tropical hardwoods in return for specific physical improvements on several reservations. Because no cash was involved, FUNAI avoided the requirement to open logging activities to public bidding. According to published allegations, some high FUNAI officials also demanded kickbacks in exchange for timber contracts. In some cases, Indian leaders bypassed FUNAI altogether, accepting new homes, automobiles, cash and other gifts in exchange

⁷¹ In its comments on the preliminary draft of this report, FUNAI concludes: "notwithstanding the implementation of some protective actions, the result of POLONOROESTE for the Indians can be considered catastrophic since the underestimation of its impacts propitiated, at the end of the program, a reversal of the protection that the indigenous groups had themselves achieved in their territories. The incentive by FUNAI's directors to extract timber from the indigenous areas in 1987, together with the collapse of assistance as the program's resources ran out and with no guarantee of the budget required to continue the health, education, control, squatter removal, and demarcation activities, have led to irreparable losses that are not yet fully dimensioned since their consequences in terms of the socio-cultural destructuring of many groups, the exploitation of their territories, and the expropriation of various communities whose lands were not demarcated are still being felt."

⁷² The Yanomani are a nomadic indigenous group located in the border region between Brazil and Venezuela. Over the past few years, this area has become increasingly subject to widespread and, until very recently, largely uncontrolled gold prospecting activity. As a result, the Yanomani have been decimated due to malaria and a variety of other diseases transmitted by prospectors, as well as by direct violent contact between the two groups. For a recent account of the Yanomani situation, see the articles entitled "A Morte Ronda Os Indios na Floresta," "A Fronteira sem Lei" and "Os Pajés Brancos," in Veja, September 19, 1990, pp. 70-83.

for timber rights which they did not possess the authority to grant.⁷³ In Mato Grosso, deals were also reportedly struck between FUNAI and miners to permit prospecting on certain Indian reservations.⁷⁴

5.88 FUNAI has also generally neglected to file required forest management plans with IBAMA (formerly IBDF). Where logging contracts have been signed between Amerindians and other groups, consequently, there has been little, if any, control over the actual amount of timber cut, the environmental damage resulting from such activity or the quality of the "improvements" undertaken in exchange. In some areas, loggers built roads that became totally impassable after a single rainy season. In May of 1989, the Assistant Attorney General of Brazil issued an opinion that the neither FUNAI, nor the Amerindians themselves, had the legal right to sign logging contracts in tribal areas. As a result, FUNAI's contracts with sawmills have been cancelled and enforcement of the law has been stepped up in several areas, most notably the Uru-eu-wau-wau Reserve and the Guapore Biological Reserve which is believed to be the habitat of a sizeable group of uncontacted Indians. In these specific cases, the actual extent of environmental damage appears to have been relatively small and limited to areas accessible by road or air.

5.89 There are also several reserves in the POLONOROESTE region on which non-Indian squatters continue to live. Various circumstances give rise to this situation. In some cases, the residents in question are titled landowners who settled in the area before it was identified and demarcated.⁷⁵ Others have illegally moved onto Indian lands after they were demarcated. The most serious such case is in the Zoro Amerindian Reserve in Mato Grosso where more than 600 families live in a non-Indian community known as Paraiso da Serra. Although the state of Mato Grosso and the Ministry of the Interior attempted to reach an agreement for the resettlement of these people, as of late 1989, they had been unsuccessful. In the meantime, several violent incidents have occurred between Indians and non-Indians in which lives have been lost and property destroyed.

7. The Role of Outside Evaluators

5.90 As specified in the various loan contracts, POLONOROESTE was to come under continuous review by an external evaluation unit. An inter-disciplinary group from the Institute of Economic Research (FIPE) of the University of Sao

⁷³ This took place on the Roosevelt, Sete de Setembro and Igarape Lourdes Amerindian reserves and possibly in a few other areas.

⁷⁴ This occurred most notably on the Aripuana Reserve.

⁷⁵ For example, as of late 1989, there were ten titled landowners with properties inside the Japuíra Amerindian Reserve in Mato Grosso. These settlers, however, were willing to leave and were simply awaiting compensation for improvements they had made on their lands before actually moving out. At least three small landholders were likewise occupying areas within the Guapore Valley Reserve due to errors in the original demarcation of the area. In addition, titled farming properties exist inside the Tereza Cristina and Aroes Amerindian Reserves.

Paulo was specifically hired for this purpose and undertook this activity until its contract was discontinued by SUDECO in 1987. As part of this effort, a team of anthropologists was recruited to monitor and perform an on-going evaluation of the Amerindian component. As many as ten different anthropologists worked on this team, each visiting one or more Indian communities at regular intervals.

5.91 The anthropological evaluators wrote detailed reports of their findings on each community, in the process producing a sizeable compendium of data dealing with Amerindian health, local economies, social organization, relations with outsiders, etc., as well as detailing the various services provided by FUNAI in each reserve. One major contribution of this team was to identify additional groups in the expanding area of influence of the BR-364 highway which, by virtue of this fact, deserved to be included under the Special Project. Their studies also provided valuable baseline data and snapshots of events in each of the indigenous areas.

5.92 The anthropological evaluation, however, also resulted in several problems. The descriptive nature of the evaluators' reports was more appropriate for an academic audience than for Project administrators, the style of presentation occasionally making it difficult to draw firm conclusions about general tendencies on which to define policies. The evaluation reports, furthermore, often tended to lack a quantitative base and strong assertions were sometimes made without an adequate factual basis. As time went by, the evaluators began to define their role increasingly as being advocates for the Indian groups and activists in the wider political context. Finally, their reports, on occasion, made extensive criticisms of FUNAI, but failed to propose concrete ways in which the situation could be improved.

5.93 As a result, over time the evaluators became increasingly involved in disputes with FUNAI that created difficulties in terms of their continued access to the Amerindian areas.⁷⁶ The adversarial tone of some of the evaluation documents and oral presentations helped to create an atmosphere of distrust within both SUDECO and FUNAI, while the anthropologists became increasingly frustrated at the failure of these agencies to give credence to their reports. Eventually, even though the evaluation exercise was intended to provide information to be used by SUDECO in the on-going implementation of the program, relations with FIPE and its consultant anthropologists became so strained that the coordinating agency became defensive and unresponsive to the evaluators' potentially useful observations and suggestions.

8. The Bank's Role

5.94 The role of the Bank in the implementation of the Amerindian Special Project also deserves a brief comment. The Bank's influence on this part of the

⁷⁶ In the area of the Guajara-Mirim regional administration of FUNAI, for example, Project evaluators took the administrator to task for his alleged collaboration with protestant missionaries, heaping criticism on him and the area under his jurisdiction. Outside evaluators, including Bank consultant anthropological and Amerindian health specialists, however, found conditions in this part of the region to be relatively better than in other areas.

program, and on the process and pace of land regularization in the Northwest in particular, appears to have been crucial. More specifically, the demarcation of most of the identified areas, encompassing a majority of the Indian population in the region (see Table 7 above), appears to have been largely the result of the Special Project and, by extension, of the existence and enforcement of the Bank's loan agreements with the Brazilian Government in relation to Amerindian protection. The Bank's influence was particularly important with regard to the initial demarcation of the Uru-eu-wau-wau Reserve and the resettlement of squatters from the Sete de Setembro and Igarape Lourdes Reserves.

5.95 More generally, Bank supervision of the Special Project took place on a regular basis despite the fact that this component was financed exclusively with domestic resources. Furthermore, the Government's failure to meet its contractual commitment to take the necessary measures to protect Amerindian communities in the program region was the one of the major factors, as well as the principal declared reason, for the suspension of Bank loan disbursements in early 1985. Even though the project files reveal that, prior to stopping disbursements for the program, the Bank came under considerable pressure from both the United States Congress and Treasury Department and from a variety of Brazilian, American and European non-governmental organizations with respect to the program's adverse physical and human environmental effects, including those on Amerindians, the record also clearly shows the persistent concern of Bank supervision staff with the ever-widening imbalances and distortions in program implementation, as well as with the numerous areas in which the Borrower had failed to comply with its contractual obligations. Bank supervision of the Special Project, finally, is generally considered by those who accompanied the program both inside and outside the Bank to have been one of the bright spots in an otherwise rather gloomy picture.

9. Principal Lessons Learned

5.96 POLONOROESTE has been much maligned in the international press, partly because of the plight of the Amerindian populations in its area of influence. That there have, in fact, been many regrettable events that are directly or indirectly traceable to improvement of the BR-364 highway or the associated expansion of the regional feeder road network is undeniable. Many of these incidents have involved loggers, miners, prospectors or squatters who are among the groups that have most benefitted from the improved road system in the region.

5.97 What the program's critics frequently ignore, however, is that, had the Cuiaba-Porto Velho highway been improved without the Bank's support, in all likelihood, there would have been no Special Amerindian Project at all. In the absence of the Special Project, in turn, it is probable that most of the thirty-five demarcated reservations containing nearly 8,000 Indians would not have been demarcated, nor would illegal settlers have been removed from several of these areas. The critics likewise frequently downplay the tangible benefits which have, in fact, accrued to the Indian populations in the region as a result of the Project. To be sure, there have been deficiencies as well as advances, but the actions taken with the Bank's insistence between 1982 and 1989 may

ultimately prove to have been essential for the physical survival of many of the tribal peoples in the region.

5.98 The poor performance of some aspects of the Special Project has sometimes been attributed either to insufficient concern on the part of the Bank or to corruption in Brazil. For those who witnessed events from the inside, however, it was clear that the Bank staff involved were tireless in their efforts to gain compliance from the Brazilian Government with both the letter and the spirit of the loan covenants specifically concerning Amerindians. The Bank was also generally well-informed, receiving up-to-date information on every critical situation as it developed. Nonetheless, there were occasions when it was not possible to gain the willing cooperation of the Borrower on each issue as it arose. To some observers, this may have grown, in part, out of the constant demands placed on Brazilian agencies, particularly FUNAI and SUDECO, by the Bank and other outside sources, leading to a kind of fatigue or unresponsiveness. In this context, it should also be remembered that domestic political and economic factors often constrained the Government from giving its full attention to and compliance with the relevant loan covenants.

5.99 While misconduct may have played a role in FUNAI's unsatisfactory performance, other considerations should not be ignored. First among these is the aforementioned chronic understaffing of FUNAI itself and the slow disbursement of financial resources by the Government to fund the Special Project. Poor communication and insufficient coordination among the various agencies involved in the program frequently also occurred. Interagency cooperation was tenuous at best and tended to depend largely on personal contacts among different institutions. Whenever one of FUNAI's frequent administrative changes occurred, furthermore, the Project was set back because both internal and external relations were affected. The lack of capable people to implement the Special Project, especially at the field level, was likewise a serious problem. In addition, FUNAI showed a limited ability to monitor its own activities. Communications within the agency were poor, the chain of command was often unclear and there were frequently long lapses between visits to the field by regional and central administrators. ⁷⁷

⁷⁷ In its comments on the draft of this report, FUNAI observes that the factors having the greatest impact on performance of the Special Project were: "non-existence of a diagnosis that considered the globality of the program and its interfaces with tribal communities; absence of preventive measures such as the demarcation and control of indigenous areas prior to pavement of the highway; lack of a systematic monitoring and evaluation program within the Indian protection agency to correct previously proposed targets; non-inclusion of isolated Indians who are still suffering the program's impacts; insufficient political will on the part of the Government in implementing protection measures; poor coordination among participating public agencies, leading to the invasion of tribal areas; the overlapping of conservation units and indigenous areas; and indiscriminate contact between Indian groups and settlers....The inefficacy of the Indian agency itself, which was unable to integrate the various actions proposed in the Special Project, resulting in disequilibria in the injection of resources such that means took precedence over actions to improve living conditions of the tribal population, should be added to the above."

5.100 The general position of Indians in Brazilian society, particularly in a fluid and rapidly developing region such as the Northwest, is also a very relevant and important consideration in assessing the results of POLONOROESTE's Amerindian protection component. Tribal peoples in Brazil are a small, discriminated minority, who, in practice, possess limited political rights. Even though they are formally protected by both the federal Constitution and ordinary legislation, enforcement of these laws is often problematic. In general, the political economy of Brazilian frontier development, about which more will be said in subsequent chapters, is such that rules created in more developed and stable parts of the country are frequently suspended or ignored in peripheral regions.

5.101 The prevailing socio-political climate on the frontier, in short, favors staking claims, "mining" natural resources,⁷⁸ including soils and water as well as minerals and timber, and reaping profits as quickly as possible. Furthermore, the elements of frontier society that are in closest contact with the indigenous population, loggers, prospectors, squatters, speculators and adventurers of many sorts, are normally those least prepared or inclined either to honor the law or to comprehend the delicate situation of Amerindian communities. Amazonian Indians are often viewed by these groups primarily as obstacles to increased access to land and other natural resources on the frontier.⁷⁹ The fact that Indian reserves also frequently occupy very large areas serves only to heighten this perception, especially in light of the comparatively small size of the tribal populations involved.⁸⁰

5.102 On the other side of the ledger, the State, which is weak in much of the rest of the country, is particularly weak on the frontier. Within the federal public sector, in turn, FUNAI is a chronically underfunded, often forgotten part of the bureaucracy that has rarely attracted a high calibre of administrators. In view of these circumstances, it is, indeed, worthy of considerable note that approximately one-quarter of the land area of Rondonia

⁷⁸ For a more systematic and detailed discussion of the importance of natural resource "mining" in the contemporary frontier occupation process in Amazonia, see Robert Schneider, Brazil - An Economic Analysis of Environmental Problems in the Amazon, World Bank, Report No. 9014-BR, October 30, 1990 (yellow cover).

⁷⁹ The situation of non-Amerindian traditional populations in parts of Amazonia, including rubber tappers, Brazilnut gatherers and small subsistence farmers and fishermen, among others, is largely similar. As a result, during the course of rapid frontier occupation, they too are often adversely affected by migrant settlers, ranchers, prospectors and other extractive industries. The well-publicized conflicts between large ranchers and rubber tappers in the neighboring state of Acre, which resulted in the assassination of the rural labor leader Chico Mendes in December 1988, are a clear example of this.

⁸⁰ An expression often heard on the Amazonian frontier, "so much land for so few Indians" ("muita terra para pouco Indio"), is typical of this common perception among land-hungry prospective settlers and other migrants.

has been legally reserved for the exclusive use of Amerindians, even though the long-run security of these areas remains very much an open question.

5.103 Finally, several important lessons can be drawn from the experience with POLONOROESTE's Amerindian Special Project.⁶¹ These include the following:

- (i) The Bank's emphasis on legalizing the land base by stressing the demarcation of Indian land has helped to create a legacy for the Amerindians in the Northwest region for many years to come.
- (ii) Future projects, however, need to place greater emphasis on securing the legal reservations through regular maintenance of boundaries and improved monitoring and enforcement. Where possible, artificial boundaries should be planted with marker species to make them clearer and more permanent. Protection programs should encourage Amerindian populations to assume direct responsibility for full utilization of their respective reserve areas, as well as for the permanent monitoring of all reserve boundaries. Indians should likewise be encouraged to explore sustainable economic activities in the entirety of their reservations.
- (iii) FUNAI needs to be greatly strengthened as an institution before it can be relied upon to accept major responsibilities such as those required under POLONOROESTE. Among the many areas that need to be reinforced are health care planning and service delivery, supervision and implementation, personnel recruitment, allocation and training, the monitoring of agency activities, administrative and financial control and internal communications.
- (iv) Total responsibility for Amerindian affairs should not be lodged in a single agency. Ideally, Amerindian protection and

⁶¹ In its observations on the preliminary version of this report, FUNAI concludes that "the impact of POLONOROESTE and other development programs on the indigenous population in various states of the federation demonstrates that it is necessary to rethink the form of insertion of Indian protection projects in these programs. This requires adequate planning, with analysis of the various components of the program and their interface with special [protection] projects, diagnosis of their impact on indigenous groups, and adoption of preventive measures. The injection of resources is not sufficient in the absence of prior dimensioning of the problems, political will to implement the program's mitigating actions, strengthening of the Indian protection agency, and participation -- in defining the solution to problems -- of governmental and non-governmental organisms that are committed to the indigenous cause....Only a change in perspective in the elaboration and implantation of large projects with adequate treatment of the indigenous question will impede that, after their conclusion, we are forced to recognize the [adverse] impacts and oppression of these programs for indigenous peoples."

support efforts would be coordinated by FUNAI, but the responsibility for implementation should be shared by agencies and/or NGOs specialized in public health, health care delivery, tropical ecology, agriculture and livestock development, education, community development and other relevant areas. Wherever possible, furthermore, there should be increasing participation by the Indians themselves in the planning, execution and monitoring of development projects that affect them.

- (v) Amerindian legislation in Brazil requires clarification. While the Bank cannot interfere in Brazil's legal structure, adequate protection of Amerindians and Amerindian areas will require innovations in the country's judicial structure and practices. Under the 1988 Constitution, Amerindians now have the right to represent themselves in court or to be represented by counsel of their choosing. The Bank can support this in future projects by providing the means for retaining effective legal counsel on a consultant basis.
- (vi) FUNAI currently does not have a structure equal to the task of promoting economic development in Amerindian communities. Where possible, other agencies and NGOs should be encouraged to work in collaboration with FUNAI to further development projects such as the commercialization of forest products (eg. latex production, Brazilnut gathering, etc.) when these are desired by the Indians themselves.
- (vii) Nor does FUNAI presently have a staff or structure adequate to the task of promoting primary education in Amazonian Amerindian communities. As in the case of health care and economic development, the Bank should encourage FUNAI to work with other agencies and NGOs to promote educational activities. At present, there are no viable suggestions for developing this activity. In the long run, however, literacy and numeracy are fundamental if Amerindians are to break the traditional cycle of dependency and exploitation.

D. Conclusion

5.104 Several general conclusions can be drawn on the basis of the experience with POLONOROESTE's environmental and Amerindian protection components. First of all, these efforts were only partially (Amerindian) or marginally (environmental) successful. Only recently have reasonably strong environmental protection measures been taken in connection with the program and their effectiveness still remains to be seen, while, despite the significant efforts on the part of the Bank to guarantee the protection of Amerindian areas in the Northwest, the long-run sustainability of these reserves and preservation of the regional natural environment more generally, will ultimately depend on political and economic forces over which the Bank has very little, if any, effective control.

5.105 A related finding is that, by the time of the Bank's mid-term review of the program in 1984 and the subsequent suspension of loan disbursements in 1985, it was already too late to reverse or even substantially alter the demographic and socio-economic tendencies responsible for increasing environmental degradation and growing pressures on Amerindian reserves in the area. To have been more effective, the essential preconditions for the successful implementation of POLONOROESTE's environmental and Amerindian protection activities, especially institutional strengthening and political commitment, should have been assured well in advance of the execution of the program's major infrastructure (especially highway) investments and the evolving results, or non-results, of these measures should have been monitored more closely from the outset. In short, even though many of the steps taken in response to the mid-term review were undoubtedly necessary, their delayed timing vis-a-vis program transport investments largely condemned them to relative ineffectiveness.

5.106 More generally, the unhappy experience with the program's environmental and Amerindian protection components points both to the very significant difficulties associated with efforts to control population movements and settlement patterns in frontier regions, particularly in places such as Rondonia and northwestern Mato Grosso which are comparatively rich in natural resources, and the very significant potential damage to the natural and human environments that can result from the uncontrolled occupation of large and ecologically sensitive tropical areas which are also the home of vulnerable tribal peoples. Not least among the problems encountered in attempting to direct rural settlement and the economic occupation of such areas are the normally very weak and incipient institutional capabilities in the (especially local) public sector for dealing with these processes and, more fundamentally, the near total absence of political and economic incentives to preserve or more rationally utilize the physical environment. For the most part, the predominant focus of both economic and political activity as it affects natural resource use on the Amazonian frontier is the maximization of short-run private gain rather than the minimization of long-term social and environmental costs. In light of the experience under POLONOROESTE to expect it to be otherwise represents an inadequate understanding of the underlying complexity and dynamics of the frontier expansion process in contemporary Brazil.

5.104 Finally, while it can be argued that there is likely to be a tendency for frontier areas such as Northwest Brazil to "mature" over time into economically, politically and institutionally more stable and less predatory societies from the standpoint of natural resource use, this scenario presupposes that enough of the original regional resource base will remain after the initial occupation has run its course to support such activity on a longer-term sustainable basis. In short, it implies that the underlying ecological carrying capacity of the area has not been degraded, "mined" or depleted to such an extent that sustainable development is no longer physically possible, or is possible only at increasing, and eventually prohibitive, costs given available production technologies and evolving local and extra-local market conditions. These considerations will be further explored in the next three chapters which will examine POLONOROESTE's principal non-Amerindian human and physical environmental consequences and assess the adequacy of its design and execution in light of these impacts respectively.

VI. HUMAN ENVIRONMENTAL IMPACTS

A. Introduction

6.01 The road investments associated with POLONOROESTE, by sharply reducing transport costs and greatly increasing accessibility to and within the region, strongly reinforced existing tendencies for migration to and within the Northwest. Internal migration, in turn, resulted in an intensification of the progressive, but largely predatory, occupation of the area, in the process contributing to the accelerated deterioration of its natural environment. The present chapter will examine the recent evolution and origins of migration to and its general impact on the (non-Amerindian) human environment in the Northwest. Of particular concern will be the effect of increased population inflows on rural development (including both agriculture and ranching), extractive activities, urbanization and public health. The principal consequences of stepped-up migration and rural settlement on the physical environment will be examined in the next chapter. In both chapters, the focus will be primarily on Rondonia where the bulk of POLONOROESTE's investments were made and where the program and related influences have had their most significant environmental impacts to date. ¹

B. Migration and Population Growth

6.02 Even before the Bank-Borrower discussions in the late 1970's that led to the creation of POLONOROESTE, migration to the Northwest from south-central Brazil was on the rise. By 1980, the ratio of migrants to the resident population born in Rondonia was already the highest in the country. The flows of prospective settlers to the Northwest prior to 1980 have been described in Chapter II and Annex II. The objective of the present section is to survey the impact of POLONOROESTE and associated developments on regional population movements during the 1980's.

6.03 Fortunately, the major trends in terms of population flows to Rondonia over the past two decades can be readily identified since migration estimates are available for this part of Brazil on a yearly basis. For the Mato Grosso portion of the region, in turn, until the results of the 1990 Demographic Census become available, the principal evidence concerning post-1980 population movements must be drawn from the 1985 Agricultural Census. The reductions in the number of farm units and the size of the rural labor force documented by this latter source (see Annex Table IV-3) suggest that the Mato Grosso subregion absorbed relatively few new migrants during the 1980-85 period. ² In sharp

¹ The program's impact on the Mato Grosso portion of the Northwest region has already been discussed in Chapter IV and is further assessed in Annex IV.

² As indicated in Table IV-3, the number of rural establishments in the Mato Grosso part of the region declined at an annual rate of 4.4% between 1980 and 1985, while the farm labor force decreased at an average rate of 5.3% per year over the same period. The number of establishments and the size of the

contrast to the experience in Rondonia, in fact, the Mato Grosso part of the region witnessed a net loss of rural population during the program implementation period due to substantial outmigration.

6.04 The annual migration data provided by SIMI (ie. the Migrant Information System set up by the Ministry of the Interior) for Rondonia, have peculiar characteristics which are discussed in the next paragraph and cannot be taken simply at face value. Starting in the mid-1970's, SIMI gathered information on people passing through migrant assistance centers and other checkpoints in various parts of Brazil. Even prior to this time in the case of Rondonia, migration data were collected by INCRA at a checkpoint in Vilhena.³ This operation was later expanded by the Ministry of Interior which added other checkpoints to the program.

6.05 As revealed in Table 7 below, annual migration to Rondonia varied considerably over the past decade and a half, largely as a result of real differences in the number of arrivals, although changing enumeration procedures⁴ also played a role in the observed fluctuations. It should be observed, however, that the SIMI data include only those migrants (or some portion thereof⁵) who arrived in Rondonia by road through official checkpoints and, thus, exclude those entering the state by other means or at other points including those, admittedly a small minority, who came by boat or plane. More importantly, the SIMI data do not differentiate between migrants and visitors, nor do they enumerate persons, including return migrants, travelling in the opposite direction. As concerns the latter, it is likely that the number of people coming to Rondonia to visit relatives and friends and later returning to their places of origin increased substantially as the local population grew and interregional communications improved, such that the extent of this bias in the SIMI data probably increased over time.

6.06 Even though the SIMI data have to be utilized with some caution, they, nevertheless, provide a useful indication of the overall trends. Accordingly, it can be concluded from the data presented in Table 7 that migration to Rondonia during the second half of the 1970's and the 1980's was marked by several clearly differentiated stages. The disincentive campaign carried out by federal authorities in the late 1970's appears to have succeeded in reducing the flow of population to Rondonia in 1977 and 1978, while inauguration of the Teixeira administration in March 1979 is associated with the

rural labor force in the rest of the state, in comparison, increased at annual rates of 6.8% and 2.4% respectively between 1980 and 1985.

³ Vilhena is the first town in Rondonia on the BR-364 highway after crossing the border with Mato Grosso.

⁴ These included modifications in the working hours of checkpoint officials, alteration of the target population to which the migration questionnaire was directed and changes in the interview schedules.

⁵ Those arriving at Vilhena at night, for example, were not surveyed during the initial years covered by the SIMI data.

restoration of migration to its pre-1977 level. The attainment of statehood in December 1981, the associated propaganda campaign carried out by the Teixeira government and the prospect and subsequent reality of major transport and other improvements under POLONOROESTE, coupled with the general economic crisis in Brazil in 1982-84 combined to generate an increasing flow of migrants to Rondonia during the early and middle 1980's.

6.07 More concretely, reconstruction of the Cuiaba-Porto Velho highway, together with expansion of the feeder road network, increased official support for rural development, a major export-oriented logging boom and the spread of gold and cassiterite mining, attracted a greatly increased flow of migrants to Rondonia after 1981 which appears to have reached its peak in 1986. Only in 1987 did the level of migration begin to abate, with the 1988 figure representing a significant decline over those registered in immediately preceding years. Of greatest importance for the present analysis, however, is that annual migration to Rondonia more than tripled between 1982 and 1984, or precisely during the initial phase of POLONOROESTE's implementation including the period when the BR-364 road was paved.

Table 7

Migrants Arriving in Rondonia and their Principal States of Origin, 1976-88

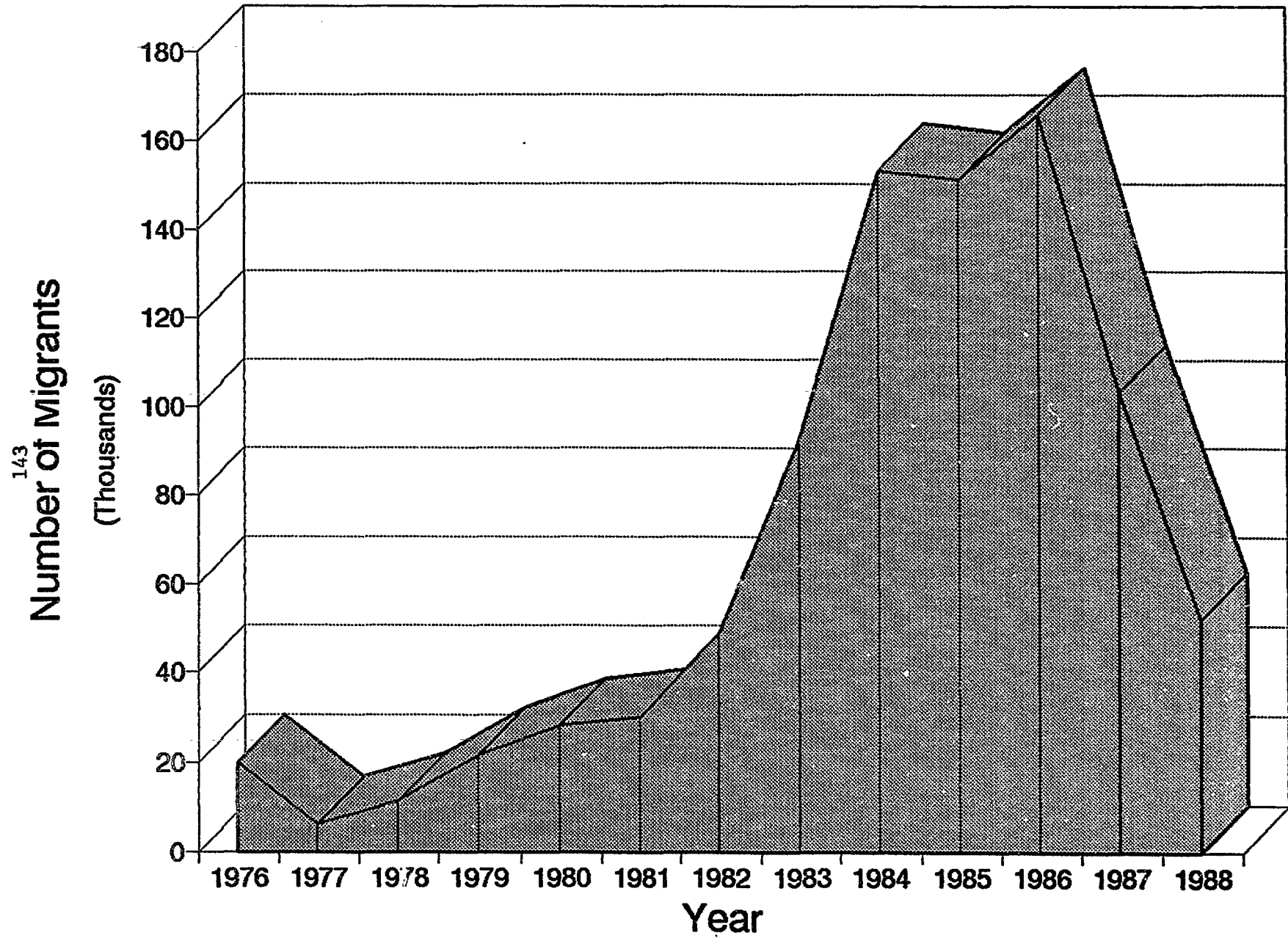
<u>Year</u>	<u>No. of Migrants</u>	<u>Principal State of Origin by Order of Importance</u>
1976	20,000	-
1977	6,000	-
1978	11,500	PN, MT
1979	21,479	PN, MT, MS
1980	28,320	PN, MT, MS
1981	30,072	PN, MT, AM
1982	48,851	PN, MT, MG
1983	92,723	PN, MT, SP
1984	153,327	PN, MT, SP
1985	151,621	PN, MT, MG
1986	165,899	PN, MT, MG
1987	103,654	PN, MT, ES
1988	51,950	MT, PN, ES

PN - Parana; MT - Mato Grosso; MS - Mato Grosso do Sul; AM - Amazonas; MG - Minas Gerais; SP - Sao Paulo; ES - Espirito Santo

Source: For 1976-79, unpublished tables from INCRA and SIMI/MINTER; for 1980-88, SEPLAN/Rondonia, Boletim de Migracoes, various years.

6.08 The high volume of population movement to Rondonia in the first half of the 1980's observed in the SIMI data is corroborated by a mini-census carried out by IBGE in 1985. According to this source, Rondonia had a population of roughly 909,000 on July 1, 1985, revealing a total increase of 418,000 people

Migration to Rondonia



after September 1, 1980. As natural growth would have contributed at least 70,000 individuals to the state's population over this interval, net migration was responsible for a maximum increase of some 340,000 people between September 1980 and July 1985. SIMI data for the same period indicate an influx of roughly 410,000 migrants. The discrepancy between the two figures can be largely attributed to the fact that the former represents an estimate of net in-migration, while the latter is a count of "total" movement into the state which, as mentioned above, fails to take out- or return migration into account.

6.09 Although no precise data are yet available on the present (ie. 1990) population in Rondonia, a projection used by the Secretariat of Health in September 1989 put the total at 1,570,000, of which 817,000 (or 52%) were urban residents and 753,000 (48%) were located in rural areas. These figures imply an increase of more than 660,000 people between 1985 and 1989 which corresponds to an annual growth rate of close to 15%. Such high figures, however, are inconsistent with IBGE's 1985 mini-census which reveals that average annual population growth between 1980-85, while elevated, was, nevertheless, lower than that observed on a yearly basis during the 1970's. They are also inconsistent with the SIMI data presented above which suggest that a significant reduction of migration flows has probably occurred since 1986. A more accurate population estimate for Rondonia at the end of the 1980's is likely to be in the range of no more than 1.3 to 1.4 million. ⁶

6.10 Whatever the actual figure, it can be concluded that population increased very rapidly in Rondonia during the 1980's, due primarily to the high rates of in-migration in the early and middle parts of the decade which were induced to a considerable extent by the implementation of POLONOROESTE. The data in Table 7 further confirm that most of the migrants to Rondonia during the 1970's and 1980's came from the previous agricultural frontier states of Parana and Mato Grosso. The table, however, also indicates the increasing importance of the more urbanized southeastern states, particularly Sao Paulo, Minas Gerais and Espirito Santo, in migration to Rondonia after 1981, or at precisely the time when these flows began to sharply accelerate. The period of relatively greatest participation of migrants from Sao Paulo in these flows (ie. 1983-84) largely coincides with the height of the national recession which had an especially serious impact on urban-industrial employment in that state.

C. Spontaneous Settlement and Rural Development

1. Impact on and Role of POLONOROESTE

6.11 The unprecedented movement of population into Rondonia during the 1980's was probably, in and of itself, sufficient to keep POLONOROESTE from achieving its general objective of promoting "harmonious" regional development. As noted in Annex III, the magnitude of these flows was far larger than the beneficiary targets set for the program which, as indicated in Chapter IV, were

⁶ The PCR for the Agricultural Development and Environmental Protection Project (Annex I), op. cit., cites state government estimates which suggest that the total population in Rondonia in 1990 was slightly over 1.4 million, of which 51% were in rural areas and 49% in urban centers.

only partially met. The relatively reduced number of project beneficiaries, in turn, contrasts sharply with the significant growth in the number of farm units and the size of the rural labor force (see Annex Tables II-2 and V-1) occurring in Rondonia in the late 1970's and early 1980's. As a consequence, except through its roadbuilding components, at best, POLONOROESTE may have directly benefitted no more than a fourth of all rural settlers arriving in the state over the past two decades.

6.12 The large number of families who had illegally occupied land in rural areas or were waiting in towns and cities to be awarded plots by INCRA had already lent a chaotic nature to the settlement process in Rondonia even before the initiation of POLONOROESTE. As a result, one of the federal government's main initiatives in the years just prior to the program entailed an attempt to discourage migrants from going to the region. The impact of the agricultural modernization process on small farmers and rural wage earners in south-central Brazil, particularly Parana and Mato Grosso, nevertheless, produced an increasing stream of migrants, many of whom were unwilling or unable to find sustenance in urban centers in their areas of origin.

6.13 The timing of POLONOROESTE's implementation coincided with one the most serious recessions in Brazil during the post-war period. Together, these factors helped to transform Rondonia into a "promised land" for an increasing number of landless migrants and urban unemployed during the early and mid-1980's. Governor Teixeira's efforts to reinforce the state's image as a new Eldorado through direct appeals to potential migrants, furthermore, helped to transform it into one of the few parts of the country that unequivocally received large net rural migration inflows during the 1980's.

6.14 Within the Northwest, however, the action of speculators and the presence of earlier "landowners," including rubber tappers, indigenous groups and assorted "entrepreneurs," was already putting considerable pressure on the available land by the early 1980's. Only the first official colonization projects were, in fact, located on highly fertile soils, while the lack of infrastructure, the growing proliferation of malaria and violence and the general absence of government services was already resulting in increased settler turnover on the newly-occupied lots. In the face of such obstacles, land-hungry migrants were increasingly forced to engage in sharecropping, wage labor and tenant farming or to turn to rapidly growing urban areas for employment.

6.15 Designed to resolve some of these problems, in practice POLONOROESTE exacerbated them, on the one hand by encouraging increasing waves of migration to the Northwest and on the other by facilitating the expansion of extractive, as well as agricultural, activities in the region. As the 1980's progressed, the worsening economic situation in the Center-South and the real or apparent availability of fertile land and other natural resources, together with improved rural infrastructure and services, fuelled increasing movements of population to rural areas, often well in advance of directed settlement projects. A boom mentality was nourished by prospects of obtaining quick fortunes in logging

activities, particularly the extraction and export of mahogany,⁷ or in recently discovered garimpos (see the next section for additional details). The expansion of logging led inevitably to the illegal harvesting of commercial hardwoods in, and hence the physical invasion of, official reserve areas as described in the previous chapter.⁸

6.16 As another consequence of the extractive boom, an increasing share of migrants to the Northwest came from urban areas. Many of these migrants were absorbed in logging and related activities or went to the garimpos, while others found employment in commercial and service activities and still others swelled the ranks of rural settlers.⁹ Since most of Rondonia's better soils had already been appropriated, if not physically occupied, by this time, pressure increased on areas of marginal agricultural potential such as the Guapore valley. Even though, with the important exception of Machadinho, POLONOROESTE did not itself attempt to promote or support settlement in areas possessing inferior soils, INCRA's general policy in Rondonia appears to have been to attend as many migrants and rural squatters as possible independently of the agronomic conditions in the areas they were attempting to settle. The state government, in turn, actively encouraged colonization in some areas, particularly the Guapore valley, that were clearly inappropriate from the standpoint of sustainable agricultural development.

6.17 As indicated in Chapter IV above, furthermore, POLONOROESTE's package of agricultural and social services was unevenly implemented, thereby hampering

⁷ For a discussion of the "mahogany boom" in Rondonia and elsewhere in Amazonia in the early 1980's, see John O. Browder, "Brazil's Export Promotion Policy (1980-84): Impacts on the Amazon's Industrial Wood Sector," The Journal of Developing Areas, No. 21, April 1987, pp. 285-304. According to this article, highly subsidized credit as part of the Brazilian government's export promotion campaign and expansion of the rural road network were the factors primarily responsible for the rapid depletion of native mahogany stocks in Rondonia during this period.

⁸ According to Browder (*ibid.*, pg. 291), for example, "three different trading company logging contractors raided mahogany timber from the Guapore River Biological Reserve, where logging is expressly prohibited by Brazilian federal law. One lumber company went so far as to build a cattle ranch in the ReserveThe loggers had bulldozed and set fire to Indian hunting trails and ransacked Indian campsites....The families of several ranch employees were resettled in the Reserve, providing the company with a first line of defense against Indian attacks and a deceptive justification for its own illegal activities in the Reserve. The ranch's isolation in the Rondonian wilderness rendered these activities impervious to the Government's haphazard enforcement effort. The Indians, who have undoubtedly lived in this Reserve for centuries, although never contacted by FUNAI, have been continually victimized by marauding teams of corporate loggers, the beneficiaries of government export subsidies."

⁹ Haroldo da Gama Torres, "A Urbanizacao e o Migrante de Origem Urbana na Amazonia," in Anais do VI Encontro Nacional de Estudos de Populacao, Olinda, ABEP, 1988, Vol. 2, pp. 483-501.

achievement of the program's overall objectives. This shortcoming sprang from a combination of planning errors, execution problems and contextual constraints, some of which have already been described and others of which will be discussed in Chapter VIII below. A case in point is the preferential treatment given to tree crops in program design and their eventual destiny.

6.18 To briefly recapitulate, the installation of perennial crops had been recommended for both economic and environmental reasons. Relatively high value export crops such as cocoa and coffee were expected to guarantee a reasonable cash income for settlers once these crops matured. Due to the relative fragility of many of the soils in the region, tree crops were expected to significantly reduce the fertility loss and erosion generally associated with the installation of annual crops and pasture land in areas formerly covered with tropical forest. Because of the slow maturation of investments in perennial crops, however, farmers required long-term credit which was expected to be provided in parallel to POLONOROESTE by official credit institutions.

6.19 The size of the demand for such credit would have made this a selective policy in any event. However, given the general shortage of official financial resources during the recession of the early and mid-1980's, in practice most small farmers were forced to largely rely on environmentally more damaging annual crops. In addition to the shortage of credit, the inadequate initial reading of soil conditions by program planners, declining international commodity prices, the considerably greater distance to markets when compared with other producing areas in Brazil¹⁰ and their susceptibility to diseases resulted in tree crops, especially cocoa, becoming economically less feasible for small farmers than originally anticipated. The rapidly increasing local demand for food crops in response to the logging, prospecting and related urban "booms" in the state was undoubtedly also a major factor in the more rapid expansion of annual than perennial crops during the latter half of 1980's. These tendencies are further examined in the next section and Annex V.

6.20 In synthesis, massive migration flows to Rondonia made it exceedingly difficult to implement POLONOROESTE's complex settlement schemes which, under the best of circumstances, could have directly benefitted no more than perhaps a fourth of all rural migrants to the region. Indiscriminate rural settlement, land speculation and violence, complicated by INCRA's land policies which recognized clearing of the forest as a legitimate way of staking claim to land title, further aggravated the situation. The presence of lower fertility soils, together with a high and rising incidence of malaria, persistent transport difficulties as distances increased from the main highways and other factors, all ultimately contributed to the reduced feasibility of the program's planned settlement schemes.

2. Recent Rural Development Tendencies

6.21 The significant dynamism and principal characteristics of rural development in Rondonia during the first half of the 1980's can be illustrated

¹⁰ Sao Paulo, Minas Gerais, Espirito Santo and Parana in the case of coffee and Bahia in the case of cocoa.

with reference to the preliminary results of the 1985 Agricultural Census. Based on information presented in the PCR for the Phase I Agricultural Development and Environmental Protection Project, POLONOROESTE's impact on incremental perennial and annual crop production and cattle raising in the state can also be roughly assessed. The findings of this analysis are summarized in the following paragraphs and presented in more detail in Annex V.

6.22 As concerns general rural development trends, census information reveals that more than half the growth in population occurring in Rondonia between 1970 and 1985 took place after 1980, as did 40% or more of the growth in the number of rural establishments, the rural labor force, the area planted in annual crops and the number of tractors. The relative expansion of the cattle population (or "pecuarizacao") was even more dramatic as nearly 70% of the total increment observed between 1970 and 1985 occurred after 1980. More recent data indicate that this tendency continued at least through 1987. The largest increment in the livestock population, however, occurred between 1982 and 1984, or at the time pavement of the BR-364 highway was being completed. It is also noteworthy that 70% of the increment in the number of rural establishments in the state between 1980 and 1985 was accounted for by farms between 10 and 100 hectares, while those having less than 10 ha made up most of the rest of the total of more than 33,000 new farms and ranches. As a result, the average size of rural establishments declined from 108 ha in the former year to 75 ha in the latter.

6.23 The Agricultural Census, in short, clearly reveals the importance of both directed and smaller-scale spontaneous rural settlement in Rondonia during the early 1980's. It likewise documents the comparatively greater dynamism of ranching over farming activities and, at least in terms of area planted, of annual crop production over that of perennial crops. With respect to livestock, more specifically, both the relative share of rural establishments possessing some cattle and the average number of cattle per establishment increased for virtually all farm/ranch size classes over the period, thus indicating that pecuarizacao was a widespread phenomenon in the state. This suggests that ranching activity, whether mixed with farming or by itself and for reasons which will be explored in the next chapter, was economically advantageous for both small and large producers in Rondonia during the 1980's.

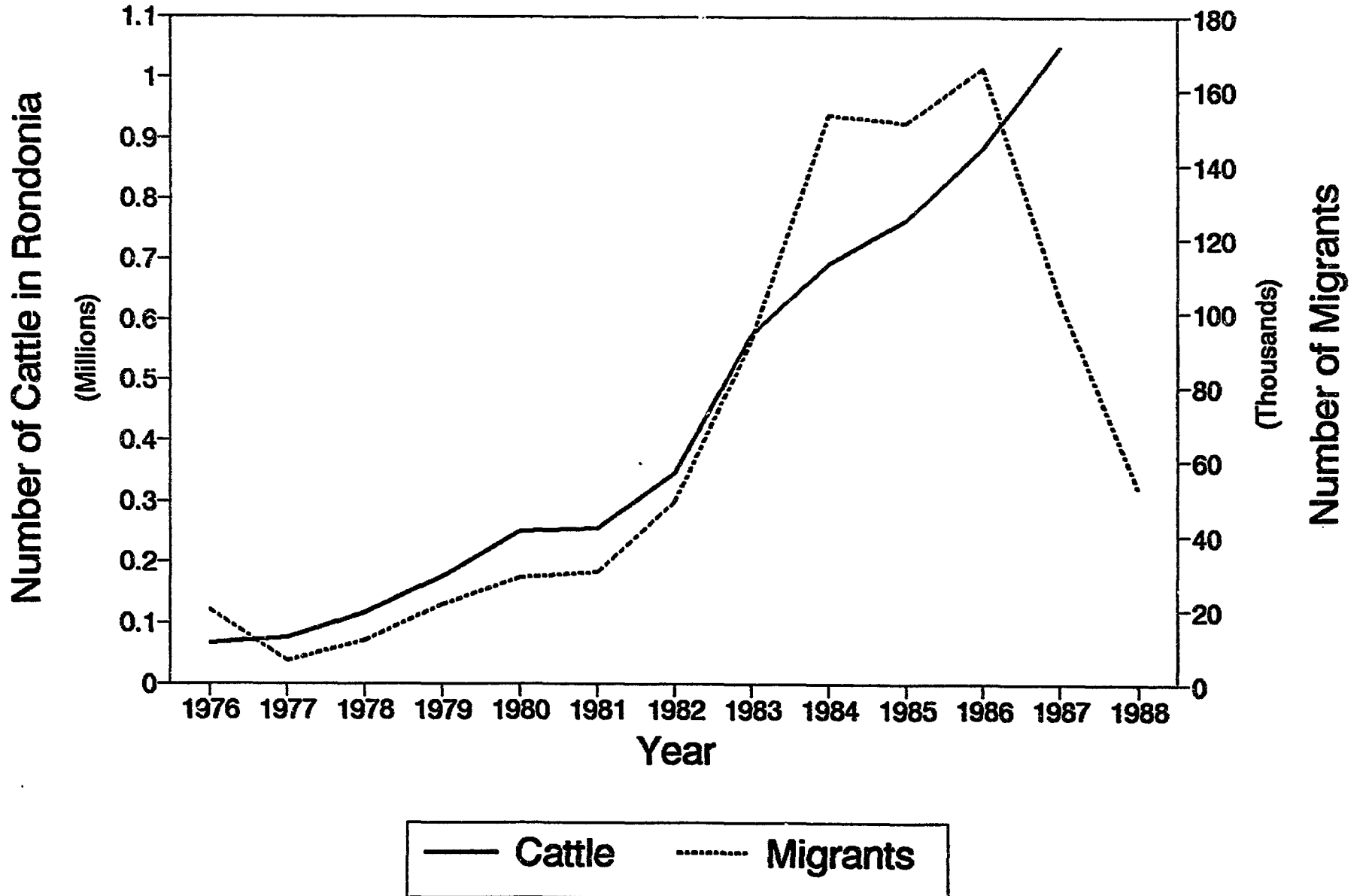
6.24 Agricultural output figures indicate that cocoa production grew very rapidly between 1980 and 1986 then fell off during the latter half of the decade, while coffee production expanded more slowly in the early and mid-1980's, but accelerated toward the end of the period. The principal annual crops (i.e. beans, corn, manioc and rice), in turn, while growing less rapidly than tree crops during the early 1980's, nevertheless, expanded steadily during the decade and, in 1987, together accounted for an area which was two and a half times larger than that planted in coffee and cocoa. Due to falling prices, additionally, the relative share of the two major tree crops in the total value of the state's output of the six major annual and perennial crops declined from 69% in 1985 to 45% in 1987, after having risen from 37% in 1980.

6.25 Data on agricultural production by farm size reveal that, while nearly 80 of all rural establishments in Rondonia produced annual crops in 1985, just over half produced tree crops. However, while the share of all rural

Cattle in Rondonia

Compared with Incoming Migration

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establishments producing annual crops increased slightly between 1980 and 1985, that producing perennial crops fell from close to 70% to 52%. The average areas planted in both annual and perennial crops varied significantly by farm size, although in all but the very smallest units, most of the total area was not utilized for agricultural purposes. The area not used for crop production in most cases consisted of active or abandoned pasture land, including areas formerly planted in annual crops, and, especially in larger units, as yet uncleared, but not necessarily unlogged, forest. Finally, the census data indicate that both labor input and crop area per establishment increased in farm and ranch units of all sizes in Rondonia during the first half of the 1980's, but especially in the very largest ones.

6.26 PCR data permit a rough approximation of POLONOROESTE's impact on agro-ranching activity in Rondonia. Figures on expected incremental farm output at full development in the project area when compared with IBGE estimates of incremental production for the state as a whole during the 1980-89 period suggest that farms assisted by the program may account for as much as 60% of the increment in cocoa production and half of that in coffee production in Rondonia. POLONOROESTE's impact on annual crops, with the partial exception of beans where as much as 30% of the incremental area planted over the past decade appears to have been in program-assisted establishments, was considerably less significant. On the other hand, according to the PCR, perhaps as much as 70% of the increment to the cattle population in Rondonia between 1981 and 1988 may have occurred in the area directly benefitted by POLONOROESTE. This result is surprising considering that the promotion of livestock was not a major objective of the program. On the contrary, because of its generally adverse ecological effects in tropical areas, the program's strategy was to be actively discouraged cattle raising through the promotion of tree crops.

D. Extractive Activities

6.27 As affirmed in para. 6.15 above, the major highway and feeder road investments made in connection with POLONOROESTE, in addition to stimulating rapid migration and thus hampering the orderly development of rural settlement schemes, also generated largely unexpected consequences in terms of the expansion of economically profitable, but environmentally predatory, extractive activities in much of the Northwest. More specifically, in addition to farming and ranching activities, program-supported transport investments have facilitated the growth of both large and small-scale mining, prospecting and logging ventures.

6.28 Cassiterite (ie. tin oxide) mining and lumbering activities in particular have benefitted from improved road infrastructure in the Northwest, both by greatly improving their access to expanding markets in southern Brazil or abroad and by opening up interior areas possessing substantial mineral and timber reserves within the region, especially Rondonia. The importance of the road network for extractive activities is clearly suggested by one study of logging activities in Rondonia which concludes that "the lumber industry is the

main supplier of out-bound business for long-haul truckers." ¹¹ However, neither the impact of road investments on regional mining and logging activities, nor the impact of the latter on local urban development as described below, while foreseeable, was adequately anticipated or dimensioned at the time POLONOROESTE was appraised.

1. Mining and Prospecting

6.29 In 1989, it was estimated that as many as 100,000 people were directly or indirectly involved in gold ¹² and cassiterite prospecting, while at least another 50,000 were employed in logging activities, in Rondonia alone. This state possessed approximately 55% and 10% of Brazil's measured cassiterite and gold reserves, respectively, in 1986, according to IBGE. Cassiterite production from the Bom Futuro area near Ariquemes, which accounts for the vast majority of the ore presently extracted in Rondonia, more specifically, was estimated to be as high as 48,000 tons in 1989, having a market value in southern Brazil, where it is transported by road for processing, of close to US\$ 200 million. ¹³ About half of the revenue from cassiterite mining is paid out to the prospectors themselves and, thus, is at least partially reinjected into the local economy.

6.30 Even though similar figures on gold production are not available, some 6,000 barges ¹⁴ were engaged in the extraction of gold from the beds of the Madeira and Mamore Rivers between Porto Velho and Guajara-Mirim in 1989. The value of the gold extracted from this area, much of which reportedly leaves the

¹¹ See John O. Browder, "Lumber Production and Economic Development in the Brazilian Amazon: Regional Trends and a Case Study," Journal of World Forest Resource Management, Vol. 4, 1989, pg. 10. The long-haul trucking industry, in turn, is correctly described as the "life-line for most settlements in Rondonia, conveying raw materials to the industrial Southeast and returning to the frontier with vital manufactures."

¹² A recent study by Ministry of Health estimates that there were on the order of 800,000 garimpeiros operating in Legal Amazonia in 1989, including some 60,000 along the Madeira River in Rondonia alone. These figures are cited in Schneider, op. cit., Annex IV, paras. 219-220. In commenting on the preliminary version of this report, however, the National Department of Mineral Production (DNPM) of the Ministry of Infrastructure observes that official government figures indicate some 16,000 persons were directly involved in gold prospecting in Rondonia in 1990 and another 3,000 in cassiterite mining in 1991.

¹³ According to DNPM's official figures, however, only 17,000 tons of cassiterite, corresponding to roughly 42% of the national total (40,700 tons having an approximate value of US\$ 252 million), were produced in Rondonia in 1990.

¹⁴ This number fell to less than 5,000 in 1990 according to DNPM.

region illegally,¹⁵ may be as high as US\$ 700 million per year. The corresponding figures for northwestern Mato Grosso are also significant, since local sources estimate that as many as 50,000 people may be involved in gold and other prospecting activities in POLONOROESTE's area of influence in the state.¹⁶

2. Timber Extraction

6.31 According to state forestry officials, finally, the number of sawmills operating in Rondonia may presently exceed 1,500, which compares with one-tenth that number a decade earlier, while on the order of 4 million cubic meters of lumber are currently being processed in the state annually. According to IBGE, approximately 3.6 million cubic meters were produced in Rondonia in 1987, accounting for roughly 5% of total national timber production in that year.¹⁷ This compares with less than 350,000 cubic meters in 1980 and 700,000 cubic meters in 1982.¹⁸ Some twenty-five different species are currently being commercially exploited in the state, largely for markets in southern Brazil or within the region itself, following the collapse of an earlier mahogany export boom after 1984. As indicated in the previous chapter and in para. 6.15 above, moreover, this lumber has been increasingly -- and illegally -- drawn from biological and Amerindian reserves, over which there appears to be very little fiscal or environmental control. Similarly, there is virtually no reforestation in the state.

¹⁵ It is estimated that 93.3 tons of gold were produced by garimpos in Rondonia between 1980 and 1988, of which more than 80% was not officially reported. Schneider, op. cit., Annex IV, Table 3. DNPM figures for 1990 are 8.9 tons, representing a value of US\$ 136 million. DNPM also indicates that official gold production in Rondonia over the last decade was 65 tons as compared with the higher figure cited for 1980-88 by Schneider, op. cit.

¹⁶ Gold production in Mato Grosso as a whole appears to substantially greater than that in Rondonia, as an estimated 222.5 tons were produced between 1980 and 1988 in the former state. As in Rondonia, however, most gold production was by garimpeiros, while more than 80% of the total was not officially reported. According to DNPM data, gold production in northern Mato Grosso in 1990 was on the order of 10 tons and the number of people directly involved was on the order of 30,000.

¹⁷ More generally, the North region accounted for 54% (24.6 million cubic meters) of all reported log production in Brazil in 1987, as compared with only 14% (4.5 million cubic meters) of this total in 1975. These figures are drawn from IBGE, Anuario Estatístico do Brasil, as reproduced in Schneider, op. cit., Annex II, Table II-1.

¹⁸ The index value for the growth of timber production in Rondonia between 1980 and 1987, accordingly, was 1043, as compared with 1202 for cocoa, 420 for the cattle population and 330, 166 and 162 for beans, coffee and corn, respectively (see Table 20 above).

E. Urbanization

1. Causes and Characteristics ¹⁹

6.32 As indicated above, large numbers of rural migrants were initially attracted to the Northwest by the prospect of obtaining inexpensive and allegedly fertile land, on the one hand, and in response to the rapid transformations occurring in traditional agricultural areas outside the region, on the other. The combination of large investments in transport infrastructure, agricultural support and other services through POLONOROESTE, politicians' promises of unlimited opportunities and the rapid expansion of extractive activities, however, later accelerated the movement of population to and within the region during much of the 1980's. Even though rural areas were the preferred destination of migrants to Rondonia in the 1970's, difficulties in obtaining, working, retaining or living on the land, together with comparatively greater economic returns in non-agricultural activities, forced or induced a significant share of all migrants to reside, at least temporarily, in towns or cities. As a consequence, a total of some 169,000 people, or roughly 45% of Rondonia's incremental population, were added to urban areas during the 1970's.

6.33 In the 1980's, in turn, the proportion of migrants to Rondonia having urban origins increased significantly, both as a natural response to the rapid growth of opportunities in local industry, commerce and services generated by a booming, extractive-based, frontier economy, but also due to the high unemployment rates resulting from the crisis in the Center-South, particularly in the largest urban areas such as Sao Paulo. As one researcher has expressed it: "the perception of possible opportunities in Rondonia was as much of a driving force among unemployed professionals with college-level education as among skilled and unskilled wage labor." ²⁰ According to SIMI data, over half of all migrants arriving in Rondonia in the early and mid-1980's listed their places of origin as urban, while it has been estimated that more than half of the population increase in the state between 1980 and 1985 accrued to its towns and cities. ²¹

6.34 The growing number of migrants who were initially unable to find land or employment in agricultural activities, accordingly, has clearly been one major source of urban growth in Rondonia since the mid-1970's. More recently, however, even though the dynamism of urban areas continues to reflect their continued role in providing temporary or seasonal employment for land-seeking migrants or members of their families, an increasing share of urban growth appears to be

¹⁹ For an excellent general discussion of the causes and characteristics of recent urbanization in the Brazilian Amazon region, see Schneider, op. cit., Annex I.

²⁰ John F. Wilson, Ariquemes: Settlement and Class in a Brazilian Frontier Town, Ph.D Dissertation, University of Florida, 1985, pg. 57.

²¹ George Martine, "Rondonia and the Fate of Small Producers," in David Goodman and Anthony Hall, eds., The Future of Amazonia: Destruction or Sustainable Development, MacMillan Publishers, London, 1990.

resulting directly from the significant multiplier effects that extractive activities have had on local urban economies, particularly in terms of the establishment and expansion of a broad range of processing industries and commercial and service activities.

6.35 Both gold and cassiterite prospecting operations are highly capital intensive, entailing the use of large amounts of heavy earth-moving equipment, trucks, barges, generators, pumps and, in the case of gold, even small airplanes, often resulting in the creation of substantial local manufacturing (eg. barge construction) and mechanical repair industries. Some 2,000 trucks and 15,000 people, for example, are reported to be directly employed in cassiterite mining activities at Bom Futuro alone. Another 15,000 to 25,000 people may be occupied indirectly (ie. in service activities) as a result of cassiterite prospecting in Rondonia. A similar situation exists with respect to gold mining, but on an even larger scale.

6.36 Less information is available in the aggregate with respect to the direct and indirect employment impacts of the logging industry in Rondonia, but these too are undoubtedly significant.²² A study of the role of lumbering activity in one Rondonian town, Rolim de Moura, however, found that wood consuming and servicing sectors employed roughly 47% of the local labor force and provided 67% of total household income generated in the urban sector in 1985.²³ Direct linkages were observed between logging and such other local economic activities as transport, construction, furniture making and fuelwood gathering, leading the study to conclude that lumber mills were the "industrial backbone of Rondonia's fledgling economy."²⁴ In addition to building materials and furniture, locally produced wooden bridges, fencing and utility poles were of

²² Browder ("Lumber Production," op. cit., pp. 4-5) notes, for example, that the industrial wood sector is the single largest employer of skilled and semi-skilled labor in all of the Amazonian states and territories except Amazonas (due to the free zone in Manaus), accounting for about 26% of all secondary sector employment in the region in 1983. In four of the region's administrative subdivisions, moreover, wood production and processing accounted for more than a quarter of the total value of industrial output in 1980, while in Rondonia the output of the lumber industry represented more than 60% of total state industrial product, excluding mineral extraction, in that year.

²³ Ibid. According to this study, Rolim de Moura was first settled in 1977 by a handful of pioneers from nearby Cacoal on the BR-364 highway. After feeder roads had been opened from Cacoal and the neighboring town of Pimenta Bueno, Rolim de Moura "burst into life," growing rapidly in size to 5,000 inhabitants by 1980 and to about 20,000 by 1984-85. This demographic growth was paralleled by an increase in the number of sawmills from 10 in 1980 to 36 five years later, whose total output expanded from 12,860 cubic meters in the former year to over 135,000 cubic meters in 1985.

²⁴ Ibid pg. 16 (emphasis OED). More specifically, in 1984-85, the lumber and related industries in Rolim de Moura generated approximately 1,600 jobs, 55% of which were in activities other than lumber production per se (eg. transport, construction, furniture).

particular importance for the local rural and urban economies. The transport of wood-based products, both locally and to export markets outside the region, also provided employment and income to a substantial share of the town's population.²⁵

6.37 In addition to the industries and services linked directly to mining and logging ventures, a number of other urban-based service activities have also proliferated in connection with rapid rural settlement in the region. Among these are a major "health industry" (ie. physicians, paramedical personnel, pharmacies, private clinics and hospitals, etc.) that has emerged primarily in response to the spread of malaria and other tropical diseases. Similarly, the full complement of entertainment services (including boarding houses, bars, restaurants, brothels, etc.) that typically accompany potentially high income extractive activities in Amazonian frontier areas have likewise emerged in the region.

6.38 Frontier towns, including those in the Northwest, furthermore, normally develop a wide variety of both retail and, as they increase in size, wholesale commercial activities to support the local rural and urban populations. The same applies with respect to productive services such as fuel provision and vehicle and equipment sale, maintenance and repair. Many of these activities, moreover, are "protected by distance" from similar ones located in other regional urban centers, thus contributing directly to the proliferation of local service and commercial enterprises in frontier areas, as does the need for small farmer families to supplement their incomes through some type of off-farm, often urban-based, employment.²⁶ Finally, as the rural settlement projects and their urban nuclei (including the NUARs) grow over time, many of the latter have been converted into the seats of municipal government or other local administrative centers, resulting in the installation and/or expansion of an equally broad range of bureaucratic, judicial and other public services. All of these tendencies have clearly characterized the urban growth process in the Northwest over the past decade, especially in Rondonia.

²⁵ According to Browder's study (ibid., pg. 10), an estimated 511 truck drivers were fully employed in the inter-regional transport of industrialized wood products from Rolim de Moura in 1985, while another 32 drivers were engaged full time in the local delivery of lumber and related goods. The value of these transport services, in turn, was estimated to be some US\$ 5.1 million in 1985, as compared with an estimated cost of US\$ 16.9 million for the production of lumber itself. More generally, it was estimated (pg. 16) that for every 100 cubic meters of industrial sawnwood produced in Rolim de Moura, nearly 1.2 jobs were created, generating an annual wage bill of US\$ 1,842 and a total value of production of US\$ 18,324 in five different sectors of the urban economy, suggesting "the significant degree to which economic expansion in Amazonia is taking place in rapidly industrializing urban centers" (emphasis OED).

²⁶ Employment of the wives and children of agricultural settlers in small town commercial activities, for example, is a common occurrence in Rondonia, as in other Amazonian frontier areas, especially when colonization plots are located in relatively close proximity to, and/or when the farm family itself resides in, a NUAR or other urban center.

2. Urban Environmental Problems

6.39 Even though POLONOROESTE attempted to expand and/or consolidate urban-based support activities for rural settlers through the NUARs, neither the recent demographic explosion in the larger towns and cities, nor the key role of urban growth and urban-based economic activity in regional development was adequately anticipated or taken into account in program planning and appraisal. In short, the essential importance of urban development and of key rural-urban linkages on the Northwest frontier were essentially ignored by POLONOROESTE's designers and ex-ante evaluators both in Brazil and in the Bank. The intensification of urban growth associated with program-supported or induced rural settlement and extractive activities since 1980, however, has led to a significant increase in the dimensions, and a change in the nature of, urban problems in the region. While the supply of power, water and sewage facilities, solid waste disposal, health and educational services has always been precarious in frontier towns, boom-time demands have greatly multiplied this problem.

6.40 As a result, most smaller Northwestern towns and cities, as well as the rapidly growing poor peripheral neighborhoods of its larger urban centers (eg. Porto Velho, Cuiaba, Ji-Parana), are presently lacking in basic urban infrastructure and essential public services, as well as in adequate local administration more generally, factors which directly contribute to the deteriorating sanitary conditions and associated public health problems observable at the local level in the region.²⁷ Urban housing is similarly inadequate in many parts of the Northwest. In addition to insufficient basic sanitation services, especially sewage and solid waste collection, disposal and/or treatment facilities, frequently resulting in contamination of local water sources, a growing industrial pollution problem also exists in many urban areas in the region due to the recent proliferation of sawmills and other primary raw material processing activities.

6.41 As in other respects, however, official control of environmentally damaging or potentially damaging activities in urban centers, as well as the provision of basic urban sanitation services, is presently inadequate in the Northwest, particularly in Rondonia. Future efforts to reduce environmental degradation in the region, accordingly, should include specific attention to urban, as well as rural, environmental protection needs, especially since much of the future growth in the Cuiaba-Porto Velho corridor is likely to be concentrated in urban areas. This has important implications in terms of future public investment priorities in the region.

²⁷ Poor urban sanitation and other environmental deficiencies, however, were among the problems specifically examined by SEMA in the diagnostic studies undertaken in Rondonia in 1985, on the basis of which a comprehensive set of environmental guidelines subsequently proposed for the state. See SEMA, Programa POLONOROESTE - Diretrizes Ambientais - la Etapa - Estado de Rondonia, Brasilia, 1986, especially Chapter XVI D. "Problemas Decorrentes da Urbanizacao em Rondonia."

F. Public Health

6.42 As described in Chapters III and IV and Annex III, a specific health project was designed as part of POLONOROESTE to intensify malaria control and strengthen primary and secondary health care for rural populations living in the vicinity of the NUARs through construction of health referral centers, training of rural health workers and reinforcement of local health-related research capacity, including specific studies on malaria. As a result of these activities, health services were expanded to reach about one-half of Rondonia's previously unserved population, while the malaria control component helped to avoid an even greater explosion of the disease. In addition, reductions in infant and maternal deaths, as well as a lower incidence of immunopreventable diseases, were reportedly observed during the project execution period.²⁸

6.43 On the whole, however, the advances registered in the health sector have tended to be limited. With respect to malaria in particular, as noted in Chapter VI above, increased migration, widespread spontaneous rural settlement and the rapid expansion of prospecting activities, together with associated changes in the physical environment, among other factors, have resulted in the Northwest region presently having one of the highest incidences of this disease in the world, as the number of reported cases of malaria in Rondonia rose from some 59,000 in 1980 to nearly 280,000 in 1988 (see Table 4 above). In the latter year, Rondonia accounted for almost half of all reported malaria cases in Amazonia, which in turn, registered close to 95% of all such cases in Brazil. Ariquemes and Porto Velho individually had the highest number of malaria cases recorded by municipalities anywhere in Brazil in 1986.²⁹

6.44 The high degree of spatial mobility of the Amazonian populations affected by malaria due to permanent, seasonal and other kinds of migration to and within the region, furthermore, has been largely responsible for the increasing transmission of the disease to people in other parts of the country, including many areas where it had previously been brought under control. More concretely, Rondonia, together with the state of Para in Eastern Amazonia, has been the principal source of this "backward flow" of migrants and malaria. Clearly, therefore, the public health impacts of rural settlement in Rondonia extend well beyond the administrative boundaries of the region per se.

6.45 The current situation in Rondonia and elsewhere in Amazonia has been described in one recent World Bank document as one of "frontier malaria" to underscore the fact that the disease is part of a "social condition associated almost universally with the historical process of Brazil's expanding frontier."³⁰

²⁸ See the PCR for the health project (OED Report No. 8469, op. cit.) and Wilson and Alicbusan, op. cit., pp. 14-15.

²⁹ Report No. 7535-BR, op. cit. Until 1989, when this distinction apparently passed to even more recent prospecting and rural settlement areas in Roraima, Ariquemes was commonly, and not incorrectly, referred to in Brazil as "the malaria capital of the world."

³⁰ Ibid., para. 2.11.

Frontier malaria has specific characteristics related both to the local (ie. humid tropical) physical environment and the nature of the affected populations and settlements which make effective control extremely difficult. In addition to the geographic mobility of the regional population already mentioned, these factors include: (i) high vector density resulting from the fact that temperature, precipitation, humidity and vegetation in the tropics favor proliferation of the anopheles mosquito; (ii) the rapid and precarious settlement of migrant populations, both in colonization and mineral prospecting areas, which at the same time increases their exposure to the vector and provides a large "human reservoir of infection;" (iii) a migrant population that has generally had no previous experience with the disease and possesses reduced immunity to it; and (iv) the presence of various strains of malaria, some of which are resistant to the drugs normally used for treatment.

6.46 The incidence of malaria in new settlement areas, however, does tend to improve over time. Deforestation leads to reduced exposure to the malaria vector, while the improvement of shelter and living conditions more generally, due in part to the selective retention of settlers and better shelter and health services provide increased protection. Reversals can, nevertheless, occur, particularly if major new settlements spring up nearby or if garimpeiros invade the area.³¹ Although treatment for malaria in the Northwest has been reasonably successful in preventing fatalities, it has been considerably less successful in preventing reinfection and strengthening resistance to the disease. As a result, even though mortality levels are generally low, morbidity is high and many victims suffer multiple cases of malaria each year.

6.47 As indicated in Chapter IV, furthermore, the disease can have very important economic consequences for the affected populations, both on account of the relatively high treatment costs involved -- hence the booming local "health industry" or, more precisely, "malaria industry" mentioned above -- and the amount of labor time and, thus, potential income which is lost from productive activity due to what are known colloquially in the region as "malaria days." Empirical studies of the economic impact of malaria in new colonization areas in Rondonia, including Chadinho, indicate, additionally, that poor health and disease tend to result in a "downward spiral of decapitalization" among settlers as treatment costs accumulate and erode both current income, which is often low in any event during the early years of settlement, and frequently the limited capital assets of rural households as well, leading many families to abandon the area altogether.³²

6.48 As concerns other public health problems and consequences, finally, the extent to which POLONOROESTE was able to produce a lasting positive impact on conditions in the region remains unclear. Insufficient resources for the operation and maintenance of health care facilities and equipment, a shortage of trained personnel, low salaries and, above all, poor sanitary conditions in many rural and urban areas have combined to reduce the program's overall health impact. In addition to malaria, furthermore, many other serious health problems,

³¹ Wilson and Alicbusan, op. cit., pg. 13.

³² Sawyer and Sawyer, op. cit., sections 5 and 6.

including leishmaniasis, schistosomiasis, tuberculosis, leprosy, diarrheal diseases, intestinal parasites and injuries resulting from work-related accidents and violence, persist in the area.

G. Conclusion

6.49 Directly and indirectly, POLONOROESTE has contributed to a very significant transformation of the human environment in Northwest Brazil over the past decade. Implementation of the program and other influences have led to intense migration to the region, particularly Rondonia, as the state was increasingly seen as a new Eldorado by land-hungry migrants from other parts of Brazil. Although altogether beyond the control of its formulators, in retrospect it is clear that the timing of the program was unfortunate since its inception coincided with the most severe economic crisis of Brazil's post-war history up to that time. Ill-conceived state government propaganda campaigns surrounding the program combined with major local logging and prospecting booms and growing unemployment in the Center-South to motivate increasing numbers of urban dwellers, as well as rural migrants, to head for the Northwest. This increased demographic pressure lies at the root of many of the adverse physical environmental impacts that have come to be associated with POLONOROESTE.

6.50 The economic crisis of the early 1980's, in fact, jeopardized the program's execution in at least two important senses. On the one hand, it contributed as a "push" factor to the intensification of migration to the Northwest after 1981, thereby substantially increasing the demand for land, employment and services in the region, while at the same time making it considerably more difficult to "manage" or control the settlement process. On the other hand, it also led to a fiscal crisis, both at the state and the federal government levels, which sharply limited the financial, and, ultimately, the human and institutional resources available to execute the program and supply productive support and community services more generally.

6.51 The rural settlement process, in turn, had already been chaotic in Rondonia prior to POLONOROESTE, even with much lower volumes of migration than subsequently experienced in the 1980's. However, in the face of constantly growing population pressures, the program's attempts to consolidate existing colonization projects and to establish new ones met with considerably greater difficulties. In addition, given the increasing prevalence of lower fertility soils in the areas coming under new, directed and spontaneous, settlement, a frequently hostile physical environment, the distance to major consumer markets outside the region and other problems, the economic feasibility of planned colonization schemes was correspondingly reduced. Nevertheless, POLONOROESTE appears to have played a significant role in the expansion of both agricultural, particularly perennial crop, production and cattle raising during the decade, although the latter was largely an unexpected result of the program.

6.52 Similarly, program transport investments, although intended primarily to support small-farmer agricultural development, simultaneously facilitated the expansion of high value mining, prospecting and logging activities as well as larger-scale commercial farming and ranching. As a consequence, substantial areas were opened up for ranching, timber extraction and mining ventures. Also as a result, towns and cities, as well as rural settlements have grown rapidly

in the region, particularly in Rondonia, in response to the swell of migrants and to the very substantial linkages and other multiplier effects generated by extractive activities. Largely in response, an entire complement of industrial, commercial and service activities is currently being provided in regional urban centers. These, in turn, generate additional local employment, income and demand for goods, including agricultural products, and services, many of which are produced or provided locally.

6.53 The intensity of regional urban growth, which, although largely foreseeable, was essentially ignored in POLONOROESTE's planning and appraisal, has multiplied, in the process also magnifying the extent of local urban, including urban environmental, problems. Consequently, most towns in the Northwest, as well as larger cities such as Porto Velho, Cuiaba and Ji-Parana, while outwardly quite prosperous, are generally also lacking in basic infrastructure and local services, especially in their often sizeable low-income residential neighborhoods. Public health, in particular, despite execution of a specific Bank-supported project to deal with rural health concerns under POLONOROESTE, continues problematic. The incidence of malaria remains extremely high, but other diseases typical of tropical areas characterized by rapid settlement and poor sanitation also persist.

6.54 POLONOROESTE and associated influences leading to rapid migration to and increasing occupation of the Northwest, especially Rondonia, in short, have had a major and by no means universally positive impact on the human environment, both rural and urban, in the region. Rapid migration and rural settlement, together with the recent proliferation of extractive activities, have likewise had significant direct and indirect impacts on its natural environment. The program's principal physical environmental impacts, not already examined in Chapter V above, will be summarized in the next chapter.

VII. PHYSICAL ENVIRONMENTAL IMPACTS

A. Introduction

7.01 At the time POLONOROESTE was appraised, Northwest Brazil was already undergoing a process of rapid rural and urban settlement, accompanied by land clearing and increasing contact with Amerindian populations. Most of the region, however, was still in tropical forest and the program, as initially evaluated by the Bank, proposed numerous measures intended to preserve important ecosystems and protect native tribal communities. As discussed in the two immediately preceding chapters, these environmental and Amerindian protection measures were often implemented and with considerable delays and local resistance, while the volume and rate of migration, stimulated in part by the program's transport and rural development components, made it virtually impossible to control or direct the occupation process and, thus, use of the region's natural resources. The result has been a massive assault on the physical environment in the Northwest over the past decade for which POLONOROESTE clearly bears part of the blame.

7.02 The present chapter will assess, in a general sense, the principal physical environmental impacts of POLONOROESTE and the larger regional development process of which it was an essential part during the 1980's. Particular attention will be given to deforestation and the principal factors associated with it, but changes in soil and water quality, the loss of biodiversity and possible effects on climate at the local, regional and global levels will also be briefly described. In the following paragraphs, no attempt will be made to associate specific (ie. localized) changes in the natural environment with specific actions taken in connection with POLONOROESTE. In this sense, as was also the case with the previous chapter, the discussion should, therefore, not be interpreted as an ex-post environmental impact assessment of the program per se, but rather as a survey of the principal physical environmental changes that have occurred in the region, particularly in Rondonia, over the past decade in which POLONOROESTE has clearly played a role. A more micro-level environmental impact assessment of specific program investments and activities, however, should be undertaken as part of any more detailed and systematic ex-post evaluation of the operation as a whole.

B. Deforestation

1. Extent of Deforestation

7.03 The principal physical environmental impact associated with the rapid expansion of spontaneous and directed rural settlement and extractive activities in the Northwest region has been even more rapid and territorially extensive deforestation. The degree to which clearing of the forest in Rondonia, as in Amazonia as a whole, has occurred over the past two decades has caused intense debate both inside and outside Brazil. Conflicting evidence provided by Landsat and AVHRR satellites has given rise to sharply varying interpretations and, as a result, considerable confusion exists as to the real extent and present rate of deforestation in the region. Since the resolution of Landsat images is much

more detailed than that of AVHRR¹ and since the interpretations based on Landsat tend to show somewhat lower rates of deforestation, it is likely that some exaggeration concerning the actual extent of this process to date may have occurred.²

7.04 Be that as it may, the fact that deforestation in the Northwest region has been extremely rapid and extensive is beyond question. Based on existing studies, it can be estimated that at least 46,000 square kilometers had been cleared in Rondonia by 1990, a figure which corresponds to 18% of the total surface of the state and 22% of the area originally under forest cover.³ This compares with a substantially higher estimate of deforested area (58,000 sq. km., corresponding to 24% of the state's territory) presented for Rondonia for 1988 in a recent World Bank publication.⁴ More importantly, it compares with figures of roughly 1,200, 7,600 and 28,000 square kilometers of forest area cleared in the state in 1975, 1980 and 1985, respectively.⁵

7.05 In all likelihood, the above figures understate the total area which has been affected (or "disturbed") through partial (or "selective") deforestation by logging interests in Rondonia. This latter area is estimated to be considerably larger than that which has thus far been totally cleared by farmers and ranchers, perhaps corresponding to as much as 40 to 50% of the area

¹ Philip Fearnside, "Rondonia: Estradas que Levam a Devastacao," Ciencia Hoje, Vol. 11, No. 61, January/February 1990, pp. 48-49.

² Schneider, op. cit. (Executive Summary, para. 3), also concludes that "the public appears to have an exaggerated view of the rate of deforestation in the Brazilian Amazon."

³ This figure is a linear extrapolation of an estimate for 1988 (41,521 km²) in a POLONOROESTE-sponsored study by Philip Fearnside entitled A Ocupacao Humana de Rondonia: Impactos, Limites e Planejamento, op. cit., pg. 12.

⁴ See Dennis Mahar, Government Policies and Deforestation in Brazil's Amazon Region, Washington, 1989. It also compares with an estimate of 51,000 km², corresponding to 21% of the state's territory, for 1987 by the Secretariat of Planning (SEPLAN/RO) as indicated in Governo do Estado de Rondonia, Plano Agropecuario e Florestal de Rondonia - PLANAFLORO, Porto Velho, 1989, pg. 20. Interestingly, this document (pg. 17) describes the 1982-89 (ie. POLONOROESTE) period as one in which "the inaptitude of part of the soils selected for rural settlements, allied with institutional and administrative, as well as technical factors, generated serious socio-economic-ecological conflicts. The region is characterized worldwide as an area of drastic ecological disequilibrium."

⁵ Fearnside, A Ocupacao..., op. cit., pg. 12. According to the Agricultural Census, the total area occupied by rural establishments in the state in 1985 was on the order of 61,000 km², of which roughly 5,400 km² was in crops (approximately 2,200 km² in perennial crops and 3,200 km² in annual crops).

originally under forest cover in the state⁶ and to an even larger share of the total in the Mato Grosso portion of the POLONOROESTE region. While less information is presently available for Mato Grosso than for Rondonia, a total of some 24,000 square kilometers, or roughly 21% of POLONOROESTE's area of influence in the former state, had reportedly been deforested by 1983, while local project technical staff interviewed by the OED/SEPLAN mission in October 1989 estimated that only 15% of the area initially covered by native forest remained intact.

7.06 One of the available sources presents estimates of the level of deforestation by municipality in Rondonia in 1987. This information, reproduced in Table 8 below, reveals the existence of considerable variation in the extent of deforestation in various parts of the state, generally reflecting a combination of differential physical accessibility (ie. the existence of and proximity to roads) and differing intensities of agricultural and extractive occupation. According to this source, the municipalities having the highest percentage of their total areas cleared in 1987 included Rolim de Moura, Presidente Medici, Ouro Preto d'Oeste, Cacoal and Colorado d'Oeste, all of which are located on or near the BR-364 highway and/or are official colonization areas.⁷ All but Colorado D'Oeste, furthermore, were among the municipalities directly benefitted by POLONOROESTE. By contrast, municípios in the Guapore valley such as Costa Marques and Guajara-Mirim registered comparatively much lower levels of deforestation.

7.07 While these figures undoubtedly underestimate the actual extent of deforestation at present,⁸ if, for no other reason, than because they do not take into account additional land clearing occurring since 1987, they, nevertheless, confirm that the municipalities that have been subject to the most intensive rural settlement over the past two decades have also been those most subject to deforestation. This is especially true for those municípios located

⁶ For one recent study of the extent of "disturbed," as opposed to totally deforested, area in Amazonia, see J.P. Malingreau and C.P. Tucker, "Large-scale Deforestation in the Southeastern Amazon Basin of Brazil," Ambio, Vol. 17, No. 1, 1988, pp. 49-55.

⁷ According to the Agricultural Census, the municipalities having the largest numbers of, and total area in, rural establishments in 1985 were Ariquemes, Ouro Preto d'Oeste, Porto Velho, Cacoal, Presidente Medici and Rolim de Moura. Several of the municípios which possessed the largest cattle populations in 1985 (ie. Ouro Preto d'Oeste, Cacoal, Ariquemes, Ji-Parana and Pimenta Bueno, which together accounted for more than half of all the cattle in the state) were the same as those having the largest number of farm units and/or the largest amount of deforested areas.

⁸ According to this source, the total area cleared in Rondonia in 1987 was only on the order of 23,000 sq. km (or less than 10% of the total area of the state), as compared with Fearnside's (A Ocupacao..., op. cit.) estimate of 36,900 km for the same year. This gives an additional idea of the range of estimates that currently exists with respect to levels and, hence, rates of deforestation in the region.

along the Cuiaba-Porto Velho highway where INCRA's initial rural settlement schemes were installed. A clear relationship, accordingly, exists between rural settlement and deforestation in Rondonia.⁹

Table 8

Forest Clearing in Rondonia by Municipality, 1987

<u>Municipality</u>	<u>Total Area of the Municipality (in ha)</u>	<u>Cleared Areas, 1987</u>	
		<u>Area Cleared (in ha.)</u>	<u>Percent of Area Cleared</u>
Alta Floresta d'Oeste	990,000	66,013	6.7
Alvorada d'Oeste	255,000	28,575	11.2
Ariquemes	1,382,590	286,250	20.7
Cabixi	180,000	50,731	28.2
Cacoal	480,000	135,056	28.1
Cerejeiras	1,040,000	50,769	4.9
Colorado d'Oeste	520,000	143,975	27.7
Costa Marques	1,705,000	22,838	1.3
Espigao d'Oeste	460,000	69,081	15.0
Guajara-Mirim	2,535,000	62,613	2.6
Jaru	1,070,000	181,200	16.9
Ji-Parana	625,000	102,887	15.7
Machadinho	1,250,000	30,538	2.4
Nova Brasilandia d'Oeste	185,000	25,294	13.7
Ouro Preto d'Oeste	640,000	215,556	33.7
Pimenta Bueno	1,175,000	193,320	16.5
Porto Velho	5,456,810	211,320	3.9
Presidente Medici	200,000	70,838	35.4
Rolim de Moura	295,000	106,956	36.3
Santa Luzia d'Oeste	170,000	44,281	26.1
Sao Miguel do Guapore	1,090,000	22,425	2.1
Vila Nova do Mamore	950,000	48,175	5.1
Vilhena	1,620,000	122,206	7.5

Source: IBDF, Alteracao da Cobertura Vegetal Natural do Estado de Rondonia - Relatorio Tecnico, Brasilia, 1989 (mimeo)

⁹ This relationship is even more dramatically demonstrated in satellite photographs which reveal the "fishbone" pattern of deforestation that has occurred over the past decade in Rondonia following the trunk, feeder and connecting road system installed in connection with directed and spontaneous rural settlement. See, for example, National Geographic Magazine, op. cit.; Mahar, Government Policies, op. cit.; and Norman Myers, "The Future of Forests," in L. Friday and R. Laskey (eds.), The Fragile Environment: The Darwin College Lectures, Cambridge University Press, Cambridge, England, 1989.

7.08 One recent study of the environmental impacts of POLONOROESTE points out, furthermore, that the rate of deforestation in the state has been even more rapid than that of population growth.¹⁰ This tendency is attributed in part to the subdivision of lots by colonists, on the one hand, and by the substitution of many of the original settlers by more recent arrivals, on the other.¹¹ Based on empirical analysis of the land clearing process in Rondonia, the study finds that the normal tendency is for colonists to deforest their lots most intensively during the first six years of occupation, after which time the rate of clearing tends to proceed considerably more slowly. Whenever a lot is resold, however, the new occupants resume the process of deforestation, in many instances clearing land even more rapidly than their predecessors.¹²

7.09 In addition, settlers are frequently motivated to sell their lots in order to take advantage of the increase in land values resulting from public infrastructure investments, especially roads, which improve accessibility both to local markets and to urban services. Much land occupation in frontier areas, thus, appears to take place at least in part for speculative reasons. The building or improvement of roads, thus, serves both directly, by opening up new areas for settlement, and indirectly, by inducing rural land speculation, as a stimulus for deforestation. In the Amazonian frontier context, moreover, as previously noted, land clearing has traditionally been considered by INCRA to be a demonstration of "productive" occupation, thereby providing visible support to squatters' claims to land ownership rights.

7.10 The OED/SEPLAN mission, finally, made a rough estimate of the amount of forest that can still be legally cleared in Rondonia. For this purpose, those areas included in previously established official Amerindian Reserves (48,000 km²), national parks and biological reserves (22,000 km²), plus those areas in agricultural and ranching zones legally required to be maintained in block and other forest reserves (ie. 50% of the total area not included in Amerindian or biological reserves, or roughly 69,000 km²) were subtracted from the total forested land in the state (208,000 km²). On the basis of this calculation, it was initially determined the total area that could legally be deforested in Rondonia was on the order of 69,000 square kilometers.

7.11 Of this total, as mentioned above, as much as 46,000 km² have probably already been cleared, leaving an area of no more than 23,000 square kilometers for future legal deforestation. However, since the recently (ie.

¹⁰ Fearnside, A Ocupacao..., op. cit.

¹¹ The PCR for the Agricultural Development and Environmental Protection Project (para. 6.12) confirms the high degree of settler turnover in both official colonization (two-thirds) and other rural areas (90%) in the state.

¹² Ibid., pp. 18-19. Fearnside attributes this behavior to the fact that many of the new settlers may have had less previous agricultural experience than the original colonists, leading them to clear a larger area than strictly necessary for the production of annual crops. An alternative explanation might be the increasing tendency of rural settlers in Rondonia to covert forest directly into pasture land, as discussed in greater detail below.

September 1989) ratified state Constitution has established additional areas as extractive and biological reserves, the actual area available for legal deforestation in Rondonia is correspondingly smaller. Furthermore, to the extent that the area already cleared in the state may be understated by the 46,000 km² figure utilized above, the amount legally available for deforestation would be even further reduced.¹³

7.12 Whatever the actual figure, it is evident that the area available for legal land clearing in Rondonia diminished rapidly over the past decade and that if present trends continue, it could totally disappear over the next several years, in the process greatly increasing existing pressures on Amerindian and other reserves.¹⁴ This tendency and its underlying causes, therefore, should be taken directly into account in the preparation of any future Bank lending operations involving the rural sector in the state. In this connection, the principal factors underlying deforestation in the Northwest can be briefly summarized as follows.

2. Agricultural Settlement and Environmental Degradation

7.13 As indicated in paras. 7.06-7.09 above, much of the recent deforestation occurring in Northwest Brazil is closely associated with the rapid spread of directed and spontaneous rural settlement. While the underlying causes of this phenomenon have to be sought in the structural determinants that have led hundreds of thousands of migrants to seek their fortune in the region, even the more immediate relationships between agricultural settlement and environmental degradation in a tropical frontier area such as the Northwest are both complex and dynamic, ultimately involving a large number of individual small-farmer land use decisions. Two recent studies have specifically examined some of these relationships in the case of Rondonia.¹⁵

¹³ Eleven thousand (11,000) square kilometers, not including the newly established state extractive and biological reserves, if one were to use Mahar's (Government Policies..., op. cit.) estimate of deforested area in Rondonia in 1988, for example.

¹⁴ Even though the rate of deforestation in Rondonia during 1989 appears to have decreased over that observed in previous years, this is likely to have been due as much, if not more, to decreasing migratory pressures and favorable weather conditions, since the rainy season lasted longer than usual, thereby reducing the period normally used by settlers for forest clearing and burning, than to official inspection and control efforts which, in fact, also increased. In any event, as reported in Chapter V, substantial burning of both existing pasture land and newly cleared forest areas was observed during the September-October 1989 OED/SEPLAN mission, especially along the BR-429 highway, as well as within the Pacaas Novos National Park and the Guapore Biological Reserve.

¹⁵ See Fearnside, A Ocupacao..., op. cit., and Stephen Vosti and William Loker, "Some Environmental and Health Aspects of Agricultural Settlement in the Western Amazon Basin," paper presented at the Symposium on Environmental Aspects of Agricultural Development, World Bank, Washington, October 1989. The latter paper was largely based on extensive field work undertaken in the Bank-supported

7.14 According to these studies, more concretely, in order to understand the specific linkages between agricultural production and natural resource utilization on the one hand and resource use and environmental degradation on the other in western Amazonia, it is first necessary to understand the incentives and constraints that determine local land use patterns. It is similarly necessary to recognize that aggregate land use tendencies ultimately reflect the micro level management of specific combinations of production factors (land, labor, capital, etc.) by individual farmers, ranchers and other actors and that this, in turn, occurs in response to available, but often imperfect, information regarding existing agro-ecological conditions, market opportunities and household demand, among other factors. Furthermore, the initial agro-ecological conditions themselves change over time as a result of the actions of farmers and other groups (ie. ranchers, miners, loggers, etc.) on the frontier, thereby adding another element of complexity to this relationship.

7.15 The deforestation resulting from such individual land use decisions typically occurs in several stages, independently of the tendency for the substitution of settlers over time mentioned above. The description of this process presented in one of the recent studies on Rondonia merits quoting selectively at some length:

Newly arrived migrants face severe capital and labor constraints, an often complete absence of logistical and technical assistance and a general ignorance of the inherent potential of the abundant (but poor quality) land at their disposal. Farm households, which are generally fragmented during the initial colonization process, commonly arrive with sufficient stores of food and liquid assets to survive approximately six months -- somewhat less time than is required to harvest the first annual crop and years before any perennial crop will bear fruit. This set of circumstances leads to the immediate and rational decision to deforest as much land as possible during the first drying season...Once dried, the forest is burned...since in most cases the residual ash is the only fertility-increasing additive (natural or otherwise) the Amazon soils are ever likely to receive....Once the land is cleared and burned, the first phase of ecological degradation is complete -- the forest is gone. If abandoned, something will grow up in its place, but except in special cases the complex ecology of the (primary) forest will not be regenerated.

The second phase of ecological degradation begins with longer term land-use decisions....Farmers (are) driven to clear new land for their families' survival...By and large, initial crop planting decisions are dominated by food consumption habits and the knowledge that properly

Machadinho new settlement project and funded under the Northwest Health Project.

functioning...regional markets are lacking. Annual crops of rice, beans, corn and manioc occupy a majority of land during the first two crop cycles....The rapid decline in soil fertilities associated with the production of annual food crops prompts major changes in land-use strategies [which] vary from extensive planting of perennial tree crops to beef cattle production, and choices depend...on the input and output marketing mechanisms and policies supporting these options.

One common strategy among colonists responding to rapid declines in yields of annual crops is to take that land and convert it to pasture, while continuing to slash and burn new (relatively fertile) land (as available) for annual crops. The latter provide a short-run return through the harvest and sale of crops, as well as guaranteeing a food and seed supply for the coming year. The sown pasture serves a double function -- it provides forage for cattle (if any are present) and also provides physical proof of occupancy in an environment where legal titles are rare and land disputes frequent. It may also provide a source of income if the pasture is rented to neighbors. Therefore, pasture is a valued good in its own right, independent of cattle ownership.¹⁶

3. Recent Land Use Tendencies

7.16 As indicated in Annex Tables II-2, V-1 and V-2, data drawn from the 1985 Agricultural Census bear out the fact that an increasing share of the total area in farm establishments in Rondonia has been converted either into annual crops or to pasture land. As described more fully in Annex V, these figures reveal that the area in both annual and perennial crops has grown dramatically in Rondonia since 1970, with the former continuing to predominate over the latter in absolute terms, as has the number of cattle and thus, necessarily, the land cleared and/or utilized for pasture. Accordingly, while the area in perennial crops expanded from just over 12,000 hectares in 1970 to 223,000 ha in 1985, that in annual crops increased from some 32,000 ha in the former year to over 315,000 in the latter.

7.17 It is important to add in this connection that the total area which has been cleared at one time or another to plant annual crops in Rondonia, as elsewhere on the Amazonian frontier, over the past two decades is actually much larger than the figure presented above due to the widespread practice of shifting cultivation in the region. As a result of this process, areas which have lost their capacity to sustain annual crops after two to three years are progressively substituted by newly cleared ones. For the most part, former annual crop land, as noted in the preceding section, is then either used as pasture or abandoned to second growth vegetation. Thus, over a period of

¹⁶ Vosti and Loker, op. cit. pp. 4-6 (emphasis OED).

several decades, the total land area that is used for the cultivation of beans, rice, corn and other annual crops is necessarily considerably larger than that under production at any one particular point in time such as a census year.

7.18 From the standpoint of deforestation, accordingly, census figures at five year intervals for land occupied in annual crops should be viewed cumulatively, rather than incrementally as in the case of areas planted in perennials. This is so, in part, because of the fundamental difference in the nature of the two types of crops. While tree crops require much longer maturation periods, but normally have much longer productive lives at the same location, annual crops tend to exhaust soil fertility much more rapidly and, thus, are shifted much more frequently to other locations.

7.19 More generally, it reflects the fact that, on the Amazonian frontier, increases in annual crop production are obtained primarily by physically relocating the areas under cultivation, either within the same farm unit or by setting up new establishments in previously unfarmed areas, and thus by "mining" the nutrients in the soils, rather than using chemical fertilizers and other means to maintain or enhance natural soil fertility. This, in turn, reflects the relative costs of land on the frontier which is comparatively cheap versus those of productivity-enhancing fertilizers, herbicides and pesticides, to whose initial production costs, which tend to be elevated, must also be added the cost of transportation from south-central Brazil.

7.20 Returning to the evolution of basic land use tendencies in Rondonia over the 1970-85 period, the total area in rural establishments in the state grew from 1.6 million ha (or 16,000 square kilometers) to nearly 6.1 million ha (61,000 km²). As highlighted in the preceding chapter, however, the cattle population expanded even more rapidly, from just over 23,000 in 1970 to nearly 1.1 million in 1987! Table 9 summarizes these tendencies by indicating the average annual growth rates of agricultural establishments, the total area in such units and in annual, perennial and total crops, as well as of the farm labor force and the cattle population, in Rondonia between 1970 and 1985 by five-year subperiod.

Table 9

Annual Growth of Agricultural and Ranching Activities in Rondonia, 1970-85 (%)

<u>Variable</u>	<u>1970-75</u>	<u>1975-80</u>	<u>1980-85</u>	<u>1970-85</u>
Rural Establishments	29.2	13.7	11.0	17.7
Total Farm Area	13.6	11.1	3.1	9.2
Total Crop Area	34.1	14.1	7.6	18.1
Tree Crop Area	30.1	30.0	5.6	21.4
Annual Crop Area	35.5	6.6	9.2	16.4
Farm Labor	38.3	11.2	12.9	20.2
Cattle Population	19.1	35.3	25.0	26.3

Source: IBGE, Agricultural Census, 1985 (Preliminary Synopsis)

7.21 Of particular interest in these figures, in addition to the very high magnitude of nearly all of the growth rates, and hence the dynamism of the processes involved, are: (i) the relatively more rapid expansion of annual than perennial crop areas between 1980-85, sharply reversing the tendency observed between 1975 and 1980 (i.e. prior to POLONOROESTE); and (ii) the much more rapid rate of growth of the cattle population than that of the number of rural establishments, the total area in crops and the farm labor force after 1975 and particularly after 1980. These differences clearly suggest the increasing importance of temporary crops over tree crops and of pasture formation relative to agricultural land uses in Rondonia, in the first half of the 1980's.

7.22 As a result of these tendencies, not surprisingly, the average number of cattle per rural establishment nearly tripled from 3.3 in 1970 to 9.4 in 1985, with the largest increment occurring between 1980 and 1985. In contrast, the average amount of land in both annual and perennial crops per establishment decreased slightly over this period, while the average farm size has also fallen significantly from 230 ha per unit in 1970 (i.e. prior to the official colonization schemes) to 75 ha per unit in 1985, reflecting the directed colonization effort, the parallel spontaneous occupation of rural areas and the subsequent subdivision of many of the original settlement plots.

4. Cattle Raising and Environmental Degradation

7.23 Until late 1988, as mentioned in Annex II, large livestock projects received substantial tax incentive and credit subsidies over a prolonged period in extensive parts of Legal Amazonia, particularly southeastern Para and northeastern Mato Grosso. In most of POLONOROESTE's immediate area of influence, large-scale ranching has not received widespread support from the fiscal incentive program. Nevertheless, as indicated in Annex V, the cattle population has grown very rapidly in Rondonia over the past decade, in good measure on small and medium-sized rural establishments.

7.24 Many of these establishments, furthermore, are located in the municipalities directly benefitted by POLONOROESTE's road and rural development investments. Paradoxically therefore, since this was not one of its objectives, the program appears to have contributed significantly, if inadvertently, to the sharp increase in pasture land and cattle raising in the region in recent years. More specifically, by helping to stimulate migration to an area with uncertain potential for the long-term development of market-oriented agriculture, but where land speculation proceeded apace with the inflow of migrants, the program stimulated the spread of pasture land over the past decade, largely for the reasons cited in para. 7.15 above.

7.25 The striking increase in pasture land in Rondonia during the early and mid-1980's was initially observed in field work undertaken by FIPE in 1984 as part of the on-going evaluation of POLONOROESTE, while the sharp increase in the cattle population has been confirmed by the 1985 Agricultural Census and subsequent IBGE surveys. Furthermore, it is possible that cattle raising per se has grown less rapidly than pasture acreage. As in other parts of Amazonia, the growth in pasture land in parts of the Northwest may, in fact, be only loosely correlated with the increase in cattle population. In this connection, it has been estimated that close to two-thirds of the area used at one time or

another as pasture in Rondonia has subsequently become abandoned grass or scrubland (known locally as capoeira).¹⁷

7.26 Some "pasture land," furthermore, may never have seen cattle at all. There are several reasons for this. First, the term "pasture" is often used loosely on the frontier and includes much unutilized land. Thus, even capoeira (ie. land that has been cleared for agricultural purposes and is subsequently allowed to become covered with second growth vegetation) is frequently described as pasture. Secondly, as previously noted, deforestation, whether or not it is followed by agricultural or ranching activities, has generally been accepted as physical proof of occupancy. In practice, much clearing and "pasture expansion" has been motivated by the latter.

7.27 As indicated in the previous chapter, however, cattle raising may make considerable economic sense for small farmers, as well as large-scale ranchers, in a tropical frontier area such as Northwest Brazil. New settlers who clear the land and plant annual crops may soon discover that the soil loses its fertility, that commodity prices have fallen or that markets for their agricultural products are limited. This, in turn, leads them to adopt alternative land use strategies, among which cattle raising may prove be the most rewarding.

7.28 In this connection, more specifically, one recent study suggests that, despite the relatively low productivity of grazing activities in terms of weight gain in Rondonia, cattle raising serves "multiple objectives" from the standpoint of the small farmer.¹⁸ Cattle, like land, is a capital asset which potentially represents an important "store of wealth" in a highly inflationary economy. In addition, it is a "readily-marketed high value good" whose "production" is comparatively undemanding in labor input terms. Furthermore, it possess the distinct advantage of being able to transport itself to market in a region where physical infrastructure is often precarious or poorly maintained, at the same time providing a source of milk, cheese and meat for local sale or on-farm consumption.

7.29 In spite of its rationality from the standpoint of the rural settler, the spread of pasture land is held by many observers to be the single most damaging rural productive activity in tropical forest regions from an ecological standpoint.¹⁹ The principal reasons for this view, with specific reference to Rondonia, have been summarized as follows:

Pastures...usually degrade over time with declining soil fertility and increasing weed pressure....The low inherent natural fertility of many of these soils is raised dramatically by cutting and burning the forest. The nutrients added to the soil quickly begin to decline

¹⁷ CNEC, "Uso e Ocupacao do Solo em Rondonia," (undated mimeo) pg. 43.

¹⁸ Vosti and Loker, op. cit., pg. 7.

¹⁹ See, for example, Goodland, "The Environmental Ranking...", op. cit.

due to leaching and other processes....Over time (3-5 years), nutrients in the soil continue to decline under pasture, until the land is degraded, ie. nutrient levels fall below even the low natural fertility under forest.

Loss of soil fertility is exacerbated by two other factors associated with the use of land as pasture: physical damage to the soil (compaction) caused by grazing animals and suppression of successional vegetation caused by farmers' efforts to combat weed growth. Compaction, elimination of pioneer arboreal vegetation and declining levels of fertility combine to suppress the process of revegetation, delaying the natural soil recovery upon which successful slash and burn farming depends.²⁰

7.30 One common result of this process is that, over time, pasture land loses its capacity to support grazing activities and is abandoned to second growth vegetation, a process which normally results in additional forest clearing merely to support the existing cattle stock independently of the further growth of that stock as such. In this context, local officials in Rondonia informed the OED/SEPLAN mission that more than 60% of the land utilized for agricultural purposes in the state during the 1970's and early to mid-1980's may have subsequently been converted into pasture. Of this subtotal, in turn, perhaps as much as half may already have been abandoned or was never really used.

7.31 A frequent result of the progressive abandonment of agricultural and pasture land, furthermore, is the concentration of land holdings, together with the exodus of population from former colonization areas. Both of these tendencies can presently be observed in Rondonia. Local sources reported to the OED/SEPLAN mission that in older colonization projects such as Ouro Preto it is not uncommon to encounter individuals who now possess thirty or more lots purchased from neighbors who abandoned their original holdings in favor of potential opportunities elsewhere, often including prospecting or some form of urban employment. The same process has also affected more recent colonization areas such as Machadinho due to the poor quality of local soils and the high incidence of malaria previously mentioned.²¹

²⁰ Vosti and Loker, op. cit., pp. 8-9 (emphasis OED). These observers conclude, accordingly, that, "while cattle raising provides an important source of security and income in the uncertain world of farming in the Amazon, it [also leads] to land degradation, undermining the sustainability of the farming system."

²¹ Concentration of the ownership of colonization lots, moreover, is not inconsistent with the decreasing average size of rural establishments cited above, since the Agricultural Census considers only the number of production units, not who owns them, thereby ignoring the common tendency in Brazil, and especially in frontier areas in the process of consolidation, for multiple establishments to be under the control of a single proprietor or his immediate

5. Logging, Mining and Deforestation

7.32 Logging activity also contributes to larger-scale deforestation. Even though loggers selectively "mine" the native forest by removing those species of greatest commercial value, this is frequently done in such a way that much larger areas are affected. On the one hand, this occurs directly through careless or predatory logging practices which result in the destruction of other vegetation in the immediate vicinity of the areas from which timber is extracted. More importantly, it also occurs indirectly as the result of the building of penetration roads into the virgin forest by lumber interests in order to open up new areas for logging activities since these roads are often also used by spontaneous settlers for purposes of establishing agricultural activities and/or land claims. This frequently occurs, furthermore, in areas where the predominant soils are of insufficient quality to sustain agricultural production and/or at increasing distances from local markets. In Northwest Brazil, all of these tendencies have occurred and have directly contributed to the invasion of Amerindian, biological and other reserves.

7.33 Selective logging, while doing less direct damage to the primary forest than clearcutting for agricultural or ranching purposes, in the absence of systematic reforestation, effectively converts a potentially renewable resource (ie. commercial hardwoods such as mahogany) into a non-renewable one in the localities affected. This has important implications with respect to the long-run sustainability of logging and related activities, which are presently also an important indirect source of urban employment and income in the Northwest. Thus, even though the lumber industry, like mineral prospecting, is a major source of economic dynamism in Rondonia at present, given the predatory practices involved, this activity is likely to largely, if not entirely, shift to other frontier areas farther to the north and west within a decade or two, leaving little behind in the way of commercially valuable timber. There is considerable evidence that this process (ie. the exhaustion of commercially valuable tree species and the associated "out-migration" of the logging industry) has, in fact, already occurred in the areas around Caceres and Mirossol d'Oeste in the Mato Grosso part of the POLONOROESTE region, where local informants reported to the OED/SEPLAN mission that lumbering activity is presently considerably less dynamic than it was a decade ago.²²

7.34 Prospecting activities, in turn, especially cassiterite prospecting, have also directly resulted in some, relatively small-scale, deforestation in Rondonia, as well as generating other types of environmental damage which will be described more fully below. In the Bom Futuro area, near Ariquemes, the areas where cassiterite is found are initially cleared of all vegetation in order to remove the ore. The area affected by such activity is accessed by several penetration roads, some of which extend up to ten kilometers in length.

family. The 1985 figures, furthermore, obviously do not capture any farm size distribution tendencies which may have occurred more recently.

²² This fact probably also helps to explain the exodus of population from the Mato Grosso portion of the program region over the past decade.

At the time of the OED/SEPLAN visit, however, no effort was being made to restore vegetation that had been removed or to otherwise limit environmental damage in the areas being mined.

C. Soil Alterations

7.35 The basis for the sustainable utilization of soils as a renewable natural resource is the maintenance of their physical, chemical and biological properties. Under natural conditions, a tropical forest's ecosystem presents high rates of photosynthetic and biomass production. Unlike temperate zone ecosystems, tropical forests maintain their nutrient capital in the vegetation rather than in the soil. In effect, a layer of organic material, which requires long periods of interaction between a wide variety of plant and animal species to build up, covers the soils and the constant decomposition of these materials permits the recycling of nutrients. As a result, even poor soils covered by forests in tropical areas can provide excellent support for the development of the biological system through the constant renovation of essential nutrients.

7.36 Clearcutting of the forest interrupts these sensitive nutrient-cycling mechanisms and causes the loss of fertility. On the frontier, moreover, clearcutting is almost inevitably followed by burning, which removes the physical obstruction of the downed vegetation, while releasing plant nutrients into the soil. Without the natural replenishment of nutrients and the natural control of pests by the ecosystem, the soil tends to lose its fertility in a few years' time unless substantial investments are made in fertilizers and other correctives. In addition, pest and plant disease control becomes more taxing and costly, particularly for homogeneous crops and in larger fields.

7.37 Beside the depletion of soil fertility, clearing the tropical forest frequently results in leaching and accelerated soil erosion. Empirical research reveals that this has, in fact, occurred in Rondonia in recent years. Through direct field observation in older colonization areas near Ouro Preto, it has been found that erosion rates are nearly eleven times higher in planted pasture land than in areas remaining in native forest.²³ Even areas planted in perennial crops such as cocoa, as well as previously abandoned pasture lands later covered by second growth vegetation, are subject to considerably greater erosion than similar areas where the native forest has not been removed. Due to the removal of vegetation, finally, surface water run-off is considerably greater in pasture lands than in areas of native forest, a factor directly associated with increased erosion.

D. Loss of Biodiversity

7.38 Tropical forests are a virtual treasure trove of living things. At least half (and probably much more) of all animal and plant species on the earth

²³ Fearnside, A Ocupacao..., op. cit., pp. 39-42.

live in these complex interdependent ecosystems. ²⁴ A one recent Bank publication on the subject has observed:

there are compelling economic, scientific, aesthetic, and ethical reasons for preserving biological diversity. All of them are grounded in the view that because species extinctions are completely irreversible, preserving biological diversity keeps open important options for the future.

The economic justification for preserving biological diversity is that many species of wild plants and animals are undeveloped resources -- that is, they have significant economic potential that is currently undiscovered, undervalued, or underutilized. Biological resources are essential to human existence, and the preservation of biological diversity is important to the maintenance and improvement of agriculture, forestry, ranching, fisheries, medicine, industry, and tourism.

The importance of genetic diversity for sustaining and increasing agricultural production is increasingly acknowledged. Without a diverse genetic base for plant breeding, the development of high-yielding crop varieties probably could not be sustained. The disappearance of many domesticated crop varieties and their wild relatives has made many of the world's productive farming areas increasingly susceptible to catastrophic attacks by pests and diseases. Despite efforts to preserve crop germplasm, many domestic varieties and wild relatives of crop plants remain threatened. ²⁵

7.39 The transformation of large areas of tropical forest into farmland, pasture and capoeira in northwestern Mato Grosso and Rondonia which has occurred directly or indirectly as a result of POLONOROESTE has contributed to a reduction of unknown proportions in the number of local plant and animal species in the region. In particular, there is a serious risk of the loss of specific plant and animal species adapted to the particular local habitats that are destroyed in those areas where tropical forest cover has been removed. This

²⁴ On the nature and importance of biodiversity, see the recent publication by Jeffrey A. McNeely, et. al., Conserving the World's Biological Diversity, Gland, Switzerland and Washington, D.C., 1990. This publication was jointly prepared and published by the International Union for Conservation of Nature and Natural Resources, the World Resources Institute, Conservation International, the World Wildlife Fund-US and the World Bank.

²⁵ George Ledec and Robert Goodland, Wildlands. Their Protection and Management in Economic Development, World Bank, Washington, 1988, pp. 9-10 (emphasis in the original).

risk is ultimately proportional to the amount of deforestation involved and to the degree to which the habitats destroyed have unique characteristics. While little information exists at present as to the extent to which recent forest clearing in the Northwest may already have affected the stock of native plant and animal species, it is, nonetheless, evident that the persisting tendency to extract timber from and illegally occupy ecological and other reserves, as well as to clear non-reserve areas, directly affects the possibility of preserving natural habitats in the region.

7.40 The destruction of natural habitats causes the loss not only of land fauna, but also of aquafauna through alterations in the quality of river and lake water. The fauna which survive and adapt themselves to the new ecosystems frequently tend to be predators, especially insects. Thus, based on research financed under the program, it has been estimated that the number of ant species in the POLONOROESTE region has surpassed the 800 mark. By contrast, the number of bird species has apparently diminished, as have the number and variety of primates, reptiles and amphibians.²⁶

7.41 Another problem affecting local fauna consists of predatory (and frequently illegal) hunting and fishing activities in parts of the region. This concern is greatest in the Pantanal region, just to the south of the project area in Mato Grosso, which is an extremely important wildlife habitat. During the October 1989 visit to this part of the BR-364 highway's area of influence, the OED/SEPLAN mission was informed by local sources that the hunting of alligators and mammals such as the capivara, for their commercially valuable skins and meat respectively, was a persisting problem in the Pantanal which, until that time, had occurred largely in the absence of government control.²⁷ Other problems observed in the Pantanal area included water pollution from nearby alcohol distilleries, the frequent use of chemical fertilizers and pesticides in local agricultural production and increased sedimentation due to farming practices which generated substantial soil erosion in the areas immediately to the north of the marshlands. On account of the range and scale of these problems, a significant share of the undisbursed loan funds for the Phase I Agricultural Development and Environmental Protection Project were reallocated to finance preservation efforts in the Pantanal. In addition, one major component of the National Environmental Project for Brazil (Loan 3173-BR), approved in February 1990, will be specifically dedicated to further strengthening protection activities in the area.²⁸

²⁶ S. A. Marques, Levantamento Faunístico da Área de Influência da BR-364, Relatório de Pesquisa, No. 4, Programa POLONOROESTE, SCT/PR, CNPq, 1989.

²⁷ Information provided by Bank operational staff, however, indicates that predatory hunting has decreased in the area over the past several years.

²⁸ This operation, to be partially financed by a Bank loan in the amount of US\$ 117.0 million, was approved on February 27, 1990. The Pantanal component of the project, more specifically, is expected to entail a total cost of US\$ 19.5 million and to have the following objectives, among others: (i) to contain the pollution of river systems by toxic substances used in agriculture, industry and mining; (ii) to improve the protection of local flora and fauna by the forest

E. Water Quality

7.42 Monitoring and analysis of the chemical and physical-chemical properties of water in the principal river basins in the Northwest region was planned as a sub-component of POLONOROESTE. Activities carried out under the program appear to have been reasonably efficient with respect to the establishment of fluviometric and pluviometric stations, but apparently made less headway in terms of the analysis of water quality. Nonetheless, some preliminary information generated by this activity is of interest.

7.43 Data collected in connection with the program reveal, for instance, that the discharge of solid sediments is extremely high in Porto Velho (731 tons/year/km²) and moderately high in Ji-Parana (135 tons/year/km²). The largest discharge of suspended sediments was registered on the Madeira River in January 1986 (2.85 million tons/daily). The largest loads are generally transported during the high water season, due to the remobilization of sediments from the river bottoms. In addition to the discharge of urban sewage, the major changes in water quality in the region have occurred primarily as a result of cassiterite and gold garimpos and motor oil pollution from dredges on the Madeira and Mamore Rivers. Since water pollution due to gold and cassiterite prospecting is, next to deforestation and the associated loss of biodiversity, probably the most serious environmental problem resulting from primary sector productive activity in the Northwest, it will be examined here in somewhat further detail.

1. Gold Prospecting

7.44 The principal adverse physical environmental consequences of gold mining activities, particularly on and near the Madeira and Mamore Rivers, include the following: i) contamination of the ecosystem (including local aquafauna) with the mercury utilized to separate gold from other river sediments; ²⁹ (ii) contamination of the river and its margins with the

police; (iii) to establish a system for monitoring water quality; (iv) to develop special programs to reduce the negative impact of garimpo mining techniques on the environment and to contain the present degradation of vegetation in ecological reserve areas; and, (v) to establish guidelines and plans for the development of the area. See Report No. 8164-BR, dated January 31, 1990, for additional details.

²⁹ According to a study on the environmental impacts of gold prospecting in Rondonia, reported in Ambio (Vol. 17, No. 4, 1988) by Luiz Martinelli and his colleagues from the University of Sao Paulo at Piracicaba and the University of Washington at Seattle, entitled "Mercury Contamination in the Amazon: A Gold Rush Consequence," in the separation process, mercury is added to the sieves through which the aspirated gold-bearing river sediments are passed at a ratio of roughly two kilos of mercury per kilo of gold. Part of this mercury inevitably escapes into the river. During the purification stage, in turn, the gold-mercury amalgam is heated in order to evaporate the latter. This process is generally performed in the open air and few, if any, precautions are taken

lubricating oil used to operate the barges and run the pumps that aspirate the gold-laden sediments from the river bottom; and (iii) localized changes in the river bottoms as the result of dredging activities which affect the transportation of sediments.

7.45 The first two of these problems are the most serious, at least in the short run, and also the easiest to quantify and potentially control. The OED/SEPLAN mission made rough estimates of the amounts of mercury and lubricating oil discharged into the Madeira and Mamore Rivers in 1989. It was determined, for example, that in order to economically maintain a single large barge, it is necessary to produce at least 50 grams of gold per day which corresponds to a minimum production of 15 kilograms of gold per year.³⁰ For the roughly 1,000 large barges reported to be involved in prospecting activities on the Madeira-Mamore Rivers at the time of the OED/SEPLAN mission, this represents an aggregate gold production of some 15 tons per year. An additional 5,000 small barges, whose production capacity is estimated by DNPM to be 10 grams of gold per day, are capable, in the aggregate, of producing at least another 15 tons per year, for a combined total of at least 30 tons per year. The associated annual consumption of mercury is in the range of 45 to 60 tons (assuming 1.5 to 2 tons of mercury for each ton of gold produced), of which as much as 50% -- or between 22.5 to 30 tons -- may have been discharged into the rivers.³¹

7.46 A POLONOROESTE-sponsored study of mercury contamination along the Madeira River undertaken in January 1986, when gold production in the area was below 1989 levels, confirmed the results of earlier research suggesting that certain parts of the Amazon Basin had already become contaminated with mercury due to placer mining activities.³² This study concluded that mercury levels in muscle and eggs from a variety of fish sampled in the Madeira basin exceeded safety limits established by the World Health Organization. Mercury concentrations in suspended sediments, riverbed load, floodplain sediments and aquatic plant life in the area were also found to be significant. Of particular concern were the high mercury levels in local food fish which the researchers considered to be an "immediate threat" to human health.

7.47 Oil pollution in the Madeira and Mamore Rivers is also substantial. An approximate estimate of the amounts involved was also made by the OED/SEPLAN

to avoid the inhalation of mercury vapor by the workers involved.

³⁰ On the assumption that each barge is in service approximately ten months a year, being inactive for an average of some 60 days annually for maintenance purposes.

³¹ According to Bank operational staff, the current (i.e. May 1991) number of barges in this area is considerably lower than that reported to the OED/SEPLAN mission in October 1989. Assuming that the present number of barges were as low as half the 1989 figure (or 3,000), the amount of mercury discharged would still be in the range of some 11 to 15 tons per year.

³² Martinelli et. al., op. cit.

mission. Roughly every ten days (or every 200 hours of operation), each barge changes the lubricating oil in the engines that run the pumps used to aspirate sediment from the river bottom, involving an average of 30 liters of oil per change. Each barge, accordingly, discharges some 90 liters per month, or 900 liters per year, directly into the river, assuming operation during ten months of the year. In the aggregate (ie. for 6,000 barges), this represents a total oil discharge of on the order of 5.4 million liters per year, much of which, in the absence of government control, accumulates immediately downstream of the prospecting areas along the river banks and in areas that are periodically flooded by the affected river systems.³³

7.48 Both in the case of mercury discharges and that of lubricating oil, the resulting environmental degradation could be largely avoided or substantially diminished through a combination of government control, educational campaigns and punitive measures. Oil discharges, for example, could be minimized through periodic collection of these wastes by other barges and subsequent proper disposal. Mercury consumption in prospecting activities, while admittedly more difficult to control, could at least be more heavily taxed in order to rationalize consumption and encourage greater recycling, as well as to finance collection activities, while miners could be better protected from mercury vapors. However, at least until relatively recently, inspection and control by state and federal environmental agencies in prospecting areas in Rondonia have been highly inadequate, when they occurred at all. Finally, this problem may be equally serious, if less spatially concentrated, in Mato Grosso, where numerous water courses have reportedly also been affected by mercury and other pollutants associated with prospecting activities.³⁴

2. Cassiterite Mining³⁵

7.49 The negative environmental impacts of cassiterite mining in Rondonia are also significant. First, they involve considerable localized deforestation, as mentioned in para. 7.34 above. In addition, cassiterite mining, which, like

³³ On the basis of the reported present-day figure of no more than 3,000 barges, the maximum oil discharge would be roughly 2.7 million liters per year.

³⁴ In its observations on the previous version of this report, DNPM informs that it is initiating an environmental monitoring project in prospecting areas in the Amazon region which would include technical assistance to prospectors' cooperatives, technological research to improve the efficiency of gold extraction and mercury recycling and to promote the development of alternative technologies, and efforts to increase the awareness of local populations about the risks of mercury usage, among other measures. This project would be undertaken jointly with the federal Secretariat of the Environment, IBAMA, state environmental agencies, the Health, Agriculture, and Labor Ministries, state and municipal governments, and universities, in addition to prospectors' cooperatives and associations, indigenous leaders, and NGOs.

³⁵ While not directly supported by POLONOROESTE, to the extent that the expansion of this activity depended in part on road improvements to and within the region, it was nevertheless indirectly benefitted by the program.

gold prospecting, has, at least until recently, been subject to very little environmental control in the region, also results in water pollution and soil contamination. At the Bom Futuro site, some 80 km from Ariqueemes, for example, earth containing cassiterite ore is extracted from large holes excavated specifically for this purpose, then transported by truck to areas where it is "washed" and separated from the lower density soils. The separation process results both in substantial surface run-off of waters containing suspended clays which are discharged into local streams and rivers and the accumulation of large piles of residual dirt. The latter are generally abandoned without any further treatment, as are the holes initially dug in order to extract the ore. Even though tailing ponds are used in some localities, those observed by the OED/SEPLAN mission appeared to be neither technically well designed, nor efficiently operated.

7.50 The large numbers of people engaged in cassiterite mining activities, furthermore, are, for the most part, housed precariously in temporary "structures" (generally enclosed and roofed only with black plastic covers) in numerous small communities scattered throughout the prospecting areas and totally lacking in urban infrastructure. The spatial concentration of these types of shelter, not only increases the risk of exposure to the ever-present malaria,³⁶ but also results in the dumping of considerable debris and sewage into local rivers. A similar situation prevails, but on an even larger scale, in the gold prospecting areas along the Madeira-Mamore Rivers and elsewhere in the region.³⁷

F. Climate Change

7.51 Another major physical environmental impact frequently discussed in connection with extensive land clearing in tropical areas is localized and, depending on the scale of the deforestation involved, regional or even global climate change. This is reflected by changes in such meteorological variables as average and maximum temperatures, rainfall levels, intensities and

³⁶ Part of the difficulty in attempting to control malaria in these areas is precisely that residential "structures" often have no walls that can be sprayed to prevent the entrance of malaria-transmitting mosquitoes. Another part of the problem is that these settlements and their residents, by their nature, generally tend to be very nomadic over time.

³⁷ In commenting on an earlier draft of this report, DNPM indicated that, with the collaboration of private enterprises in the tin mining sector, it has been attempting to regulate the Bom Futuro prospecting area, whose "uncontrolled exploitation does not satisfy minimum requirements from either a technical or an environmental standpoint. A new mining enterprise, EBESA, has been constituted with the participation of the principal tin extractors and processors to substitute prospecting activity at Bom Futuro as soon as several pending judicial questions are resolved. This initiative will yield positive consequences in terms of improved use of the [cassiterite] deposits, environmental control of mining activities at this locale, and better working, health, safety, and residential conditions for the labor force involved, as well as impeding the contraband of cassiterite to Bolivia, as has been occurring."

distribution over time, as well as associated effects on soil fertility and agricultural production due to the removal of vegetative cover in tropical regions. Even though specific evidence concerning local or broader climate changes resulting from recent human occupation and related deforestation in Northwest Brazil has not yet been systematically assembled, as in the case of impacts on regional flora and fauna, this is an area that merits careful monitoring and evaluation in the future.

7.52 For the present, it can be affirmed only that widespread deforestation can provoke climate changes as a result of alterations in the components of the energy equilibrium at the regional level, which, in turn, are dependent on the components of the hydric balance. The study of climate change, furthermore, needs to be carried out on three levels. At the micro level, deforestation produces an increase in soil temperature, which causes an increase in local maximum temperatures. At the regional level, microclimate changes are hypothesized to produce alterations in the flow of water vapor to other areas, as well as alterations in the transport of advective energy. Finally, at the global level, deforestation liberates carbon from the biosphere into the atmosphere due to the fact that biomass in agricultural land and pasture is much lower than that of forests.³⁸

7.53 Data obtained for Rondonia indicate that an abrupt change in the hydric balance, in fact, occurs when forests are transformed into pasture.³⁹ As already noted, moreover, these studies reveal the occurrence of significantly higher erosion in annual crops and pasture land than in forested areas due to the soil's reduced infiltration capacity. This, in turn, diminishes the amount of water available for evapotranspiration processes in plants.⁴⁰ With less water available for evapotranspiration, incident solar energy heats the soil and, consequently the air. In short, the hydrological cycle of the Amazon is dependent upon water recycled through the forest for a substantial part of its precipitation. Should this heating process be extended over a larger area, it could eventually cause regional and, possibly, even global climatic impacts.

G. Conclusion

7.54 As concerns the natural environment in Northwest Brazil, in summary, it can be concluded that extensive deforestation caused by a combination of increased roadbuilding, land speculation, agricultural development, cattle raising and extractive activities has occurred in much of POLONOROESTE's area of influence. The clearing of tropical forest areas, additionally, often

³⁸ Eneas Salati, "O Clima Atual Depende da Floresta," in Salati (ed.), Amazonia, Desenvolvimento, Integracao e Tecnologia, Editora Brasiliense, 1983. See also, Norman Myers, The Primary Source: Tropical Forests and Our Future, W.W. Norton & Co., Inc., New York, 1985, especially Chapter 15 ("Climate Linkages") and Myers, "The Future of Forests," op. cit., pp. 32-34.

³⁹ Fearnside, A Ocupacao Humana..., op. cit.

⁴⁰ The data also confirm that perennial crops such as cocoa are effective in reducing the risk of erosion.

results in the destruction of sensitive nutrient-cycling mechanisms, causing a loss of soil fertility and increasing the risk of erosion. There is evidence based on studies financed under POLONOROESTE's ecological research component that this has, in fact, occurred in the Northwest region.

7.55 Even though empirical research in the area demonstrates that the planting of tree crops, as an alternative to annual crops and/or pasture, does reduce many of these problems, as was foreseen by POLONOROESTE's designers, factors of an economic, financial and institutional nature, particularly the lack of credit, rising input and falling output prices, appear to have impeded the wider adoption of perennials by many small farmers in the region. In any case, the planting of tree crops does not appear to have significantly limited the cultivation of annual crops or cattle raising. As a consequence, most of the formerly forested area which has been cleared is planted, at least temporarily, in annual crops, has been converted into pasture or has been left in capoeira, all of which are considerably less desirable outcomes from an ecological standpoint.

7.56 The extensive transformation of tropical forest into farmland, pasture and capoeira resulting in part, directly or indirectly, from POLONOROESTE may also have produced a reduction in the variety of plant and animal species in the area. Predators have multiplied, while the number of bird, primate, reptile and amphibian species has reportedly diminished. Prospecting activities and inadequate urban waste disposal, additionally, have increased contamination of several of the region's principal water courses and their margins with mercury, oil and other pollutants, while at the same time destroying riverbanks and increasing siltation and water turbidity. Finally, there is a possibility that increasing deforestation in the Northwest may be contributing to climate changes at the local, regional and even global levels.

7.57 In synthesis, POLONOROESTE and other influences affecting regional development, especially the recent extractive boom, have had multiple impacts on the physical environment in Northwest Brazil. While many of these impacts were anticipated by the program's designers, clearly the probability of their occurring was underestimated. This and previous chapters have discussed some of the reasons why this occurred, particularly as related to the program's highly uneven implementation performance and the much higher than expected flow of migrants to what was already, at the time of its inception, a very dynamic frontier area. With the benefit of hindsight, the next chapter will further assess the adequacy of the program's design and the unanticipated difficulties it faced in light of its subsequent human and physical environmental consequences.

VIII. ADEQUACY OF PROGRAM DESIGN AND UNANTICIPATED DIFFICULTIES

A. Introduction

8.01 For the purposes of the present study, evaluation of POLONOROESTE is best carried out in terms of its broader development objectives rather than its specific goals and targets. This is the case both because complete information on goal attainment does not currently exist and, more importantly, because undertaking an assessment solely or primarily in goal achievement terms could lead to a distorted picture of the impact -- especially the indirect impact -- of the program as a whole. In general terms, accordingly, the data and analyses presented in the preceding chapters sustain one major conclusion: POLONOROESTE was only partially able to meet its principal economic, social and environmental objectives.

8.02 Economically, the program sought to transform the Northwest into an important agricultural area, especially for the commercial production of tree crops. In social terms, it was expected to support the productive absorption of rural migrants on comparatively small-scale farms through the consolidation, expansion and improvement of directed colonization schemes. In environmental terms, finally, the program was intended to direct rural settlement within the region, promote preservation of its renewable natural resources and protect its Amerindian population. However, despite and largely because of the significant economic dynamism of the region, particularly Rondonia, during POLONOROESTE's implementation period, a fact which must be attributed in good measure to the impact of program-supported inter and intra-regional transport improvements, none of these basic objectives was fully attained.

8.03 As previously indicated in Chapter IV above, the Bank's Staff Appraisal Report for the Agricultural Development and Environmental Protection Project (Loan 2060-BR) affirmed in connection with POLONOROESTE that:

There is little doubt that, whether BR-364 is paved or not, continuing immigration would, without adequate administration, result in long-term damage to the environment and society through occupation of poorer soils with ill-adapted agricultural practices, loss of valuable timber, encroachment onto Amerindian and natural reserves, agglomeration of land in the hands of relatively few, and a possible agglomeration of migrants in urban areas ill-equipped to receive them.¹

8.04 It is, indeed, ironic that this ex-ante description of the disorder which POLONOROESTE was intended to avoid also provides a reasonably accurate ex-post characterization of the problems that subsequently occurred in parallel to, and at least partially as a result of, the program's implementation. Some of the reasons for the gap between intentions and achievements have already been presented in Chapter IV which describes the program's coordination and other

¹ Report No. 3512b-BR, op. cit., pg. 4 (emphasis OED).

implementation problems. However, other sources of POLONOROESTE's shortcomings have to be sought not in its organizational and execution problems, but in its basic planning misconceptions. Many of the difficulties encountered during implementation could have been foreseen from the outset and the bulk of these were, in fact, anticipated by some Bank staff and other outside observers. But such concerns were effectively overridden by the momentum and enthusiasm that various interests in Brazil had generated in connection with the program and by the Bank's desire to support regional development. Several important lessons can, therefore, be learned from a somewhat more detailed discussion of POLONOROESTE's principal conceptual inadequacies and oversights.

B. Adequacy of the "Regional Development" Approach Adopted

8.05 POLONOROESTE was formally presented both within the Bank and in Brazil as a "regional development" program designed to promote the "harmonious socio-economic development" of a rapidly growing part of the Amazonian frontier. As pointed out in Chapter III, however, the program, as designed, was limited in both sectoral and spatial terms. It did not involve a truly comprehensive approach to regional development, but instead consisted of what later proved to be a poorly coordinated assortment of road, rural development and public health investments. The fact that the program's activities were spread over a large and heterogeneous, but poorly-known, territory that was already undergoing rapid occupation only increased the odds against its being able to attain its admittedly ambitious general objectives.

8.06 More careful consideration of the previous history and dynamics of demographic growth and frontier settlement in Mato Grosso and Rondonia, for instance, would have been sufficient to identify the significant disparities between the two program subregions and, thus, the likely difficulties to be encountered in attempting to promote a single development program for the area as a whole. The attempt to design one large investment program for part or all of two territorially extensive states having differing comparative advantages and varying ecological and socio-economic characteristics, where the timing and types of existing rural settlement were quite distinct and which had been subject to very diverse forms of public intervention in the past (see Annex II), presented incongruities that would later be highlighted during the course of program implementation in the form of very different development tendencies in the two subregions.

8.07 This fusion of two disparate areas into a single program becomes more comprehensible, however, when it is recalled that the Brazilian Government's primary interest in the region in the late 1970's was in roadbuilding and physical occupation of northwestern frontier. The Bank, in turn, was able to induce the federal government to expand this initial narrow sectoral and geo-political concern into a broader, poverty-oriented, rural development effort for the area at least in terms of program design. Largely at the Bank's insistence, the POLONOROESTE's formulators in Brazil were also later required to add environmental and Amerindian protection components to the evolving "regional development" concept. None of this, however, alters the fact that regional development, especially on the frontier, cannot be reduced to roadbuilding and the promotion of productive activities in one subsector (i.e. small-farmer agriculture) in selected parts of a much larger geographic area.

8.08 As suggested in the previous paragraph, another element in the way the "integrated regional development" concept was applied in Northwest Brazil was the selection of a specific social group and specific subregions for preferential treatment under POLONOROESTE. The choice of a particular set of municípios in Mato Grosso, for instance, was justified on the basis that they constituted an area of recent occupation characterized by relatively good soils where prospects for small-farmer development were expected to be most favorable. Subsequent events, however, contain little to confirm such prospects. The preferential treatment afforded the project subregion in Mato Grosso vis-a-vis the rest of the state, moreover, resulted in inconvenient budgetary, administrative and political imbalances for the state government itself. In retrospect, it appears that the preference given to these municipalities stemmed essentially from their proximity to the Cuiaba-Porto Velho highway, on the one hand, and the comparative absence of large ranching establishments within their boundaries, on the other. Their selection, in short, was determined by the merger of major highway improvement and small-farmer-oriented area development investments under a poorly defined "regional development" concept.

8.09 By the same token, the targeting of certain communities and farmers in the two rural development projects in Rondonia was expected to enhance possibilities for the success of agricultural settlement therein. Nevertheless, such an approach, which admittedly never sought to accommodate the entire small-farmer population already residing in the state, let alone the full host of additional rural settlers that subsequently flocked to it, if successfully implemented, would inevitably have tended to accentuate existing disparities between beneficiary and non-beneficiary groups.² Among the latter, were non-farmer rural populations, including rubber tappers, Brazilnut gatherers, prospectors and others, in addition to larger farmers and ranchers and many small sharecroppers and tenant farmers and the non-rural population in general. Theoretically, even though the increased prosperity of some small farmers could be expected to generate greater employment opportunities and better incomes for the regional population as a whole, given the prevailing "survival of the fittest" mentality in the Northwest during the early 1980's, the preferential treatment given to some small farmers could also be expected simply to lead to further social imbalances within the region.

8.10 More importantly, by largely neglecting non-small farmer economic actors on the Northwest frontier, the program also ignored the nature and importance of the relationships and interactions between the target population and other social groups in the region. Similarly, it overlooked the role and importance of the regional extractive and urban economies, as well as their specific linkages with the regional agricultural economy. In summary, the program did not take into account the full socio-economic complexity and

² Project results, as reported in the PCR for the Phase I Agricultural Development and Environmental Protection Project and summarized in Annex V, indeed, suggest that this occurred, given the disproportionately large share of coffee and cocoa output, especially when compared with that of annual crops, apparently accounted for by project beneficiaries relative to farmers in the rest of Rondonia.

dynamics of the evolving frontier development process in northwestern Mato Grosso and Rondonia during the late 1970's and early 1980's. Nor did it adequately assess the likely impact of introducing a major transport improvement on this broader on-going frontier development process, especially in terms of how program-sponsored road improvements would differentially benefit or harm other key economic actors in the region, including large farmers and ranchers, land speculators, loggers, miners, prospectors, rubber tappers and urban residents, and how this, in turn, would be likely to affect natural resource use and the human and physical environments more generally.

C. Imbalances Between Roadbuilding and Other Program Components

8.11 The unanticipated imbalanced implementation of POLONOROESTE's various components contributed directly to the adverse nature of many of its environmental impacts. Pavement of the BR-364 highway was completed ahead of schedule, while most other physical infrastructure investments (particularly the installation and/or improvement of feeder roads) also proceeded more or less as originally planned. In sharp contrast, many other program interventions, especially those actions and activities designed to support rural development and to protect the natural environment and Amerindian communities and which had been introduced largely at the Bank's request, lagged considerably. Such uneven development, however, favored easy access to and within the region by multitudes of settlers, speculators, loggers, prospectors and adventurers and at the same time made "harmonious and integrated regional development" much more difficult to attain.

8.12 This situation reflects a number of factors, not the least of which was the much greater political and economic interest in, and hence commitment to, paving the road both at the federal and the state government levels, when compared with the objectives of supporting rural development and protecting the region's environment and Amerindian populations. Furthermore, the interest of state and local political leaders, particularly in Rondonia, in improving access to the rest of the country through better road linkages so as to stimulate rapid economic growth and induce the further inflow of population closely coincided with the more narrow self-interest of the main (and politically influential) construction contractors based in southern Brazil in carrying out large physical infrastructure works, particularly at a time of national economic recession. Once the needed financial resources, especially the Bank loan, were assured, furthermore, the technical requirements of building and paving the road were relatively straightforward. Thus, it is not surprising that this part of the program was, in fact, implemented rapidly and with comparative ease.

8.13 Timely and successful execution of the rural development, Amerindian and environmental protection components, by contrast, required, in addition to political commitment at all levels which was largely lacking, much greater institutional capabilities and inter-agency coordination, together with a steady flow of financial resources, which, in practice, were frequently delayed and/or insufficient, if not, as in the case of rural investment credit for perennial crops, absent altogether. This situation was further complicated by the rapidly increasing demands and pressures brought on by the acceleration of migration to the region during the initial years of program implementation to the point where the settlement process became totally unmanageable.

8.14 Unlike investments in physical infrastructure, furthermore, the provision of agricultural support and social services and the enforcement of environmental and Amerindian protection measures necessarily require sustained intervention on the part of the public sector, as well as properly trained, dedicated and adequately remunerated human resources. All of this again requires a reliable flow of financial resources, a continual process of institution building and, above all, strong political commitment to the goals that are sought. This was especially important in the case of Amerindian and environmental protection in Northwest Brazil, where strong local economic and political interests were pursuing, and for the most part continue to pursue, precisely the opposite objectives.

8.15 Had the imbalances between the timing and completion of road construction on the one hand and the execution of the program's non-transport components on the other been perceived earlier, perhaps different operational measures might have been adopted by government authorities. However, there is no guarantee that this would have occurred given the impetus of road construction and extractive interests in the region.³ Nevertheless, the essential point is that the failure to adequately anticipate the possible uneven development of POLONOROESTE's different components made the region increasingly vulnerable to added migration flows, which, among other consequences, more than offset the positive results of program efforts to support the consolidation of rural settlement and promote environmental and Amerindian protection.

D. Impacts of Roadbuilding

8.16 In retrospect, it is clear that POLONOROESTE failed to adequately consider important aspects of the larger frontier development processes which were already observable in Mato Grosso and Rondonia at the time the program was appraised by the Bank. Together, these factors help to explain the widespread, and largely negative, human and physical environmental impacts that have come, not incorrectly, to be associated with the program, together with the largely uncontrolled processes of rural and urban settlement which it strongly, if unintentionally, facilitated in much of the region. The following sections will briefly illustrate the principal ways in which POLONOROESTE's design failed to adequately account for these aspects.

³ It should be remembered in this connection that, not only were small farmers in colonization projects and large construction contractors directly interested in roadbuilding in the Northwest, but so also were speculators, loggers, miners, large farmers and ranchers and, not surprisingly, therefore, state and local politicians themselves. In short, since all of these actors stood to gain from improved transport infrastructure, if only as the result of increasing land values, there was considerable pressure to build and maintain the road network. Only those having little or no vote, particularly rubber tappers, Amerindians and the physical environment, were, in fact, initially harmed by rapid expansion or improvement of the regional highway and feeder road system.

1. Impacts on Migration Flows

8.17 Insufficient assessment of the likely impact that reconstruction and pavement of the BR-364 highway could have on the flow of migrants to Rondonia and that expansion of the feeder road network could have on spontaneous rural settlement and the growth of extractive activities within the state were among the principal impediments to a more adequate ex-ante understanding of the program's likely human and physical environmental consequences. Existing information and a more careful examination of earlier roadbuilding-based frontier occupation experiences elsewhere in the Brazilian Amazon region, particularly in the immediate areas of influence of the Belem-Brasilia, Transamazon and Cuiaba-Santarem highways, would have made it possible to better foresee the effects which major road improvements were likely to have on migratory movements to Rondonia, as well as the added complications which increased migration might cause for the implementation of POLONOROESTE's other components. Not only did some existing studies predict that improvement of the BR-364 highway could have a significant and, by no means, universally positive impact on rural development in the region,⁴ but, as already mentioned, federal intervention during the previous administration had consciously attempted to discourage migration so as to permit the then Territory of Rondonia to better organize the settlement of the rural and urban populations already in the area.⁵

8.18 The consequences of underestimating the possible impacts of roadbuilding on migration were greatly magnified by the politically motivated propaganda campaign undertaken by Governor Teixeira of Rondonia. Indeed, responsibility for the multiplication of migration flows to the region can be attributed at least in part to the political aspirations of such key figures in early stages of POLONOROESTE, a factor which the Bank appears to have totally ignored in its appraisal of the program. Governor Teixeira, in fact, made several appearances on national television in which he presented a glowing picture of possibilities in the new state. In his nationally televised address commemorating the elevation of Rondonia to statehood on December 29, 1981 less than two weeks after the first three Bank loans in support of POLONOROESTE had been signed, for example, Governor Teixeira literally invited: "Brazilians from

⁴ In a 1979 paper, for example, one researcher affirmed: "It is worth pointing out that the proposed paving of the main thoroughfare which cuts through Rondonia and links its capital to the Center-South will have an ambivalent function in the Territory. On the one hand, a permanent link with the more developed regions will resolve one of the principal problems of the colonization projects, namely access to Center-South markets for their agricultural produce. Paradoxically, the capacity of colonization projects to retain population will be simultaneously reduced since the provision of an all-weather road will help quicken the process of capitalist penetration and, ultimately, accelerate the expulsion of small farmers." See George Martine, "Colonization in Rondonia: Continuities and Perspectives," paper presented at the Workshop on State Policies and Internal Migration, Geneva, November 1979, and later published by Peter Peek and Guy Standing (eds.) in State Policies and Migration Studies in Latin America and the Caribbean, Croom Helm, London, 1982, pp. 147-172.

⁵ MINTER, "Rondonia: Sugestoes do Ministerio do Interior," op. cit.

all over Brazil and people of all countries to come to Rondonia, where they will be offered work, solidarity and respect." ⁶

8.19 This initiative had a particularly strong impact in view of the fact that Brazil was then entering one of the worst recessions of its post-war history. Urban unemployment and underemployment were growing rapidly, thus having a significant dampening effect on normally heavy urban-bound migration flows in the country. ⁷ Inasmuch as can be ascertained, migratory activity in Brazil as a whole was considerably reduced during this period, such that Rondonia was one of the few parts of the country that continued to attract large numbers of migrants at the height of the crisis. The data presented in Table 7 in Chapter VI above clearly illustrate the dramatic increase in migration to the state after 1981 that was associated with POLONOROESTE, the interests behind it and those which it generated. The massive inflow of migrants attracted to the area in the expectation of gaining access to agricultural land and employment opportunities, while not irrational from the standpoint of the individual actors involved, not only made it virtually impossible for the program to attain many of its non-physical infrastructure goals, but ultimately is at the root of the severe social and environmental problems subsequently, and still now, affecting the region.

2. Impacts on the Expansion of Ranching and Extractive Activities

8.20 One of POLONOROESTE's major objectives was to protect the physical environment from potential damage due to the increased migration and rural settlement expected to occur in response to the paving of the Cuiaba-Porto Velho highway, expansion of the feeder road network and provision of improved agricultural and social services in the region. As indicated in Chapter V above, the program appears to have had only limited success in this respect. Not only was it unable to steer potential settlers away from areas possessing inadequate soils or to substantially improve prospects for sustainable agriculture in existing colonization projects, but it failed to anticipate or take into account the impact that POLONOROESTE's road investments would have on environmentally-harmful ranching and extractive activities. Pavement of the BR-364 and the construction of feeder and penetration roads greatly benefitted cattle raising and extractive activities by facilitating access on the part of ranchers, loggers, miners, prospectors, speculators, adventurers and others to unoccupied land, extra-regional markets and, in the specific case of extractive activities, regional timber and mineral resources.

⁶ This statement was quoted verbatim in an internal Bank memorandum dated February 18, 1982.

⁷ As noted in an earlier chapter, GDP growth fell significantly after 1980, decreasing at an average rate of 1.3% a year between 1981 and 1983, while industrial output declined by an annual average of 3.8% over this period. Manufacturing employment in the Sao Paulo metropolitan area, in turn, fell by about 25% between November 1980 and December 1983 and recuperated only very slowly thereafter.

8.21 It can be argued that, at the time of the program's inception, the magnitude of the ranching and extractive booms which subsequently occurred in the Northwest, particularly Rondonia, was unpredictable. Even though the extent of regional cassiterite deposits was known to some degree, while some gold prospecting was already taking place in northwestern Mato Grosso and Rondonia, the dimensions of the subsequent mining explosion were, indeed, difficult to anticipate. Similarly, even though selective logging was already occurring on a limited scale in the area at the time POLONOROESTE was appraised, the mahogany boom of the early 1980's was not foreseen, nor was the possibility that widespread logging activities, covering a broad range of tree species, would soon become economically feasible. Finally, the rapid expansion of livestock production and the economic and ecological factors associated with it in Rondonia were not anticipated, in part because of the predominance of comparatively small rural establishments and poor understanding of the role of cattle in small-farmer survival strategies.⁶

8.22 Be that as it may, the uneven implementation of the program's various components directly favored the expansion of land-extensive ranching and predatory extractive activities over agricultural development and environment protection. Thus, while those program investments that permitted access to regional resources by ranchers, extractive interests and squatters, as well as small farmers, were for the most part efficiently executed, the measures required to steer physical occupation away from ecological, forest and Amerindian reserves, as well as from areas recognized to be inadequate for rural settlement or whose potential holding capacity in terms of future sustainable agricultural development was not yet known, have even now, more than five years after paving of the BR-364 was completed, not been fully implemented! Overall, the growing importance of the ranching and extractive economies in the Northwest effectively undermined, and is likely to continue to undermine, official efforts to control land clearing and "mining" of the forest. This latter process, furthermore, generally also opens the way for other kinds of occupation and associated environmental costs, often in precisely the areas that the program was intended to protect, including those traditionally inhabited by tribal populations.

3. Impacts on Rural Land Distribution, Values and Tenure

8.23 As in many other Bank-supported rural development projects, POLONOROESTE's agricultural components were designed to specifically benefit small farmers. Although access to land by small farmers was, in fact, increased as a result of the program, POLONOROESTE appears to have been largely powerless to impede the two main tendencies that have historically marked the evolution

⁶ For the most part, cattle raising in the POLONOROESTE region prior to 1980 was carried out on large ranches in northwestern Mato Grosso. The potential impact of the decrease in transport costs due to improvement of the road network, as well as of land speculation, the difficulties of establishing sustainable agriculture, rapidly increasing local markets for meat and dairy products and other factors, on the relative costs and benefits of cattle raising for small and large rural producers alike, however, was clearly not considered by program planners.

of rural land tenure distribution in Brazil, namely the growth of very small and very large establishments. Because of the complexity of the tendencies involved, the recent evolution of rural land distribution and tenure in the state merits further examination which will be summarized in the following paragraphs and is described in further detail in Annex VI.

8.24 Agricultural census data indicate that the number of very small establishments (ie. those having less than 10 ha), as well as those between 10 and 100 ha, increased substantially between 1980 and 1985. The increase in the number of very small units appears to have been largely due to the combination of the subdivision of earlier colonization plots and spontaneous settlement on small land parcels in areas outside these schemes. A more detailed examination of changes in land distribution, furthermore, suggests that several differing trends underlie the overall tendency for a decline in average farm/ranch sizes over the period: (i) the above mentioned very substantial increase in the number of new rural establishments under 10 ha and, particularly, between 10 and 100 ha; (ii) an increase in the number of, if not the total area occupied by, very large establishments (ie. those over 10,000 ha); and (iii) a tendency for average farm/ranch sizes to fall fairly significantly in the 10-100 ha and over 10,000 ha categories, but to rise for establishments between 10 and 10,000 ha.⁹

The decrease in the average size of units between 10 and 100 ha (from 58 to 33 ha) in the first half of the 1980's is particularly noteworthy because, like the proliferation of very small farms, in many instances it reflects the subdivision of earlier colonization plots.

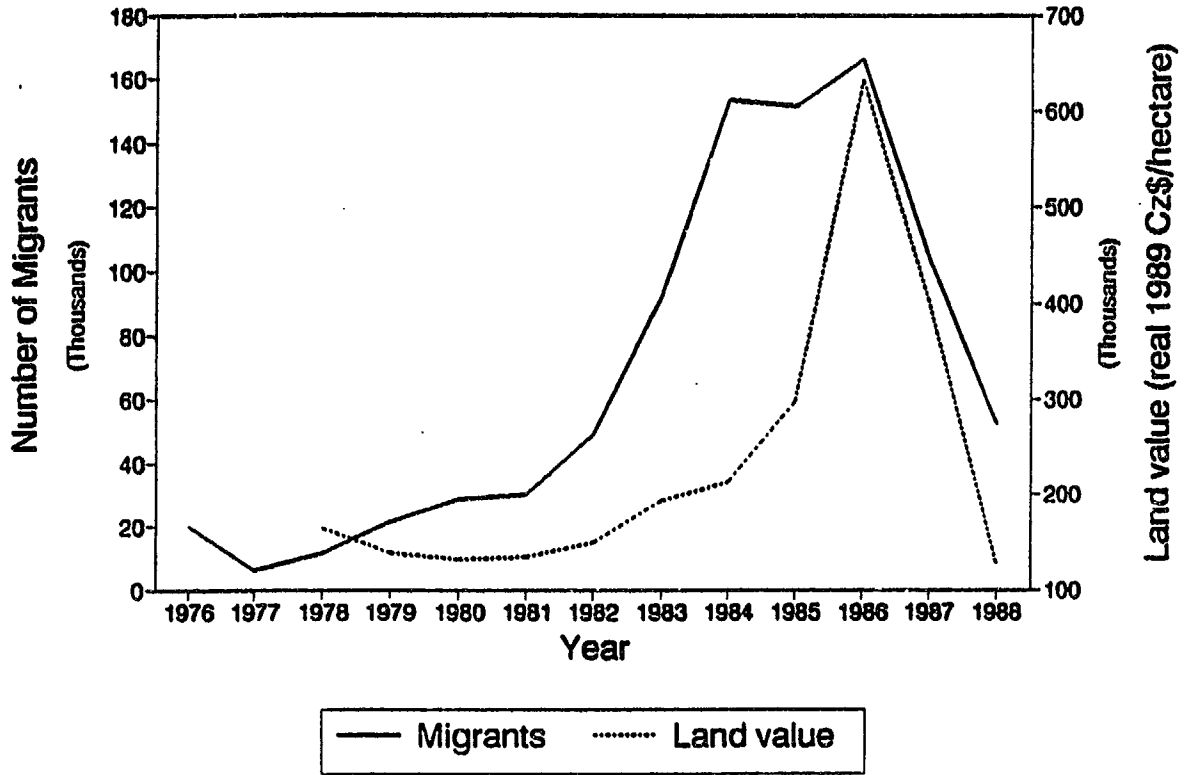
8.25 The hypothesis that land concentration within specific colonization projects may have occurred since 1980, in turn, is corroborated by field surveys by the FIPE evaluation team in directed settlement areas along the BR-364 highway. The average size of one set of lots sampled increased from 135 to 198 ha between the time they were first distributed by INCRA and 1986. The observed process of concentration was attributed by FIPE to increases in land values resulting largely from public investments in physical infrastructure and to land speculation.

8.26 The occurrence of substantial land speculation during much of the 1980's appears to be borne out by data on the recent evolution of land prices in Rondonia. These figures (see Annex Table VI-2) reveal that, while land values oscillated in the state between 1978 and 1982, once the BR-364 highway neared completion in 1983, they began to rapidly increase, reaching a maximum in 1986. However, when both the level of migration and the availability of subsidized agricultural credit declined dramatically in 1987, land prices fell correspondingly. A comparison of the evolution of land prices in the state with those for the Northe (ie. census Amazon) region as a whole further indicates that, even though fluctuations of the latter run parallel to those observed for Rondonia, the magnitudes involved were considerably lower. In addition, the ratio between the two values (ie. land prices in Rondonia relative to those in

⁹ The average size of establishments with less than 10 ha remained the same (4.4 ha) over the period.

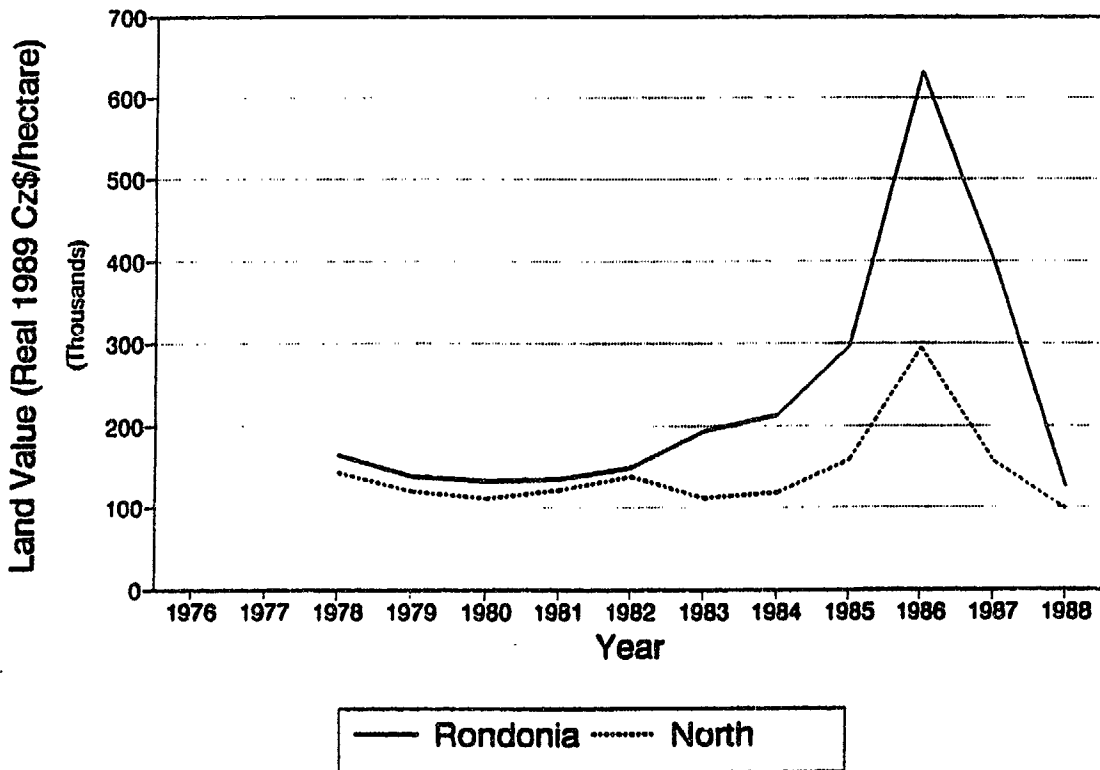
Land Values in Rondonia

Compared with Incoming Migration



Land Values in Rondonia

Compared with land values in the North



Amazonia as a whole) increased progressively between 1982 and 1987, falling to pre-1982 levels in the second semester of 1988. ¹⁰

8.27 In addition to rural land size distribution, the most recent Agricultural Census provides information on the evolution of land tenure during the first half of the 1980's. The most significant change occurring over the period was the very substantial increase in the relative number of and share of total area occupied by owners and the corresponding decrease in the participation of squatters in these totals. These tendencies can be largely attributed to INCRA's efforts, in connection with POLONOROESTE and more broadly, in the development of new colonization schemes and the promotion of "rapid settlement" through which plots occupied by squatters were granted formal title. The other notable change between 1980 and 1985 was the growing importance of sharecroppers among the various tenure categories, whose share increased from 5% to nearly 12% of all rural establishments in the state. Among other factors, this reflects increasing demographic pressures and rising land values in the state, together with the inability of most owner-occupiers to fully exploit their plots with family labor alone. Finally, the census data reveal that squatters and sharecroppers accounted for close to 80% of all farm units under 10 ha, while owners occupied 70% or more of all establishments over 10 ha including nearly 90% of those between 1,000 and 10,000 ha. ¹¹

E. Perception of Agricultural Potentialities

8.28 From the outset, the principal economic justification for roadbuilding and regional development, ultimately leading to the creation of POLONOROESTE, was the need to reduce the time and costs of transportation from what was considered to be a rich agricultural area to the populous markets of the Center-South or beyond. However, this justification was, in fact, founded on two erroneous premises. First, it was assumed that a larger portion of Rondonia's soils than subsequently proved to be the case were of superior quality and, thus, capable of providing high yields and potentially large profit margins to small farmers. Secondly, it was assumed that reducing the "friction of space" through transport improvements would permit Rondonia's agricultural output to compete effectively in extra-regional, including, in the case of cocoa and coffee, international, markets. With the benefit of hindsight, the validity of these two ex-ante assumptions will be assessed in the following sections.

1. Quality of Soils and Productivity

8.29 As indicated in Annex II, the premise that Rondonia possessed a much higher proportion of fertile soils than other Amazon subregions became fairly

¹⁰ More specifically, between 1978 and 1982, average land prices in Rondonia were some 10-20% higher than those in the North region as a whole. By 1985-86, the former were roughly 100% higher than the latter, rising to 150% in 1987, then falling to 10% again in the second half of 1988.

¹¹ These figures also indicate, however, that there were a number of large squatters as 14% of all establishments over 10,000 ha and more than 20% of those between 100 and 1000 ha were occupied by squatters.

commonplace after settlement of the Ouro Preto colonization project in the early 1970's. Data from the RADAMBRASIL aerial natural resource surveys allegedly gave support to this conclusion.¹² However, this information was provided on a scale that did not permit detailed assessment and it tended to be hastily and, as it turned out, optimistically interpreted. Over time, it became increasingly clear that the supposed advantages of Rondonia's soils had been exaggerated.

8.30 The erroneous initial assessment of soil quality in Rondonia, however, could have been avoided. As early as 1975, an article in Science had warned of the poor quality of the soils in the (then) federal Territory, suggesting that agricultural production should be limited to crop varieties and species more tolerant to nutritional deficiencies or toxicities.¹³ At a Conference on the Development of Amazonia in Seven Countries, held in 1979, in turn, another scientist, in discussing soil fertility in Rondonia, affirmed that:

Our present day understanding of the soil potential is based upon a scale of 1 to 1 million reduced from drafts at 1:250,000. It is emphasized by the RADAM reports that the excellent reconnaissance surveys will have to be supplemented by more detailed investigation (at a scale of 1 to 10,000) before long-term plans can be formulated at a local level....A limited number of soils are fertile by Amazon standards, but most have either been developed already or are likely to be exploited... in the near future....There is, therefore, much sense in the suggestion that farming enterprises should be encouraged elsewhere.¹⁴

8.31 Even within the Bank, the viewpoint that Rondonia's soils were superior was not universally shared at the time POLONOROESTE was appraised. As one Bank agricultural adviser stated in an internal memorandum in mid-1981, "in an area the size of which is yet to be determined, we are dealing with extremely low fertility soils often associated with acid soil infertility....In my view,

¹² Based primarily on this source, for example, the report of the Bank's economic survey mission to the Northwest in 1979 indicated that 10% of Rondonia's soils were "good" and another 60% were of "moderate" quality, while only 30% were "marginal" or "unsuitable" for agricultural production, concluding from this that "more than half of the region's land area is suitable for annual or permanent crops." See IBRD, Brazil: Integrated Development..., op. cit., Table 12 and para. 7.03.

¹³ P.A. Sanchez and S.W. Buol, "Soils of the Tropics and the World Food Crisis," Science, Vol. 188, No. 4, 1975.

¹⁴ Peter Furley, "Development Planning in Rondonia Based on Natural Renewable Resource Surveys," in Proceedings of the Conference on the Development of Amazonia in Seven Countries, 1979, pp. 42-43 (emphasis OED).

the investigation of lands is presently inadequate to justify the Program." ¹⁵ In short, considerable doubt existed both in the scientific community and among some Bank technical staff with respect to the adequacy of Rondonian soils for the development of sustainable small-farm agriculture. In retrospect, however, it is evident that the momentum generated by increasing migration and the coalescence of different interest groups overwhelmed such cautionary opinions.

8.32 As described in previous chapters, one practical consequence of the controversy over the quality of Rondonian soils was the recommendation that perennial crops be emphasized over annual crops. This suggestion was correct and generally accepted. However, the installation of tree crops by small farmers proved to be more difficult than expected under the concrete circumstances of Rondonian settlement during the early and mid-1980's. On the one hand, small farmers, who were the principal intended beneficiaries of both agricultural consolidation and new settlement projects, did not themselves, in most cases, possess the necessary resources to invest in the planting of cocoa, coffee or rubber trees or to await the maturation of these investments. In the absence of official credit and in the face of falling coffee and cocoa prices, they were, thus, forced to rely more extensively on annual crops whose cultivation consumed most of their labor resources and which, as indicated in Chapter VI, tended to deplete the soil's natural fertility in a period of only two or three years.

8.33 Subsidized long-term investment credit, in short, would have been necessary for small farmers to install larger amounts of perennial crops, but, as a consequence of the economic-fiscal crisis of the early 1980's, these resources were not effectively made available to small producers until after the suspension of Bank loan disbursements in 1985. In addition, some of the tree crops that were planted in the region reportedly produced inferior quality crops and/or suffered from disease. As a result, the initial optimism surrounding tree crops as an economically and environmentally sound approach to small-farmer development in the Northwest, like that surrounding soil fertility in the region, later proved to have been excessive.

8.34 An auspicious beginning in growing cocoa in Rondonia, more specifically, was interrupted by falling international prices and the spread of the "vassoura de bruxa" (literally "witch's broom") blight. Even today, agronomists continue to try to adapt new tree plants to Rondonian conditions. The latest such "miracle crop" being advocated is cotton. But, even if an ideal commercial crop in terms of Rondonia's soil and climate conditions is found, it would still have to be of high unitary value in order to overcome the equally significant distance-to-market factor.

2. The Distance-to-Market Factor

8.35 Failure by the Bank to adequately consider the importance of the distance-to-market factor can also be cited as a "technical" shortcoming of POLONOROESTE's design. The basic assumption underlying the program that

¹⁵ World Bank Office Memorandum on the "Brazil Rondonia Rural Development Program" dated July 21, 1981.

roadbuilding would reduce the friction of space sufficiently for agricultural production in Rondonia to compete in extra-regional markets was not confirmed. Continued subsidies to transport masked this situation for a number of years, but the more recent resource squeeze has exposed the inherently dependent nature of agriculture in much of the Northwest. Given the comparative inferiority, or at least the non-superiority, of much of its soils and farming technologies relative to those in the Center-South, pavement of BR-364 did not facilitate the export of Rondonian agricultural produce so much as it stimulated a flow of consumer goods, including some agricultural products, in the opposite direction. In retrospect, the experience in Rondonia suggests that reduction of the friction of space may only increase, rather than decrease, the dependency of outlying regions on more developed parts of the country unless costly equilibrating subsidy mechanisms are introduced.

8.36 Recent analyses of freight costs for various crops following different routes in Brazil highlight the dilemma of agricultural production in locations such as Rondonia. The data presented in Table 10 reveal, for instance, that transport costs to the closest markets are at least twice as high from Rondonia as they are from the earlier frontier states of Goias or Parana. These figures underestimate the real dimensions of the distance factor for the POLONOROESTE region since they are based on transport costs from Rondonia to the closest urban markets (ie. the "Triangulo Mineiro" in western Minas Gerais and Anapolis, near Brasilia, in Goias), rather than to the much larger, but more distant, metropolitan centers of Sao Paulo, Belo Horizonte and Rio de Janeiro. Furthermore, since the two former areas themselves produce many of the same food crops (ie. rice, beans and corn) as Rondonia, they cannot really be considered as the final destination of the latter's produce. Thus, the real differentials in freight costs are likely to be even higher than those indicated below.

Table 10

Participation of Freight Costs in the Price of Agricultural Produce, 1989

<u>Crops and Routes</u>	<u>% of Producer Costs</u>	<u>% of Wholesale Price</u>	<u>% of Retail Price</u>
<u>Corn</u>			
Goias to Sao Paulo	38.2	20.4	-
Parana to Sao Paulo	27.3	15.7	-
Rondonia to Triangulo Mineiro	112.4	43.5	-
<u>Rice</u>			
Goias to Sao Paulo	10.3	16.3	4.6
Rondonia to Anapolis	11.8	34.6	10.1
<u>Beans</u>			
Parana to Sao Paulo	7.5	5.1	3.5
Rondonia to Triangulo Mineiro	22.2	13.8	9.7

Source: FAO/UNDP/MINTER/SUDECO, 1989

8.37 Even the conservative estimates of the relative weight of transport costs from Rondonia to the central markets presented in the table below, however, clearly underline the competitive disadvantage of agricultural commodities produced in much of the Northwest in terms of extra-regional markets. As one recent FAO study on the marketing of agricultural produce from the Northwest concludes: "these results indicate why the production of cereals and grains from the POLONOROESTE area is marginally consumed on the market and why it only becomes viable during periods of scarcity. Products coming from Goias and Parana are more competitive."¹⁶

8.38 As suggested in para. 8.35, the relative disadvantages of the most recent Brazilian frontier regions such as the Northwest with respect to the distance-to-market factor were somewhat camouflaged in the past as the result of uniform price policies on diesel fuel.¹⁷ To the extent that cultivation is mechanized, such policies constituted an explicit subsidy to production in more distant regions. More importantly, the transport costs of both production inputs and agricultural output were artificially reduced in such areas. Uniform prices for diesel fuel also made it easier to sustain minimum price policies for agricultural produce. Minimum price policies, in turn, constituted another important source of subsidy that tended to favor less competitive farmers and/or more distant regions. A study recently carried out by IPLAN/IPEA indicates that the interaction of such policies has played an important role in the expansion of agricultural production in frontier regions in the past.¹⁸ This study concludes that the comparative lack of competitiveness of agricultural production resulting from higher transport costs on the frontier implies, in the absence of substantial soil fertility or other crop productivity differentials in favor of these areas and/or of very significant local demand for local agricultural output, that such production can only be sustained at a high cost to public coffers.

F. Conclusion

8.39 Throughout this report, the various difficulties faced by POLONOROESTE have been discussed at some length. The sum of these problems ultimately made it impossible for the program to achieve many of its initial social and environmental goals. The gamut of obstacles encountered ranged from an inhospitable climate and a poorly-known physical environment to the intricacies of administering a complex, multi-agency program involving different

¹⁶ FAO/UNDP/SUDECO/MINTER, "Comercializacao na Area do POLONOROESTE," Documento de Trabalho No. 12, Projeto BRA/87/037, Brasilia, November 1989, pg. 44.

¹⁷ This refers to the fact that the diesel prices charged to final consumers were the same independently of the differential costs of transporting the fuel itself which are much higher in outlying areas such as Rondonia.

¹⁸ See Enid Rocha Andrade da Silva, "A Politica de Preco Uniformizado do Oleo Diesel e suas Implicacoes no Avanco da Fronteira Agricola," Texto para Discussao, No. 18, IPLAN/IPEA, August 1989.

levels of government in the midst of a severe economic and fiscal crisis and the absence of real political commitment on the part of the Borrower to many of the program's stated objectives.¹⁹

8.40 With the benefit of hindsight, the present chapter has highlighted the principal factors and risks which POLONOROESTE's planners in Brazil and its ex-ante evaluators in the Bank either overlooked or underestimated. In retrospect, it is evident both that the program was implemented in a very uneven fashion and that its initial planning did not adequately consider important aspects of the larger frontier development process that were already observable in the Northwest or elsewhere in Amazonia at the time POLONOROESTE was appraised. Together, these largely unanticipated, but not unforeseeable, difficulties help to explain the widespread human and physical environmental impacts which have come to be associated with the program.

8.41 It is unquestionable that the more encompassing, but, nonetheless, partial "regional development" approach proposed by the Bank in response to the Government's initial request for assistance in funding pavement of the Cuiaba-Porto Velho highway reveals sensitivity to the wider social and ecological impacts that were likely to occur as a result of improvement of the road. The approach eventually followed, however, was too narrow and resulted, at the same time, both in placing areas that had little in common under the umbrella of a single investment program and incorrectly characterizing specific interventions

¹⁹ In its comments on an earlier version of this document, the Secretariat of Regional Development (SDR-PR) observes that: "many of the distortions and the unsuccessful execution of some [of POLONOROESTE's] components were principally due to two factors: the first relative to the conception of the program and the second to its administration. In the first case, the lack of basic studies and better knowledge of [the region's] natural resource potentials on the appropriate scale, which would have permitted a more consistent appraisal and better management, contributed decisively to the only fair performance of the program. With or without the program, occupation of the Northwest would have been inevitable given social and political circumstances at the time of its conception and absence of the necessary studies and reflection in anticipation of the increasingly intense migration flows....In the second case, the complexity of a multi-faceted program, the institutional fragility of the entities involved and principally of the coordinating unit in SUDECO should be highlighted among the factors which contributed to the program's not having reached its desired objectives. These questions have their roots in the political pressures of economic groups which gave greater emphasis to construction of BR-364 and the feeder roads in detriment to the other components. Conclusion of the highway further intensified migration flows, permitting the advance of uncontrolled occupation -- spontaneous settlement -- and deterioration of natural resources among other effects. These questions also originated in the economic crisis and political and institutional changes at the federal and state levels...which had a direct impact on the allocation of counterpart resources and, principally, in the lack of necessary means on the part of and stronger support to SUDECO, making it impossible for the agency to make all the essential adjustments and maintain more rigid control, especially with respect to actions affecting the environment, since the experience was new both for the program's coordination and the Bank."

in several sectors (ie. road transport, rural development and public health) and particular subareas and which were targeted on selected social groups as "integrated regional development."

8.42 Had road construction and the promises of prosperity in the Northwest generated in part by POLONOROESTE not multiplied the flow of migrants during a period of economic crisis, the program might still have salvaged satisfactory social results by virtue of its commitment to -- by Amazonian standards -- relatively small-scale farmers. Even before the program and the crisis, however, migration flows to Rondonia had surpassed the ability of official settlement projects to absorb them. When POLONOROESTE paved the Cuiaba-Porto Velho highway and migration continued to increase, however, Rondonia was literally swamped by migrants, a substantial number of whom apparently came from the northwestern Mato Grosso portion of the program region itself.

8.43 If better quality soils in Rondonia had been more widespread and if farmers in the newly-settled areas had been able to sell their produce at better prices in southern markets, perhaps the large flow of migrants would not have produced such serious consequences in environmental terms. But, in practice, the unclaimed lands possessed increasingly poor soils and most small farmers were not able to produce competitively because natural soil productivity, in the absence of comparatively expensive chemical correctives, was relatively low and/or decreased rapidly with the production of annual crops or because the distance to markets, added to other difficulties (eg. poor feeder road maintenance, lack of credit, etc.), presented significant obstacles to successful agricultural development even for prescribed perennial crops.

8.44 Given the difficulties of introducing sustainable agriculture on the scale necessary to absorb a larger than expected number of prospective settlers, the discovery of rich mineral deposits, coupled with the policy-enhanced profitability of logging activities -- which roadbuilding also helped to facilitate -- provided alternative, if frequently temporary, sources of income and employment for part of the recently-arrived population. Indeed, in the absence of a strong local extractive economy, it is likely that many small farmers who still remain in the region might already have abandoned Rondonia in favor of even more recent settlement areas, as had previously occurred in northwestern Mato Grosso and other Brazilian agricultural frontier regions before it.

8.45 The extractive economy, in short, has been extremely important in the Northwest, both directly as a source of employment in logging and mining and indirectly on account of the significant linkage and multiplier effects between these and other local economic activities, including transportation, industrial processing, commerce and a broad range of other urban services. It has likewise been important for regional agricultural growth over the past decade since a substantial share of the local demand for food products is generated by those directly or indirectly involved in extractive and related activities. In the absence of the anticipated export markets for tree crops, particularly cocoa, it is likely that a large portion of locally produced agricultural goods is, in fact, consumed locally by those dependent on extractive activities, including many small farmer families themselves. However, the environmental costs of the

resource degradation associated with logging and mining activities have also proven to be considerably greater than initially expected.

1. The Extractive Economy and Sustainability

8.46 Several aspects of the natural resource-based recent occupation of the Northwest merit brief additional comment. On the one hand, both non-renewable (ie. mineral) and potentially renewable (ie. soils and forest) regional resources are presently being "mined," to the extent that even the latter are, in practice, being treated as -- and hence are in real danger of becoming -- non-renewable resources. Commercial hardwoods are being extensively harvested, while other forest resources are being destroyed with little, if any, attempt to replace them or to protect the other animal and plant species that are threatened or damaged in the process. Regional soil resources are also increasingly being mined through the conversion of forest directly into pasture land or first into annual cropland and then into pasture, much of which is subsequently abandoned once soil nutrients are consumed. Mining, prospecting, logging and urban development, among other activities, in turn, are contributing directly to the growing pollution of regional water resources.

8.47 As a result, most current land uses in the region appear to be largely unsustainable in the absence of much greater investments in soil and forest conservation than most farmers, ranchers and other economic actors are able or willing to make, especially in light of: (i) the continued availability of uncleared land and timber resources and, hence, of an unexploited nutrient stock, in the region; (ii) prevailing market conditions, including the distance to extra-regional markets and the local demand generated by the extractive economy, which favor cattle raising over agriculture and annual crops over tree crops; (iii) the continued need to heavily rely on family labor for most rural development activities; (iv) the prospect of further public investments in roads and other types of physical infrastructure that facilitate access to new areas and markets and of public expenditures more generally that help to stimulate local demand for food and other locally produced natural resource-based commodities through the expansion or maintenance of public sector employment; and (v) the continued limited effectiveness of official control, particularly at the state and local level, over prevailing predatory resource extraction and land use practices, including the invasion, logging and mining of official reserve areas.

8.48 In addition, the long-run sustainability of these extractive activities, which by their very nature tend to deplete or exhaust the natural capital on which they are based, remains to be seen. Clearly, the stock of mahogany and other commercial hardwoods in the Northwest is rapidly diminishing and, thus, at least in the short and medium-run, is non-renewable. Mineral (ie. gold and cassiterite) reserves, in turn, while not fully known, are, nonetheless, also finite. Once the possibility of exploiting these resources decreases and the focus of logging and prospecting shifts elsewhere, many associated food production, raw material processing, supply, transport and other service activities will undoubtedly move with them. Sooner or later, in short, the extractive boom will fade and, in the absence of other major export commodities, so will the local economies -- possibly including a substantial

share of present regional agricultural activity -- which it has helped to generate and sustain.

8.49 In synthesis, in a tropical frontier area such as Northwest Brazil, natural resource-based "development" that has been largely induced and partially sustained by large-scale public investments, particularly roadbuilding, and public policies and interventions that distort private sector resource allocation -- including, in the present case, subsidized transport costs and credit, minimum price guarantees, export promotion policies and free or cheap access to agricultural land -- together with the possibility of "mining" a potentially valuable, but ultimately limited, natural resource stock, faces two very important challenges related to long-term sustainability. One has to do with the already mentioned possibility of continuing to extract non-renewable mineral resources over the long-run and in a way which minimizes degradation of regional water and other environmental resources. The other concerns the effective possibility of converting the presently predatory exploitation of potentially renewable forest and soil resources into a more sustainable pattern of resource use in the region.

2. Sustainability and Regional Carrying Capacity

8.50 Both possibilities, however, will ultimately be constrained by the human carrying capacity of the areas involved. As one World Bank publication has described it,

the carrying capacity of a particular region is the maximum population of a given species that can be supported indefinitely, allowing for seasonal and random changes, without any degradation of the natural resource base that would diminish this maximum population in the future. The concept of carrying capacity is familiar to biologists and wildlife managers who devised it to express the capacity of natural areas (ecosystems) to support animal life. With modifications, it is also an important measure of the ability of regions to support human populations.²⁰

8.51 While, due to spatially differing and constantly changing technologies and resource use patterns, as well as the possibility of supplying food and other consumption requirements from elsewhere through interregional

²⁰ James Kirchner, George Ledec, Robert Goodland and Jane Drake, "Carrying Capacity, Population Growth and Sustainable Development," in Dennis Mahar (ed.), Rapid Population Growth and Human Carrying Capacity: Two Perspectives, World Bank Staff Working Paper No. 690, Washington, January 1985, pg. 45 (emphasis OED). For interesting applications of this concept to the Amazonian regions of Brazil and Ecuador, respectively, see Philip Fearnside, Human Carrying Capacity of the Brazilian Rainforest, Columbia University Press, New York, 1986, and James Hicks, et. al., Ecuador's Amazon Region: Development Issues and Options, World Bank Discussion Papers No. 75, Washington, April 1990. Fearnside's study was partially financed by POLONOROESTE's ecological research component.

trade, determination of carrying capacity constraints at the regional level is far more complex for human populations than for other species, there is, nonetheless, an ultimate limit to the extent to which the natural resource base in any particular geographic area can support, or continue to support, local economic activity and population. This is clearly the case in areas where the principal economic activity involves the exploitation of a non-renewable (eg. mineral or fossil fuel) resource, but it is equally true for areas where potentially renewable resources are "mined" or exploited unsustainably as is presently occurring in Northwest Brazil.

8.52 Regions differ, moreover, in terms of their inherent carrying capacities at given levels of technology and resource consumption. While some areas possess hospitable climates, fertile soils, adequate water supplies and are well located with respect to markets, others have a much poorer natural resource base and/or are situated at considerably greater distances from national consumption centers and international markets. Not surprisingly, the former are normally developed more rapidly and are able to productively absorb and sustain much larger populations than the latter, while the settlement of "lower-potential" areas occurs later and often, as in the case of northwestern Mato Grosso and Rondonia, in response to demographic pressures from "higher-potential" regions such as south-central Brazil.

8.53 These pressures, in turn, are a reflection of both population growth and other factors, including the evolving land tenure structure and policy-induced or supported changes in rural land use. A clear example of the latter is the rapid substitution of a large number of small family-operated food and coffee producing farms by a much smaller number of large-scale, highly capitalized, export-oriented soybean or energy-substituting sugar cane farms in substantial parts of south-central Brazil during the 1970's and 1980's. All of these factors affect the rate at which "surplus" rural population is generated in "high-potential" regions and forced to seek alternative employment opportunities in areas that may be considerably less well suited to accommodate them either in terms of their initial natural resource endowments or their possibility of sustaining agricultural development over time.

8.54 Northwest Brazil, while possessing significant mineral and timber resources, is characterized by a humid tropical climate which, among other drawbacks, is highly conducive to the proliferation of diseases such as malaria, and has limited quantities of fertile soils that are not subject to rapid nutrient loss when improperly managed. It is also situated several thousand kilometers from the major metropolitan areas where most of the country's industry and much of its population is concentrated, as well as from the principal outlets to external markets. As a result, the economic and human costs of installing and sustaining rural settlement are high, even in the absence of rapid population growth, leading to a pattern of resource use (ie. extensive deforestation, soil degradation, pasture creation and subsequent abandonment, etc.) that, in most subareas, contributes directly to the rapid

depletion of the regional natural capital stock. In the face of increasing demographic pressures, this tendency is even further magnified.²¹

3. Future Prospects and Regional Development Considerations

8.55 Given the fragility of the tropical ecosystems which predominate in the Northwest, together with its considerable distance from major domestic and external markets, both the region's inherent human carrying capacity and its future possibilities of absorbing additional population and expanding agricultural and livestock production on an environmentally sustainable basis would appear to be limited.²² This conclusion is supported by the results of a detailed empirical study of another Amazonian subregion in Brazil which possesses characteristics similar to those of many other parts of the region including the Northwest. This study, more specifically, confirmed:

the informal opinion of many that carrying capacity of tropical regions...is very low for agriculturalists supported primarily on annual crops. This is not to suggest that development of these lands by larger enterprises, as in the conversion of extensive areas to cattle pasture, can provide the sustained yields necessary to support a human population at a higher carrying capacity. On the contrary, simulations of cattle pasture cast serious doubt on whether this form of production can produce such sustained yields.²³

8.56 While the implications of this conclusion in terms of future Bank activity in Northwest Brazil and other tropical frontier regions will be explored more fully in the next chapter, several general considerations can be immediately put forward. First of all, it is essential that any future proposal to support, or continue to support, rural settlement and/or other forms of

²¹ The recent experience in the Northwest, together with those along the Transamazon highway in the eastern part of the Brazilian Amazon region and in several other Amazonian regions in Peru and Colombia, Sri Lanka's Mahaweli Ganga program, Nepal's Terai settlement, Kenya's Bura irrigation settlement project and Indonesia's Transmigration program, are specifically cited by Kirchner, et. al. (op. cit., pg. 82) as examples of "economically and environmentally costly land settlement schemes, stimulated at least in part by land pressures in high-potential areas." For a more detailed assessment of the latter of these experiences, see Indonesia - The Transmigration Program in Perspective, World Bank Country Study, Washington, July 1988.

²² This is especially likely in view of the aforementioned tendency to reduce the levels of public expenditures and subsidies that, together with the extractive boom, have helped to support the regional economy over the past decade.

²³ Fearnside, Human Carrying Capacity..., op. cit., pg. 145 (emphasis OED). The subregion in question was an official colonization area along the Transamazon highway near the city of Altamira in central Para.

natural resource-based productive occupation in tropical areas be adequately assessed in light of the carrying capacities of these areas. Secondly, especially when new settlement and hence the in-migration of population and increasing demographic densities are involved, local carrying capacities should be clearly assessed in relation to those of alternative locations in non-tropical areas.

8.57 This, in turn, suggests that the need to "productively occupy" tropical frontier areas should not be viewed by national policy makers or the Bank as a foregone conclusion, as appears to have been the case at the time when the latter decided to support POLONOROESTE, but rather as only one, and under most circumstances a very high (social and environmental) cost, alternative to dealing with the underlying problem of reducing or accommodating "surplus" rural population generated elsewhere. In short, the range of policy options and possible interventions to deal with this problem should, from the outset, be considerably broader than merely attempting to use undeveloped regions, especially those having inherently low holding capacities, as an, almost inevitably temporary, "safety valve" for demographic pressures arising for whatever reasons in other parts of the country in question.

8.58 When intervention in support of rural settlement in tropical areas such as the Northwest is inevitable, however, certain principles or development objectives that explicitly take carrying capacity constraints into account should be applied in the definition and subsequent implementation of such measures. These regional development objectives have been well summarized by one perceptive observer of the environmental impacts of major development initiatives in the Brazilian Amazon region, including POLONOROESTE, over the past several decades in the following terms: ²⁴

- (i) Sustainability: Long-term sustainability, both agronomic and social, of any [agroecosystem] ²⁵ to be promoted is of paramount importance. Agronomic sustainability requires a reasonable balance of nutrients in the system, including compensation for losses from leaching, erosion and nutrient export in the products harvested. Other requirements for continued productivity, such as control of soil compaction and energy from renewable sources, must also be met. Probabilities of destruction by pests or diseases must be low and consideration should be given to an alternate land use should the present system fall victim to one of these biological problems....Social sustainability requires that the system remain profitable over time. Fluctuations in yields and variations in market prices for inputs or the product can jeopardize long-term social sustainability. Also important is the practicality of enforcing regulations required for the system's functioning....In addition, social inequality and

²⁴ Ibid., pp. 147-150 (emphasis OED).

²⁵ An "agroecosystem" refers to an ecological system, or ecosystem, that includes crops and other organisms used to supply human needs.

other underlying social conditions can affect a system's long-term sustainability. Sustainability is therefore linked with social forces arising from resource distribution and population pressure.

- (ii) Unsubsidized Economic Competitiveness: Systems that depend on government subsidies for their survival often end up costing more than their intrinsic merit justifies. Distortions introduced by such subsidies as tax incentives and low-interest loans have a way of becoming self-perpetuating even when the system has proven to be economically unfeasible. Systems must show themselves to be profitable in immediate (discounted) terms, thus obviating any need for governmental or other subsidies.
- (iii) Maximum Self-Sufficiency: A balance must be struck between integration with the larger economy and local self-sufficiency. Dependence on imports of energy supplies, agricultural inputs and basic food staples puts colonists at the mercy of price increases and the vagaries of supplySelf-sufficiency should include both economic self-sufficiency, meaning that enough is produced to satisfy demand, and nutritional self-sufficiency, meaning that enough is produced to satisfy nutritional needs of all regardless of purchasing power.
- (iv) Fulfillment of Social Goals: To be viable, an agroecosystem must ensure minimum human living standards...Containing the probability of [settler] failure within acceptable limits is one important condition. The amount of employment generated by different types of development must also be considered. On a regional scale, the cost of installing an agroecosystem can also be important if opting for an expensive development type means that goals are not fulfilled elsewhere in the region.
- (v) Consistency with Development of Adjacent Areas: Development plans must ensure that adequate areas are available for ecological, Amerindian and other types of reserves requiring intact forest. Boundaries of such reserves, once created, must be respected: development of surrounding areas must not create pressures to encroach on previously committed reserves.
- (vi) Retention of Development Options: A prime consideration in selecting development strategies should be avoiding land uses that close the door to other possible uses....The extensive destruction of the forest for cattle pasture is the most dramatic instance of short-sighted land use.
- (vii) Minimal Effects on Other Resources: A minimization of adverse effects such as water pollution on other resources should be part of any development planning.

- (viii) Minimal Macroecological Effects: Development strategies for rainforest areas must not be adopted without serious consideration being given to potential larger ecological effects. Species and genetic diversity, coevolved ecological relationships and climate stability are often sacrificed with little serious consideration given to applying effective... measures to curb these losses. Costs of ignoring these potential problems could be high, even though individuals and corporations enjoying the immediate profits of development will not pay the bulk of these costs which may not come due for some time.

8.59 The latter point, finally, raises the fundamental conflict that underlies much environmental degradation -- including the "mining" of renewable natural resources -- on the Amazonian frontier and elsewhere. This refers to the conflict mentioned earlier in this report between the private desire to maximize short-run benefits versus the societal (and inter-generational) need to minimize long-run social and environmental costs that is associated with all major investment decisions and development initiatives, but is particularly acute in the case of natural resource-based frontier region occupation. More generally, as one researcher has put it:

The conflict between individual profit-seeking and the environmental and social concerns of society at large arises from a basic disparity between a system's sustainability and the investment pattern producing the highest economic returns. Investment decisions are made by comparing potential investments with returns obtainable from alternative investments in other parts of the larger economy (the latter summarized as a discount rate). Unfortunately, the rate of return that can be sustained by managing a renewable resource is limited by...biological factors...which have no logical link with bankers' discount rates. If the discount rate is more than twice the rate of regeneration, as is often the case, it is to the investor's advantage to simply destroy the resource as soon as possible and reinvest the profits in other enterprises....The problem is not a lack of knowledge, but the fundamental nature of economic decision making.²⁶

²⁶ Ibid, pg. 150 (emphasis OED). Fearnside also observes (pg. 151) that the current reliance on discount rates in investment decision making "poses a dilemma" for development planners since "high discount rates lead to overexploitation of potentially renewable resources, while artificially low rates lead to investment in economically inviable projects with poor returns," concluding that "a new approach to financial analyses is needed to make sustainable forms of development profitable and non-sustainable forms unprofitable."

8.60 Thus, while policy-induced distortions in private investment decisions which result in the non-sustainable utilization of renewable natural resources should be avoided, at the same time there is also clear need for public intervention to ensure that the interests of the larger society (including the global community) and future generations are represented in private decision making affecting large-scale natural resource use and management in the humid tropics. In the case of Northwest Brazil in particular and of Amazonia more generally, this implies the need to reduce rapid deforestation and other forms of environmental degradation in areas where it is already taking place and to take actions to prevent these processes from occurring elsewhere in the region. As will be further discussed in the next chapter, this requires both the redirection of prospective and, to the extent possible, existing Amazonian settlers to other regions, together with the more rational management and development of those areas that are already occupied.²⁷

²⁷ Fearnside (ibid., pp. 151-152) proposes, moreover, that "encouraging intensive development of small areas is one way of relieving pressure on larger expanses of rainforest" and that "already deforested areas should be the sites for such intensive developments, not those still under native forest."

IX. THE BANK, THE ENVIRONMENT AND THE FUTURE OF NORTHWEST BRAZIL

A. Introduction

9.01 The preceding chapters have surveyed POLONOROESTE's execution performance and general results, the adequacy and effectiveness of the program's environmental and Amerindian protection components, its direct and indirect impacts on the human and physical environments in Northwest Brazil and the principal design shortcomings and unanticipated difficulties experienced during implementation that help to explain its inability to fully achieve many of its initial economic, social and environmental objectives. This and the following chapter, by way of summary and conclusion, will focus more specifically on how - and how well -- the Bank perceived and dealt with POLONOROESTE's environmental aspects and consequences. They will likewise try to draw the principal lessons that can be learned at this point from the recent demographic and economic growth cum environmental mismanagement in the Northwest, as well as to trace the principal implications of this experience for on-going and future Bank activities in the region and other tropical frontier areas. The institutional and policy impacts of POLONOROESTE both in Brazil and within the Bank will also be briefly described. Much of what follows, however, will be an attempt to bring together the principal findings presented in earlier sections of the report.

B. Adequacy of Bank Perception of Environmental Risks

9.02 As both the regional economic survey report (ie. the publication entitled Brazil: Integrated Development of the Northwest Frontier) and the appraisal documents for the various projects which together composed much of POLONOROESTE demonstrate, the Bank was clearly aware of many, if not most, of the potential environmental impacts and risks associated with undertaking the program and paving the Cuiaba-Porto Velho highway in particular. This situation compares favorably with the Bank's relative lack of awareness of the principal environmental impacts and risks at the regional level associated with the nearly simultaneous preparation, appraisal and implementation of the Carajas Iron Ore Project in eastern Amazonia.¹ Indeed, in many ways, the Bank's approach to POLONOROESTE in terms of attempting to identify and prevent or mitigate potential adverse environmental and Amerindian impacts of major infrastructure and productive (in this case, road and rural development) investments was a pioneering effort that anticipated the more systematic environmental assessment procedures that have recently been adopted on an institution-wide basis.² As mentioned earlier in this report and further discussed in the next chapter, moreover, POLONOROESTE directly resulted in important environmental policy initiatives within the Bank, the tribal peoples policy being a clear example.

¹ See the OED case study report entitled Environmental Aspects..., op. cit., for a similar discussion as to how the Bank dealt with environmental issues and problems in connection with this operation.

² These procedures are detailed in Bank Operational Directive (OD) 4.00, Annex A, entitled "Environmental Assessment," which was first issued in its present form in October 1989.

9.03 In retrospect, however, it is also evident that the Bank underestimated the probability that, and extent to which, the potential negative environmental impacts associated with improving physical access to and within the Northwest would, in fact, occur. Similarly, the Bank significantly overestimated the institutional capacity and, above all, the political willingness of the Borrower to take the actions necessary to effectively limit or control these adverse impacts. As has been suggested throughout this report, these shortcomings reflected a poor *ex-ante* understanding by the Bank of both the agro-ecological and socio-economic constraints to achieving sustainable rural development and of the underlying complexity and dynamics of the frontier occupation process in the Northwest. While the deepening recession in south-central Brazil after 1981 unquestionably added to the demographic pressures on the region, and hence, on its physical environment, this does not negate either the fact that the Northwest's human carrying capacity at existing levels of technology was, and continues to be, inherently limited or that this fundamental constraint was not adequately taken into account in the Bank's appraisal and subsequent decision to support the program.

9.04 Explicitly or implicitly, the Bank made several key assumptions with respect to POLONOROESTE's likely impact on the environment which subsequently proved to be partially or totally incorrect. Among these were:

- (i) that while migration flows to the region would undoubtedly increase as a result of program road and rural development investments, they would not be so large or so rapid as to hinder its implementation or interfere with the achievement of its basic social and environmental objectives; in this connection, no attempt appears to have been made by the Bank during the appraisal process to project migration, consider alternative demographic scenarios or assess the likely impact of varying levels and rates of population inflow on rural settlement, urban growth and natural resource utilization in the region;
- (ii) that rural settlement could and would be directed to areas with comparatively fertile soils and away from those where soil conditions were known to be inadequate or were still largely unknown; a related assumption was that sufficient amounts of relatively good soils existed in the region to accommodate a reasonable number of additional settlers whether already present in the Northwest or still to arrive, either in areas that had not yet been occupied or through the subdivision of existing, presently underutilized, colonization plots in areas that were known to possess fertile soils;
- (iii) that environmentally less damaging perennial crops would be installed, expanded or consolidated on small-farmer colonization plots even though the investment credit required for this to occur was to be provided in parallel to, rather than as an integral part of, the program itself;

- (iv) that environmentally less desirable cattle raising and annual crop production through shifting cultivation would be discouraged by the program; while it was recognized that the production of annual crops was necessary to ensure the subsistence of settlers and their families, it was expected that temporary crops would be interplanted with tree crops so as to reduce the tendency of the former to rapidly deplete soil nutrients, thus leading to the need for additional deforestation;
- (v) that implementation of the program's various components would proceed sufficiently apace that by the time road improvements were completed existing colonization projects would be largely consolidated, the installation of new settlement schemes would be well advanced and environmental and Amerindian protection measures would be in place; the very different institutional and implementation requirements for investments in physical infrastructure, especially roads, on the one hand and for agricultural support and public health services and environmental protection measures on the other and, more importantly, the very different political and economic interests associated with these different types of public intervention, appear to have been largely overlooked;
- (vi) that the financial resources, institutional strengthening and political commitment necessary for the timely and adequate implementation of the program's "software" components, including its environmental and Amerindian protection measures, would be forthcoming and sufficient to guarantee the effectiveness of these actions and investments; and,
- (vii) that small farmers would reap significant benefits from program-sponsored trunk and feeder road improvements which would greatly facilitate the commercialization of their products and their access to agricultural inputs, support services and community facilities; while this assumption was not wrong per se, program design did not explicitly recognize that, especially in rapidly growing frontier areas, road

³ Independently of the ecological and socio-economic settings in which they occur, the design and implementation of poverty-oriented rural or area development projects are generally characterized by considerable institutional complexity, while their performance and results often critically depend on the ways in which they affect existing political interests at the local level. For more specific discussions of these factors, see OED, Rural Development: World Bank Experience, 1965-85, World Bank Operations Evaluation Study, Washington, April 1988; Judith Tendler, "Rural Projects through Urban Eyes: An Interpretation of the World Bank's New-Style Rural Development Projects," World Bank Staff Working Papers, No. 532, Washington, 1982; and Judith Tendler et. al. "New Lessons from Old Projects: The Dynamics of Rural Development in Northeast Brazil," report to OED, January 1991.

construction and/or upgrading has a direct impact on land values and, hence, on land speculation and frequently also on land concentration; nor did it recognize that, in addition to rural colonists, frontier road improvements facilitate access to land, natural resources and markets by spontaneous settlers, large farmers, ranchers of all sizes, loggers, miners and other economic actors whose impact on the physical environment is likely to be far less benevolent than that of small tree crop farmers; similarly, it essentially ignored the fact that such improvements facilitate the inflow, as well as the outflow, of agricultural and other commodities, in the process leading, at least initially, to an increased dependence of the "beneficiary" region on more developed parts of the country.

9.05 Together, these incorrect or only partially correct premises suggest that the Bank's ex-ante assessment of the environmental risks associated with POLONOROESTE was, at best, incomplete. As suggested in an earlier chapter, this reflects the Bank's poor initial comprehension of both the political economy of the broader frontier occupation process in Northwest Brazil and the implications of this process in terms of potential natural resource use and misuse in the region. More specifically, it reflects the Bank's insufficient knowledge of the underlying economic, social and political forces that were "driving" migration, settlement and resource utilization in the Northwest at the time the program was appraised.⁴ It also reflects the absence of an ex-ante assessment as to how these broader forces would be likely to react in terms of natural resource use to a substantial increase in public investments and the progressive "opening up" of the area as a result of improved transport connections both to and within the region.

9.06 One of the major lessons that can be drawn from the POLONOROESTE experience for future operations in similar situations, therefore, is the need to more adequately consider the entire frontier development process and its implications for natural resource use and management. This necessarily requires an assessment as to how any proposed major investments would be likely to affect resource utilization by all major economic actors in the region rather than just one particular group such as small farmers. This analysis is essential not only to better gauge how any major investment or investments would be likely to influence natural resource use at the regional level, but also to have a more adequate idea as to the nature and extent of the environmental protection measures that would be necessary in order to avoid or mitigate adverse impacts, together with the political and institutional preconditions for the effective implementation of such actions.

⁴ While it is true that many of these forces (eg. extensive logging and ranching activities) were still largely incipient in Rondonia at the time the program was appraised, they were, nevertheless, already occurring to a more observable extent in northwestern Mato Grosso. Furthermore, they had clearly characterized the frontier occupation process elsewhere in Amazonia, particularly along the northern section of the Belem-Brasilia highway during the 1960's and 1970's, and, thus, could have been better anticipated by the Bank.

9.07 As was also stressed in OED's assessment of the environmental aspects and consequences of the Carajas Iron Ore Project, this type of ex-ante and on-going evaluation is necessary for all major infrastructure and productive sector operations which are likely to have significant physical and/or human environmental impacts.⁵ However, it is especially important for those projects in regions that are territorially extensive and/or ecologically heterogeneous or sensitive, as well as for those areas which are undergoing rapid processes of socio-economic transformation. In short, it is particularly important for projects or programs in large humid tropical frontier regions such as Northwest Brazil.

C. Program Adequacy and Effectiveness in Dealing with Environmental Problems

9.08 The discussion in the preceding section clearly suggests both that the Bank's ex-ante analysis of the potential environmental risks associated with POLONOROESTE was insufficient and that, at least partially as a result, the program's capacity to deal with the negative environmental consequences of improved access to and within the region was ultimately limited. The reasons for this have been explored in considerable detail in earlier chapters and, thus, will not be repeated here. It is important to stress, however, that perhaps the most important factor underlying the failure of POLONOROESTE's proposed environmental protection actions was the lack of political interest at the state and local levels in the effective implementation of such measures.

9.09 This lack of local political interest in environmental control and protection, which on the frontier inevitably means restricting access to at least some potentially exploitable land and natural resources, is not difficult to understand since, as indicated in previous chapters, it clearly goes against the self-interest of many of the principal economic actors involved in the frontier occupation process, including many local politicians who may often be large landowners and/or directly involved in extractive ventures themselves. Many of the main economic actors on the frontier, particularly land speculators, commercial loggers and prospectors, are primarily and understandably interested in maximizing the short-term return on their investments of capital and/or, in the case of the two latter groups, labor. Furthermore, ranchers and farmers of all sizes, to the extent that they are also holders of an important capital asset, land, whose value increases -- sometimes very rapidly -- as a direct result of the frontier occupation process, are frequently interested as much, if not more, in realizing the potential gains that can be reaped from the sale of this asset than in using it as a productive resource for cattle raising and/or agricultural purposes.

9.10 Due to the abundant availability of relatively inexpensive uncleared land on the frontier, especially as compared with the normally much less plentiful supplies of capital and labor, loggers, ranchers and farmers have, in

⁵ OED, Environmental Aspects...., op. cit., Chapter X. Precisely on account of the dynamic nature of the processes involved, moreover, the continual monitoring and evaluation of evolving regional development tendencies and their environmental impacts is of crucial importance in large-scale infrastructure and/or productive sector projects in frontier areas.

practice, tended to "mine" its potentially renewable forest and soil resources, just as miners and prospectors extract its non-renewable mineral resources. Thus, as one recent Bank economic analysis of environmental problems in Brazilian Amazonia has put it:

The agricultural economies that have evolved in the Amazon have been a market response to an abundance of accessible Amazonian land generated by the government road building program. The economic force driving these activities can perhaps best be viewed as nutrient extraction: nutrients, currently embodied (largely) in the canopy and soil of the forest, can be extracted and sold in a variety of forms -- most importantly trees, crops and meat. The complex of activities and organizations that constitute nutrient mining varies from region to region along the frontier, depending upon quality of soils, ease of forest access, availability of labor, credit and land tenure relationships.⁶

9.11 Under these conditions of relative factor availability, the principal key to resource-depleting occupation of the frontier is physical access and the associated reduction in transport costs. Except in cases where rates of return are expected to be very high (ie. some mining and commercial logging ventures), road investments are normally undertaken by the public sector which, by virtue of this intervention alone, significantly increases access to land and other natural resources on the frontier for a broad range of economic actors. Once previously unexploited areas are opened up, however, it often becomes very difficult to control the occupation/settlement process. In addition, unless construction and maintenance costs are fully recovered from their multiple users, which is seldom the case on the frontier, such public sector road investments also represent a de facto subsidy to the private interests (eg. farmers and ranchers of all sizes, loggers and others) who subsequently utilize them to obtain access to land and other resources.

9.12 Consequently, one major -- perhaps the major -- way to discourage or prevent the future invasion and destruction of sensitive tropical forest ecosystems and Amerindian habitats is to sharply curtail roadbuilding in such areas, thereby effectively limiting access and reducing the incentive to occupy land on an unsustainable basis. This recommendation, moreover, coincides with one of the policy instruments identified in the recent report of a FAO Interdepartmental Task Force on the Amazon (hereafter FAO ITFA) as being available to governments in order to promote sustainable development and avoid

⁶ Schneider, op. cit., Executive Summary, para. 9. An earlier version of this report also correctly stressed that, at least in the short run, this is a "rational and privately profitable response to the abundance of land in the Amazon and to the relative prices of land, labor and capital."

extensive further environmental damage in the region.⁷ The other policy instruments mentioned in the FAO ITFA is report include "environmentally friendly" price signals,⁸ technology development and transfer,⁹ land titles¹⁰ and the consolidation of "development poles" both inside and, to help relieve migratory pressures, outside the region.¹¹ More will be said about some of these policy instruments and other elements in the FAO's proposed "balanced development" strategy for Amazonia, as they specifically apply to the Northwest region, below.

9.13 It should first be observed, however, that future prospects for environmental and Amerindian protection in natural resource-rich tropical frontier areas that are already undergoing rapid settlement such as the POLONOROESTE region will continue to depend on the definition and, above all, adequate implementation of adequate natural resource management and environmental control measures, as well as on the effective reduction or outright elimination of existing incentives for environmentally damaging physical occupation of these areas. In both cases, three elements will be essential:

- (i) a proper understanding of the complex forces behind and relationships between improvements in physical access, migration, rural and urban settlement, natural resource exploitation and environmental degradation;

⁷ FAO, "Conservation and Sustainable Development in the Amazon Region," a working paper prepared under the direction of the Interdepartmental Task Force on the Amazon, September 1990, para. 3.9. This document affirms that "new roads should only be built into areas defined in zoning plans as having sustainable potential for development....Wherever practicable, priority should be given to river, rather than road access, because of the better control it gives to the flow of migrants and simpler maintenance needs." (emphasis OED)

⁸ As stated in the FAO ITFA document, "the ultimate means of conservation is to ensure that it is in no-one's financial interest to claim or clear land which needs to be protected." (Ibid., para. 3.9, emphasis OED)

⁹ This is further described as "the search for more sustainable technologies, truly compatible with the economic and social realities of the region and the needs/inclinations of its farmers." (Ibid., para 3.9)

¹⁰ It is recommended that "land title should only be granted in zones defined as having sustainable potential [and that] even there, rights of occupancy, possession and title should be dependent on the use of appropriate forms of exploitation which minimize unnecessary clearing and maximize soil and water conservation." (Ibid., para. 3.9, emphasis OED)

¹¹ More specifically, "intensive development efforts should be concentrated at locations where resources are planned to be exploited....Priority should be given to intensifying development around existing centers." (Ibid., para. 3.9)

- (ii) sufficient legal, technical, institutional and, above all, enforcement capabilities to adequately anticipate, monitor and control the direct and indirect adverse environmental impacts of on-going development processes at the local, state and/or regional levels; and
- (iii) political will.

9.14 In the specific case of Northwest Brazil, it is presently doubtful whether any of these three elements fully exists. The frontier occupation process is still not well understood either by Brazilian policy makers or the Bank and needs to be constantly monitored and re-evaluated precisely because of its complex and dynamic nature. While an adequate legal basis for environmental protection and control may or may not already exist in the region, it is, nevertheless, very unlikely that the public agencies responsible for natural resource management and environmental protection in Mato Grosso and Rondonia currently possess the human, financial and material resources required to adequately carry out these responsibilities. Most importantly, it is highly questionable if the political will necessary to revert the present tendency for the unsustainable use of renewable natural resources currently exists in the region, especially at the state and local levels.¹²

9.15 In the absence of these preconditions, no large-scale development effort in tropical frontier areas such as Northwest Brazil is likely to be effective in stemming environmental degradation and/or fully and sustainably protecting regional indigenous populations. This suggests, furthermore, that future environmental prospects in the region will ultimately depend primarily on the continued profitability of extractive and other resource-depleting activities and secondarily on public sector efforts to control land use, improve natural resource management, strengthen local environmental protection agencies

¹² This latter conclusion is also reached by Schneider (initial version, op. cit., Executive Summary with respect to the prospects for environmental protection and control in Brazilian Amazonia more generally. He affirms, on the one hand, that "despite the relatively low cost of forest preservation ...individual incentives to deforest are high, leading to serious difficulties in implementing forest preservation policies." More importantly, Schneider notes that "experience from land use zoning the world over has taught that in the absence of a substantial local constituency for land-use restrictions, zoning policies have little chance of effective implementation. The uniquely extractive characteristics of economies in the Amazon suggest that here more than elsewhere, policies to preserve the [region] will have little local constituency -- reducing their chances of success. With the exception of relatively few communities which have a diversified economic base in mining, government and agriculture, most frontier communities are based on...nutrient mining....In general the duration of the sequence from opening of the forest with timber highgrading to abandonment as unproductive pasture is on the order of 10 to 20 years. During this period of intense nutrient mining the process provides substantial economic activity. Proposals to force the adoption of (geographically) sustainable techniques -- if they are to imply a major reduction in this current economic activity -- will find little local political support." (Emphasis in the original)

and/or introduce environmentally more benevolent rural development practices. It is, thus, important to consider the future prospects of the major natural resource-consuming activities that presently constitute much of the regional economy, as well as the principal development alternatives associated with each one, in somewhat further detail.

D. Future Economic and Environmental Prospects and Strategies for the Northwest

9.16 One of the great paradoxes of POLONOROESTE is that, despite its inability to achieve many of its initial objectives, considerably greater wealth appears to have been generated in the Northwest region during the program's implementation period than was initially anticipated by its designers. As shown throughout this report, however, much of the region's present economic prosperity has come about in unexpected ways, may prove to be transient and has involved considerable human and physical environmental costs. Given this situation, as suggested in the preceding chapter, a real question exists as to the long-run sustainability of much of the economic base that has developed in the region over the past two decades.

1. Agriculture

9.17 Increasing small-farmer agricultural output on an environmentally sound basis was one of POLONOROESTE's principal goals. At present, however, it appears that much of the potentially best agricultural land in the Northwest may already have been degraded through a combination of slash and burn annual crop production in smaller plots and the increasing installation of pasture land on both small and larger farms and ranches. In neither case has "productive and sustained agricultural development" been clearly attained. As a result, it is estimated that as much as half of the area that has been deforested in Rondonia over the past several decades may already have been abandoned, while much of the rest has been given over to pasture lands. Of the latter, more than 60% may already have become capoeira.¹³ The situation may be somewhat better in Mato Grosso, particularly in the area north of Caceres. Nonetheless, it can be safely affirmed that initial program expectations that the installation and/or consolidation of tree crops on small farms would divert resources from

¹³ These tendencies, moreover, appear to be a characteristic of recent rural development in Amazonia as a whole. The aforementioned FAO ITFA report ("Conservation and Sustainable Development...", op. cit., para. 1.24) states, for example, that "most deforested land [in the region] has been cleared for agriculture and ranching." It likewise observes that "it seems that more than half of all cleared land has been abandoned to secondary growth or degraded pasture, rather than continuing under crops or productive grazing. Although many farm families have improved their financial standing, most of their productive systems are inherently unstable. If the families remain, they face declining productivity and higher costs." (Emphasis OED)

environmentally more harmful alternative land uses have, for the most part, not been fulfilled.¹⁴

9.18 As concerns future prospects, it is commonplace in some quarters to place considerable hope in the ability of technological breakthroughs to overcome the current difficulties faced by agriculture in Amazonia. Just how - and how quickly -- such technological progress can be achieved, on the other hand, remains unclear.¹⁵ As one ecologist familiar with the region has put it, furthermore, "the faith that research results will someday overcome any given agronomic and environmental limitations is pernicious: it can and does lead planners to dismiss concern for future consequences of present development decisions."¹⁶

9.19 On the other hand, adaptation of presently available technological packages to Amazonian conditions remains problematic. Perennial crops are unequivocally more adequate than annual crops from an environmental standpoint yet, with few exceptions, such crops can be grown more cheaply in regions closer to domestic consumer markets and existing export outlets. Another set of concerns revolves around the needs to develop the skills and know-how to deal with Amazonian ecosystems in a way that will avoid the potentially disastrous consequences of massive deforestation and to alter past tendencies to attempt to transfer alien, and thus often inappropriate, agricultural practices to the tropical forest environment.

9.20 In this connection, the possibilities of adopting indigenous or "caboclo" technologies and/or of promoting "extractive reserves" in tropical areas have recently received increasing attention.¹⁷ On the one hand, based on

¹⁴ This does not mean, of course, that in the absence of the program-supported introduction or expansion of perennial crops the present situation in the region might not have been even worse in this respect.

¹⁵ To again cite the recent FAO ITFA report (ibid., para. 1.18), "Amazon development...was often...seen as engaging in a national 'battle' to 'integrate' or 'subdue' the region. Scant attention and little time was given to filling the large gaps in the resource data base on which such plans were founded, or to establishing the type of technical support which had been set up for plantation development in other countries. It was implicitly assumed that the technical limitations on sustainable agriculture could be overcome by the use of purchased inputs, or the rapid local adaptation of existing technologies from outside the region. Little account was taken of the agricultural knowledge of the existing population. Economic realities, in particular the lack of comparative advantage of the region due to its remoteness from major markets, was largely ignored." (Emphasis OED)

¹⁶ Philip Fearnside, "Development Alternatives in the Brazilian Amazon: An Ecological Evaluation," Interciencia, Vol. 8 No. 2, 1983, pg. 66 (emphasis OED).

¹⁷ See, for example, Robert Goodland (ed.) Race to Save the Tropics: Ecology and Economics for a Sustainable Future, Island Press, Washington, 1990 and P.K.R Nair, "The Prospects for Agroforestry in the Tropics," World Bank

careful management and preservation of existing ecosystems and the rotation of crops, this approach is land-extensive and low in productivity. On the other, it possesses obvious ecological advantages since it primarily involves the harvesting of renewable native forest products (fruits, nuts, rubber, etc.) rather than the forest itself, while the fact that it is centered on small farmers and other traditional Amazonian populations (eg. rubber tappers, Brazilnut gatherers, subsistence fishermen, etc.) has made it attractive to many analysts.¹⁸ In areas near Iquitos in the Peruvian Amazon region, for instance, hybrid forms of settlement, adapting the native indigenous model to small-scale farming, are presently being attempted. This model, moreover, eschews individual and commercially-oriented enterprises for community or associative forms of production which are just slightly above the subsistence level.

9.21 Despite their relative appeal to different groups, none of the above approaches appears to pave the way for the absorption of large volumes of small farmers and landless rural workers. While the cautious "ecological" approaches to rural development would produce evident environmental benefits relative to other alternatives, it is, nonetheless, difficult to see how they could accommodate large numbers of existing or future settlers. In addition to significant educational, informational and "cultural" obstacles (ie. migrant families possessing varying degrees of previous agricultural experience come from a variety of other regions often possessing very different ecological conditions, and hence different agro-ecological potentials and constraints, all of which influence their current agricultural practices) in light of the predominantly extractive nature of the frontier occupation process in the Northwest, as suggested in the preceding section, it is questionable whether such ecologically favorable, but low labor-absorbing, alternatives could ever obtain the necessary local political and administrative support for anything other than relatively marginal "demonstration" projects, or, indeed, whether they would be economically feasible on a large enough scale to have a significant impact.

9.22 In short, for reasons ultimately related to the carrying capacity constraints touched on in the previous chapter, prospects for the continued, large-scale and permanent absorption of "excess" rural population in agricultural activities in northwestern Mato Grosso and Rondonia, as elsewhere in Amazonia, without incurring substantial additional environmental costs, appear to be slim. Furthermore, it is unlikely that broad, encompassing,

Technical Paper, No. 131, Washington, November 1990.

¹⁸ See, for instance, C.M. Peters, A.H. Gentry and R.O. Mendelsohn, "Valuation of an Amazonian Rainforest," Nature, Vol. 339, pp. 655-656. The study briefly reported in this article concluded, more specifically, that "the total net revenues generated by the sustainable exploitation of 'minor' forest products are two to three times higher than those resulting from forest conversion," such that the actual benefits of timber are small when compared with the potential benefits of non-wood resources, at least at relatively low levels of production/collection and assuming sufficient demand and adequate marketing arrangements for the non-timber products in question.

once-and-for-all solutions such as massive land redistribution schemes or the application of a specific new technology will materialize, at least in the foreseeable future. Rather, less ambitious approaches tailored to the ecological, economic and social conditions of specific sub-areas will have to be implemented. Relatively small-scale exploitation of agricultural products having high unitary value and/or comparatively low transport costs, for instance, may still prove to be a viable alternative in certain subregions of the Northwest.

9.23 In addition, since frontier expansion in Northwest Brazil over the past fifteen years has resulted in considerable urbanization and much of this growth, especially in larger cities such as Cuiaba, Porto Velho and Ji-Parana, is likely to be irreversible, an important and possibly expanding regional market for locally-produced vegetables, fruits, poultry, meat and dairy products exists. Much of the food that is presently consumed in Amazonian cities is brought in (sometimes by plane) from the Center-South. Paving the BR-364, in fact, made this easier than before. Accordingly, there may be considerable room for rationalization of the local market structure which could make limited small-farm production of subsistence and cash crops, if properly managed and supported, feasible on both an economically and an environmentally sustainable basis.

9.24 In terms of the national market, however, it is difficult to envisage how agricultural production in distant locations such as Rondonia could ever compete on a large scale with produce from equally or more fertile lands in areas that are far more accessible to major domestic consumption centers. If, moreover, due to the distance factor, it is impossible to overcome the natural disadvantages of the Northwest in terms of soil, climate and topography, then, in the absence of substantial government subsidies, it seems inevitable that the profit margins of commercial farmers in the region will be squeezed. Under this scenario, places like Rondonia could, nevertheless, still become a more or less privileged habitat for subsistence farmers and experiments in sustainable agriculture based on the recovery of capoeiras, etc., as well as the "extractive reserves" mentioned above. Given the patchy nature of fertile soils in Amazonia, together with the region's vulnerability to the effects of large-scale monoculture, limiting future rural settlement in the Northwest to selected areas by a comparatively reduced number of small farmers, if properly oriented and supported, appears to make both economic and ecological sense.

9.25 More generally, one observer of large-scale agricultural colonization projects in the region over the past several decades suggests that a more incremental approach to rural settlement planning should be followed given the "experimental nature of the Amazonian adventure in development."¹⁹ This proposal is compatible with the recommendation of another Amazonian researcher that "no single development option should be promoted, but rather a carefully planned mosaic of natural ecosystems and agroecosystems with different

¹⁹ Emilio F. Moran, "Colonization in the Transamazon and Rondonia," in Marianne Schmink and Charles H. Wood (eds.), Frontier Expansion in Amazonia, University of Florida Press, Gainesville, 1984, pg. 297.

intensities and types of management." ²⁰ It is likewise consistent with the strategy proposed more recently by the FAO's Interdepartmental Task Force on the Amazon, one of whose principal elements ("minimizing risks") affirms that:

because Amazon forest ecosystems are highly sensitive to modification and the flora and fauna are both extremely rich and irreplaceable, losses incurred by misguided actions will be very great. Caution must therefore be exercised in instigating any intervention in the Amazon region and, where there are doubts as to future impact on the environment or sustainability of production, preference should be given to preserving original ecosystems. ²¹

9.26 Finally, among other measures, the FAO ITFA report recommends the following guiding principles for future agricultural development in Amazonia as a whole which are also directly applicable to the Northwest:

- (i) agriculture should be concentrated on fertile upland soils and on the wide floodplains (varzeas); efforts should be directed towards devising cropping systems which mimic as far as possible the protection given by the natural forests against rainsplash, direct sun and high soil temperatures, minimizing the loss of nutrients and organic matter;
- (ii) in general, and subject to market opportunities, perennial tree crops, including trees, should be preferred to annual crops; cash crops such as coffee and cocoa can be grown on the best soils; oil palm and other palms, rubber, black pepper and other local fruit or nut crops are alternatives;
- (iii) among the annual crops, roots and tubers generally perform better than cereals and legumes, except for rice on varzeas and areas with similar soil and topographic conditions;

²⁰ Fearnside, "Development Alternatives...", op. cit., pg. 118 (emphasis OED).

²¹ FAO, "Conservation and Sustainable Development...", op. cit. para. 3.2. This document further affirms that "forms of development that increase risks of depredation should be exchanged, where practicable, for those which are less harmful... Rehabilitation of areas where ecosystems have already been disturbed should take priority over activities in previously unoccupied areas. Large-scale applications of innovations, whether technical, institutional or social, should only be proposed after their validity has been confirmed by smaller-scale precedents." (Emphasis OED) The other elements in this strategy (ibid., paras. 3.3-3.8), about which more will be said below, are: (i) reducing pressure to migrate; (ii) promoting social equity; (iii) increasing the organization and participation of target populations; (iv) defining development potentials; (v) developing adequate land use plans; and, (vi) mobilizing political will.

however, development of varzeas would require careful examination of the impact on river life; and

- (iv) achieving a reduction in deforestation rates from slash and burn agriculture depends on understanding the needs of subsistence cultivators and developing technologies which meet those needs.²²

2. Ranching

9.27 The explosive expansion of pasture land and cattle raising in the Northwest also raises the question of the future prospects of ranching activities in the region. Without going into this issue in depth here, the following points should be briefly recalled. First, ecologists generally regard cattle ranching as the potentially most damaging use of tropical forest areas from an environmental standpoint. Secondly, in the absence of substantial tax and other incentives and subsidies, large-scale ranching is generally deemed to be economically unsound in much of Amazonia. The liberal distribution of fiscal incentives during the 1970's and 1980's has clouded this issue somewhat, but poor results even in incentive-supported ranches clearly tend to corroborate this affirmation.²³ Furthermore, as shown in Chapter VI above, the rapid expansion of the area in pastures in Rondonia is associated not only with significant increases in the livestock population per se, but also often represents a form of speculation or provides a convenient way of leaving the land "on hold" in view of the current predicament of commercial agriculture in the region.

9.28 On the other hand, small family cattle herds may not only be economically feasible, but presently appear to constitute one of the principal survival strategies of small farmers in the region.²⁴ If present trends persist, however, the livestock population will continue to increase rapidly in the region, thus requiring that additional forest be converted into pasture. As a result, relatively land-extensive cattle raising, together with the contamination of regional waterways by prospecting and other activities, is probably the principal long-term threat to the physical environment in the Northwest. Specific measures are, therefore, required to increase the intensity of ranching activities in areas that have already been deforested through the

²² Ibid., paras. 4.9-4.12. This report (para. 4.16) also points out that "there is still an urgent need...for the definition of sustainable integrated farming systems for existing and new small-scale settlers." (emphasis OED)

²³ See Yokomizo, op. cit., and Susana Hecht, Richard B. Norgaard and Giorgio Possio, "The Economics of Cattle Ranching in Eastern Amazonia," Interciencia, Vol. 13, No. 5, 1988, pp. 233-240.

²⁴ See Vosti and Loker, op. cit., pg. 7. The FAO ITFA report, in turn, affirms (op. cit., paras. 4.13-4.14) that "small animals can provide valuable contributions to family food supplies and income [and that] cattle can play an important role in stabilizing and improving the incomes of small farmers and providing milk supplies to local populations."

recuperation of degraded pasture lands, to introduce improved pasture management techniques and to limit the spread of cattle in parts of the region yet to be cleared.²⁵

3. Forestry

9.29 The extraction of forest products, especially lumber, is unquestionably bringing considerable prosperity to the Northwest at present, particularly in Rondonia. As indicated in the previous chapter, however, as currently practiced, this is also an environmentally destructive and largely temporary source of wealth. Small-scale timber production in the form of salvage logging was identified by POLONOROESTE's planners, together with commercial agriculture, as one of the two main sources of income for rural settlers in the region. But the notion of sustainable development proposed by the program implied the rational exploitation of forest resources and not the largely indiscriminate and economically, as well as environmentally, wasteful short-run "mining" that is presently taking place.

9.30 The construction of penetration roads and the existence of high value hardwoods, especially mahogany, initially spurred development in this sector. However, in good measure as a result of program investments, the feeder road network, the number of towns and, hence, the number of sawmills has grown rapidly, while, as a result of decreasing transport costs, commercial interest has progressively spread to other species. Technical advances, improved road transportation and favorable market conditions, in short, have now made it possible to utilize some twenty-five species which are currently being extracted and processed locally in Rondonia for shipment south or consumption within the region. The backward and, particularly, forward linkages of lumber extraction, furthermore, appear to have played a major role in the generation of recent economic dynamism in the area, particularly in its urban centers.

9.31 Current logging practices, however, are far-removed from those originally intended by POLONOROESTE's designers, since timber extraction in the region is reportedly being carried out for the most part in a predatory manner. As a result, it is an inherently short-term and self-destructive activity in addition to one that frequently causes serious ecological damage.²⁶ Until very

²⁵ The FAO ITFA working paper (op. cit., para. 4.14) observes in this connection that "better locally-adapted technologies for pasture management, with legume strips, small applications of phosphate and mineral supplementation of cattle, are now available [and that] each country needs to assess the comparative advantage of beef production at different locations within the region versus those offered by production at other locations outside the region." (Emphasis OED)

²⁶ The FAO ITFA report (ibid., para. 1.25), for example, cites an estimate that, for every cubic meter of high value timber that is extracted from the standing forest in Amazonia, another seven cubic meters is destroyed. The report (para. 1.24) affirms, more specifically, that much of the land cleared for agricultural and ranching purposes "results in the waste of vast amounts of timber. It is estimated that on average 63 m³/ha could be utilized, half of

recently, little has been done to prevent this destruction, while virtually nothing is presently occurring in terms of reforestation.

9.32 Although on-going experiments with a variety of species could considerably shorten this time span, the regrowth of commercial trees in the region is currently estimated to require some 25 to 30 years even for species that have substantially less market value than those presently being harvested. Since nothing is being done in terms of reforestation, however, the theoretical time span for regrowth is largely irrelevant at present. Furthermore, the homogeneous nature of most forest plantations would still signify a loss in genetic diversity and wildlife habitats, as well as a likely increased susceptibility to disease. Given this situation and the fact that "much of the Amazon region will support only forest as a sustainable land use," in the specific case of Northwest Brazil, OED agrees with the FAO ITFA report's more general recommendation that, to the extent possible, "a considerable proportion of the Amazon forest lands should be set aside and protected, not only for environmental conservation, but to prevent the high rates of wastage currently involved in logging operations and agricultural development."²⁷

9.33 Finally, in a statement that is also directly applicable to the future development of the POLONOROESTE region, the FAO ITFA report affirms that:

protected areas should include a range of different types of reserves each aimed at a specific level of conservation: for example, strict biological and Indian reserves with no public access, national parks accessible to tourists and reserves where logging is prohibited, but which can be exploited either communally or individually for the extraction of forest products such as rubber, nuts, fruits, plants and game. Areas could be assigned for extractive activities, agro-forestry or wildlife farming around the more strictly preserved reserves to act as buffer zones. Plans need to include provision for identification, reservation and adequate administration of protected areas. An immediate challenge is to ensure effective protection of reserves and parks which already exist.²⁸

which consists of species which are acceptable commercially. On the 4 million ha estimated to be cleared annually this translates into totals of 240 m3 and 120 m3 respectively. By contrast, total roundwood production from the Amazon in something on the order of 35 million m3, most of it from Brazil."

²⁷ Ibid., para. 4.3 (emphasis OED).

²⁸ Ibid., para. 4.3 (emphasis OED). This is particularly important, moreover, in light of several of the main conclusions of a recently published study on protected areas, specifically: (i) few protected areas are "privately beneficial" and thereby protected and managed by individuals; (ii) establishment of protected areas does not ensure that these areas will be effectively protected; and, (iii) the costs and benefits of protection are often not

4. Mining and Prospecting

9.34 The other major activity that accounts for much of Rondonia's and, to a lesser extent, northwestern Mato Grosso's recent prosperity and which, like commercial logging, was not explicitly considered in the preparation and appraisal of POLONOROESTE, is mineral extraction. Cassiterite mines were already in operation in Rondonia prior to the program's inception, but improved access within the region has led to the discovery and commercial exploitation of additional sites such that production is now at an all-time high. Even more important in the present context is gold prospecting, which has bloomed into a large-scale, capital, as well as labor, intensive activity. Altogether, some estimates set the number of people directly employed in mining and prospecting activities in the region at more than 150,000. The number of those indirectly dependent on these activities may be even greater.

9.35 The future prospects and probable duration of such activities, however, are difficult to foresee. It is quite possible that the intensity of regional mining and prospecting activities could actually increase in the short run with both an increase in their local economic multiplier effects and even more serious consequences for the physical environment. Federal government attempts at forcefully evicting garimpeiros from Amerindian and other reserve lands in the Northwest and elsewhere in Amazonia have thus far met with little real success and, unless a concerted effort backed by strong national and international public opinion is launched in the near future, the likely long-run tendency is for mineral resources to be depleted and the immediately surrounding and downstream areas to be further degraded.²⁹

9.36 Clearly, therefore, any future development initiatives aimed at improving natural resource management and environmental quality in the Northwest region must necessarily include a substantial reduction of the adverse environmental consequences of extractive activities. Such initiatives should dedicate considerable attention to limiting and controlling mercury

distributed equally, thereby leading to management problems. See John A. Dixon and Paul B. Sherman, Economics of Protected Areas: A New Look at Benefits and Costs, Island Press, Washington, 1990, especially Chapter 10.

²⁹ In its observations on the preliminary draft of this report, DNPM affirms that: "the future of mining activities in Rondonia and their relation with POLONOROESTE will depend essentially on three factors: (a) actions by the federal, state, and municipal governments with regard to inspection, control, and the implementation of measures -- including taxes and incentives -- to stimulate or discourage these activities; (b) identification of the mineral potential of the state beyond that which is already known, either through systematic studies undertaken by the Government or by chance (ie. fortuitous discoveries of new high quality/low cost deposits of gold, cassiterite or other minerals); (c) the results of short and medium-term government economic policies and their greater or lesser success in guaranteeing minimum survival conditions for the low-income population, including the generation or expansion of other economic activities which are capable of attracting the prospectors."

contamination and other forms of environmental damage directly associated with on-going mining and prospecting activities. Furthermore, the "polluter pays" principle, whereby those responsible are charged in direct proportion to their contribution to environmental degradation, should be rigorously applied in order to obtain the resources necessary to carry out corrective and/or mitigatory actions.³⁰ More generally, every effort should be made, through the application of pollution taxes and other mechanisms, to increase state and local fiscal revenues from both mineral and forest extractive activities in the region. Part of any such revenues should be utilized to finance environmental protection per se (eg. water pollution control, institutional strengthening of environmental agencies, etc.), while part could be used to help support environmentally less damaging and more sustainable rural development activities, including reforestation and the recuperation of degraded pasture lands.³¹

5. Industry and Services

9.37 The industrial and service activity generated directly (linkages) and indirectly (multiplier effects) by the rapid expansion of extractive activities, together with that resulting from increased public expenditures stimulated in good measure by POLONOROESTE's efforts to consolidate occupation of the region, should also not be overlooked. While, on the one hand, many early rural settlers brought some capital into the area, program resources and other government investments have created thousands of new jobs in construction and services. Both factors provided an incentive for other commercial, industrial and financial establishments to set up operation and/or expand in the Northwest. Even though the economic benefits of such direct and indirect employment generation within the region have been substantial, by the same token, any abrupt stoppage of extractive activities or any major reduction in public expenditure flows are also likely to have a depressive effect on employment crisis in the region.

9.38 As described elsewhere in this report, the rapid expansion of secondary and tertiary activities in the Northwest has been associated with equally rapid rates of urban growth, as well as the proliferation of urban

³⁰ On the "polluter pays" principal and the use of economic instruments for environmental protection in general, see OECD, Economic Instruments for Environmental Protection, Paris, 1989.

³¹ In its comments on the previous version of this report, DNPM observes that "at the level of the enterprises, the principle that the polluter should pay for environmental degradation is assured by the Constitution, such that its effectiveness will depend on the greater or lesser vigor with which it is applied by IBAMA or the state environmental agency. This question, however, becomes more serious with respect to prospecting activities due to the incipient technical level of the cooperatives and the cultural dispreparedness, nomadic character and low awareness of the prospectors, whether in relation to the nation's mineral patrimony or in relation to the environment, as well as their philosophy of making a fortune in the shortest time possible regardless of the consequences. In this case, we must be realistic, the onus of environmental degradation in the short run will remain with the Government."

environmental problems, not the least of which are inadequate basic sanitation and increasing pollution of local waterways by domestic sewage, sawmills and other raw material processing industries. As also indicated above, however, POLONOROESTE's potential urban development, and hence urban environmental, impacts were largely ignored at the time of program preparation and appraisal. Given the increasing concentration of population and productive activities in its towns and cities, future efforts to improve environmental protection and natural resource management in the region should give priority attention to urban, as well as rural, environmental issues.

9.39 In summary, considerable economic activity has been created or stimulated, directly or indirectly, as a result of POLONOROESTE. However, since both types of extractive activities that currently "drive" much of the region's economy, especially logging, are inherently limited in time span, longer-term prospects for sustained economic development of the region are uncertain. In addition, the continuation of direct and indirect transfers of public resources to the region is ultimately subject to fluctuations in national political and external, including multilateral, support. By contrast, the ecological damage wrought by both mining and logging activities, as well as by the agro-livestock sector as a whole, may well be considerably more long-lasting.

E. Alternative Paths for the Region

9.40 Despite these prospects, considerable divergence continues to exist between "developmentalists" and "environmentalists" with respect to the future of the Northwest region. In Brazil, the former frequently tend to regard the forest as an obstacle to progress and consider any attempt to restrict full exploitation of the region's natural resources as inconsistent with the need to promote its continued economic growth. Nonetheless, they are hard put to identify any long-term and clearly sustainable economic activities that would be capable of absorbing an increasing population without leading to further environmental damage to the region.

9.41 At the other extreme, environmentalists sometimes tend to view the forest as a sacred preserve and the indigenous populations as its natural preservers. Given the existing economic and political importance of logging, mining and ranching interests in the region, however, it would seem that the realistic possibilities of enforcing this vision are also limited. Furthermore, the presence of some 2 to 3 million people, many of whom were initially attracted to the Northwest by government propaganda and expenditure, seems to require that some level of continued federal attention be given to the area. The problem is that further investments in support of regional development may only attract additional migration and, thus, further activate the need for public intervention, as well as magnifying existing environmental problems.

9.42 Within the context of this dilemma, three alternative (but not mutually exclusive) paths seem to present themselves, none of which involves explicit attempts to attract further population to the region. The choice between these alternatives should ultimately be made on the basis of ecological/social criteria and the answers to the following questions: How important is it to retain population in northwestern Mato Grosso and Rondonia and how

critical are the present level and rate of deforestation and environmental degradation in the area?

9.43 If it is judged that the present social situation is calamitous, but that the ecological situation permits a certain leeway, then a first alternative would be to attempt to productively settle the current regional population in a less predatory manner. Attempts should then be made to define and implement measures which would make small-scale agricultural production more feasible and sustainable, at least during the short and medium run, including many of those mentioned in section D.1 above. In any event, these measures would necessarily involve technological solutions with respect to productivity levels, proper crop mix,³² the utilization of more adequate tree crops, recuperation of capoeiras, a solution for the commercial utilization of the babacu palm (which abounds in the region), training in the more effective management of forest resources, as well as more associative forms of production and commercialization.

9.44 A second alternative would be directed more to environmental conservation, without explicitly discarding or discouraging further agricultural, mining or lumber activities per se. It would involve a three-pronged effort directed to massive re-education of existing residents in the POLONOROESTE region with respect to environmental issues and management, arresting further migration to the area and aggressively enforcing anti-environmental abuses. These three measures would admittedly be difficult to implement but, collectively, they should be taken as an emergency program to reduce poverty levels and minimize additional environmental degradation.

9.45 Immediate re-education of rural residents in northwestern Mato Grosso and Rondonia, more specifically, would emphasize the rational and integrated management of natural resources at the farm level, for which proven working experiences would have to be further developed, as well as the reinforcement of associative and cooperative groups.³³ Arresting migration flows, in turn, would involve public information campaigns on television and radio, publicizing the region's ecological problems and the longer-run limitations on its economic opportunities. To make this more credible,

³² Changes introduced in POLONOROESTE's rural development components after the suspension of disbursements in 1985 have clearly already moved in this direction for those farmers directly affected by the program. This approach, however, needs to be extended to other small producers in the region.

³³ The latter also coincides with one of the key elements of the FAO ITFA's proposed development strategy for Amazonia as a whole, the organization and participation of target populations. According to the Task Force's report (para. 3.5), more specifically, "programs aimed at promoting sustainable development should provide for the organization of target populations in associations or groups. This is necessary both to enable communities to participate in the planning, implementation and management of actions affecting their localities and to rationalize provision of supporting services to large numbers of small independent units. Projects should thus be developed locally, ensuring they are compatible both with the resource endowment and the aspirations of the populations of each sub-area." (Emphasis OED)

lumbering and prospecting activities would have to be carefully controlled. The enforcement of anti-environment abuses, finally, would require an extensive strengthening of the entire public sector institutional apparatus in the area, reinforcement of state environmental agencies in particular and a substantial increase in the wages of law enforcers, possibly through some form of participation in all fines and other penalties applied.

9.46 The third alternative would be for both national and international agencies to undertake a concerted campaign to enforce the curtailment of further penetration and predatory natural resource exploitation in the region. The premise underlying this approach is that, unless such an effort is made soon, it is likely that the present tendency of rapid deforestation and the encroachment of existing biological and Amerindian reserves will continue largely unabated until little of these areas is left. It is also assumed that any attempt by state and local governments to accommodate a significant number of additional farmers in the Northwest would necessarily involve or require the further expansion and/or improvement of roads, the continued influx of population, the need to clear substantial additional areas both for agroranching and timber extraction purposes, the expansion of ancillary activities and, ultimately, the persisting devastation of forest and savannah lands. In this light, the only real alternative is to begin facing the need for the rationalization and control of extractive and unsustainable agricultural activities and the further reduction of migration to the area.

F. Interregional Dimensions

9.47 Recognition of the inherent limitations on human carrying capacity and sustainable rural development in the Northwest serves to reassert the fundamental linkages between the problems of Brazil's various regions. As indicated in Annex I, in Brazil, frontier settlement has traditionally been looked upon and used, albeit from a long-term perspective largely unsuccessfully, as an "escape valve" for demographic and social pressures generated in other parts of the country, some of which have been created or greatly exacerbated by public policy initiatives such as agricultural export promotion in the 1970's and 1980's. While this safety valve mechanism worked to some extent in the past, particularly in northern and western Parana from the 1940's through the 1960's, rarely have frontier "booms" proven capable of absorbing large amounts of rural population for more than a decade or two. Furthermore, given the fact that more privileged frontier areas, both in terms of soils and location, have already been occupied and that the size of the "surplus" populations dislocated from rapidly transforming rural areas increased substantially during the 1970's and 1980's, the "frontier solution" now appears to be increasingly ineffective even in the short run.

9.48 Figures cited elsewhere in this report indicated a rural exodus on the order of 15.6 million people during the 1970's alone. Given the dimensions of this flow, the attempt to solve the problem of "excess" population created by intense agricultural modernization coupled with rapid rural population growth by stimulating migration to Amazonia was doomed from the start. The earlier Transamazon experience, in which a top-down planned settlement approach was applied to an area whose soils were essentially incapable of supporting agricultural development, was particularly unrewarding in this connection.

9.49 But even in Rondonia, where official concern with supporting small-scale farmers intensified after directed colonization efforts in eastern Amazonia were abandoned in the mid-1970's, the disparity between the demand for land and the possibilities of introducing sustainable rural settlement was overwhelming. The fact that technical and judgment errors were made with respect to such crucial variables as the extent of fertile soils and the distance-to-market factor only aggravated this underlying disequilibrium. Altogether, less than half a million rural migrants were absorbed in the entire Amazon region during the 1970's, while the great majority of the population leaving rural areas in other parts of Brazil ended up in towns and cities, with the largest metropolitan centers being most affected in the process.

9.50 It seems very unlikely, therefore, that any technical solution capable of generating sustained employment and income for a sizeable population in tropical forest areas in western Amazonia will be forthcoming in the foreseeable future.³⁴ Given the precedent created by efforts to resolve socio-economic problems in the Northwest -- which, among other distortions, bestowed a level of official attention and expenditures upon the region's inhabitants that needy populations outside the program area generally did not receive -- and despite decreasing demographic pressures on the frontier in general and Rondonia in particular, any significant additional infrastructure investments are, nevertheless, likely to attract some further migration. Such considerations, in short, accentuate the need to refocus development strategies and solutions on areas having greater comparative advantage and larger inherent carrying capacities than outlying tropical regions such as the Northwest which, as a result, are often also relatively more susceptible to ecological disaster.

9.51 In other words, the experience in the Northwest and in Brazilian Amazonia, more generally, points to the need both to deal directly with the underlying demographic and socio-economic problems which ultimately can not be resolved by attempts to settle the frontier and to consider any proposed regional development effort in a broader interregional, or national spatial policies, framework. Over the long-run, any persisting demographic pressures should be dealt with through adequate national population policies and programs.³⁵

³⁴ Fortunately, however, due to generally declining rural population growth rates over the past decade and the fact that most of the areas (outside the Northeast) where population densities were formerly high have already been transformed in terms of their land use, technology and tenure patterns, the potential stock of rural migrants has probably diminished significantly in comparison with that in the 1970's and 1980's, meaning that likely future demographic pressures on the frontier have also lessened. See Schneider, *op. cit.*, especially Annex I, for further details.

³⁵ As Kirchner, et. al. (*op. cit.*, pg. 85) conclude, "populations cannot be sustained beyond the carrying capacities of their regions. To develop sustainably, countries have only two viable choices. First they can act to lower their population growth rates, through measures such as family planning. Second, they can seek to expand sustainably their carrying capacities. While both options are necessary for most developing countries to bring their populations

Over the short, medium and long run, furthermore, such pressures should be dealt with by attacking their underlying structural causes, such as poor land distribution and distorted agricultural modernization policies, as well as by consciously seeking to increase rural and urban employment generation in the migrants' regions of origin and other areas (eg. the carrados in the Brazilian case) which possess greater holding capacities than those presently covered by tropical forest.

9.52 The need to develop and implement policies aimed at reducing pressures to migrate to tropical areas that have inherently low carrying capacities such as northwestern Mato Grosso and Rondonia has been explicitly recognized both in a recent Bank study of the Ecuadorian portion of the region and by the FAO's Interdepartmental Task Force on the Amazon. The conclusions and recommendations of these reports are of direct relevance for future planning and development activities in the Brazilian portion of Amazonia and for the Northwest region in particular. The former of these two documents observes, for example, that:

[T]he Amazon population [in Ecuador] has been growing at almost 5.0 percent per year. If this trend persists, and the fragility of the Amazon Region's natural resources is not properly recognized, the Amazon Region may be projected to absorb a significant part of the next generation's population growth. Furthermore, under existing and currently foreseen technology, rapid population growth in the region founded on agricultural, cattle, timber and mining activities would result in: (a) irreversible loss of the region's renewable and non-renewable resources and of their potential to produce regional and national economic benefits; (b) diminishing returns of economic activities over time as the fragile resource base is depleted; (c) social conflicts between indigenous and migrant populations; and, (d) eventually, reverse migration as people must abandon the then resource-poor Amazon Region, thus contributing to even greater population pressures in non-Amazon Regions.

If the results noted above are to be avoided, policy and actions at the national and regional scales are required. At the national level, policies directed at: (a) expanding economic opportunities (and therefore population carrying capacity) country-wide, but especially in the [non-Amazonian] Costa and Sierra Regions and (b) reducing the national rate of population growth are indicated. These would require a long time to show significant effects, however. In the meantime, other national efforts would be necessary and one, or a combination, of the following may be explored as a preferred alternative to rapid agricultural settlement of the [Amazonian] region: (a) significant increases in productivity of existing agricultural areas located in the Sierra and Costa Regions;

into a sustainable balance with their natural resource base, the former option has often received less attention than the latter. Moreover, because carrying capacity cannot be increased forever, pursuing the second policy at best only delays the need to adopt the first."

(b) expansion of agricultural areas outside the Amazon Region, especially the Costa Region; and (c) significant expansion of the urban labor market in the Sierra and Costa Regions. ³⁶

9.53 The FAO ITFA report, in turn, recommends that "more systematic efforts by governments to improve the equity of land access outside the region, to intensify agriculture in the areas of origin of migrants, to raise agricultural profitability in these areas and to create jobs both in the rural and urban sectors, could do much to take the pressure off the Amazon region." The report notes, moreover, that "where areas of origin of migrants have greater comparative advantage for agricultural production, such efforts may represent a better economic use of scarce government resources than further financing of interventions within the Amazon region itself." ³⁷ In short, both efficiency and equity, as well as environmental, considerations suggest that any future attempt to promote the occupation or settlement of tropical frontier areas such as Northwest Brazil should first be assessed in terms of the comparative costs and benefits of seeking to achieve the principal social and economic objectives expected to be served by any such intervention (eg. the absorption of surplus rural population, increases in agricultural output, etc.) through alternative means and in alternative locations.

9.54 Before deciding to support major investment projects in frontier areas, and particularly in tropical frontier areas, accordingly, the Bank should carefully assess other options in other parts of the country which might provide both a more effective way of meeting the same goals in an economic and social sense and/or a less costly way of doing so in environmental terms. National governments should likewise critically examine any proposal to open up ecologically vulnerable tropical areas in terms of its probable long-run costs with respect to the country's natural capital stock (and, thus, to its future generations), as well as the possible short-term gains to be obtained from exploiting the regional resource base in what is likely to be an unsustainable manner. ³⁸ In any event, frontier region development, whether in tropical or non-tropical areas, should be explicitly assessed in both an economic and an environmental cost-benefit sense, as well as in the context of a larger set of spatial and sectoral development alternatives such as those indicated for the Ecuadorian case above.

³⁶ James Hicks et. al., Ecuador's Amazon Region..., op. cit., Executive Summary, paras. 8-9 (emphasis OED). The Amazon region of Ecuador accounts for about half of the country's territory, but contained only 4% of its population in 1982, while the Costa (or coastal) and Sierra (or highlands) regions held about 49% and 47% of the national population, respectively, in that year.

³⁷ FAO, "Conservation and Sustainable Development...", op. cit., para. 3.3 (emphasis in the original).

³⁸ In this context, the recent work by Richard Norgaard for the Bank's Asia Region on "sustainability as intergenerational equity" is of direct relevance. See Norgaard's preliminary paper with this title (January 1991) for additional details.

9.55 While it is certainly true that market forces may still lead over time to the exploitation of natural resources, including timber and soils as well as minerals, in previously unsettled tropical regions, to the extent that the public sector does not actively encourage migration to, and agricultural and ranching activities in, such areas through massive land giveaways, infrastructure investments and fiscal, credit and other forms of subsidy, it is likely that the environmental costs of this process will be considerably lower than in the presence of such interventions. In any event, rural settlement in tropical areas that do not demonstrably possess the capacity to sustain agricultural and/ or ranching activity over the long term on the basis of present levels of technology and foreseeable market conditions should be actively discouraged. Under no circumstances, should rural settlement be stimulated in such areas in the absence of detailed and reliable natural resource surveys and adequate and enforceable environmental controls. Furthermore, in those cases where market forces lead to results which are undesirable from a broader social or environmental (including intergenerational and/or international) standpoint (ie. in cases of "market failure"), as proposed by the FAO ITFA report, pricing and taxation policies should be consciously and consistently used to discourage such outcomes.

G. Conclusion

9.56 One important lesson from the POLONOROESTE experience, in synthesis, is that, prior to promoting or supporting large-scale agricultural occupation or other forms of potentially extensive natural resource-depleting productive activities in tropical areas, alternative approaches and strategies involving other parts of the country that possess more favorable conditions in terms of long-term carrying capacity and/or existing market access should first be carefully explored. More generally, plans to "develop" any particular region or subregion, especially when the area in question is known to be ecologically sensitive or vital, should be assessed in terms of a truly national (in the sense of multi-regional) set of spatial and sectoral policy options, as well as in terms of existing natural, human, institutional and other resource constraints of the region or subregion in question. The implications of this and other environmentally-relevant lessons of the POLONOROESTE experience for future Bank country policy dialogue and economic and sector work and for the preparation, appraisal and supervision of future Bank-assisted investment projects will be further explored in the next chapter.

X. LEGACIES AND LESSONS OF POLONOROESTE

A. Introduction

10.01 As the previous chapters have attempted to illustrate, POLONOROESTE has had significant direct and indirect impacts on the human and physical environments in Northwest Brazil over the past decade. Even though many of these impacts have been negative, the program and its consequences have also contributed to a number of important and potentially very positive institutional and policy changes both in Brazil and within the Bank. They have likewise spawned several specific follow-on operations that have either already received or may eventually receive the support of multi-lateral lenders, most notably the Bank.

10.02 This concluding chapter will briefly survey the program's most important institutional and policy impacts. It will then indicate the principal lessons that can be drawn from the POLONOROESTE experience to date in terms of program planning and design on the one hand and program execution and supervision on the other. The chapter will also summarize the major implications of this experience for Bank activities and procedures in similar situations with respect to country policy dialogue and economic and sector work (ESW) and project identification, preparation, appraisal, monitoring, supervision and evaluation. Finally, it will indicate the general areas where additional research including impact evaluation is necessary.

B. Institutional and Policy Impacts and Follow-on Projects

10.03 POLONOROESTE and its effects on the environment in the Northwest have directly contributed to institutional and policy changes both in Brazil and in the Bank itself. While the program and its consequences in most cases were not the exclusive causes of such changes, the former have unquestionably played a role in the occurrence of the latter. These changes, furthermore, reflect both positive and negative aspects of POLONOROESTE's implementation performance and results, especially its environmental results. In addition, POLONOROESTE and associated developments in northwestern Mato Grosso and Rondonia have been at least partially responsible for two Bank-supported follow-on operations involving parts or all of the program region, together with other parts of Brazil, while two additional projects are currently under preparation.

1. Impacts in Brazil

10.04 Three different kinds of institutional change associated with the program inside the Northwest region itself should be briefly mentioned. One refers to the formal creation and subsequent internal organization of the state of Rondonia which took place shortly after the first three Bank loans for POLONOROESTE were approved in December 1981. The second concerns the establishment of several new institutions in connection with implementation of the program par se, especially following the mid-term review and suspension of disbursements in 1984-85. The third involves the creation of a large number of

new municipalities in northwestern Mato Grosso and Rondonia, both during the period when the program was under preparation and more recently.¹

10.05 As suggested in earlier chapters, one of the main impulses behind pavement of the BR-364 highway and parallel efforts to accelerate and expand directed rural settlement in Rondonia was the desire on the part of the federal administration that took office in March 1979 to transform the Territory into a state. This aspiration was enthusiastically endorsed and pursued by the newly-appointed Territorial Governor, who reversed the earlier policy of discouraging migration to the area, first through the proposed expansion and improvement of its physical, especially transport, infrastructure, rural land distribution and agricultural support and social services and later through the active recruitment of new settlers from other parts of the country. As a result, within Rondonia, POLONOROESTE was seen simultaneously as, and in effect became, a vehicle both for facilitating the attainment of statehood and obtaining autonomy from direct federal control and for guaranteeing a substantial flow of federal transfers to the area. At least in the latter respect, the situation was similar in Mato Grosso which had itself only recently become a state apart from Mato Grosso do Sul at the time the program was identified and, like Rondonia, was then highly dependent on federal revenue transfers.

10.06 Several key institutions, furthermore, were created at the territorial or state level in connection with the program, particularly in Rondonia. One of these, CODARON, the state development company and program coordinating agency, was later abruptly abolished for internal political reasons shortly before the Bank's mid-term review, leaving POLONOROESTE without clear leadership and direction in Rondonia for a period of time. After the mid-term review, in turn, and largely at the Bank's insistence, a forestry development and environmental protection agency, the State Forestry Institute (IEF), was also established in Rondonia. Unlike CODARON, however, this entity still exists and presently forms part of the network of state environmental protection agencies in Brazil. As noted in Chapter V, several other environmental institutions or advisory councils were also created and/or supported at the state level with Bank assistance during the latter stages of the program.

10.07 Reflecting the dynamics of its population growth and settlement patterns which were stimulated in good measure by POLONOROESTE, the number of municipios, or local governments, in the program region and particularly in Rondonia has grown very substantially over the past decade or so. Soon after the program was identified in 1979, the number of local jurisdictions in northwestern Mato Grosso increased from ten to sixteen due to the subdivision of three of the original municipalities (Caceres, Vila Bela and Mirassol d'Oeste) in the area. In Rondonia, in turn, while there were only two very large municipalities (Porto Velho and Guajara-Mirim) in 1970, ten years later the number had increased to seven with the creation of Ariquemes, Cacoal, Ji-Parana, Pimenta Bueno and Vilhena, all of which had their administrative centers located

¹ In addition to the creation of new institutions and municipalities in connection with POLONOROESTE, it should be noted that the new federal administration which took office in March 1990 immediately abolished at least one of the agencies that played a key role in the program's execution, SUDECO.

in rapidly growing towns along the still unpaved Cuiaba-Porto Velho highway. Due to further dismemberments, the number of municípios in Rondonia increased to twenty-three by 1989. Several of the newest municipalities such as Machadinho, additionally, have come about as the direct result of official colonization activities supported under POLONOROESTE, while all of these units reflect the rapid rural and urban settlement occurring in the state over the past decade.

10.08 One of the program's indirect institutional impacts, accordingly, has been to contribute to the proliferation of new municipal jurisdictions and local government units in Northwest Brazil, especially in the state of Rondonia, which was itself in part an institutional by-product of the program. The rapid formation of new municipal governments in the region, however, was not explicitly foreseen by POLONOROESTE's planners, nor did program design include specific actions or resources to support the creation, administrative organization, financial management and/or on-going operation of these units. Since the role of municipal governments in both the planning, financing and provision of many basic services and in controlling rural and urban land use is an important one, especially in light of the decentralization measures incorporated in the new Constitution adopted by the Brazilian Congress in October 1988,² any future Bank-supported projects in the region should include the more active participation of the affected local governments, together with that of the target beneficiary populations themselves, in the design and implementation of these interventions. They should likewise dedicate particular attention to local government needs for institutional and financial strengthening in areas related to environmental sanitation, management and control.

10.09 At the federal government level, in turn, POLONOROESTE and its environmental effects have also contributed to important recent policy and institutional changes. These changes have occurred at least partially in response to significant media and non-governmental organization (NGO) pressures both inside and outside Brazil in response to the increasing clearing and burning of Amazonian forest areas, particularly in Rondonia, together with the associated impact of frontier occupation on Amerindian populations and other traditional communities, especially rubber tappers. External pressures and media attention, while building up throughout the 1980's, increased sharply in connection with the growing concern over possible global climate change and the role of tropical deforest clearing in this process following the unusually hot and dry summer experienced in large parts of the northern hemisphere in 1988. They were further accentuated in reaction to the assassination of the rubber tapper leader and environmental activist, Chico Mendes, in the neighboring state of Acre in December of the same year.³

² On the specific functions, powers and responsibilities of the municipalities under the new Constitution, see Edgar Bastos de Souza, O Município na Constituição de 1988, IPEA/IPLAN, Brasília, 1989.

³ Largely as a result of these events, since 1988 there has been a very rapidly growing literature on these issues both inside and outside Brazil. Within Brazil, for example, two major national news and features publications, Veja and Manchete, produced special issues on Amazonia in June and September

10.10 The Brazilian Government's response to these pressures has been two-fold. The initial reaction was the highly publicized launching of a new environmental action program entitled "Nossa Natureza" (or "Our Nature") by then President Sarney in October 1988. Much of the nationally televised presidential address announcing the program was given over to defending Brazil's previous achievements in the environmental arena including the establishment and/or regularization of ecological and Amerindian reserves in Rondonia which, although this was not explicitly mentioned, occurred under the auspices of POLONOROESTE. More importantly, however, certain concrete environmental protection measures were taken in connection with the new program including an immediate, but initially temporary, suspension of fiscal incentives for new agriculture and ranching projects in forested parts of Amazonia⁴ and an intensification of official efforts to monitor and control forest burning in the region, especially Rondonia, in part using reallocated resources from the Bank-supported Phase I Agricultural Development and Environmental Protection Project.⁵

10.11 The second major reaction was the merger of several existing federal agencies that had previously dealt with different aspects of natural resource management and environmental protection to form a single new entity, the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA),

1989, respectively. Outside Brazil, in addition to the December 19⁸⁸ National Geographic Magazine pieces on the environmental effects of recent settlement in Rondonia and the Uru-eu-wau-wau Indians (op. cit.), Newsweek magazine's international edition of January 30, 1989 carried a cover article entitled "Amazonia in Peril: The World's Biggest Rain Forest Is Shrinking Fast," while Time (September 18, 1989) and The Economist (September 9-15, 1989) featured nearly simultaneous cover stories entitled "Torching the Amazon: Can the Rain Forest be Saved?" and "The Month Amazonia Burns," respectively. Recent books on the subject, in turn, include: Susana Hecht and Alexander Cockburn, The Fate of the Forest: Developers, Destroyers and Defenders of the Amazon Rain Forest, Verso, London, 1989; Andrew Revkin, The Burning Season: The Murder of Chico Mendes and the Fight for the Amazon Rain Forest, Houghton Mifflin Co., Boston, 1990; Alex Shoumatoff, The World is Burning, Little, Brown and Co., Boston, 1990; and Adrian Cowell, The Decade of Destruction: The Crusade to Save the Amazon Rain Forest, Henry Holt & Co., New York, 1990. The latter is also the name of a five hour public television series produced by the same author on the same subject and first aired in the United States in mid-September 1990.

⁴ Under the Sarney administration this temporary suspension was later extended. Soon after taking office in March 1990, the current Brazilian President, Fernando Collor de Melo, in turn, further extended the suspension of all fiscal incentives for regional development activities pending further study, but, more recently, has proposed their revision. The environmental implications of the proposed revisions have yet to be fully analyzed.

⁵ As previously noted, however, most of the observed decrease in forest burning in Rondonia in 1989 appears to have been due to favorable weather conditions (ie. a longer than normal rainy season) rather than to increased government monitoring and control.

under the Ministry of the Interior, in January 1989.⁶ The most recent institutional milestone, finally, has been the creation of a Secretariat of the Environment within the Presidency itself by the recently-installed Collor de Melo government in March 1990. A prominent Brazilian ecologist was appointed as the first Secretary of the Environment⁷ and IBAMA was transferred from the Ministry of the Interior, which was abolished, to the new Secretariat. On the policy front, in turn, the new administration thus far appears to be taking considerably greater interest in environmental matters than its predecessors. Although it is still unclear how this increased environmental concern on the part of the federal government will affect future developments in the Northwest region, it should be observed that a "natural resource management" project proposed by the Government of Rondonia has been retained by in-coming federal environmental authorities for further review prior to being submitted to the Bank's Board of Directors for possible financing.

2. Impacts within the Bank

10.12 POLONOROESTE and its environmental consequences likewise appear to have exerted considerable influence on and within the Bank itself. As indicated in the previous chapter, the program had an immediate policy impact with respect to tribal peoples protection since the Bank's operational guidelines in this area were a direct outgrowth of its experience in appraising the Amerindian protection component of the program. The Operational Manual Statement on tribal peoples in Bank-financed projects (OMS 2.34) was issued in February 1982. It was largely based on a background report first circulated inside the Bank in July 1981 and later published in May 1982 under the title Economic Development and Tribal Peoples: Human Ecologic Considerations. One of the first applications of this policy was in connection with the Carajás Iron Ore Project in Brazil, approved in August 1982, which, like POLONOROESTE, contained a non-Bank-financed Amerindian Special Project.

10.13 Subsequent Bank environmental policies and guidelines, including OMS 2.46 ("Environmental Aspects of Bank Work"), dated May 1984, and Operational Policy Note (OPN) 11.02 ("Wildlands: Their Protection and Management in Economic

⁶ As noted in an earlier chapter, the agencies that were merged to form IBAMA included several that were directly involved in the execution of POLONOROESTE, specifically: (i) the Special Secretariat of the Environment (SEMA) of the Ministry of the Interior; (ii) the Brazilian Institute of Forestry Development (IBDF); and (iii) the Superintendency for the Development of Rubber (SUDHEVEA). The former Superintendency for the Development of Fisheries (SUDEPE) was also included in the new national environmental agency.

⁷ Interestingly, this ecologist, Jose Lutzenberger, was one of the persons who testified before the Subcommittee on Natural Resources, Agricultural Research and the Environment of the United States House of Representatives' Committee on Science and Technology on September 19, 1984 with respect to the adverse environmental impacts of POLONOROESTE. In the conclusion to his testimony, Mr. Lutzenberger specifically affirmed: "on behalf of the environmental groups of Brazil, I call on the [World] Bank to stop the [BR-364] road and re-think its policy on Rondonia."

Development") of June 1986, were also influenced by POLONOROESTE. The latter of these statements specifically lists parts of Brazilian Amazonia (including the Amazon River itself and associated wetlands), as well as the Pantanal swamplands in Mato Grosso, among the tropical wildlands and aquatic areas of particular concern to the Bank. Like the tribal peoples policy, the wildlands policy was further elaborated by a more detailed document having the same title as the aforementioned OPN.⁸ This latter publication specifically mentions both the Northwest I Agricultural Development and Environmental Protection Project and the Carajas Iron Ore Project as examples of Bank-assisted operations containing specific wildland management components.⁹

10.14 More generally, it can be argued that POLONOROESTE also played a role in that part of the Bank's July 1987 reorganization which resulted in the creation of an Environment Department within the then Policy, Planning and Research (PPR) -- now Policy, Research and External Relations (PRE) -- Senior Vice Presidency and Environment Divisions within each of the four regional Technical Departments, as well as in a significant increase in the Bank's environmental staff and the formalization and strengthening of its environmental impact assessment procedures. These major organizational and operational changes came about at least partly as the result of increased pressures on the Bank by member country governments and NGOs in reaction to the adverse environmental impacts of a number of large Bank-financed projects over the preceding decade. POLONOROESTE was one of the most frequent cases of "environmental mismanagement" in Bank-assisted operations cited by these groups.¹⁰ In addition, POLONOROESTE was specifically referred to by Bank President Conable, in a speech to the Washington-based World Resources Institute in May 1987 during which many of the

⁸ George Ledec and Robert Goodland, Wildlands: Their Protection and Management in Economic Development, World Bank, Washington, 1988.

⁹ With respect to POLONOROESTE, however, the report (*ibid.*, pg. 129) acknowledges that "implementation of the wildland component lagged seriously behind other components...[and] unless unplanned settlement and illicit timber extraction are effectively controlled, the long-term integrity of some of the [wildland management areas] may be in doubt."

¹⁰ See, for instance, the Sierra Club publication entitled Bankrolling Disasters: International Development Banks and the Global Environment (San Francisco, 1986) for an example of the ways in which environmental NGOs have criticized Bank support of large investment projects, including POLONOROESTE, perceived to have resulted in adverse impacts on tribal peoples and/or the natural environment. The cover of this particular document, in fact, consists largely of a photograph of a recently deforested area in Rondonia. The other Bank-assisted operations cited in this publication were the Narmada Valley Dam Project in India, the Transmigration Program in Indonesia and a beef export project in Botswana. For a more detailed critical discussion of the social and environmental impacts of most of these same operations, including POLONOROESTE, see Graham Searle, Major World Bank Projects: Their Impact on People, Society and the Environment, Wadebridge Ecological Centre, United Kingdom, 1987.

above mentioned institutional changes were announced, as one of the cases where the Bank itself had been part of the environmental "problem" in the past. ¹¹

10.15 The adverse environmental consequences of POLONOROESTE had, in fact, drawn the attention of a broad coalition of American, European, Brazilian and other environmental groups, ¹² as well as of the United States Congress and, through its instigation, the United States Treasury Department, at least since the fall of 1984. As already noted, a United States House of Representatives' Subcommittee on Natural Resources, Agriculture Research and Environment held specific hearings on the program in mid-September 1984. ¹³ Less than a month later, then World Bank President Clausen received a letter signed by Brazilian and German parliamentarians and representatives of more than twenty-five NGOs from around the world expressing "grave concern...over disturbing evidence of the consequences of the continued neglect of sound management of natural resources and protection of indigenous peoples in the design and implementation of World Bank projects," most notably POLONOROESTE. ¹⁴

¹¹ In this address, President Conable characterized the program in the following terms: "POLONOROESTE [is] a sobering example of an environmentally sound effort which went wrong. The Bank misread the human, institutional and physical realities of the jungle and the frontier. In some cases, the dynamics of the frontier got out of control. Protective measures to shelter fragile land and tribal people were included; they were not, however, carefully timed or adequately monitored." (Emphasis OED)

¹² In an article entitled "Environmental Reform and the Multilateral Banks," (World Policy, Vol. V, No. 2, Spring 1988, pp. 301-321), Pat Aufderheide and Bruce Rich affirm (pg. 306) that "mindful of the limitations of [earlier ad hoc attempts to influence] the basic policy orientation of the multilateral development banks...[environmental NGOs have built] a coalition that includes not only U.S. environmental groups, but European and Third World organizations as well." The article likewise claims (pg. 308) that "environmental organizations have been successful in their efforts to force institutional change by recognizing the political underpinnings of multilateral development aid and by bringing pressure to bear on these institutions at their most vulnerable points," in particular by mobilizing public opinion and taking advantage of the need for the U.S. Congress and other national legislative bodies to approve capital or funding increases for these institutions.

¹³ The environmental impacts of several other Bank-supported projects, including a series of livestock operations in Panama, were also discussed at these hearings, as was the need for increased agro-forestry research in Bank-assisted forestry, rural development and agricultural projects more generally.

¹⁴ Letter dated October 12, 1984 from Bruce Rich, Natural Resources Defense Council, Washington, and others to A.W. Clausen. Among other observations, this letter affirmed that: "several independent sources in Brazil have called our attention to the accelerating and uncontrolled ecological and human destruction occurring in the World Bank financed Northwest Development Program....Information we have received strongly indicates that the Bank's...investment has so far contributed to uncontrolled migration, accelerated deforestation, conversion of

10.16 Among the recommendations contained in the NGO letter were the need for the Bank to "increase [its] professional environmental staff and systematically implement more rigorous procedures to ensure improved environmental design so that [it] does not repeat the costly mistakes in resource management that are occurring in POLONOROESTE."¹⁵ In addition to suggesting that the Bank "seriously reconsider the implications of funding programs such as POLONOROESTE," the NGO's argued that the "profoundly disturbing situation" in Northwest Brazil, "underscores all the more the urgent need for the World Bank to undertake concrete measures and commit real resources...to improve the ecological design and review of its projects." The NGO letter was shortly followed by a memorandum from the United States Department of the Treasury to the U.S. Executive Director requesting the views of Bank management on the issues raised during the Subcommittee hearings on the environmental impacts of POLONOROESTE and other Bank-financed operations.¹⁶

10.17 The extent to which these and other external manifestations influenced the Bank's subsequent handling of POLONOROESTE is unclear. It is probably no coincidence, however, that the aforementioned communications were sent to the Bank just prior to the already scheduled mid-term review of the program. The back-to-office report of the mid-term review mission, in fact, makes specific reference to these documents and indicates its "general agreement" with the information contained in them.¹⁷ However, there can be little doubt that the environmental problems and negative publicity associated with POLONOROESTE and other Bank-supported projects (eg. the Indonesian Transmigration

land to unsustainable cattle ranching, land speculation and increased encroachment on Indian land areas."

¹⁵ Ibid. It was also recommended that "a key element in improved design should be the early inclusion and participation in project planning of representatives of the local groups that are affected: indigenous peoples, farmers and settlers, environmental conservation organizations, and members of the church working in rural areas."

¹⁶ Memorandum from James Conrow, Deputy Assistant Secretary for Developing Nations of the U.S. Department of the Treasury to James Burnham, U.S. Executive Director of the World Bank dated October 29, 1984. This memorandum, in turn, annexed a letter from the Chairman of the House Subcommittee on Natural Resources, Agriculture Research and the Environment to then U.S. Treasury Secretary Donald T. Regan in which the former expressed his "deep concern over the progress and impact" of POLONOROESTE...[which was] contributing to uncontrolled migration and accompanying deforestation."

¹⁷ Internal memorandum dated December 13, 1984, para. 13. The report recommended, however, that, in formally responding to these communications, "the Bank should point out...that the situation would probably have been even worse without our intervention, since the Brazilian Government would have paved the BR-364 in any case, but would probably not have made any effort to mitigate the negative effects of the resulting flood of migrants on the environment and the Indians."

Program, the Narmada Project in India, etc.) played a role in the Bank's decision to reinforce its environmental assessment procedures and capabilities. As one recent internal publication on the Bank's evolving activities in Brazil has put it:

The Bank-supported POLONOROESTE program...included environmental protection measures at their inception. But the projects' unanticipated spillovers and the inability to control spontaneous unrelated activity have had a serious social and environmental impact. The need for greater attention to a project's intersectoral links has resulted, in part, in a new Bankwide policy for systematic and comprehensive environmental analysis of projects, including the indirect and spillover effects in contiguous areas.¹⁸

3. Follow-on Projects

10.18 In addition to its institutional and policy impacts, POLONOROESTE and its environmental effects have also contributed to the undertaking of several follow-on projects including one financed by the Inter-American Development Bank (IDB) to improve the 502 kilometer segment of the BR-364 highway connecting Porto Velho and Rio Branco in the neighboring state of Acre. This project, involving two IDB loans for a total of US\$ 58.5 million, was approved on January 24, 1985. The project was intended to widen and pave the highway, modify five existing railroad bridges between Porto Velho and Abuna (also in Rondonia) for use by automobile traffic, build eight new concrete bridges between Abuna and Rio Branco, install ramps and establish a maintenance program. In addition, it was to include specific "safeguards to protect the ecology and the indigenous population [so as to preserve] the area's soils and forests and to avoid damage to the native population from the increased economic activity brought about by improving the road."¹⁹

10.19 This operation, not surprisingly, has encountered problems very similar to those previously experienced by POLONOROESTE. While implementation of road improvements proceeded rapidly, the project's environmental and Amerindian components lagged. In addition, when a required environmental protection plan for the highway's area of influence was eventually submitted to

¹⁸ World Bank, Brazil and the World Bank: Into the Fifth Decade, Washington, 1990, pg. 17 (emphasis OED). This document (pg. 14) also states: "Many of POLONOROESTE's physical targets have been met, including some of the more difficult activities, such as protection and assistance to Amerindian communities. But severe problems -- limited technical knowledge, funding delays, lack of agricultural credit, institutional weaknesses, inappropriate government incentives and unexpectedly high spontaneous migration in the area -- resulted in unchecked deforestation and the encroachment of farming and ranching into unsuitable areas."

¹⁹ Inter-American Development Bank, Annual Report 1985, Washington, February 1986, pg. 56.

the IDB, it was found to be seriously deficient. As a result, loan disbursements were halted in December 1987, pending presentation of an acceptable environmental protection plan by the Brazilian Government.²⁰ Disbursements were resumed in July 1989 once the IDB was satisfied that the revised plan would permit both project execution and its environmental impacts to be carefully controlled by the federal government. Among other noteworthy features, the revised plan included a detailed action program and implementation schedule to facilitate monitoring of the project's environmental and Amerindian protection components by the IDB's environmental officer who is permanently based in Brasilia and, thus, is able to travel frequently to the project area, as well as to maintain continuous contact with executing agencies and other affected parties, including local NGOs, in the region.

10.20 In terms of World Bank funding, in turn, two recently approved operations have also provided additional assistance to the Northwest as part of more general efforts to combat malaria in Amazonia and to strengthen Brazil's environmental protection institutions and activities. The Amazon Basin Malaria Control Project was approved on May 25, 1989 and is being partially financed by a Bank loan (Loan 3072-BR) in the amount of US\$ 99.0 million. The project is designed to reduce malaria transmission in the Amazon region and prevent reintroduction of the disease in areas where it is presently under control. The operation will also seek to increase the organizational efficiency and responsiveness of SUCAM (the federal agency primarily responsible for combatting malaria) to changing conditions in the field, a problem which hindered execution of the malaria control component of POLONOROESTE's health project.

10.21 The operation has two major components: (i) a malaria control program to support epidemiological and entomological surveillance, the treatment of malaria cases, source reduction projects, vector control, community participation and education activities and endemic disease control activities in Amerindian areas; and (ii) institutional strengthening of SUCAM, focusing on in-service training and the establishment and/or support of district offices, computerized information systems, operational research and inter-institutional actions.²¹ As indicated in Chapter IV above, design of this project benefitted directly from malaria-related studies carried out under the research component of the Northwest Health Project. Even though the operation covers the entire Brazilian Amazon region, due to the continuing high incidence of malaria in Rondonia, one of its principal areas of activity will be the Northwest. The Bank loan for this project became effective on September 20, 1989 and, as of January 31, 1991, US\$ 30.5 million had been disbursed.

²⁰ The appeal by rubber tapper leader Chico Mendes during the IDB's Annual Meetings in March 1987 that the Bank withhold its support for the project until associated environmental abuses could be corrected is credited by some observers as being one of the principal reasons for the IDB's subsequent decision to suspend disbursements for the operation. See, for example, the article by Bruce Babbitt in the June 25, 1990 issue of The New Republic entitled "Amazon Grace."

²¹ For further details, see World Bank Report No. 7535-BR, op. cit.

10.22 The National Environmental Project for Brazil, in turn, was approved on February 27, 1990 for Bank funding (Loan 3173-BR) in the amount of US\$ 117.0 million. The corresponding Loan Agreement was signed on August 16, 1990 and close to US\$ 10 million had been disbursed by January 31, 1991. The objectives of this operation are: (i) to strengthen the protection of the country's most important conservation areas and imminently endangered ecosystems with special emphasis on the reduction of economic and environmental losses associated with uncontrolled deforestation, soil erosion and air and water pollution in the Pantanal, Legal Amazonia, the Atlantic Forest and Brazilian Coastal areas; (ii) to reinforce the institutions of the "environmental sector," with special emphasis on the strengthening of IBAMA and state agencies in Legal Amazonia and the Pantanal area; and (iii) to improve the regulatory framework of the "environmental sector." More specifically, the project would support the first three-year phase of Brazil's National Environmental Program (PNMA).²²

10.23 Finally, follow-on "natural resource management" projects for possible Bank financing are also presently under preparation by the state governments of Rondonia and Mato Grosso. An earlier version of the proposed "Rondonia Natural Resource Management Project," however, was the object of considerable misgivings on the part of many of the same environmental groups that had previously expressed concern with POLONOROESTE.²³ In addition, as indicated in para. 10.11 above, shortly after taking office in March 1990, the new federal Secretary of the Environment requested that formal Bank consideration of the Government of Rondonia's project be postponed until the proposed operation could be reassessed in Brazil.²⁴

²² The specific actions included under this operation to improve protection of the Pantanal have already been briefly summarized in an earlier chapter of this report. Additional details can be found in World Bank Report No. 8146-BR, op. cit.

²³ These misgivings were indicated in a letter to the Bank's Executive Directors dated January 9, 1990 and signed by representatives of some thirty-five American, European, Japanese, Australian and Brazilian NGOs. The letter concluded that "the project [which relies heavily on agro-ecological zoning] contains serious flaws in its design and proposed implementation...which are likely to seriously undermine its effectiveness [and] discredit what is in theory a very promising approach to environmentally sustainable development in tropical regions." This same concern is mentioned in a recent article by Bruce Rich entitled "The Emperor's New Clothes: The World Bank and Environmental Reform," World Policy Journal, Vol. VII, No. 2, Spring 1990, pp. 312-313.

²⁴ In commenting on the draft version of this report, SDR-PR observes that "it is currently proposed to correct the distortions that have occurred in [POLONOROESTE] and its management. In this sense, the fact that the program is [now] linked to SDR-PR represents progress in its institutional strengthening. SDR-PR, in pursuit of adequate corrections and sustainable development of the Northwest, will implant new forms of regional intervention, through PLANAFLORO and PRODEAGRO in Rondonia and Mato Grosso respectively, on a concrete basis and adjusted to the reality [of the local situation] so that they can be immediately corrected as soon as any distortion is detected. Thus, they will feature a

C. Lessons for Future Bank Operations

1. Pitfalls of Program Planning and Design

10.24 Bank influence was instrumental both in transforming a request by the Brazilian Government to fund road construction into what was later characterized as an "integrated regional development program" and in incorporating progressive social and environmental concerns into its design. Emphasis on small-farmer settlement, as well as on environmental and Amerindian protection, was effectively translated by Bank initiative into specific and often elaborate measures and a proposed allocation of substantial resources for their implementation. Despite such precautions, the program contributed to multiple forms of environmental degradation, as well as to the invasion of Amerindian lands, and appears to have been unable to produce a replicable model of sustainable small-farmer development for Amazonia.

10.25 Some of these shortcomings can be attributed to errors in program design. Even though implementation of POLONOROESTE was preceded by numerous fact-finding and planning missions, the Brazilian Government and the Bank failed to adequately consider the impact which roadbuilding was likely to have on future migration to and the spread of rural and urban settlement in the region and proposed an incomplete approach to regional development which incorporated overly optimistic judgments with respect to the extent of high quality soils, the ability of small farmers from other parts of the country to adapt to the tropical forest environment and the relative importance of the distance-to-market factor. Partially on account of these deficiencies, attainment of the program's social and environmental objectives was largely frustrated.

10.26 At least part of the reason for the Bank's failure to recognize the basic limitations of roadbuilding and small-farmer settlement in the Northwest from an environmental perspective stems from its not having adequately perceived the nature and strength of the economic and political forces behind the program. Attention was drawn in Chapter III to the fact that formulation of POLONOROESTE reflected the conjugation of widely disparate elements and interests. From the

continuous monitoring and evaluation system; better articulation among the various executing agencies at the federal, state, and municipal levels; better coordination of the different institutions linked to them, involving continuous and permanent discussions so as to avoid distortions in the execution of actions which, for greater effectiveness, have to be taken concomitantly (eg. incentives to productivity and conservation practices); better planning of activities and disbursement of resources; the same political connotation for all components so that there will be balanced commitment to their development; greater attention to environmental issues (indigenous reserves, parks, organized prospecting, mining, and forest extraction areas); greater involvement of civil society and private initiative, in part as a way of strengthening them in the planning and execution processes; specific disbursement and counterpart norms and more agile cost accounting to avoid exchange devaluations and delays in the execution of program actions or components; and technical support for new investments through instruments which ensure the integrity of the environment."

standpoint of the Brazilian Government, the program met the concerns of various economic and political groups both inside and outside the region. Even though the original Government request for the financing of highway improvement was not compatible with internal Bank policy, furthermore, the program, as it eventually emerged, struck a responsive chord in the Bank on at least two accounts: one involved the Bank's interest in attempting to promote sustainable small-farmer development in a tropical forest setting, while the other concerned the possibility of making a large loan, or more precisely set of loans, to an important client country at a time when the latter was in increasing need of foreign exchange.

10.27 Diverging viewpoints regarding the proposed plans for the region were, nevertheless, manifested during program preparation and appraisal. Within the Bank, serious questions were raised both with respect to the program's probable impacts on the natural environment and local tribal populations and, particularly in view of the lack of detailed knowledge of agro-ecological conditions in the region, in relation to its economic feasibility. In Brazil, in turn, several studies questioned the possibility of using Amazonia as an outlet for the resolution of demographic and social problems caused by rapid agricultural modernization elsewhere in the country and/or suggested that paving the BR-364 highway might prove to be catastrophic as a result of the likely acceleration of migration to the area. The "developmentalist" view, however, ultimately prevailed and various dissenters were essentially removed from the Northwest scene both in the Bank and in Brazil.

10.28 Despite dissenting views, POLONOROESTL generated considerable momentum in various sectors, eventually resulting in a coalescence of different interests in support of the program. In addition, powerful lobbies inside and outside the Government were dependent on the disbursement of funds through the program and thus attempted to forge a favorable public image for it. Numerous jobs were created both inside and outside the public sector in connection with the program, thereby multiplying the number of individuals and groups directly interested in its existence and continuation, particularly at a time of increasing recession.

10.29 As a result of the different interests involved, in retrospect it appears that the Bank was pressured, and pressured itself, into adopting postures and attitudes that failed to adequately consider the broader socio-economic and political dynamics of the frontier occupation process in the Northwest. Once variegated interests had joined forces to support a road improvement cum rural development program in northwestern Mato Grosso and Rondonia, the role of both Government planners and Bank appraisers basically became one of attempting to operationalize this approach to the best of their abilities. In the process, however, fundamental problems and constraints were ultimately overlooked or given insufficient attention, despite the unquestionable prominence given to social and environmental concerns and objectives by the Bank.

10.30 The crucial question from the standpoint of assessing the Bank's role in POLONOROESTE is: should it have become involved in Northwest development at all? Part of the justification given, then and now, for Bank participation in the program is that, during the Figueiredo administration, the Brazilian

Government would have gone ahead with pavement of the BR-364 highway with or without Bank support. This assumption, however, merits closer examination since it is likely that, had the Government clearly possessed sufficient resources, to rapidly improve the road and meet other priorities it not would have come to the Bank for assistance in financing in this connection in the first place.

10.31 It is, indeed, true that during the middle years of the military regime in the early 1970's resources were plentiful. In addition, roadbuilding and other major infrastructure construction activities were of such high priority that they were frequently initiated by large domestic construction companies before federal funds had been specifically earmarked for this purpose and, in some cases, even before a formal decision to proceed with the project in question had been taken. Such initiatives and the coincidence of interests between certain segments of the federal bureaucracy and the large private construction companies, furthermore, gave the latter considerable political clout. By the end of the 1970's, however, when paving of the Cuiaba-Porto Velho highway was first discussed with the Bank, the federal government's financial situation had changed considerably. Thus, there is no unequivocal evidence that rebuilding of the road would have been undertaken immediately or rapidly without the Bank's support. In contrast to the earlier Transamazon highway for which no external funds were requested, insistent Government lobbying to obtain financial assistance from the Bank for improvement of the BR-364 road, in fact, point in the opposite direction.

10.32 But, perhaps a better question would be: under the actual circumstances, what could or should the Bank have done differently? It is not likely that the Bank could have impeded reconstruction and/or paving of the BR-364 highway altogether. Indeed, given the comparatively much lower levels of environmental awareness and concern in both Brazil and the Bank at the time, how could non-construction have been justified? Northwestern Mato Grosso, Rondonia and Acre are parts of the national territory and their overland integration with the rest of the country was a legitimate aspiration of the Brazilian Government, even if the uses to be made of the region's renewable natural resources were not completely clear or, as has subsequently proven to be the case, were likely, in many instances, to be ecologically detrimental. The key point, however, is that, in the absence of Bank support, it would probably have taken much longer to transform the BR-364 highway into an all-weather thoroughfare and to expand the regional feeder road network. Had road construction been delayed, the hordes of migrants that rapidly spread throughout the Northwest during the early 1980's might not have materialized as soon or as quickly as they did.

10.33 This time element is important in assessing the recent development path of the Northwest since, as indicated in earlier chapters of this report, the dominant characteristics of the region's occupation over the past two decades have been its largely uncontrolled "spontaneous" rural settlement and the rapid spread of extractive activities. Had improvement of the road been delayed, valuable time could have been gained to undertake more accurate soil surveys, to perform more thorough and effective evaluations of regional agro-ecological, agronomic and socio-economic development potentials and constraints, to rationalize and consolidate existing settlement strategies and colonization project designs, to better absorb those migrants already arrived or gradually

coming to the area and, perhaps most importantly, to establish and/or strengthen natural resource management and environmental protection legislation, institutions and enforcement mechanisms. In short, it could have permitted both a more realistic appraisal of longer-term settlement possibilities in the region and more adequate management of existing, as well as likely future, demographic pressures in an area whose carrying capacity was still largely unknown.

10.34 In addition to the fact that its involvement helped to speed up road construction, Bank support provided another ingredient, legitimacy, which, in practice, gave the coalition of political and economic forces that supported the rapid, but environmentally costly, growth of the Northwest a tremendous boost. Despite the authoritarian setting of the period, a few voices in government, as well as in the Brazilian academic and scientific communities, had already called attention to the social and ecological abuses associated with both directed and spontaneous settlement in Amazonia during the 1970's, singling out Rondonia as a particularly intense case. Furthermore, as previously noted, the federal government itself briefly sought to curb migration to the region. However futile the 1977-78 disincentive campaign proved to be over the longer run, it was, nevertheless, part of a conscious attitude calling for re-appraisal of the traditional role of an ever more distant and ecologically sensitive land frontier. If nothing else, it urged consideration of alternative (ie. non-Amazonian) outlets for the population that continued to be expelled from rural areas in south-central Brazil, as well as alternative (ie. land intensive rather than land extensive) agricultural development policies.

10.35 When such alternatives were rejected by the new federal administration in 1979 in favor of a return to the early-1970's approach to economic development and territorial integration through the construction of "grandes obras" (literally "large works") and this strategy received, for all intents and purposes, the Bank's endorsement, events were set into motion that became extremely difficult to restrain. While to call the Bank's position with respect to POLONOROESTE an "endorsement" may appear exaggerated to some internal observers in light of the strong misgivings expressed by a number of Bank staff members before the project was approved, it is not so in terms of the support which the institution eventually provided, the prevailing public attitudes of key Bank officials during the early years of program implementation and the apparent distancing from the Brazil scene of the more outspoken among its internal critics. To the eyes of the outside world, additionally, the financial and technical backing provided by the Bank was generally interpreted as full institutional subscription to the objectives, basic approach and timing of the program.

10.36 The more important point, however, is that once Bank formally agreed to support the program, it unwittingly became party to a series of actions or inactions by the territorial, state and regional administrations that were to have serious adverse environmental consequences in subsequent years. Chief among these was the launching of the propaganda campaign by the Governor of Rondonia which, by directly stimulating the acceleration of migration to the state, compounded all the other problems already encountered in the region. Subsequent roadbuilding and colonization efforts in ecologically unsuitable areas by the state government using resources not provided through, but perhaps

"freed up" as a result of, the program served only to further exacerbate the situation.

10.37 It would clearly be unfair and incorrect to blame the Bank for publicity campaigns or other actions undertaken by state or federal government authorities. Bank officials, in fact, appear to have vehemently protested against such measures which were clearly inconsistent with the program's basic objectives, while disbursements for POLONOROESTE were, indeed, eventually suspended due to the Government's persisting failure to comply with its contractual obligations concerning Amerindian and environmental protection. Nonetheless, the Bank could have made more effective use of the instruments at hand to forestall unauthorized actions and correct environmentally harmful inactions. Namely, it could have suspended disbursements at a considerably earlier date. Furthermore, had more precise and specifically dated environmental and Amerindian protection covenants been included in the various Loan Agreements and had the Bank carried out more forceful and systematic monitoring and supervision of Government compliance with these obligations during the initial years, it could have reacted more quickly to uneven program execution by stopping loan disbursements, including those for road improvements, at a time when it still possessed substantial leverage over the Borrower.²⁵

10.38 The same is true with respect to reported administrative abuses and inefficiencies within the regional coordinating agency, SUDECO, or on the part of other participating executing agencies. Even though internal Bank documents make repeated references to such abuses, as well as to the Government's inaction with regard to environmental problems, it was not until 1985 that loan disbursements were withheld in order to force corrections in the system. By this time, however, pavement of the BR-364 highway had already been completed and migrants had been arriving in the region in large numbers for several years. Furthermore, even in the absence of the state government's propaganda campaign and the national economic recession, it was apparent to many observers that paving the BR-364 highway was likely to substantially increase migration in view of the continuing expulsion of rural population in older agricultural areas.

10.39 As suggested in earlier chapters, accordingly, one of the principal lessons to be derived from the POLONOROESTE experience is that, in similar circumstances, the Bank should first carefully sort out the various economic and political interests at play and evaluate how they are likely to respond to proposed program or project actions. More importantly, the Bank should attempt to gauge the real extent of the Borrower's commitment to different program objectives and components, as well as its effective institutional capacity and political willingness to meet its contracted obligations. As a general rule, when a large, multi-faceted investment program or project is designed to meet a variety of objectives and/or is made up of a number of components some of which were proposed by the Borrower, while others were introduced largely at the

²⁵ The environmental NGOs' letter concerning POLONOROESTE to then Bank President Clausen in October 1984, moreover, further suggested that "to ensure that Bank loan conditions are respected in the future, the Bank must exercise its maximum leverage in this situation, including reconsideration of planned funding for other agricultural projects in Brazil."

Bank's insistence, it should not be surprising if performance in relation to the former exceeds, and perhaps, greatly exceeds, that with respect to the latter, nor that there is a corresponding differentiation in terms of results.

10.40 From an environmental standpoint, in turn, prior to defining specific interventions for a particular region and/or deciding whether or not to finance such investments when proposed by a prospective borrower, the Bank should also carefully evaluate both the real carrying capacity of the areas in question and the potential environmental costs associated with their future development. When newly settled (or about to be settled) tropical frontier areas are involved, the Bank should also fully assess the nature of existing development tendencies in these regions and/or in areas similar to them where these processes have already occurred, as well as the impacts of these tendencies in terms of natural resource use and environmental quality. As suggested in the preceding chapter, one of the options that should be explored in this connection is that of supporting alternative interventions that do not involve encouraging or facilitating the potentially predatory occupation of tropical areas at all, but which would permit achievement of many of the socio-economic objectives normally associated with frontier development schemes (eg. the establishment of small-farmer settlement, the expansion of agricultural production) in other parts of the country where both environmental and financial costs are likely to be lower.

10.41 Consistent with this general orientation, additionally, any future Bank-supported efforts to diminish or correct environmental degradation in Northwest Brazil should begin by attempting to better understand and directly address the underlying economic and political forces, in terms of both extractive and agro-ranching activities, that have led thus far and will continue, if uncontrolled, to result in deforestation and pollution, together with the other environmental problems described above. In order to limit future environmental degradation in the POLONOROESTE region, furthermore, a very significant policing and control effort will be required, as will both considerable strengthening of existing institutions and unequivocal political commitment and support at all levels of government. In order to avoid the further spread of environmentally damaging extractive and agro-ranching activities within the region, finally, future roadbuilding should be sharply limited and other public sector incentives for the occupation of areas still remaining in native forest should be eliminated.

10.42 In a dynamic extractive frontier context such as Northwest Brazil, however, these measures will be difficult to achieve and the Bank should be realistic about the possibilities of doing so. In any event, attainment of these objectives is likely to be largely impossible unless greater accountability can be built into the public sector resource allocation and regulatory process at the state and local levels. In addition to the substantial strengthening of state natural resource management and environmental protection agencies and the need to undertake widespread public education campaigns, this is also likely to require much more effective local community and NGO participation than presently appears to exist in the region.

2. Pitfalls of Program Implementation

10.43 Once road improvements were well advanced and extractive forces were unleashed in the Northwest, the Government appears to have largely lost control over the management and timing of program implementation. Part of the problem was that command over this complex multi-agency initiative was centered in a traditionally weak and ineffective institution, SUDECO. Not only was the latter incapable of coordinating the various sectoral agencies involved in program execution, but it was severely understaffed and unwilling or incapable of dealing with the improper allocation of resources at the state level. As a result, theoretically "subordinate" but in fact much stronger agencies such as DNER and INCRA ended up wielding an inordinate influence over the course of the program, directly contributing to the serious implementation imbalances which it subsequently experienced. An obvious lesson for the future is the need to give particular attention to the judicious selection of the coordinating agency, as well as to the design of inter-institutional and implementing arrangements, in programs of similar complexity. More generally, this implies the need for the Bank to give much greater attention to institutional analysis and assessment during project appraisal and to institutional strengthening and development in project design and supervision.

10.44 Furthermore, the implementation of multi-faceted programs such as POLONOROESTE, especially in environmentally sensitive areas, requires frequent, intensive, consistent and multi-disciplinary Bank supervision, together with continual external monitoring and on-going evaluation, preferably by responsible non-governmental entities and/or technically competent public agencies that are not themselves directly involved in project execution. In the case of POLONOROESTE, on-going evaluation activities were, in fact, carried out for several years by the Economic Research Institute (FIPE) of the University of Sao Paulo. FIPE was instrumental in undertaking the mid-term review which later led the Bank to suspend disbursements and recommend considerable redirection of the program, but this activity was effectively suspended by SUDECO with the Bank's tacit approval, in 1987. Especially in the dynamic frontier region context, however, such independent monitoring and evaluation, perhaps by the new federal Secretariat of the Environment, assisted by a University research institute and/or specialized outside consultants, is essential.

10.45 In such cases, furthermore, permanent Bank supervision through its representation in Brasilia or by staff or long-term consultants located in the program region is strongly indicated. The possibility of placing a full-time specialist in the field to monitor all Bank-funded projects that are likely to have significant environmental impacts and/or which have important environmental components should be seriously considered in this connection.²⁶ Given the growing number of Bank operations that are directly concerned with environmental

²⁶ The Bank's field office in Brasilia already has a full-time macroeconomist who monitors economic events and policy formulation in the country, while the Bank office in Recife houses specialists in rural development and irrigation. Both the Inter-American Development Bank and the UNDP, in turn, presently have permanent environmental specialists, among other professionals, in their representations in Brasilia.

matters in Brazil, the need for such specialized local supervision will increase correspondingly. This recommendation is likely to also apply to other major individual Bank clients (eg. China, India, Indonesia, Mexico and the Philippines) or client regions (eg. East and West Africa) where the environmental content and consequences of Bank lending are already substantial and/or likely to increase significantly over the coming years.

10.46 On another level, one of the clearest operational lessons derived from observation of POLONOROESTE's implementation is that those activities which are physical engineering projects and/or can be handled as straight business deals with private contractors, such as road construction, tend to be carried out rapidly and straightforwardly, while activities that require or involve the protracted participation of government agencies and/or permanent dealings with target populations, such as rural extension, credit, administration, community development and the like, are often susceptible to considerable delays or encounter a broad range of financial, institutional and other problems. These difficulties are likely to be magnified when, as in the case of settlement schemes in tropical areas, basic know-how on key issues simply does not exist.

10.47 In the implementation of POLONOROESTE, the roadbuilding component was the centerpiece of the program and it was in the contractors' interest to fulfill their obligations as quickly as possible. However, the disparity between the velocity of road construction on the one hand and the provision of agricultural support and community services and the implementation of environmental and Amerindian protection measures on the other only serves to accentuate the problems experienced with respect to the latter. As a result, pavement of the trunk highway between the Northwest region and south-central Brazil was completed long before adequate support services and/or environmental protection could be provided. On a lesser scale, health posts, NUARs and other physical facilities were built before staff had been hired or trained and before the respective communities could learn to effectively utilize and maintain them.

10.48 In the future execution of complex and multi-dimensioned projects, whether in tropical areas or elsewhere, accordingly, sufficient care should be taken to ensure that uneven implementation velocities of different components do not damage the overall integrity and effectiveness of the project or program in question. More importantly, in any future operation such as POLONOROESTE, non-physical infrastructure components, especially those involving environmental planning and protection, should ideally be completed or at least very well advanced prior to initiating any major new infrastructure investments. In this connection, finally, the Bank must be willing to suspend loan disbursements in order to induce needed institutional strengthening, compliance with environmental (including tribal peoples) protection covenants and/or reformulation of program or project priorities and strategies as soon as there is concrete evidence that implementation is not proceeding properly and/or that serious physical and/or human environmental damage may be occurring as the direct or indirect result of the investments involved.

D. Implications for Bank Activities and Procedures

1. Country Policy Dialogue and Economic and Sector Work

10.49 Insofar as its environmental aspects and consequences are concerned, the POLONOROESTE experience, as reviewed in this report, has several important implications for Bank policy dialogue with, and associated economic and sector work (ESW) in, countries proposing the productive occupation and/or settlement of tropical frontier areas or affecting large regions more generally. While most of these concerns have already been mentioned earlier in this chapter or elsewhere in this report, they can be briefly summarized as follows:

- (i) Any attempt to promote roadbuilding and agricultural settlement, particularly on a large scale in an ecologically sensitive tropical region such as Amazonia, should be approached very cautiously and, in most instances, probably be discouraged rather than supported by the Bank. In any event, it should not be undertaken in the absence of prior detailed assessment of regional carrying capacity, including regional natural resource potential and constraints, and of existing institutional and enforcement capabilities in the fields of environmental management, protection and control.
- (ii) Any proposal to promote the occupation of tropical areas should first be assessed in terms of what are likely to prove to be less costly alternatives in other regions from both an economic and an environmental standpoint. This requires the development of an interregional and intersectoral policy framework at the national and regional levels. Among the (non-mutually exclusive) options that should be considered in order to achieve greater absorption of "surplus" rural population and increased agricultural production are the intensification of such production in areas of existing agricultural settlement through more equitable land distribution and/or improved support to small farmers, the expansion of cultivation in environmentally less vulnerable non-tropical areas and the promotion of employment generation in urban areas. In order to relieve demographic pressures over the long run, appropriate national population policies should also be defined and adopted.
- (iii) More generally, this implies the need for the Bank to encourage the federal or central governments in its borrowing member countries, especially in demographically large and territorially extensive and heterogeneous countries such as Brazil, to develop explicit policies and mechanisms for population distribution and natural resource management at the national level. Environmentally-informed national spatial development policies should then be further detailed for implementation at the regional, state and local levels. The role and intervention of national governments, however, are particularly important in frontier regions because of the

strong tendency, amply exemplified by the recent (and continuing) experience in Northwest Brazil, for narrowly focused private extractive interests to "mine" potentially renewable resources in these areas.

- (iv) The POLONOROESTE experience also suggests the need to consider the potential environmental consequences both of public investments per se, such as road construction and rural development, and of other public policies and interventions, such as credit and fiscal incentives, fuel pricing subsidies, land development regulations or the lack thereof, etc., which will inevitably affect the utilization of natural resources. In many instances, these implicit environmental and/or natural resource use policies can and will generate serious distortions and inefficiencies both in an economic and in an environmental sense which should be identified and eliminated.
- (v) Considerable emphasis should be given both in policy dialogue and sector work, on the one hand, and in project development, on the other, to the need to strengthen national and subnational technical and institutional capabilities for the monitoring and evaluation of on-going regional development processes, as well as to boost understanding at all levels of public administration with regard to the implications of these processes for, and their likely consequences on, natural resource use and misuse. Similarly, considerable attention should be given to developing the legal, regulatory and institutional framework and the enforcement and control mechanisms necessary to ensure adequate protection of the physical environment in tropical frontier areas and elsewhere.
- (vi) Since the above mechanisms will only be effective if sufficient accountability and political commitment exist at the various levels of public administration to guarantee that environmental planning, monitoring and control capabilities will be adequately utilized, the mobilization of public opinion and internal political support for the achievement of environmental goals should, in and of itself, be a conscious objective of Bank-assisted development efforts in countries where environmental degradation in both rural and urban areas remains a serious problem.
- (vii) Bank ESW, in turn, should focus much greater attention on natural resource management and environmental protection issues, capabilities and constraints at both the national and the subnational levels. This is particularly important for countries possessing large tropical forest areas with comparatively sensitive ecosystems such as Amazonia. In this connection, ESW recently undertaken by the Bank in the

Philippines, Ecuador, Indonesia and Brazil²⁷ should be further developed and replicated elsewhere. More generally, there is a need to better integrate Bank country economic and environmental analysis at the policy and sector, as well as at the project, level.²⁸

- (viii) In ecologically sensitive frontier regions such as Northwest Brazil or Amazonia more generally, ESW should assess the relative role of market forces and public sector interventions (ie. both public investments and other expenditures and policy incentives) in stimulating and/or sustaining productive occupation and settlement, as well as the ways in which various economic actors respond to these forces and interventions and how these responses, in turn, have affected or will be likely to affect natural resource use and environmental quality in these areas. In the process, the nature of the linkages and interactions between the various economic, institutional and political actors involved, including those (eg. large construction contractors and suppliers, national politicians, central government agencies, etc.) physically located outside the area itself, as well as the environmental implications and likely consequences of these relationships, should also be specifically examined.²⁹

²⁷ See World Bank, Philippines: Environmental and Natural Resource Management Study, Washington, September 1989; James Hicks, et. al., "Ecuador's Amazon Region....," op. cit.; World Bank, Indonesia: Sustainable Development of Forests, Land and Water, A World Bank Country Study, Washington, December 1990; and Robert Schneider, "Brazil: An Economic Analysis of Environmental Problems....," op. cit., forthcoming.

²⁸ For a more general discussion as to some of the ways in which this can be done, see Gunter Schramm and Jeremy Warford (eds.), Environmental Management and Economic Development, Johns Hopkins University Press, Baltimore, 1989, especially chapters 2, 4, 5, 6 and 11.

²⁹ The forthcoming report on the Brazilian Amazon region mentioned above (Schneider, op. cit.) is an excellent example of an economic actor-focused regional natural resource utilization sector study which explicitly attempts to integrate economic and environmental concerns. To OED's knowledge, moreover, this study is unique among Bank ESW for countries possessing tropical forest areas and, thus, may be of wider substantive, as well as methodological, interest.

2. Project Identification, Preparation and Appraisal ³⁰

10.50 The program experience also clearly contains several important lessons with respect to the identification, preparation and appraisal of future Bank operations in circumstances similar to those of POLONOROESTE. In addition to the points raised in the previous paragraph, these include:

- (i) The need to have a much better ex-ante understanding than has often been the case in the past of the ecological context and constraints, as well as of the underlying socio-economic and political-institutional processes, which characterize the on-going development of the specific geographic area or areas where any proposed intervention, especially a major infrastructure investment, is proposed to take place. This implies the need for the Bank to inform itself to a much greater extent than in the past in relation to the evolving development history of the area in question and/or, in the case of previously unsettled frontier regions, of similar areas, together with the extent to and ways in which such tendencies have affected local natural resource use and environmental quality.
- (ii) The need to avoid a partial comprehension of the factors which influence natural resource use and environmental quality. Thus, as suggested in the previous section, knowledge of the nature and dynamics of the relations and linkages between all major social groups and types of economic activity on the frontier (as in other kinds of regions) will be essential in order to assess the likely impacts of any large infrastructure or productive sector investment on natural resource exploitation and possible environmental degradation in the project area.
- (iii) This knowledge will be necessary in order to adequately anticipate the types of environmental (including tribal peoples) protection measures that will be required, as well as the institutional and political preconditions for the effective implementation of such measures. Particular attention should then be given in project design to the preparation of these protection measures, as well as to developing the legal, regulatory, technical and institutional mechanisms and capabilities required for their subsequent implementation and/or enforcement and to obtaining and verifying the political commitment upon which such implementation and/or enforcement will ultimately depend.

³⁰ Although the discussion in this and the following sections refers specifically to projects, it applies equally well to multi-project or multi-loan programs such as POLONOROESTE and should be understood as such.

- (iv) This analysis should be part of a mandatory ex-ante environmental assessment of any major infrastructure and/or productive sector investments in humid tropical frontier regions (and elsewhere), which must include an evaluation of the likely indirect and long-term, as well as direct and short-run, environmental consequences of the proposed interventions, both in the immediate and in the larger areas of influence of these investments. In this context, it should be remembered that, especially in frontier areas, indirect effects may be even more important than direct ones.
- (v) This also suggests that, particularly for operations involving active frontier areas, it will be necessary to carry out a more extensive risk analysis than has traditionally been the case in connection with project preparation and appraisal. Among other elements, any such analysis should carefully consider alternative demographic, settlement and resource exploitation scenarios and determine what types of institutional and political response will be required in order to deal with associated potential adverse environmental impacts.
- (vi) Environmental assessment of proposed future interventions in tropical frontier regions and elsewhere should also take more adequately into account than has been the case in the past the likely effects of both market and public policy-induced incentives and constraints on potential natural resource use and misuse in such areas. In short, not only should such assessments be more comprehensive in a spatial sense, they should be more encompassing in an economic and, ultimately, a political sense as well.
- (vii) Future Bank-supported interventions that are likely to have significant direct and indirect social and environmental impacts in tropical frontier areas should not be restricted to the rural sector or, within the rural sector, to small farmers in directed colonization projects. In particular, other small subsistence farmers and existing non-predatory extractivist groups such as rubber tappers, nut and fruit gatherers and subsistence fishermen, as well as tribal populations, should be assisted, while environmental sanitation, education, protection and control activities should be extended to rural and urban areas and populations alike.
- (viii) As occurred in the case of POLONOROESTE, investment projects in tropical frontier regions should be identified, prepared and appraised, both on the Government and on the Bank side, by multi-disciplinary teams which must necessarily include environmental and institutional development specialists, together with social scientists from a variety of backgrounds, in addition to the agriculturalists, economists, financial

analysts and engineers who traditionally carried out most of these activities in the past. To the extent that such interventions are intended to deal with broader regional development issues, as was the case with POLONOROESTE, moreover, they should also include specialists in regional and natural resource economics, planning and management.

- (ix) Finally, while all of the above recommendations suggest that the project preparation and appraisal processes are likely to require greater time and human and financial resources than have generally been consumed in such activities in the past, the long-term economic and environmental benefits of more careful project planning and ex-ante assessment will almost certainly outweigh the additional costs involved. In any event, the Bank and the Borrower should be willing to incur these costs and they should be considered and properly accounted as part of the costs of the proposed investment project itself.

3. Project Monitoring, Evaluation and Supervision

10.51 The POLONOROESTE experience clearly illustrates the difficulties of adequately monitoring, evaluating and supervising the implementation of a multi-component investment program spread over an area which is larger than that of Great Britain. In addition to the mere territorial scale of the areas involved, these activities were made even more difficult because of the very dynamic and complex nature of the settlement/occupation and natural resource use processes taking place in connection with evolving frontier development in the region. These same characteristics, however, give added importance to the need to adequately monitor and evaluate both the execution of project investments and their direct and indirect environmental impacts and parallel and often closely related broader development and natural resource use tendencies at the regional level. Under these circumstances, the need for adequate Bank supervision of project implementation, monitoring and on-going evaluation is also likely to be considerably greater than in smaller, less complex operations and/or in less dynamic settings. In this connection, several points are of relevance:

- (i) Monitoring and on-going evaluation of project implementation and preliminary results are an essential part of project management. Like project preparation and appraisal, where appropriate, these activities should be carried out by multi-disciplinary teams that include adequate social science and environmental expertise. Wherever possible, evaluation activities should be undertaken by, or at least systematically involve the inputs of, entities which are administratively independent of the principal project coordinating and executing agency or agencies.
- (ii) In rapidly changing frontier areas such as Northwest Brazil, broader regional development tendencies and their environmental impacts should be closely monitored and evaluated together with project investments per se, while

sufficient flexibility should exist in project implementation to permit the necessary adaptations to be made in a timely fashion.

- (iii) Monitoring and evaluation, as well as initial planning and design, activities should be organized and conducted in such a way as to permit systematic and productive interaction with project beneficiaries and other affected populations, as well as with local and extra-local non-governmental organizations, including labor unions and church and environmental groups.
- (iv) Bank supervision missions for such projects should also involve multi-disciplinary teams and be sufficiently frequent and of sufficient duration to permit an adequate reading of both evolving project implementation performance and consequences, including environmental consequences, as well as broader development tendencies in their areas of influence.
- (v) Especially in complex and environmentally significant operations like the present one, the Bank should strive to ensure that the orientation provided to the Borrower and its executors through the supervision process be as consistent as possible over time. This suggests that, wherever possible, changes in supervision leadership (ie. task managers) should be avoided or minimized. Where more than one sectoral division is involved, care must be taken to guarantee adequate cross-divisional coordination of Bank supervision efforts.
- (vi) In the case of large, complex and potentially problematic operations such as POLONOROESTE, the Bank should strongly consider the possibility of establishing its own permanent monitoring and supervision capability in the field. Ideally, this would involve placement of at least one Bank staff member or experienced long-term consultant in or near the project region itself. In addition to facilitating contact with project agencies, areas and affected populations, this would send an important signal to the Borrower in terms of the Bank's particular concern with any such operation and its environmental aspects and potential consequences. Such staff and/or consultants could also play a major role in the monitoring and supervision of other Bank-supported projects having important environmental features and/or potential impacts, as well as in the preparation of new lending operations.
- (vii) To facilitate Borrower and Bank monitoring and supervision activities in the case of complex and potentially problematic operations such as POLONOROESTE, implementation activities should be programmed and scheduled in considerable detail, as part of the initial and continuing project design process.

- (viii) As occurred in the case of POLONOROESTE, large, risky, institutionally complex and/or environmentally significant investment projects, especially in rapidly changing frontier regions, should be subject to a comprehensive mid-term review on the part of the Bank carried out by a multi-disciplinary team. This, however, should not preclude the more intensive Bank monitoring and supervision of project execution recommended above. Nor should it preclude rapid and decisive action on the Bank's part if key environmental (including tribal peoples) protection covenants are not complied with by the Borrower during the early stages of project implementation.
- (ix) As in the case of project preparation and appraisal mentioned above, more intensive and detailed (possibly including permanent field) monitoring, evaluation and supervision of project implementation and social and environmental impacts may require the expenditure of considerably greater resources both on the Borrower's and on the Bank's part than has been the case in the past. Adequate provision for these activities should be made in project administration and Bank operational budgets respectively. These incremental monitoring, supervision and evaluation costs should be treated as part of the overall costs of the project itself and, to the extent possible, be recovered accordingly.

E. Future Research and Impact Evaluation

10.52 One of the conclusions that can be drawn from the survey of POLONOROESTE's territorial, ecological, socio-economic, institutional and political context, on the one hand, and from its general design characteristics, implementation performance and environmental consequences, on the other, is that there is a clear need both for additional research into the on-going frontier occupation and development process in Northwest Brazil and for a more systematic and detailed ex-post evaluation of the program's general and environmental impacts. Such research and impact evaluation activities should ideally precede, or at least occur in parallel to, the definition and initial implementation of any major new development initiatives for the region, whether or not they are supported by additional financial resources from the Bank. For future planning purposes, furthermore, it would be essential to carry out an assessment of the program's social and environmental impacts at the micro level (ie. on a component by component and a geographically localized basis), as well as in the general terms sketched above.

10.53 While no attempt will be made here to define a specific future research agenda for Northwest Brazil, hopefully the discussion in the preceding chapters will be useful in suggesting the types of questions which need to be explored in further depth and/or greater detail. In general terms, however, it will be necessary to more fully examine the complex and dynamic interaction between public sector interventions in the form of roadbuilding, rural development projects both inside and outside the Northwest, a variety of fiscal and credit incentives and other measures and migration behavior, the growth and

spatial distribution of productive activity, settlement patterns and political-institutional responses within the region over the past several decades. The latter, in turn, will need to be more systematically associated with regional and subregional land and natural resource use tendencies and the implications of the latter in terms of future possibilities for sustainable rural development, the integrity of the natural environment and the longer-run security and welfare of Amerindian and other traditional populations.

10.54 Similarly, while no attempt will be made here to indicate a specific ex-post evaluation design for POLONOROESTE, given the extent and nature of the program's impacts both inside and outside the Northwest, the importance of undertaking such an exercise for the benefit of both Brazilian authorities and the Bank should, nevertheless, be stressed. Within Brazil, any such exercise should be carried out by an experienced and independent, multi-disciplinary research team, as was contemplated in POLONOROESTE's original appraisal and legal documents. Any such undertaking, should give particular attention to the program's direct and indirect physical and human environmental consequences, both at the level of its individual components, subcomponents and major investments and the specific localities involved and in a more systematic manner than has been possible in the present study at the level of the program and the region as a whole.

10.55 Within the Bank, finally, it is recommended that, once all the corresponding project completion reports have been presented, OED should undertake a combined performance audit of the various Bank operations which composed the bulk of POLONOROESTE, as well as its Amerindian Special Project. This should be carried out by an inter-disciplinary team of OED staff and consultants which could coordinate its activities in the field and present a single program performance audit report. At some later future date, OED should also seriously consider the possibility of carrying out a comprehensive impact evaluation of the program. Among other dimensions of the POLONOROESTE experience, these evaluations should explicitly revisit and reassess its environmental performance and impacts.

F. Conclusion

10.56 Largely because of its environmental consequences and the public attention which they have received, POLONOROESTE has, albeit unintentionally, contributed to significant institutional and policy changes both in Brazil and in the Bank itself over the past several years. Much, accordingly, has already been learned from this experience which has unquestionably had an influence on the way both the Brazilian Government and the Bank presently view the potential impacts of large transport and rural development projects in tropical areas. As suggested in the preceding sections, however, the POLONOROESTE experience also contains numerous important lessons for Bank country policy dialogue and economic and sector work, as well as for its project preparation, appraisal and supervision activities, that still need to be more fully integrated into Bank practice in Brazil and elsewhere.

10.57 As also highlighted above, adequately incorporating these lessons into Bank and borrower procedures and operations implies possibly significant additional time and human resource costs in terms of planning horizons,

preparation and appraisal efforts, supervision frequency and intensity and, ultimately, personnel requirements, staffing profiles, consultant use, internal training and so on. The Bank, furthermore, should not expect that often already severely constrained operational divisions and staff, even with substantially increased environmental awareness and training, will be able to undertake or evaluate needed ex-ante environmental assessments and/or provide the necessary monitoring and supervision of the environmental aspects and consequences of on-going projects in the absence of greater resources than, in most cases, they presently have at their disposal.

10.58 In synthesis, just as the potential environmental and social costs of any investment project need to be weighed together with its expected economic and financial benefits, so too must the true time and human resource costs required to properly identify and understand, and thus to more effectively minimize or prevent, the potential undesired social and environmental impacts of any such operation be properly recognized and absorbed by those, including the Bank, who provide financial support for the intervention in question. Only if such costs are adequately provided for are unfortunate experiences from the environmental standpoint such as that witnessed in Northwest Brazil over the past decade more likely to be avoided in the future. From the Bank's perspective, this is perhaps the ultimate legacy and lesson of POLONOROESTE.

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ANNEX I

THE NORTHWEST FRONTIER IN HISTORICAL PERSPECTIVE

A. Introduction

1. Historically, the availability of enormous and diversified expanses of open land has conditioned the nature and locus of economic -- especially agricultural -- activity in Brazil. During the past half-century, moreover, frontier expansion has performed two basic functions. First, occupation of the frontier in a land-rich country has permitted the expansion of agricultural output in response to rapidly growing internal and external demand without altering the land tenure system, the predominant forms of social organization or the technological base in the rural sector. Secondly, the frontier has served as a "safety valve" to deflate social tensions generated by economic stagnation, high rates of population growth and a rigidly-stratified social structure in areas of earlier agricultural settlement, particularly the impoverished Northeast and parts of southeastern Brazil, most notably Minas Gerais.

2. When the effects of the 1929 Stock Market crash reached Brazil, most of the country's population was still situated along the coast, reflecting its traditional role as a predominantly export-oriented economy. At the time of the first modern census in 1940 Brazil possessed only 51 cities of 20,000 inhabitants or more, the great majority of which were located on or within several hundred kilometers of the coastline. The world crisis, shortly followed by the Second World War, together with rapid population growth, however, produced important changes in the country's patterns of development and capital accumulation including shifts in investment from agrarian exports to urban industry and in the destination of domestic output from external to internal markets. These, in turn, stimulated important spatial transfers of economic activity and population. Two basic patterns of geographic redistribution were promoted after 1930: accelerated concentration of urban population and productive activity along the dominant Sao Paulo-Rio de Janeiro axis prompted by import-substituting industrialization and progressive incorporation of the vast interior hinterland through rapid expansion of the agricultural frontier.

3. Three major frontier movements can be identified during this modern period: (i) the opening up of northwestern Parana and adjacent areas in the 1940's and 1950's; (ii) the occupation of a vast central strip extending from the present state of Mato Grosso do Sul in the south to that of Maranhao in the north in the 1950's and 1960's; and (iii) more recently, attempts to occupy parts of the Amazon region. These three phases are clearly distinguishable not only in terms of their chronology, but also with respect to their impact on agricultural production and their relative capacity to absorb population.¹

¹ The following discussion is largely based on George Martine, "Frontier Expansion, Agricultural Modernization and Population Trends in Brazil," in Ronald D. Lee, et. al. (eds.), Population, Food and Rural Development, Clarendon Press, Oxford, 1988, pp. 187-203. See also, Thomas W. Merrick and Douglas H. Graham, Population and Economic Development in Brazil: 1800 to the Present, Johns Hopkins University Press, Baltimore, Maryland, 1979, especially Chapter VI.

B. Non-Tropical Frontier Areas

4. In retrospect, the logic of the chronological order which marks modern Brazilian frontier expansion has proven to be impeccable in that the best areas were occupied first. The "Parana frontier," which actually included portions of three adjacent states (southwestern São Paulo, northern and western Parana and northern Santa Catarina), possessed the best lands in terms of soil characteristics and the closest proximity to ports and internal markets. Consequently, its contribution both with respect to agricultural production and population absorption was highly significant. Parana alone absorbed 13% of all rural migrants in Brazil in the 1940's and 12% of this total in the 1950's.²

5. The intensification of frontier expansion in Parana began in the late 1930's with the outward spread of the area planted in coffee from western São Paulo and lasted until the 1960's. Private, foreign-owned colonization companies were largely responsible for the type of settlement that took place in northwestern Parana by selling thousands of small and medium-sized plots to migrant families. Colonization plans were well-formulated and diversified, while essential urban infrastructure and services were provided, particularly in the newly established planned towns -- now large intermediate cities -- of Londrina and Maringa. The proximity of internal markets, especially the rapidly growing incipient metropolitan areas of São Paulo and Rio de Janeiro, as well as the port of Santos, the excellent quality of the predominant terra roxa soils, the previous agricultural experience of the settlers and the comparatively unconcentrated land tenure structure in the region all heightened its ability to absorb migrants and generate increasing volumes of agricultural production, both for export (coffee) and domestic consumption (a variety of food crops).

6. As can be seen in Table I-1 below, Parana was characterized by extremely high rates of population growth during the 1940's and 1950's due largely to the influx of migrants. While much of this population came from traditional areas of agricultural settlement in neighboring São Paulo and Minas Gerais, a substantial number of migrants came, directly or indirectly, from as far away as the rural Northeast. Even though the 1960's witnessed a reduction in the rate of migration to Parana on account of the introduction of more capital-intensive agriculture, population growth in the state still averaged close to 5% a year.

7. The second major phase of frontier growth was registered in the broad central strip involving parts of the states now called Mato Grosso do Sul, Mato Grosso, Goiás, Tocantins and Maranhão. Several factors induced the rapid incorporation of this vast central region. Most of them reflect the fact that external conditions, including increasing government intervention, favored expansion of a new, though still relatively proximate, frontier. Starting in the 1930's, but increasingly after 1950, the federal government implemented various measures designed to help physically integrate this area with the rest of the country and to stimulate rural settlement and, thus, the process of frontier occupation. These included the promotion of directed colonization, the

² Martine, op. cit., pg. 190.

transfer of the capital of the state of Goias to the planned city of Goiania located in the heart of a rich agricultural area, the building of new roads linking the Center-West region to southeastern Brazil (ie. Sao Paulo and Minas Gerais) and, ultimately, the transfer of the national capital from Rio de Janeiro to Brasilia and construction of the Belem-Brasilia highway.³

Table I-1

Rates of Population Growth of Agricultural Frontier States, 1940-70

<u>State</u>	<u>Annual Rates of Growth (%)</u>		
	<u>1940-50</u>	<u>1950-60</u>	<u>1960-70</u>
Parana	5.5	7.3	5.0
Maranhao	2.5	4.5	2.0
Goias *	3.9	3.7	4.4
Mato Grosso do Sul	2.6	6.5	5.7
Mato Grosso	1.0	4.5	6.5
BRAZIL	2.3	3.0	2.9

* Includes the present state of Tocantins, created in 1988

Source: IBGE - Demographic Censuses, 1940-70.

8. The nationwide expectations generated by such actions played a major role in stimulating the occupation of central Brazil between 1950 and 1970. Migratory flows to the Center-West and Maranhao, largely originating from less prosperous areas of Minas Gerais and Espirito Santo and the Northeast respectively, contributed to rapid rates of population growth and to a significant increase in the participation of these states in the total population. However, the impact of frontier expansion in the central region on the absorption of rural demographic surpluses and national economic growth was considerably smaller than that previously occurring in Parana due to the lower carrying capacity of the less fertile cerrado soils in much of the Center-West. This pattern also corroborates the hypothesis that frontier expansion occurs most successfully in areas that are closer to major markets and/or possess other comparative advantages.

³ For a more detailed discussion of these and related measures and their consequences, see World Bank, Settlement and Agricultural Development of Brazil's Central-West Region, Report No. 1435-BR, January 21, 1977, especially Chapters II and III.

C. Initial Amazonian Frontier Settlement

9. The most recent phase of frontier development in Brazil covers different parts of the huge Amazon region over a relatively short time span.⁴ Except for the Belem-Brasilia segment, which was settled mainly during the 1960's, intensive occupation of parts of Amazonia has occurred largely after 1970 when the most ambitious government attempts at directing frontier settlement were initiated. These efforts are the direct precursors to the increasing attempts to "colonize" the Northwest region in the late 1970's and 1980's.

10. Construction of the Belem-Brasilia highway in the late 1950's promoted the partial incorporation of large segments of the country's central zone into the national economy. It also served to promote the transition of frontier expansion from central Brazil to the North region by providing an overland link to eastern Amazonia. In addition to promoting the settlement of central and northern Goias (now Tocantins) and southwestern Maranhao, the northern section of the roadway cut through dense Amazonian rainforest in the state of Para, bringing with it a large influx of land-hungry migrants to sparsely populated areas.

11. Even though some official colonization projects had been previously implemented in central Goias and eastern Para, for the most part rural settlement along the Belem-Brasilia highway occurred spontaneously. Except in rapidly growing urban areas such as Imperatriz, the overall impact in terms of permanent settlement was limited. Typically, initial occupation of the area by subsistence farmers gave rise to minifundia, while the traditional itinerant slash-and-burn agricultural practices of spontaneous settlers facilitated the concentration of small farms into larger landholdings, many of which were later converted into cattle ranches. As a result, the number of permanent employment opportunities created tended to be very small in comparison to the size of the areas occupied.⁵ Occupation along the Belem-Brasilia highway nevertheless provided a launching point for ambitious government settlement schemes in eastern Amazonia after 1970.

12. At the height of Brazil's "economic miracle" during the late 1960's and early 1970's, several factors began to focus the nation's attention on Amazonia. First, rapid economic growth heightened nationalistic feelings and generated a sense of urgency about the need to physically integrate unoccupied areas and to exploit their purported mineral and other riches. An ill-conceived Great Lakes scheme for the Amazon region proposed by the Hudson Institute was

⁴ Much of this discussion is based on George Martine, "Recent Colonization Experiences in Brazil: Expectations versus Reality," in Francoise Barbira-Scazzochio (ed.), Land, People and Planning in Contemporary Amazonia, Cambridge University, 1980, pp. 80-94.

⁵ See Jean Hebette and Rosa Marin, Colonizacao para Quem?, NAEA, Universidade Federal do Para, Belem, Serie Pesquisa No. 1, 1979.

construed as evidence that foreigners were unduly interested in the area.⁶ Rumors that non-Brazilians were purchasing large tracts in Amazonia and that its huge mineral deposits were being illegally cannibalized by foreign enterprises further fueled jingoistic concerns as to the region's future. This, combined with the general mood of expansionist euphoria created by the economic boom at its height, appears to have provided much of the stimulus for stepped-up federal intervention in the area.

13. Although the progressive occupation of frontier areas was a major element in the military government's geopolitical strategy for the region, the immediate justification for undertaking a large-scale Amazonian colonization effort came from the plight of the drought-stricken Northeast. President Medici's emotional reaction to the latter's misery allegedly triggered the decision to accelerate settlement of the Amazon region as an escape valve for Northeastern social problems. On June 16, 1970, the National Integration Program (PIN) was announced.

14. PIN was intended to be a major step in the establishment of improved inter-regional linkages. Its major declared objectives were to reduce regional imbalances and decentralize the development process through the creation of new growth poles. For this purpose, a trunk highway network involving two major corridors, the east-west Transamazon and the north-south Cuiaba-Santarem roads, would be built and a large number of low (Transamazon) and middle (Cuiaba-Santarem) income families were to be settled along their margins. A 100 kilometer strip on either side of these roads was reserved for the installation of public or private agricultural colonization projects. Altogether, some 100,000 families were expected to be accommodated in official settlement schemes along the "Transamazonica" alone between 1971 and 1974 within a planned framework characterized as "rural urbanism."

15. Extensive propaganda campaigns featuring nationalistic slogans and optimistic predictions were set in motion. Promises of a new life in Amazonia soon found considerable resonance among the rural populations of older settlement areas, many of which were in the throes of rapid government-induced modernization, as described below. The first colonization projects in connection with PIN were attempted on a stretch of the Transamazon highway between Estreito in northern Goias (now Tocantins) and Itaituba in western Para in 1972. A series of geometrically-designed planned communities was projected at fixed intervals along the highway. Settler families were each to receive 100 hectare plots, agricultural credit and guaranteed subsistence during the first six months of

⁶ Robert F. Skillings and Nils O. Tcheyan, Economic Development Prospects of the Amazon Region of Brazil, Center of Brazilian Studies, Johns Hopkins University, mimeo, 1979, pp. 7-8.

occupation. In addition, the Government would provide basic infrastructure, support services and community facilities.⁷

16. The results of this experiment, however, were highly disappointing, especially when compared with its original goals. Roadbuilding efforts bogged down in the 1973 oil crisis and the onset of Brazil's balance of payment problems. The proposed colonization model proved largely impossible to implement as planned. Eastern Amazonian soils, which were initially untested, were found to be inadequate for sustained agricultural production, while Northeasterners and other poor families were unprepared for the requirements of colonization in a humid tropical environment.

17. As a consequence, migrants were attracted in much greater numbers than could be effectively absorbed and most of the elaborate settlement schemes originally proposed by the National Colonization and Agrarian Reform Institute (INCRA) never materialized. The number of families actually accommodated in official projects along the Transamazon highway (less than 7,000 by 1974) was very small in comparison to initial targets, while many of the families who attempted to settle in the colonization schemes were later forced to move on due to varied hardships. In short, even though parallel private colonization efforts along the Guiaba-Santarem highway in north-central Mato Grosso did experience some success, the official colonization model attempted along the Transamazonica turned out to be costly and impractical for purposes of large-scale settlement.

18. The failure of this top-down approach also provided a convenient excuse within the federal government to respond to growing political pressures to turn over the task of "productively" occupying Amazonia to large commercial enterprises from south-central Brazil and abroad. Such enterprises were alleged to possess the advantages of scale and technology necessary to develop the region's potential along the lines of an increasingly popular "growth pole" approach. After 1974, accordingly, government development efforts in eastern Amazonia focused primarily on the promotion of large-scale private investment, in the process leaving the Transamazon colonists and an increasing number of spontaneous settlers essentially to fend for themselves.⁸

19. The fact that land values throughout the country multiplied during the early 1970's due to the combination of government-subsidized agricultural modernization, the local stock market crash, public infrastructure investments and official tax and credit incentives helped entice many large business concerns to the region. Optimistic projections regarding the prospects for raising and exporting cattle from eastern Amazonia to European markets further fueled this

⁷ For additional details, see Dennis Mahar, Frontier Development Policy in Brazil: A Study of Amazonia, Praeger Publishers, New York, 1979.

⁸ For additional information on events in eastern Amazonia over the past several decades, see OED, Environmental Aspects and Consequences of the Carajas Iron Ore Project, September 4, 1990, especially Chapter IV, and Anthony L. Hall, Developing Amazonia: Deforestation and Social Conflict in Brazil's Carajas Programme, Manchester University Press, Manchester, UK, 1989.

movement. As further discussed below, the incoming Geisel administration inaugurated a new growth pole program for the region (POLAMAZONIA) to complement existing fiscal incentives in 1974. Even though such measures did not produce the anticipated economic boom, they did effectively signal an end to official efforts to absorb large numbers of rural migrants in areas in the eastern part of the region.

D. Agricultural Modernization and the Migrant Pool⁹

20. The intensive occupation of Brazil's Northwest region during the 1970's was not only the result of the relative stagnation of earlier frontier areas and the failure of official colonization projects in Eastern Amazonia. More importantly, it was a response to the profound transformations occurring in regions of older settlement. Before briefly summarizing these changes, it should be observed that relatively high rates of population growth alone resulted in average increments of some 1.5 million people a year in Brazil's rural areas between 1960 and 1980. Such large demographic increases in and of themselves would probably have generated considerable demographic surpluses and, hence, substantial rural out-migration. However, inasmuch as this growth occurred simultaneously with wholesale changes in the structure and relations of agricultural production in south-central Brazil, in fact it provoked a massive rural exodus.

21. The origins of this exodus are worth examining in some detail since they determined the size and characteristics of the migrant population which subsequently flocked in large numbers to the Northwest, thus shaping the nature and dynamics of its settlement process. Intensification of import substituting industrialization efforts in the 1950's set the stage for the modernization of agricultural production in Brazil. The early 1960's witnessed the first efforts at large-scale manufacturing of farm machinery in the country. But it was only after the military takeover in 1964 that several factors coalesced to induce extensive modernization of agricultural practices. First, the attractive promises of Green Revolution technology motivated public sector decision makers to attempt a quick breaching of the technological gap in the agricultural sector. The increasing industrialization of farm inputs also contributed to rapid output growth in the recently expanded manufacturing sector.

22. The Brazilian Government instituted a series of measures aimed at motivating farmers to adopt new technologies and practices. The most important among these was the rapid expansion of subsidized credit which favored the progressive integration of agricultural, commercial, industrial and financial capital, in the process permitting consolidation of a national agro-industrial complex. Subsidized rural credit was specifically directed to the purchase of high yield variety (HYV) seeds, farm implements, fertilizers, pesticides and insecticides. Other measures working to the same end were minimum price policies, crop insurance and a variety of indirect subsidies, together with a number of special programs directed to particular crops (eg. coffee, sugar and

⁹ This section is largely based on George Martine and Ronaldo C. Garcia, Os Impactos Sociais da Modernizacao Agricola, Sao Paulo, Caetes/Hucitec, 1987, especially Chapters 1 to 4.

cocoa) and regions. The national systems of agricultural research and rural extension were also expanded and streamlined to fit the new model.

23. The impact of these measures was reinforced by the sharp rise in international commodity prices during the latter part of the 1960's. This was particularly fortunate for the budding agricultural modernization process since it occurred at a time when the growing internationalization of the Brazilian economy required export-oriented sectors to increase their output in order to meet expanding external commitments. Due to policy-induced disequilibria in the structure of agricultural production, however, a growing duality and division of labor emerged in the sector between 1965 and 1980. As a result, larger landholders on more privileged lands had easy access to credit, subsidies, research, technical assistance and technology and produced essentially for the external market or domestic agro-industries. In contrast, smaller producers, who were progressively pushed off the land or relegated to less fertile and accessible areas, continued to utilize traditional farming practices and family labor to provide many of the foodstuffs consumed on the internal market where prices were kept low because of the reduced buying power of the rapidly growing urban population.

24. The second manner in which agricultural subsidies favored the concentration of holdings was through their effect on land speculation. The fact that access to rural credit required title to the land was, in itself, a source of disequilibrium. Furthermore, the larger the land area owned, the greater the access to subsidized credit. Such resources, in the absence of rigorous monitoring and control, were ultimately used in a number of manners including the purchase of additional land. This, in turn, often served as collateral for the obtention of even more subsidized credit, nourishing further speculation and so on.

25. Perhaps the clearest illustration of how the new model favored land concentration is the transformation that occurred in Parana between 1970 and 1980. Total agricultural land area in this state increased from 14.6 to 16.4 million hectares in the 1970's, while the number of farm establishments decreased from 554,000 to 454,000. The categories of rural workers most affected by land concentration were squatters, sharecroppers and tenants, who controlled 242,000 farms in 1970, but only 148,000 in 1980. Since these establishments tended to be relatively small and labor-intensive, the total number of persons employed in the agro-ranching sector decreased by 10% in absolute terms, from 2 million to 1.8 million, despite the 1.8 million hectare increase in agricultural land occupied in the state. Such changes in the structure of agricultural land use are directly traceable to the substitution of small, family-operated, multi-crop establishments by larger monocultural (particularly soybean producing) commercial farm enterprises.¹⁰

¹⁰ For further discussion of the impact of recent land use and land tenure changes in Parana, see IPARDES, "Consequencias Sociais das Transformacoes Tecnologicas na Agricultura do Parana," presented as Chapter 6 in Martine and Garcia, op. cit.

26. The results of these changes are clearly reflected in internal migration data for Brazil. The state of Parana as a whole, which during the 1940-70 period had consistently registered high rates of net in-migration, suffered a net loss of 1.3 million people during the 1970's. Outmigration from rural areas was, in fact, much higher since urban centers within the state absorbed a large part of the exodus. Such rural out-migration was at the heart of the peculiar dynamics of the migration stream between Parana and the Northwest which was responsible for a significant proportion of all movement to Rondonia through the mid-1980's.

27. On a more general level, the increasing capitalization of agricultural production reduced the physical and social space available to small-scale producers of all types in south-central Brazil. Since small farmers make much more intensive use of all factors at their disposal, especially labor, the reduction in the size of this group translates directly into a heavy rural exodus. Although conditions on small family farms were frequently far from ideal, with the higher yields per unit in such establishments being largely the result of an intense exploitation of family labor, these units, nevertheless, have traditionally been the main source of stable employment and subsistence for the rural population throughout Brazil. The abrupt land use changes affecting smaller farmers were, thus, at the root of the accelerated rural exodus occurring during the 1970's. According to the estimates in Table I-2 below, altogether, a total of some 28.4 million people, which is roughly equivalent to the entire population of Argentina, abandoned Brazil's rural areas between 1960 and 1980.

28. The analysis of extensive rural outmigration during the past several decades, in short, indicates that this was not so much a response to relative levels of poverty in the various parts of the country as it was a reflection of the timing and rhythm of the process of agricultural modernization. In this connection, it is significant that the rural exodus of the 1970's occurred first and most intensively in the more developed areas of Sao Paulo, Parana and Rio Grande do Sul, where modern agricultural technology is most prevalent, rather than, as in earlier decades, in the less developed Northeast and the poorer parts of the Southeast such as Minas Gerais and Espirito Santo. Even though migration due to agricultural "stagnation" also occurred in the latter areas, as during the 1960's when the natural increase of the rural population was at its height, the main causes of rural exodus in the 1970's and early 1980's were disequilibria resulting from the modernization process. This is the larger sectoral and demographic context within which rapid settlement of the Northwest region has to be understood.

29. As indicated in the preceding section, massive government propaganda campaigns surrounding the National Integration Program (PIN) helped channel part of the rural exodus in the 1970's from areas of traditional settlement, including former frontier regions in the South, Southeast and Northeast to the allegedly rich lands of Amazonia. However, the subsequent abandonment of large-scale colonization projects along the Transamazon highway and the turnover of huge tracts of partially-inhabited land to large enterprises, together with the generally poor quality of soils in eastern Amazonia, severely restricted possibilities for small-farmer settlement in the area. By contrast, the Northwest, and particularly the federal Territory of Rondonia, although characterized by serious problems of physical access, appeared to possess much

better soils and was one of the least densely-occupied areas in the country. As a result, with the failure of the Transamazon venture and the acceleration of rural out-migration from southern Brazil during the mid-1970's, Rondonia became a prime target for spontaneous settlers and government colonization efforts alike.

Table I-2

Net Rural Migration by Region and Selected States, 1960-80
(in thousands)

<u>Region/State</u>	<u>1960-1970</u>	<u>1970-1980</u>
North	-447	-1
Northeast	-4,373	-4,990
Southeast	-6,801	-5,038
Minas Gerais	-2,933	-2,611
Sao Paulo	-2,954	-1,552
South	-1,079	-4,395
Parana	+166	-2,516
Rio Grande do Sul	-854	-1,199
Center West	-135	-1,199
Mato Grosso*	+114	-243
Goiias	-249	-956
BRAZIL	-12,835	-15,611

* includes the present states of Mato Grosso and Mato Grosso do Sul

Source: IBGE, Demographic Census, 1960, 1970, 1980

E. Development Policy for Amazonia Prior to 1979

30. In a world which that occasionally sees itself as running out of natural resources and living space, the six million square kilometer Amazon Basin generally appears as the ultimate reserve.¹¹ In light of international concern over the fate of Amazonia, Brazilians have historically treated the region with ambivalence. On the one hand, possession of such a large proportion (70%) of this "ultimate reserve" has brought feelings of pride and security. On the other, the at times intense interest shown by other nations, which sometimes

¹¹ Martin T. Katzman, Cities and Frontiers in Brazil: Regional Dimensions of Economic Development, Harvard University Press, Cambridge, Mass. 1977, pg. 69.

appear to border on the covetous, generates insecurity and has periodically provoked a need to reassert national sovereignty over the region.¹² Given the lack of a durable consensus as to how best to establish effective dominion over the area, however, official involvement in the Amazon has taken different forms over time. These initiatives, nevertheless, reveal a common preoccupation with strategic geopolitical and economic control over a huge territory, whose natural resource wealth, until recently, was largely unknown.¹³

31. While initial interest in the region dates from the colonial period, it was only in the last quarter of the nineteenth century that wild rubber first brought economic significance to Amazonia. The prosperity generated by the export of this forest product lasted half a century. Once plantation-grown rubber in southeast Asia began to dominate world markets after 1912, however, the region quickly met with economic and demographic stagnation.¹⁴ It was only in 1953 that the Superintendency of the Economic Valorization Plan for Amazonia (SPVEA) was created in order to promote transport infrastructure, communications, energy and health projects in strategic parts of the region. Massive roadbuilding programs, including construction of the Belem-Brasilia and Porto Velho-Cuiaba highways, were among the major achievements of the 1950's and 1960's. Other programs sponsored by SPVEA had little impact, in part because roadbuilding efforts had absorbed much of the agency's budget.

32. After the military took power in 1964, government policy for the region underwent a drastic redirection. "Operation Amazonia," which was launched at this time, clearly reflected government intentions to promote settlement in an area of "vast emptiness." To this purpose, a series of legislative acts and decrees were passed during 1966-67 committing the new administration to the objectives of regional development and national integration. Included among these plans were new roadbuilding programs, agricultural colonization schemes and fiscal incentives. The motivation for such plans, however, was largely geopolitical and little thought was given to designing a development strategy appropriate to the unique environmental characteristics of the region.¹⁵

¹² For one classic example of this sentiment, see Arthur Cezar Ferreira Reis, A Amazonia e a Cobica Internacional (or "Amazonia and International Greed"), Companhia Editora Americana, Rio de Janeiro, 1972.

¹³ See, for instance, Bertha K. Becker, Geopolitica da Amazonia: A Nova Fronteira de Recursos, Zahar Editores, Rio de Janeiro, 1982.

¹⁴ In addition to Mahar, Frontier Development Policy, op. cit., see Roberto Santos, Historia Economica da Amazonia, T. A. Queiroz Editor, Ltda., Sao Paulo, 1980.

¹⁵ In addition to the sources cited in previous notes, see Dennis Mahar, "Government Policies and Deforestation in Brazil's Amazon Region", World Bank, Environment Department Working Paper No. 7, June 1988, pg. 10. This was republished as "Deforestation in Brazil's Amazon Region: Magnitude, Rate and Causes" in Gunter Schramm and Jeremy Warford (eds.), Environmental Management and Economic Development, Johns Hopkins University Press, Baltimore, 1989.

33. In 1966, SPVEA was replaced by a new regional development agency, the Superintendency for the Development of Amazonia (SUDAM), and a regional development bank, the Bank of Amazonia (BASA), was created in order to coordinate and finance new plans for the integration of Amazonia, respectively. With the aim of attracting private enterprise to the region, the federal government increased its expenditures on physical infrastructure and created a program of fiscal and tax incentives for "Legal Amazonia" which included parts of Maranhao, Goias (now Tocantins) and Mato Grosso, together with the states and territories that composed the North census region. Fiscal benefits available to qualifying firms included a reprieve on corporate income taxes on holdings in the region for a 10 to 15 year period and exemptions from export and import duties. Such benefits favored industrial firms, including both domestic and foreign companies, and it was on the basis of these and other incentives that the city of Manaus was made a zona franca or free-trade zone.

34. The most powerful incentives, however, permitted registered Brazilian corporations to take up to a 50 percent credit against their federal income tax liabilities if the resulting savings were invested in projects approved by SUDAM in Legal Amazonia. Both new industrial enterprises and expanded or modernized establishments were eligible for such investments. Agriculture, livestock and selected service sector (eg. tourism) projects became eligible to receive fiscal incentives in 1966. Between 1966 and 1974, up to 75% of total investment in such undertakings could be constituted by tax-credit funds. After 1974, a ceiling was set at 25% of income tax liability.¹⁶

35. As could be expected, such incentives proved extremely attractive to private investors and, by late 1985, some 950 projects had been approved by SUDAM, of which 631 were in the livestock sector. A recent study by the Brazilian planning ministry reveals, however, that, despite the huge subsidies involved, the performance of such projects has been generally disappointing.¹⁷ Very little employment has been created and few projects are actually producing anything worthwhile. On the other hand, considerable deforestation has reportedly resulted from such initiatives and other agro-ranching activities in the region. Many projects appear to have been undertaken mainly for their fiscal benefits and to facilitate access to and effective control over huge tracts of land.¹⁸ But, as one recent study demonstrates, commercial cattle ranching appears to be intrinsically uneconomic under present conditions in much of Amazonia.¹⁹

¹⁶ Mahar, op. cit., pg. 11-12.

¹⁷ See Jose Garcia Gasquez and Clando Yokomizo, "Resultados de 20 Anos de Incentivos Fiscais na Agropecuaria da Amazonia," XIV Encontro Nacional de Economia, ANPEC, Vol. 2, pp. 47-84.

¹⁸ See Guilherme Delgado, Capital Financeiro e Agricultura no Brasil, Sao Paulo, Icone, 1987, especially Chapters 5 and 6.

¹⁹ Susana B. Hecht, Richard B. Norgaard and Giorgio Possio, "The Economics of Cattle Ranching in Eastern Amazonia," Interciencia, Vol. 13, No. 5, 1988, pp. 233-240.

36. While the fiscal incentives scheme was still at an incipient stage, the Government announced the aforementioned National Integration Program (PIN) in 1970. As previously indicated, this new phase of public intervention in the region aimed primarily at the reduction of social tensions in the Northeast through unprecedented small-farmer colonization in the Amazon Basin and greatly improved physical linkages between Amazonia and the rest of the country. The reasons why such plans were soon shelved were discussed above. For the present purpose of tracing the evolution of federal involvement in Amazonia, however, PIN is of considerable importance since heavy government expenditures in transport infrastructure, in conjunction with fiscal incentives and rapidly-rising land values throughout Brazil, induced an increasing number of large private enterprises to invest in the region.

37. Several government initiatives undertaken after 1973 reflect both the disenchantment with small-farmer colonization and the growing interest of private companies in Amazonian projects. First, based on the unsuccessful attempts to establish agricultural colonization projects along the Transamazon highway, the Planning Ministry declared that small farmers were predatory and that the Government would turn to large-scale enterprises to bring adequate technology to bear on the productive occupation of Amazonia. Then, in 1974, a new special program, POLAMAZONIA, was announced. This program identified fifteen "growth poles" scattered throughout the region as the main focal points for its development. Under this approach, public and private investments would be concentrated in large-scale cattle ranching, timber and mining ventures and road and hydroelectric projects.

38. The major shift in focus represented by POLAMAZONIA was also reflected in the activities of INCRA, the official colonization agency. As part of the effort to entice private enterprise to a region which, due to its considerable distance from internal markets and inhospitable climate among other factors, experienced significant disadvantages in attracting investors, INCRA initiated the "Projetos Fundiarios" or "Land Regularization Projects." The objective of these initiatives was to discriminate and map frontier lands through their physical demarcation and the concession of legal property title to "legitimate" owners, with the remaining areas either auctioned off or set aside for various social or ecological purposes such as colonization, Amerindian and biological reserves. Throughout Amazonia, some 300 million hectares were incorporated into "productive" use in the mid-1970's in thirty such projects and various settlement models were tested.²⁰

39. In much of the Amazon region, but particularly in Mato Grosso, the principal utilization of the land thus "incorporated" was for the installation of private colonization projects. Private settlement was also stimulated by the PROTERRA credit program created in 1971. Jointly with PIN, PROTERRA provided widespread credit incentives at highly negative real interest rates at the same time that the land regularization program was selling off huge tracts of public

²⁰ Anna Luiza Osorio de Almeida, "The Cost of Amazon Colonization," paper presented at the 9th World Congress of the International Economics Association, Athens, 1989, pp. 2-3.

lands at nominal prices. Dozens of firms bought glebas or areas of hundreds of thousands of hectares, but were only legally obligated to promote settlement on 20% of the area purchased.

40. It is now generally recognized that, even though some productive activities were established on non-settled lands, most of these highly subsidized purchases have been held idle for speculative purposes.²¹ Altogether, some eighty private colonization projects were initiated under the PIN/PROTERRA programs, mostly along the Cuiaba-Santarem highway in Mato Grosso. Massive road construction, in turn, which reportedly consumed more than 80% of the estimated US\$ 4.7 billion equivalent spent by the federal government on Amazonian occupation during the 1970's, together with other policy measures, stimulated rising land prices, thereby effectively impeding access by small producers outside official colonization areas.²²

41. The conjunction of the various government programs initiated or redirected after 1974, including POLAMAZONIA, the Projetos Fundiarios, PROTERRA and the fiscal incentives, with an expanding and heavily-subsidized agricultural credit program served to further exacerbate land concentration in the region. With the exception of Rondonia, which soon became the main focus of the public sector's small-farmer colonization efforts, and private colonization projects in north-central Mato Grosso and despite the region's vast dimensions, legal access to land for small producers became severely restricted in much of Amazonia in the latter half of the 1970's. This situation provoked an intensification of land conflicts in eastern Amazonia which would later lead the military, through the National Security Council, to assume direct administration of the settlement of huge areas through the GETAT and GEBAM task forces.²³ It also reinforced the attractiveness of the Northwest to an increasing number of rural migrants from the Center-South.

²¹ Ibid., pp. 4-5.

²² Ibid., pp. 4 and 8. On the more general large farmer bias in Brazilian agricultural and fiscal policy and its environmental impact, see Hans Binswanger, "Brazilian Policies that Encourage Deforestation in the Amazon," Environmental Department Working Paper No. 16, World Bank, April 1989.

²³ GETAT was the Executive Group for Lands in the Araguaia-Tocantins region and GEBAM was the Executive Group for Lands in the Lower Amazon River area.

ANNEX IISETTLEMENT IN THE NORTHWEST REGION PRIOR TO POLONOROESTEA. Rondonia1. Initial Settlement

1. The Territory of Rondonia was created in 1945 on land previously belonging to the states of Mato Grosso and Amazonas. Despite two waves of immigration provoked by the demand for rubber in the late 19th century and during World War II respectively, as of 1950 Rondonia had only 37,000 inhabitants. A cassiterite boom following the discovery of large deposits of this ore in 1952, however, stimulated another flow of migrants to the Territory. The construction of a precarious dirt road at that time provided Rondonia with its first overland link to south-central Brazil and, as a result, the Territory's population increased to 70,000 by 1960. Cassiterite extraction through labor-intensive placer mining techniques attracted additional migrants during the 1960's. The road was rebuilt by the Army in 1966, permitting traffic during much of the year, and population increased to 111,000 in 1970. The new migrants, who came mainly to exploit the Territory's rich cassiterite deposits, transformed the river town of Porto Velho and the district of Calama into a re-edition of the wild mining scenes of the old American West.

2. Government intervention in favor of industrial-scale mining, by banning the manual extraction of cassiterite in 1971 subsequently led to the expulsion of thousands of prospectors. Some moved to Porto Velho, others turned to rubber tapping or subsistence farming, thereby helping to generate initial pressures on the land, while still others were flown by the military to other states.¹ Nonetheless, completion of the Cuiaba-Porto Velho highway, news that the region possessed above-average soils and a 1967 INCRA survey revealing that only a small proportion of the Territory's total area had legitimate proprietors all contributed to radically alter patterns of land occupation in Rondonia. Together, these factors attracted the first wave of speculators who began dividing up the land and selling it to unwary settlers.

3. Historical documentation as to exactly how this occurred is difficult to find, but stories abound. One relates that a group of some 200 farmers from the region of Andradina in Sao Paulo arrived in 1967, "purchased" a million hectares from rubber tappers and resold it to 500 buyers from all over Brazil.² Other accounts relate how grileiros (land grabbers) invaded Amerindian lands

¹ Ministerio do Interior (MINTER), "Em Rondonia, O Problema da Terra," Interior, Revista do Ministerio do Interior, Brasilia, 3(18), July/August 1977, pg. 38; Millikan, op. cit., pg. 24.

² MINTER, "A Estrada, O Garimpo e A Aventura Explodiram As Arterias de Rondonia," Interior, Revista do Ministerio do Interior, Brasilia, 3(19), September/October 1977, pg. 33.

and then sold them to would-be settlers arriving in the region.³ A better known case is that of the colonization program promoted by Calama, which was to exert a very significant influence on the region's future. This Parana-based company allegedly acquired a million hectares from the Government of Mato Grosso in 1909, deciding only in the mid-1960's, once the Cuiaba-Porto Velho road was a reality, to initiate a colonization project in Rondonia.

4. For this purpose, some 300 families were trucked in from Parana to Rondonia and settled on plots in the present municipality of Ji-Parana as part of a scheme to sell 1,500 plots to in-coming migrants. However, the company never provided the minimal services it had promised and the area soon became a source of growing tensions and violence. This situation, coupled with information as to the good quality of the soils in Rondonia, prompted the Brazilian Institute of Agrarian Reform (IBRA) to intervene in the area. It is likely that the later willingness of its successor, INCRA, to accelerate directed settlement activities in Rondonia was partly fueled by the resounding failure of colonization along the Transamazon highway, together with the Government's need to find alternative outlets for the increasing flow of Amazon-bound migrants that it had helped to provoke.⁴

2. INCRA's Land Development Activities in the Early 1970's

5. In any event, as of 1970, INCRA stepped in to organize settlement on the original Calama site. The first project prepared by the agency, the PIC (Integrated Colonization Project) Ouro Preto was designed for 500 families, but soon had to be expanded tenfold. The overall thrust of Amazonian migration, stimulated by PIN propaganda and the news that the federal government was giving away fertile land, quickly began to swamp Rondonia with prospective settlers. INCRA and other federal and local authorities were soon unable to handle the steadily rising flow of migrants arriving in the region.

6. Despite INCRA's presence, the physical occupation of Rondonia from 1973 onwards was, in fact, led largely by grileiros and speculators whose activities were fed by the growing numbers of migrants in search of land. As a result, an untenable land-rights situation soon developed. Indeed, when the first cadastral survey of rural properties was carried out in 1967, IBRA was only able to verify the existence of 155 legitimate claims, covering just 7% of the Territory's total area. Consequently, 93% of Rondonia was declared property of

³ MINTER, "Rondonia, Os Migrantes, Seus Problemas e Suas Esperancas," Interior, Revista do Ministerio do Interior, Brasilia, 2(12), July/August 1976, pg. 41.

⁴ MINTER, "A Estrada ...," op. cit., pg. 36. and John F. Wilson, Ariquemes: Settlement and Class in a Brazilian Frontier Town, Ph.D. Dissertation, University of Florida, 1985, pp. 43-44.

the federal Union.⁵ Later, private companies, passing themselves off as colonization enterprises, began to take possession of large tracts of land, dividing them into lots which were then sold to settlers. All of this further reduced the Government's capacity to cope with the situation and led eventually to drastic changes in strategy.

7. In retrospect, it can be seen that official intervention in Rondonia prior to 1975 involved attempts at comprehensive orientation and control of the settlement process along the lines of the Transamazon model. During this period, INCRA attempted to organize everything from land demarcation and the distribution of lots to the construction of roads, health and educational facilities and the provision of technical assistance, credit, marketing support and storage facilities. However, this system was too cumbersome to adequately deal with the rapid influx of migrants.

8. Among other problems, the region's adverse physical conditions (ie. dense tropical forest, humid climate, heavy rains during 4 to 5 months of the year) greatly hindered the work of surveyors and the construction of access roads, an essential preliminary step in INCRA's land development projects. As a result, considerable local variations in soil quality went unrecognized and, thus, were not taken into account in settlement planning. In addition, the colonization agency never possessed sufficient financial and technical resources to cope with the task of promoting massive colonization in accordance with its preconceived schemes.

9. The subsequent invasion of lands traditionally inhabited by Amerindians, caboclos (ie. small subsistence farmers), rubber tappers and other populations already in the Territory, the violence generated by speculators and grileiros, together with the dissatisfaction of disillusioned settlers, effectively undermined INCRA's attempts to "rationalize" the settlement process in Rondonia during the early and mid-1970's. Deficiencies in the Territory's administrative and legal structures made it easy for grileiros to promote chaos and manipulate existing powers to their own advantage. The municipality of Porto Velho, which at the time was roughly equal in size to the former German Democratic Republic, for example, had but a single judicial district, which was subject to all sorts of pressures, to rule on the numerous lawsuits which sprang up daily in response to land conflicts. Even though INCRA's colonization projects were eventually expanded from the original 500 to some 22,700 families, in short, demand for rural settlement plots consistently outstripped supply.

⁵ MINTER, "Rondonia ...," op. cit. pg. 41. It should also be observed in this connection that for reasons of national security, as also occurred along the Transamazon highway, a 100 kilometer strip on either side of all federal roads in Amazonia including the BR-364, as well as a 150 km section along the Brazilian side of any international border, such as that with Bolivia in the case of Rondonia, was determined to be legally under the control of the federal government. For this reason, administration of much of the land along the Cuiaba-Porto Velho highway in Rondonia was placed in the hands of INCRA, while the military controlled the less accessible strip of unoccupied land along the Bolivian border.

3. Directed Settlement after 1975

10. The year 1975 marks a clear departure from the initial strategy which was largely aimed at the paternalistic accommodation of small farmers. The high cost and low manageability of INCRA's colonization model helped to swing the balance to a more "capitalistic" approach. The new directives reflected policy changes at the national level, of which the "Projetos Fundiarios" (Land Regularization Projects) mentioned in Annex I were the mainstay. In Rondonia, the reportedly good quality of local soils had attracted the attention of agricultural entrepreneurs as well as grileiros. Consequently, at a time when rural land speculation was increasing throughout Brazil, considerable pressure was put on government authorities to adopt a more "realistic" approach to the settlement of Rondonia.

11. The specialized federal agencies that supported cocoa and coffee production (CEPLAC and IBC respectively), and which arrived in Ouro Preto shortly after the area was found to possess fertile soils, were influential in helping INCRA to define the new approach. As a result, three directed settlement projects, whose implementation initiated in 1975, pursued complementary activities in adjacent areas within the municipality of Ariquemes. Planned settlements in these areas, the PAD (Directed Settlement Project) Burareiro, the PAD Marechal Dutra and the "Licitacao" (Public Auction) Project, more specifically, were part of an ambitious scheme involving three different strata of rural producers. Marechal Dutra was to be reserved for subsistence farmers and the "Licitacao" project was to be sold to agricultural entrepreneurs who were expected to initiate capital-intensive production of rubber, pepper, coffee and other export-oriented crops, while the PAD Burareiro was to accommodate less-capitalized cocoa producers, many of whom were expected to come from the state of Bahia, Brazil's principal cocoa producing center.⁶

12. The demarcation of three contiguous tracts for different classes of producers aimed at making more "rational" economic use of available production factors than had occurred in earlier colonization schemes in Rondonia. Producers of cocoa and other export-oriented crops needed easy access to abundant labor. This was to be provided by the subsistence farmers who normally had a surplus or manpower during part of the year. Some observers have even used the image of the "demiurge" to characterize INCRA's attempt to put order into chaos in Ariquemes, dividing up the land by social class, as well as by type of crop, and projecting expected patterns of social interaction into the future.⁷

13. Be that as it may, the three projects in Ariquemes appear to have been part of a concerted shift to "economic realism" by federal authorities in Rondonia after 1975. Thus, it is probably not coincidental that INCRA also began to promote its "Projeto Fundiario" initiative in Rondonia at the same time. The objective of this measure was to identify "legitimate" title claims and weed

⁶ Jean HEBETTE and Rosa MARIN, "O Estado e A Reproducao da Estrutura Social na Fronteira: Ariquemes, Rondonia," Serie Seminarios e Debates, NAEA/Universidade Federal do Para, Belem, 1982.

⁷ Ibid., pg. 17.

out unwanted squatters.⁸ Not surprisingly, the 13,000 families which eventually benefitted from this program obtained title to average land areas which were much larger than those in all other types of settlement projects. A total of some 7.6 million hectares was distributed and/or legalized under the five Land Regularization Projects in Rondonia, with beneficiaries obtaining an average of roughly 580 hectares apiece.⁹ Another indication of the changing federal strategy is the fact that, in 1977, "Polo Rondonia" was allocated the largest individual share of POLAMAZONIA's resources among the fifteen areas participating in the program throughout the Amazon region.¹⁰

14. At the same time, concrete steps were being taken to curtail population flows to Rondonia through disincentive campaigns in the migrants' principal areas of origin and the placement of barriers on the main artery between these states and Rondonia. The National Security Council was convened on May 2, 1977 with the express purpose of devising a strategy to limit the flow of migrants to Rondonia.¹¹ As a result, several municipalities in northwestern Parana and southern Mato Grosso were identified as the main sources of migration to Rondonia and meetings were held with their Mayors and other local officials in an attempt to stem the outflow. In addition, grileiros were threatened with legal sanctions, buses and trucks transporting migrants were closely inspected, physical roadblocks were set up and pamphlets were distributed to alert prospective migrants to the climatic and other hardships they would encounter

⁸ R. Galvao Modesto, "A Contribuicao do INCRA no Processo de Ocupacao do Territorio de Rondonia" in Doencas e Migracao Humana, Ministry of Health, SUCAM, Brasilia, 1982, pp. 39-78.

⁹ Ibid., pp. 64 and 66.

¹⁰ MINTER, "Em Rondonia, O Problema da Terra," op. cit., pp. 40-41. The resources destined to "Polo Rondonia," which accounted for 20% of POLAMAZONIA's entire budget in 1977, more specifically, were earmarked for the construction of assorted physical infrastructure which was expected to improve the economic feasibility of agricultural production.

¹¹ MINTER, "Rondonia: Sugestoes do Ministerio do Interior," Grupo de Trabalho, Conselho de Seguranca Nacional, May 6, 1977, mimeo.

in the Territory. ¹² Available data suggest that these measures did, in fact, produce a temporary slowing-down of migration to Rondonia in 1977-78. ¹³

15. In 1979, however, after the roadblocks and other disincentive measures were discontinued in response to the ambitions of a new Territorial Government ¹⁴ to achieve statehood for Rondonia through massive infrastructure improvements and an increase in its population, INCRA once again took up the task of delimiting new projects. Recognizing that the flow of migrants had outrun possibilities for organized settlement along the lines of the previous model, the federal government adopted a "Rapid Settlement" (or "Assentamento Rapido") program. In practice, this involved legal recognition of spontaneous settlements which had increasingly appeared as migrants proceeded to occupy lands adjacent to whatever roads or trails already existed (or were being programmed) or wherever the grapevine suggested that public lands might soon be subject to distribution.

16. By this process, spontaneous settlers would identify plots more or less equivalent in size (normally 100 ha) to those that INCRA was expected to distribute and begin cutting and burning the forest and producing subsistence crops in order to legitimize their possession. In response, the Government attempted simply to put some sort of order into this process by controlling the amount of land to be claimed by any one squatter and later, if available resources permitted, providing minimal infrastructure in terms of access roads, storage facilities and the like. Altogether, some 23,000 families were benefitted as a result of this program through the early 1980's.

¹² The pamphlets distributed to potential migrants 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." World Bank, Brazil: Integrated Development..., op. cit., pg. 16, footnote 1.

¹³ Data prior to 1978 are extremely spotty, making their tabulation and presentation particularly risky. Nevertheless, they seem to indicate a reduction of migration to Rondonia in 1977 and 1978 (see Table 7 in Chapter VI).

¹⁴ Since Rondonia at the time was still a federal Territory under the direct administration of the Ministry of the Interior, a new Governor was appointed by the in-coming Minister shortly after the Figueiredo administration took office in March 1979.

4. The Results of Rural Settlement through 1980¹⁵

17. The unusual degree of consistency between INCRA data and that from the 1980 Agricultural Census appears to suggest that INCRA had considerable success in controlling the settlement process in Rondonia during the late 1970's. According to INCRA, a total of 48,717 families were settled with some form of assistance between 1970 and 1980.¹⁶ This is actually a slightly higher figure than the total number of agricultural establishments identified in the Territory by the 1980 Agricultural Census (48,371). However, it is legitimate to surmise that many, if not all, of the farms that INCRA claims to have "disciplined" through its Rapid Settlement and Land Regularization Programs were, in fact, originally the product of spontaneous occupation. Table II-1 indicates the various official settlement programs undertaken in Rondonia, as well as their total absorptive capacity, during the 1970's and early 1980's.

Table II-1

Official Settlement Projects in Rondonia

<u>Name or Type of Project</u>	<u>Year Initiated</u>	<u>No. of Families Settled or Plots Legalized</u>
PIC Ouro Preto	1970	5,161
PIC Sidney Girao	1971	638
PIC Ji-Parana	1972	4,730
PIC Paulo de Assis Ribeiro	1973	3,076
PIC Padre Adolfo Rohl	1975	3,462
PAD Marechal Dutra	1975	4,603
PAD Burareiro	1975	1,540
Land Regularization Program	1975	13,146
Rapid Settlement Program	1979	23,098
TOTAL	-	59,454

Sources: Modesto (1982) and FIPE (1986b)

18. The overall result of these initiatives was that roughly 334,000 people flocked to Rondonia from other parts of Brazil between 1970 and 1980,

¹⁵ A detailed discussion of the status of the various INCRA colonization projects in Rondonia in the late 1970's can be found in Orlando Valverde, et. al., A Organizacao do Espaco na Faixa da Transamazonica, Volume I, IBGE, Rio de Janeiro, 1979.

¹⁶ Modesto, op. cit., pg. 66.

some 190,000 of which went to rural areas.¹⁷ Furthermore, as the data in Table II-2 reveal, enormous changes occurred in the structure of agricultural production in Rondonia during the 1970's. From 7,082 farm establishments occupying 1.6 million hectares in 1970, Rondonia progressed to 48,371 farms incorporating 5.2 million hectares in 1980. The land area under cultivation, similarly, increased from 44,636 hectares in 1970 to 373,431 hectares in 1980, some 45% of which was planted in perennial crops. The number of tractors and heads of cattle, additionally, both increased more than tenfold over the decade, from 52 to 570 and 23,000 to 251,000 respectively.

19. The evolution of the size distribution of rural establishments in Rondonia during this period also presents an interesting study. As indicated in Table II-3 below, the most dramatic changes occurred between 1970 and 1975 when INCRA's large-scale distribution of 100 ha plots on previously unoccupied land had a significant deconcentrating effect. Between 1975 and 1980, in turn, the growing importance of smaller establishments, particularly within the 50-100 ha category, can be observed, together with a substantial reduction in the relative importance of the 100-200 ha and 200 to 1,000 ha categories. These trends closely reflect the changes in colonization policy described above.

Table II-2

Evolution of Agricultural Production in Rondonia, 1970-80

<u>Variable</u>	<u>1970</u>	<u>1975</u>	<u>1980</u>
No. of Farm Establishments	7,082	25,483	48,371
Total Area (000 ha)	1,632	3,083	5,224
Average Area/Establishment (ha)	230.4	120.9	108.0
Area in Perennial Crops (ha)	12,273	45,763	170,178
Area in Annual Crops (ha)	32,363	147,700	203,253
Agricultural Employment	20,563	103,992	176,934
Tractors	52	68	570
Cattle Population	23,175	55,392	251,419

Source: IBGE, Agricultural Census, 1970, 1975, 1980

¹⁷ Silvia Menezes Pinheiro, preliminary data from on-going work on Master's thesis, CEDEPLAR/UFMG, Belo Horizonte.

20. The general tendency toward the deconcentration of farm holdings produced by INCRA's distribution of small and medium-sized plots, however, masks two other trends which are also of considerable significance: the spread of minifundios and the growing importance of latifundios in Rondonia. The multiplication of minifundios (ie. farms having 10 hectares or less) was part of the survival strategy of migrants who were, at least initially, unable to obtain or retain larger plots of their own. Over two-thirds of these families occupied less than 5 hectares of total area and the majority were either squatters, sharecroppers or tenants.

21. At the other extreme, the larger establishments (1,000 hectares or more) tripled their land area in absolute terms between 1970 and 1980. As suggested earlier, the greatest boost to such enterprises occurred during the 1975-80 period, when the "Projetos Fundiarios" were implemented. Despite the significant presence of small farms and ranches, the relative proportion of rural land in establishments of 1,000 hectares or more in Rondonia was more than 25 times the share in that category for the country as a whole in 1980.

Table II-3

Evolution of Land Tenure Distribution in Rondonia, 1970-80 (%)

	<u>1970</u>	<u>1975</u>	<u>1980</u>
<u>Establishments</u>			
Less than 10 ha	8.0	19.1	25.1
10-50 ha	29.1	17.5	15.0
50-100 ha	10.0	10.6	25.9
100-200 ha	13.0	47.3	29.1
200-1,000 ha	38.4	4.5	3.7
More than 1,000 ha	1.6	1.1	1.1
Total Number	7,082	25,483	48,371
<u>Area</u>			
Less than 10 ha	0.2	0.6	1.0
10-50 ha	2.7	3.2	3.5
50-100 ha	2.9	6.7	18.5
100-200 ha	7.1	40.2	28.2
200-1,000 ha	48.7	16.1	10.9
More than 1,000 ha	38.4	33.2	37.9
Total Area (000 ha)	1,631.6	3,082.9	5,233.6

Source: IBGE, Agricultural Census, 1970, 1975, 1980

22. In summary, the land occupation situation in Rondonia at the time POLONOROESTE was prepared was at once complex and dynamic. On the one hand, there is no question that socially-oriented rural settlement programs had been

concentrated to a greater degree in Rondonia than anywhere else in the country. On the other hand, the structure, conditions and inequalities that prevailed both in traditional and rapidly modernizing agricultural areas elsewhere in Brazil were also already beginning to be reproduced in Rondonia. POLONOROESTE would only reinforce this tendency.

B. Mato Grosso

1. Frontier Occupation Patterns

23. The present state of Mato Grosso was officially created on January 1, 1979 when the former state with the same name was divided into two parts. The northern portion retained the name and capital city (Cuiaba) of the original state, while the southern section became Mato Grosso do Sul. Encompassing some 18% of the Brazilian part of the Amazon Basin, much of present-day Mato Grosso is a transition area between the cerrados to the south and east and humid tropical regions to the north and west. Some 10% of the state's total area consists of low-lying Pantanal wetlands.¹⁸ During the 1960's and 1970's, Mato Grosso's population grew rapidly as the result of migration to the expanding agricultural frontier. Some 80% of the 64,300 farms in the state were established after 1960. However, as of 1980, population density in the state remained low (1.3 inhabitants/km²) and the use of farm land was not intensive, with only 4.5% of the total area in rural establishments under crops, as compared with 42.8% under natural or planted pasture.

24. Although sharing recent frontier status with Rondonia, Mato Grosso, including that part of the state subsequently benefitted by POLONOROESTE, differed considerably from the former Territory in several important respects. The majority of these differences stem directly from historical dissimilarities in their settlement processes. First, population growth in Mato Grosso accelerated earlier than that in Rondonia. Roadbuilding efforts in the mid-1950's had provided key linkages between the state and the country's largest consumer market and most dynamic city, Sao Paulo, as well as to the rich agricultural area known as the "Triangulo Mineiro"¹⁹ and, later, to the new federal capital, Brasilia.

25. The area most affected by these investments was the southeastern portion of the state. Even though Mato Grosso's oldest settlement area, the "Baixada Cuiabana" (or "Cuiaba lowlands") and, within, it the capital city of Cuiaba which was established in the 18th century, also experienced considerable growth, the area where population increased most rapidly during the 1960's was the microregion of Rondonopolis where agricultural expansion was accompanied by an urban boom. Population growth in this area exceeded 11% a year during the period.

¹⁸ Report No. 3635-BR, op. cit., pg. 18.

¹⁹ "Triangulo Mineiro" is the expression used to refer to the southwest portion of the state of Minas Gerais, located between the states of Sao Paulo and Goias and dominated by the cities of Uberlandia and Uberaba.

26. The Alto Guapore-Jauru region, centered around the town of Caceres, in turn, is the heart of the small-farmer area included in the Mato Grosso portion of POLONOROESTE. Initially occupied in the 18th century when gold prospectors and explorers established settlements such as Caceres and Barra do Bugres along the Paraguay River, this area experienced slower occupation than other parts of the Brazilian frontier. Traditional land-extensive livestock production on natural pastures coexisted with fishing activities and, more recently, subsistence agriculture, much of it by squatters and itinerant small farmers.

27. The paving of roads to the south and east and extension of the highway network northward in the direction of Porto Velho, Santarem and Maraba during the 1960's and 1970's, however, had a decisive influence on the evolution of this subregion as outlying areas both to the northeast and northwest of Cuiaba became progressively integrated into the national economy. As a result, the Alto Guapore-Jauru region experienced its first effective linkages with national markets after 1972 as roadbuilding increasingly facilitated migration to the area. The subsequent dismemberment of Mato Grosso and Mato Grosso do Sul channelled additional resources to this part of the new state, further enhancing its incorporation into the national economy.²⁰

28. A second important contrast between Mato Grosso and Rondonia stems from differences in land distribution and the role of the public sector in the transformation of this system during the 1970's. Whereas INCRA's 1967 survey revealed that only 7% of Rondonia's land area had legitimate private owners, much of Mato Grosso had already been divided up into very large rural establishments, with several "owners" often having simultaneous "legal" claims to the same latifundio or some substantial part thereof. As a consequence, the Gini index of land concentration for Mato Grosso in 1975 (0.941) was the highest in Brazil. Even though this index declined slightly (to 0.919) by 1980, Mato Grosso nevertheless remained second only to Maranhao, located in the humid transitional area between the eastern part of the Amazon Basin and the semi-arid Northeast, in terms of land concentration. By comparison, Rondonia's land concentration index increased from 0.619 to 0.645 between 1975 and 1980.²¹

2. Private Colonization

29. Also in contrast to Rondonia, where small-farmer colonization constituted the main thrust of government intervention, private colonization and fiscal incentives tended to exacerbate Mato Grosso's highly polarized land tenure situation during the 1970's. The only public colonization scheme in Mato Grosso was initiated in 1977 by the state development company (CODEMAT) in Juina. Even here, unlike the situation in Rondonia, settlers were expected to pay for

²⁰ Jose Antonio da Silva, Transformacoes na Agricultura e Migracoes Internas em Mato Grosso na Decada de 70, Master's Thesis, CEDEPLAR/UFMG, Belo Horizonte, 1989, pp. 36-40 and 129-130.

²¹ Charles Mueller, "A Evolucao Recente da Agropecuaria Brasileira segundo Os Dados dos Censos Agropecuarios," in Dados Conjunturais da Agropecuaria, Edicao Especial, CAA/IPLAN, Brasilia, July 1987, pg. 38.

their land, although under a modified purchase schedule. Most directed settlement efforts, however, were private and were mainly located along the Cuiaba-Santarem highway.

30. Some of the better-known private colonization schemes in the state include projects with names such as Alta Floresta, Sinop, Canarana, Terranova, Carlinda and Colider. Preliminary evaluations of these ventures vary considerably in their findings. Official sources, not surprisingly, initially painted an optimistic picture of development prospects in such projects: "Alta Floresta, Sinop, Canarana, Terranova, Juina and many other projects are today economically active spaces, the majority of them prosperous, making inhospitable savannahs and jungles habitable. Life in these places flows quickly, whether in urban centers or on rural lots, where a new agriculture will begin to show its exuberance within two or three years time." ²²

31. The results of subsequent field research contrast with this optimism. One study of several projects in north-central Mato Grosso concluded, for instance, that: (i) the number of colonists who are eventually forced to move on because of non-payment to the colonization company or the banks is high; (ii) nearby latifundios benefit significantly from the physical improvements and influx of cheap labor brought in by private colonization ventures; and (iii) the complex system of alliances and interests underlying such projects basically serve political objectives linked to stabilization of the system. ²³

32. Other research in Mato Grosso suggests that a process of natural selectivity occurs among migrants going to private and official colonization projects. Private projects attracted a much greater relative proportion of "sulistas" (ie. migrants originating in southern and southeastern Brazil who came to Amazonia via the Center-West) than did public colonization schemes which frequently contained a much higher percentage of migrants from the Northeast and East who arrived in the region through Parana. "Sulistas" tended to have much greater financial and other resources at their disposal than settlers who originating in the Northeast. Such resources, in turn, generally were the result of the sale of land in previous places of residence. ²⁴

33. The finding that a process of natural selectivity has occurred between settlers choosing private versus official colonization projects is of considerable interest in and of itself. From the standpoint of the farmers who sold properties in southern Brazil and could afford to purchase land in Amazonia, the rationale would seem to be that buying a plot in a private colonization project provided a faster and more efficient way of obtaining definitive title to the land. The frustrations encountered by early settlers in Rondonia, who often had to wait months or years before obtaining land titles, may, thus, have

²² MINTER, "Colonizacao em Mato Grosso," Interior, Revista do Ministerio do Interior, 4(27), November/December 1978, pg. 38.

²³ Mary Dayse Kinzo, Colonizacao e As Transformacoes na Estrutura de Classes, Master's Thesis in Sociology, University of Brasilia, 1982, pp. 129-132.

²⁴ Osorio de Almeida, op. cit., pg. 13.

constituted a deterrent to later prospective colonists possessing some capital, particularly those who could afford to purchase land in private colonization schemes in north-central Mato Grosso.

34. Socio-economic differentials are also reflected in the type of land which settlers obtained or, in the case of Rondonia, which they were able to illegally occupy or purchase from speculators. In private colonization projects, better-off settlers had access to the best lands, as well as to good physical infrastructure. The resulting differentials in crop yields and profits, however, tended to provoke land concentration even in new settlements. Thus, the vicious circle leading to progressive land concentration in the migrants' areas of origin was frequently reactivated on the frontier, making it increasingly difficult for poorer settlers to acquire and retain land outside public colonization schemes.

35. No comparable research findings for the current period, which would permit a reassessment of the impact of private colonization projects in north-central Mato Grosso are yet available. In principle, however, these ventures enjoyed several advantages over official colonization schemes in Rondonia in terms of the quality and experience of the settlers drawn to them, the amount of resources available to colonists and their relatively greater proximity to national and international markets. On the other hand, it is also clear that forces of land concentration tend to operate strongly in private land settlement projects. As has also occurred in government-sponsored projects in Rondonia, finally, there is evidence to suggest that many settlers in private colonization schemes in Mato Grosso presently find at least seasonal employment as garimpeiros (placer miners) or mine workers.

3. The Role of Fiscal Incentives

36. Unlike the situation in Rondonia, government fiscal incentive policies intended mainly to promote large-scale ranching activities have also had a significant impact on the way in which land has been appropriated and used in Mato Grosso. Of the 1,325 projects approved to receive tax incentives in Legal Amazonia through March, 1989, 25% were located in Mato Grosso. Of all projects benefitting from fiscal incentives in the state, 84% were agro-ranching ventures. Overall, this type of project involved the largest land areas, had the poorest record in terms of generating sustained economic activity and devastated the largest areas of Amazon forest.²⁵

37. Some 217 of the 227 "agro-ranching" projects in Mato Grosso are located along the Barra do Garcas-Cuiaba-Barra do Bugres axis, north of the state capital. Forty-one of these projects were in the POLONOROESTE region. Since much of this area was initially covered by tropical forest or savannah grasslands and since project implementation, in practice, means razing the forest in order to plant pasture, it has been estimated that as much as one-fifth of

²⁵ Clando Yokomizo, "Incentivos Financeiros e Fiscais na Pecuarizacao da Amazonia," Texto para Discussao No. 22, IPLAN/IPEA, Brasilia, 1989, pp. 14-15.

all deforestation occurring in the state of Mato Grosso as a whole over the past several decades may have been directly associated with fiscal incentives.²⁶

38. The rural settlement process in the present state of Mato Grosso prior to POLONOROESTE, in summary, contrasts sharply with that observed in Rondonia. In Mato Grosso, official policies systematically favored large properties even when colonization schemes directed to smaller farmers were also undertaken.²⁷ It is understandably difficult to identify and reconstruct all the factors which fostered such widely divergent approaches, although the earlier occupation of Mato Grosso, its greater proximity to internal markets, its comparative vocation for extensive ranching activities and the large areas of land under federal government control in Rondonia obviously played an important role.

39. However, it can also be presumed that the different nature of the power structure in each state may have exerted a significant influence on their respective development paths during the 1970's. Rondonia was settled primarily by an extractive population (ie. rubber tappers and cassiterite miners) until the 1970's and became the target of socially-oriented government-sponsored agricultural colonization projects after the Transamazon debacle. Mato Grosso, in comparison, was dominated by traditional large landowning interests and fitted easily within the "big is beautiful" mentality of the fiscal incentives and agricultural modernization policies that prevailed in much of the rest of Brazil during the 1960's and 1970's.

4. Migration Tendencies

40. Another relevant distinction between Rondonia and Mato Grosso at the time POLONOROESTE was prepared was the differential nature and significance of internal migration in these two regions. Being an area of relatively older settlement and given the increasing brevity of the frontier cycle of migrant attraction-stagnation-expulsion, unlike Rondonia, much of Mato Grosso, including portions of the state located within the POLONOROESTE region, was already expelling significant numbers of rural migrants both to nearby towns and cities and to newer frontier zones farther to the north during the 1970's. Illustrative of this, while population in Mato Grosso as a whole grew at an annual rate of 6.5% in the 1970's, demographic growth in its rural areas was only 2.8% a year.

²⁶ Ibid., pp. 26-27.

²⁷ It is symptomatic of this bias that one of the early Bank missions (June 1980) in connection with POLONOROESTE's Phase II rural development project in Mato Grosso reported that preparation work was proceeding slowly because the state Governor was primarily interested in new physical infrastructure (ie. road and energy) and private colonization investments rather than consolidation of existing small-farmer areas. The Governor reportedly only agreed to a Bank-supported rural development project in the Caceres-Tangara da Serra area on the condition that all local counterpart funds would come from the federal government.

41. Although total net migration flows to the state amounted to 209,000 people in the 1970's, more than half of whom came from Parana, some subregions were already evidencing signs of stagnation. Parts of Mato Grosso, moreover, were later found to be among the major sources of migration to Rondonia during the middle and latter parts of the decade. Data from the 1980 census, in fact, reveal that 45% of the 105,000 migrants who left Mato Grosso during the decade went to Rondonia.

42. When the figures on migration in Mato Grosso in the 1970's are disaggregated by microregion (see Table II-4 below), three patterns emerge. First, older areas in the southeastern part of the state (ie. the Baixada Cuiabana, Rondonopolis and Garcas microregions) had high rates of net outmigration from rural areas, compensated totally or in part by high or moderate migration rates to urban areas. The Alto Paraguai and Alto Guapore-Jauru microregions, in turn, which constitute the core of the Mato Grosso portion of the POLONOROESTE region, had moderate rural outmigration rates and high rates of urban in-migration. The third portion of the state, composed of the Nordeste (Northeast) and Noroeste (Northwest) Matogrossense microregions, finally, possessed high in-migration rates to both rural and urban areas which is typical of recent frontier areas. What is of greatest significance for the present study, however, is that, even though migration patterns in Mato Grosso were highly diversified, much of the POLONOROESTE region was already affected by net rural outmigration in the 1970's.

Table II-4

Estimate of Net Migration by Microregion and Rural-Urban Residence
in Mato Grosso, 1970-80 (No. of Migrants)

<u>Microregion</u>	<u>Urban</u>	<u>Rural</u>	<u>Total</u>
Nordeste Matogrossense	29,768	29,683	59,451
Noroeste Matogrossense	47,124	84,871	131,995
Alto Guapore-Jauru	49,823	-1,045	48,778
Alto Paraguai	24,200	-2,590	21,610
Baixada Cuiabana	140,096	-40,581	99,515
Rondonopolis	49,451	-69,428	-19,977
Garcas	5,264	-24,449	-19,185
Mato Grosso	345,726	-23,539	322,187

Source: IBGE, Demographic Census, 1970, 1980 and Silva, op. cit.

5. Distance to Market

43. A final important difference between the two parts of the POLONOROESTE program area stems from the fact that the Mato Grosso section of the region was considerably closer to major domestic markets than Rondonia. Not only did this subregion's proximity to the rapidly growing capital city of Cuiaba present real market alternatives, but its core area was about 1,000

kilometers closer to metropolitan Sao Paulo than most of Rondonia. This locational advantage of northwestern Mato Grosso over Rondonia had direct implications in terms of the comparative costs of transporting agricultural produce from different parts of the Northwest to south-central Brazil.

44. In synthesis, several basic characteristics of the Mato Grosso portion of the POLONOROESTE region differed considerably from those of Rondonia. The timing and nature of rural settlement, the location, philosophy, form and consequences of public sector intervention and the nature and direction of population movements all imprinted strong differences between the two subregions. These initial differences were also later reflected in the differential impacts of the program interventions on subsequent development tendencies in each area.

ANNEX IIITHE NORTHWEST REGION DEVELOPMENT PROJECTSA. Introduction

1. POLONOROESTE was supported by six World Bank loans for five interdependent projects, with the last of these loans (2060-1-BR, approved in December 1983) consisting of supplementary financing for the Phase I Agricultural Development and Environmental Protection Project. From the outset, the Bank decided to process, in parallel, separate loans for the program's transport and rural development components. Due to preparation delays, however, the rural consolidation projects in Rondonia and Mato Grosso were soon split into separate operations and phases of the program, while appraisal of the new settlements component was scheduled for a later date on account of its comparatively greater information needs and longer planning horizon. The Rondonia Health Project, in turn, had initially been intended as a health component of the Phase I rural development operation for the Territory, but, in December 1980, it was recommended that it be processed separately because of the magnitude and complexity of the public health problems facing the area, especially malaria, the lack of rural health facilities and the significant institutional weakness of the sector.¹

2. Despite the parallel processing of the three Phase I loans by different sectoral projects divisions (ie. Agriculture, Transport and Health) within the Bank, a strong effort was made by the Brazil Division to coordinate preparation and appraisal activities. Elaboration of the Phase II (Mato Grosso Rural Development) and Phase III (Rondonia New Settlements) projects overlapped with that of the Phase I Agricultural Development and Environmental Protection Project and their appraisal involved many of the same Bank and FAO staff and consultants. Furthermore, all five projects were contractually linked to one another.² POLONOROESTE, is, thus, unique among Bank-supported programs in Brazil in that a "package" of closely interrelated loans in different sectors for the same geographic area and implementation period were prepared and appraised, if not subsequently executed, in a coordinated fashion.³ As further

¹ Preparation mission report dated December 22, 1980.

² The President's Report (No. P-3137-BR, dated November 9, 1981) for the Agricultural Development and Environmental Protection Project, for example, indicates (para. 88) that "failure by the Borrower, Rondonia or BNDE to comply with any covenant agreement or obligation under the Loan and Project Agreements for the Northwest region highway and health projects would also constitute an event of default on the proposed project." Similar provisions were included in all of the other projects, with the Phase II and III operations being similarly interlinked with the three Phase I projects, as well as between one another.

³ This contrasts sharply (and very positively) with the nearly parallel experience in eastern Amazonia where the Bank simultaneously processed major physical infrastructure and mining investments through the Carajas Iron Ore

described below, it was also interlinked with existing and future Bank loans in support of a national feeder roads program. The following paragraphs will describe these five projects, as appraised, together with the program's non-Bank-financed Amerindian Special Project. Further details can be found in the respective Bank staff appraisal reports.

B. The Highway Project ⁴

3. As the centerpiece of POLONOROESTE, the Northwest Highway Project, partially financed by Loan 2062-BR, had two major stated objectives: (i) to reduce transport costs and improve traffic conditions by providing permanent road transport facilities in the region; and (ii) to strengthen the institutional capabilities of the Rondonia Highway Department (DER-RO) in order to improve and rationalize the Territory's road administration, particularly its increased responsibility under the larger regional development program. More specifically, according to the corresponding SAR:

the lack of physical access to markets, which results in high levels of crop loss, has been recognized as a major constraint in the development of the Northwest region. The POLONOROESTE Program, consequently, places a special emphasis on the upgrading and paving of the Cuisba-Porto Velho highway, as well as on the improvement of the feeder road network in the areas of greatest agricultural potential. The POLONOROESTE Program...envisages construction or improvement of about 2,880 km of feeder roads and about 5,400 km of farm-to-market access roads. The feeder roads, with an estimated cost of US\$ 140 million equivalent, would be financed under two subprograms: one of 1,530 km in the Territory of Rondonia and one of 1,350 km in the state of Mato Grosso. These two subprograms are being prepared by DER-RO and DERMAT [the Highway Department of Mato Grosso] for financing under the BNDE/IBRD feeder road program. The two subprograms are being broken down into smaller three-year packages in line with the requirements of the rural development projects and the implementation capacities of DER-RO and DERMAT.

Project (Loan 2196-BR, approved in August 1982) and an integrated rural development effort through the Maranhao Rural Development Project (Loan 2177-BR, approved in June 1982) in the same geographic area (ie. the eastern and central sections of the Carajas railway corridor), but where there appears to have been little, if any, interaction between Bank staff in the different project divisions (ie. Industry and Agriculture) responsible for the two operations, nor any such coordination among their counterparts in Brazil. See OED, Environmental Aspects..., op. cit., for details.

⁴ This section is largely based on the SAR for the Northwest Region Development Program - First Phase - Highway Project, Report No. 3532b-BR, dated October 29, 1981.

The first packages, which would cover about 488 km for Mato Grosso and 500 km for Rondonia, would be financed under the present project through the existing BNDE/DNER/IBRD financing mechanism for the Second Feeder Roads Loan.⁵ Subsequent packages should be prepared so that there would be continuity in the execution of feeder roads. These future packages would be financed through the proposed Third Feeder Roads Project with BNDE which is under preparation.⁶

4. The specific components (and their expected total cost net of contingencies) of the project, as appraised, in turn, were:

- (i) Highway Construction and Operation (US\$ 423.8 million): (a) civil works by contract for upgrading, including paving, of about 1,084 kilometers of the BR-364 highway between Corrego Campinas in Mato Grosso and Ariquemes in Rondonia,⁷ the installation of four bridges in the Cuiaba-Caceres section of the road and construction of three maintenance residences, one weighing station and about nine highway patrol stations and depots; (b) consulting services to assist DNER in the supervision of the civil works and installation of the weighing stations; and (c) acquisition and installation of a weighing scale, vehicles and radios for the federal highway patrol and equipment, vehicles and traffic counters to monitor pavement behavior.
- (ii) Strengthening of DER-RO (US\$ 31.6 million): restructuring and strengthening of DER-RO's organization and functions to

⁵ Loan 1730-BR in the amount of US\$ 107.9 million was approved in June 1979. This loan was recently audited by OED (draft report dated April 24, 1990). It followed the First Feeder Roads Project (Loan 1207-BR, approved in March 1976) which established a line of credit at BNDE to finance roughly 50% of the latter's loans to state highway departments (DERs) or municipal consortia to carry out secondary and feeder road investments in support of increased agricultural production. The subprojects financed by this credit line were prepared and evaluated by BNDE in accordance with criteria previously agreed with the Bank.

⁶ Report No. 3532b-BR, op. cit., paras. 4.02-4.03. The Third Feeder Roads Project was partially financed by Loan 2224-BR for US\$ 154 million, approved on December 21, 1982.

⁷ The two end sections of the highway between Cuiaba and Corrego Campinas in Mato Grosso (163 km) and Ariquemes and Porto Velho in Rondonia (192 km) were in the process of being reconstructed and paved by the Brazilian Army's Engineering and Construction Battalion (BEC). According to the SAR, some 190 km of these segments of the road had been completed in 1978 and construction of the remaining 165 km was expected to be concluded by the end of 1984.

provide for the planning, programming, execution and control of the Territory's road network including: (a) construction of residences, maintenance depots and workshops; (b) purchase of equipment and vehicles for road maintenance, training and traffic control and equipment for offices, laboratories, workshops and stores; and (c) technical assistance to improve DER-RO's administrative and execution capabilities and to train its personnel, as well as that of the municipalities.

- (iii) Feeder Roads in Mato Grosso and Rondonia (US\$ 32.3 million): (a) three-year (1982-84) programs for construction of new and improvement of existing feeder roads in Mato Grosso and Rondonia to be carried out through BNDE; and (b) preparation of additional feeder road construction and improvement projects in the POLONOROESTE region.

5. Total project costs were estimated to be on the order of US\$ 687 million equivalent including contingencies. The Bank loan for US\$ 240 million would finance the foreign exchange costs of the operation which were projected to be roughly 35% of the total. The cost of the BR-364 highway improvements to be financed under the project was estimated at about US\$ 487 million equivalent including some taxes, supervision costs and physical contingencies. The average cost per kilometer of the paved BR-364 highway was projected at US\$ 449,000 including physical contingencies, while the per kilometer construction costs (including supervision and physical contingencies) for project feeder roads were estimated to be on the order of US\$ 35,600 in Rondonia and US\$ 40,000 in Mato Grosso.

6. According to the SAR, highway works for the Caceres-Ariquemes section of the BR-364, covering a total of 1,037 kilometers, were tendered in April 1981 and the corresponding contracts were signed in September 1981. Physical implementation started in October 1981 and was expected to last for about four years. The remaining section between Corrego Campinas and Caceres was expected to be tendered in December 1981 and to be completed also within four years. This execution schedule was defined in accordance with anticipated climatic conditions in the region with the bulk of construction activity programmed for the annual (roughly six-month) dry seasons.

7. The proposed highway routing would follow the original alignment of BR-364 between Corrego Campinas and Caceres in Mato Grosso (47 km) and Barracao Queimada in Mato Grosso and Ariquemes in Rondonia (601 km), together with that of the existing BR-174 highway between Caceres and Pontes e Lacerda also in Mato Grosso (222 km). A new 214 kilometer section, however, would be built through the Guapore valley between Pontes e Lacerda and Barracao Queimada (ie. the "variant" referred to in Chapter III). This segment would follow the alignment of a service road which was under construction by the Army at the time the project was appraised (January 1981) and would replace an existing state road (MT-388), as well as a portion of the old BR-364 which ran to the east of the Guapore valley on the Parecis plateau. According to the SAR, this new routing would "provide a more reliable wet weather road link between Cuiaba and Rondonia

and would facilitate construction of the proposed new road section along the same alignment."⁸

C. The Agricultural Development and Environmental Protection Project⁹

8. As described in the corresponding SAR, this project, supported by Loan 2060-BR, was divided into six subprojects¹⁰ having the following stated objectives:

- (i) a Settlement Consolidation subproject to increase the productivity and develop the migrant absorption and agricultural production capacity of already settled areas of the Territory of Rondonia where such potential clearly exists and could be further developed at minimal environmental cost;
- (ii) an Environmental Protection subproject to: (a) establish natural reserves and ecological stations in areas of more fragile ecology or with specially diverse flora and fauna; (b) strengthen deforestation control capability; and (c) study the promotion of sustainable forestry operations in suitable areas;
- (iii) an Ecological Research subproject to: (a) study and monitor the hydrometeorology and biogeochemical balances in the soils of the program region; (b) carry out an inventory of plant and animal species native to Rondonia; and (c) support small-scale research projects;
- (iv) assistance to INCRA to ensure timely land tenure regularization in previously settled rural areas of western Mato Grosso;
- (v) assistance to INCRA to identify new areas with suitable soil potential for future settlement in the region; and

⁸ Report No. 3532b-BR, op. cit., para. 5.05. The SAR (para. 5.08) observes further that the "variant through the Guapore valley to replace the material-scarce and silty-soil sections along the Parecis plateau was studied and found justified both on economic and technical grounds. The variant avoids crossing existing and envisaged Indian reserves, although it passes near them. Special measures to protect these Nambikwara tribes [would be taken under the Amerindian Special Project.]"

⁹ This section is largely drawn from Report 3512b-BR, op. cit.

¹⁰ Parallel activities mentioned in the SAR (para. 4.01) included the Amerindian Special Project described in section G. below, studies on means to improve salvage logging in settlement areas to be undertaken with FAO assistance and a Government study on the feasibility of increasing the density of settlement and agricultural development in the already occupied areas having highest agricultural potential in Rondonia.

- (vi) a component to strengthen overall program coordination and monitoring capability.

9. Total project costs were estimated to be on the order of US\$ 199.3 million equivalent including contingencies, of which the Bank would finance US\$ 67 million, or roughly 35%. Estimated costs of the three major groups of subprojects (including contingencies) were: (i) Settlement Consolidation - US\$ 149 million; (ii) Environmental Protection and Ecological Research - US\$ 24.4 million; and (iii) Studies and Program Coordination - US\$ 25.9 million. Given the importance of the first two sets of subprojects, their rationale and specific components will be described in somewhat greater detail below.

1. Settlement Consolidation in Rondonia

10. The SAR specifically justifies this subproject by arguing that:

the agricultural aptitude and present land tenure situation in the area is conducive (provided that adequate support measures are taken) to the establishment of a large number of sustainable middle-income farms. By improving the productive infrastructure of already settled areas, where production today lags far behind the sustainable capacity of the land, considerable demand can be generated for further labor, thus absorbing at a relatively low cost, part of the demographic pressure which would otherwise tend to spread out onto less suitable areas of the region. Such an approach would represent a noteworthy departure from the subsidized latifundia found in certain areas elsewhere in the Amazon basin and would have a much higher chance of success than previous attempts at settling the Amazon region which were located on poorer soils and were often inadequately planned.¹¹

11. The SAR further indicates that the subproject would assist the Government of Rondonia in its "high priority effort" to provide agricultural services to some 18,200 of "the less favored, recent settlers found in outlying areas and non-owner farmers" to help them "make better long-term use of their land and labor resources, increase their production and move towards commercial agriculture based on environmentally more acceptable perennial cropping and

¹¹ Report No. 3512b-BR, op. cit., para. 4.02 (emphasis OED). It is also observed that "most farmers living in Rondonia settlements are among the poorer farmers of Brazil, formerly sharecroppers or small farmers in other parts of the country, who have only recently settled in the area....However, their pioneering spirit and dynamism make it probable that...many of those who would obtain a legal title to land and would be located within reasonable reach of credit, extension and marketing services would be capable of achieving a much higher level of income."

continuous rather than shifting cultivation of annual crops." To achieve this objective, the subproject would provide for: (i) restructured and reinforced agricultural extension, applied research and improved inputs; (ii) reductions in crop losses through additional and improved transport, storage and basic processing infrastructure; (iii) farmer organization and training, improved land transfer mechanisms and selective siting of major rural services and infrastructure so as to direct and limit agricultural development to the better soils of the area; (iv) improved outreach and effectiveness of social services; and (v) development of the planning and implementation capability of local institutions.¹²

12. Design of the subproject assumed improvement of the BR-364 highway and construction of feeder roads under the Highway Project described in the previous section. Under the present subproject, in turn, the Territory would undertake an integrated investment program to upgrade farm access roads and expand the provision of support services and social infrastructure to be grouped for the most part at some thirty-nine "Rural Service Centers" or NUARs. The NUARs would be located at "strategic points" within the existing INCRA colonization projects, be connected to the trunk Cuiaba-Porto Velho highway by existing or proposed feeder roads and would serve as foci for community development and commercial activity. Each such center was expected to serve some 1,900 rural families residing in an area of roughly 600 km² by 1985.

13. Preparation of the subproject drew directly on previous Bank experience with rural development projects in Brazil. Among the elements taken into consideration, according to the SAR, were specific lessons learned in connection with the recently completed Alto Turi Land Settlement Project (Loan 0853-BR), especially the need to develop a "full range of environmental protection measures at the outset" and to encourage "active participation of executing agencies in project preparation, to achieve a broader consensus in project design and objectives, adequate funding arrangements and clear compatibility of project objectives with general Government development priorities."¹³

¹² Ibid., para. 4.02 (emphasis OED). The SAR adds that through these actions the subproject "aims to create agricultural production and land tenure conditions conducive to an increase of agricultural population density in the areas with good soils" and that the subproject had "considerable potential for institution building, at a time when the Territory of Rondonia is about to achieve statehood." Finally, it is observed that the "structures proposed to be developed in the subproject area were designed to provide at least the minimum infrastructure capable of sustaining private initiative on which the ultimate development of the region will rely." (Emphasis OED)

¹³ Ibid., para. 4.04. It was also noted that, as compared with earlier Bank-supported rural development projects, the present subproject proposed a broader range of production systems that were "not new to the region" and that "project activities built around community participation would count on traditions already established in the Territory."

14. The subproject would focus on the consolidation of five existing INCRA colonization schemes (Burareiro, Marechal Dutra, Adolfo Rohl, Ouro Preto and Ji-Parana) situated along a distance of some 350 kilometers on either side of the BR-364 highway in central Rondonia. These areas were located in the municipalities of Ariquemes, Ji-Parana, Cacoal, Presidente Medici, Ouro Preto do Oeste and Jaru. The three latter municípios were formally created in June 1981 through subdivision of the former municipalities of Ariquemes, Ji-Parana and Cacoal. At the time the project was appraised, roughly 37,000 families, or more than half of the total farming population in Rondonia, resided within some 3 million hectares (or 30,000 km²), constituting about 12% of the total area of the Territory. The subproject zones also included substantial areas of spontaneous settlement on the periphery of the formal colonization schemes.¹⁴ The typical settler occupied a 100 ha plot, of which 50% was legally required to be maintained in forest reserve. At the time of project approval, finally, roughly 117,000 ha of the 3 million total in the subproject areas were estimated to be planted in annual crops, together with some 80,000 ha in tree crops and 63,000 ha in natural pasture, while most of the remaining 87% of this area remained in "undisturbed dense or open tropical forest."

15. Specific subproject components (and their approximate costs excluding contingencies), as appraised, can be briefly summarized as follows:

- (i) Farm Access Roads (US\$ 29.1 million): the construction or rehabilitation of some 3,900 km of all-weather access roads linking individual farms to NUARs or NJARs to the main highway network. The executing agency would be CODARON and maintenance would be provided by DER-RO and the respective municipalities.
- (ii) NUAR Infrastructure (US\$ 42.4 million): 39 sites of roughly 40 hectares would each be provided with a deep well, public water supply system, staff dormitory-cum-guest house, multi-grade school and health post (the latter to be financed under the Health Project described below); most NUARs would also be equipped with small-scale sawmills, a 160 KVA generator, a public electricity distribution system and a crop drying and storage unit; space would likewise be provided for residential (200 lots), recreational and commercial areas. CODARON, with the assistance of the local communities, would be responsible for the installation of all infrastructure except crop storage facilities.
- (iii) Agricultural and Forestry Extension (US\$ 6.4 million): direct assistance would be provided to some 18,200 beneficiary families to improve their agricultural production and forest utilization techniques with particular attention given to soil and forest conservation and the promotion of perennial crops.

¹⁴ At the time of project appraisal, however, INCRA was reportedly well-advanced in the process of regularizing land tenure in these areas.

The implementing agency would be the Rondonia Agricultural Extension Service, ASTER-RO.

- (iv) Agricultural Research (US\$ 4.4 million): complementing research already being carried out under earlier Brazil-wide Bank-assisted projects,¹⁵ the present subproject would support agricultural research oriented specifically to the short-term needs of project area settlers, concentrating on the adaptation of annual crops including corn, rice and beans to local conditions and the identification of "the optimal crop mixture" for small and medium farms. The Rondonia unit (UEPAT) of the Brazilian Agricultural Research Enterprise (EMBRAPA) would be responsible for execution of the component.
- (v) Crop Drying and Storage (US\$ 12.6 million): 19 crop drying and storage units, having a capacity of up to 2,500 tons, would be built and supplied with grain drying and cleaning equipment in "strategically located" NUARs, selected among a total of 34 such centers which, at the time of appraisal, still did not possess such facilities. The executing agency would be the Brazilian Storage Company (CIBRAZEM), subordinated to the Ministry of Agriculture.
- (vi) Farmer Organization (US\$ 1.9 million): the project would further develop an existing informal tradition of community labor and organization of local farmers¹⁶ through the Territorial Secretariat of Social Action (SAS), working in collaboration with CODARON, ASTER-RO and other agencies. The principal activities to be promoted would include the construction and maintenance of access roads, agricultural extension, nutrition, health education and school and health post maintenance.
- (vii) Education (US\$ 5.2 million): CODARON would construct and equip a four classroom school in each NUAR and some 390 single classroom schools along surrounding access roads. The central schools would provide initially for the first four grades of basic education, but would later gradually shift to grades 5 to 8. The component was expected to result in a net increase of some 40,000 school places and roughly one-third of the single classroom schools would replace inadequate existing

¹⁵ More specifically, the First (Loan 1249-BR, approved in April 1976) and Second Agricultural Research Projects (Loan 2016-BR, approved in June 1981) which included research on perennial crops such as rubber.

¹⁶ In this connection, the SAR (para. 4.12) observes that it was decided not to attempt to organize farmers into cooperatives, but to support the establishment of additional mutual-aid ("mutirao") groups, out of which more formal farmer associations could develop at a later date.

structures. Teacher training would also be financed, together with the purchase of textbooks.

- (viii) Subproject Management (US\$ 2.0 million): this component would finance incremental salaries and operational costs incurred by CODARON and the Territorial Secretariat of Planning (SEPLAN-RO) during the project implementation period in connection with the administration and monitoring of subproject activities.

16. Several other important activities were to be carried out in parallel to the subproject with funding from other sources. On-farm credit for the installation of rubber, coffee, cocoa or livestock and/or the acquisition of farm equipment were expected to be provided by existing special lines of the national Rubber Development Program (PROBOR), the Brazilian Coffee Institute (IBC), POLAMAZONIA, the Bank of Brazil (BB) and the Bank of Amazonia (BASA), among other sources. Standard BB and BASA credit lines were also expected to be available both for annual crops and the maintenance of perennial crops.

17. These credit lines were excluded from direct financing under the program because their low nominal interest rates (ranging from 12% to 35%) in light of much higher levels of inflation (over 100% in 1980) meant that they were highly subsidized. Nonetheless, the SAR explicitly recognized that "access to adequate credit remains...a fundamental element of the development effort in the subproject area" and it was anticipated that some US\$ 38 million equivalent would be provided to the small farmers to be directly benefitted with agricultural support services under the subproject.¹⁷ Seasonal credit would be provided to the same farmers in a total amount expected to reach close to US\$ 25 million equivalent by the fifth year of project implementation. Assurances were provided by the Brazilian Government that adequate investment and working capital would be made available "in a timely and simplified manner" to project beneficiaries¹⁸ and that priority in the allocation of credit would be given to small farmers borrowing for the first time for the establishment of perennial crops.

18. In addition, a seed production program would be carried out by the territorial Secretariat of Agriculture, assisted by the federal Ministry of Agriculture. This program would finance the installation of three seed

¹⁷ Report 3512b-BR, op. cit., para. 4.15 (emphasis OED). More concretely, it was expected that such credit would help to finance the planting of coffee (some 6,600 loans), cocoa (3,000 loans) and rubber (2,000 loans), among other activities. It was also anticipated that credit would be provided for the acquisition of small quantities of cattle, pigs, chickens and on-farm equipment.

¹⁸ Section 4.01 of the Loan Agreement for this project specifically stated that: "the Borrower and the Bank agree that access to rural credit for Project beneficiaries is essential to the successful carrying out of the Project. To this end, the Borrower shall take all necessary measures to ensure the timely availability of adequate funds for an estimated 18,200 small-scale farmers, including sharecroppers."

processing and storage units and the creation of a coordinating committee for the production of improved seeds and planting material, together with the training of technicians. Total costs of this program, estimated at about US\$ 1 million equivalent, would be co-financed by the territorial and federal governments. Under an existing IBDF/EMBRAPA/FAO project salvage logging feasibility studies would be undertaken to assess the composition of the forest being cleared for the installation of agricultural activities in Rondonia, identify trees of commercial value (taking transport costs into account) and determine the most efficient means to utilize such trees from the roughly one million hectares (or 10,000 square kilometers) of forest expected to be converted to agricultural production in the areas covered by the Settlement Consolidation subproject.

19. Finally, assurances were received by the Brazilian Government that INCRA would provide all landowners in the five areas covered by the subproject with definitive titles by the end of March 1982.¹⁹ Additionally, since INCRA's requirement that settlers preserve at least 50% of their plots in forest had proven very difficult to enforce in earlier colonization schemes, INCRA agreed to carry out a study, to be presented to the Bank for review prior to June 30, 1982, to assess the legal, technical and environmental feasibility of: (a) authorizing utilization of individual forest reserves for small farming purposes where soils are proven to be suitable for crop production; and (b) where this proves feasible, simultaneously establishing compensatory agglomerated forest reserves elsewhere. Such an arrangement would permit smaller individual plots that could be fully exploited, together with larger "block" reserves which could afford greater environmental protection.²⁰

2. The Environmental Protection and Ecological Research Subprojects

20. These subprojects represented an innovative attempt to extend existing knowledge about and protect the sensitive and complex natural environment in the Northwest region. As a key part of the Bank's first major initiative in a large and predominantly humid tropical area in Brazil, these components of POLONOROESTE broke, or at least proposed to break, considerable new ground in connection with rural development activities in the country. Subsequent implementation problems notwithstanding, they constituted a pioneering effort among Bank-supported operations in Brazil to deal with the physical environment in a comprehensive manner at the regional level.

21. In light of the above, the basic rationale for, and objectives of, these subprojects, as set out in the SAR, merit reproducing verbatim:

¹⁹ Section 4.04 of the corresponding Loan Agreement.

²⁰ According to the SAR (para. 4.18), the so-called "50% regulation," although sound in principle, was potentially disadvantageous from both an economic and an environmental standpoint. On the one hand, it resulted in "higher access costs per family settled or hectare planted because of the dispersion of planted areas," while, on the other, "it may not necessarily ensure the preservation of biological diversity as well as could be achieved within agglomerated reserves."

Humid tropical ecosystems are in general far more complex and less resilient than other terrestrial ecosystems. High year-round temperatures and heavy rainfall can result in nutrient losses due to rapid soil decomposition and leaching. Nutrients are held within the dense vegetation, which quickly captures them from the soil and water before they are leached away. Tropical forest has a greater number of different plant and animal species than other forests and, in the Amazon basin, a large number of these species have their entire population confined to very small areas [because parts of the forest, including several areas in Rondonia, receded into isolated patches during drier periods of the geological past] and therefore could risk total extinction as the result of total forest clearing.

Knowledge of ecosystems specific to the Northwest region, particularly in Rondonia, is still very sparse because of difficult access, especially until the unpaved BR-364 was built in the 1960's, and because knowledge of the ecosystems cannot always be extrapolated from other Amazon regions. Furthermore, as half of the rain in the Amazon basin is estimated to originate from within the basin itself, fears have been expressed that extensive disappearance of the tree cover might affect the climate of the region through changes in evapotranspiration. Further fears have been expressed that the release of carbon dioxide by extensive burning or decomposition of the forest could affect world climate. Preliminary base studies and a program for systematic environmental monitoring would allow, however, the timely detection of adverse ecological modifications. Finally, the Northwest region's soils of moderate quality have considerable potential for sustained and economically justified forestry activities.

The Environmental Protection subproject aims therefore at: (a) strengthening the action, in the region, of IBDF, which is responsible for the protection of forests, especially in areas of poor soils, deforestation control and forestry development; (b) financing the basic infrastructure and surveillance of three natural parks and the future demarcation of one of them; (c) financing the preparation of plans for national forests; and (d) setting up four ecological stations under the management of SEMA, where baseline ecological studies could be carried out. In parallel the ecological research program...would seek to provide timely information to improve land use and conservation decisions. It would also provide a network of

environmental monitoring stations and enhance basic knowledge of the Amazon environment and of technological possibilities based on local resources. Such research would be complementary to similar activities already being implemented elsewhere in the Amazon basin.²¹

22. Environmental protection in the Northwest would include a variety of land capability information and zoning activities, some of which were already occurring outside POLONOROESTE and others which would be undertaken with program resources. The former included existing RADAMBRASIL (ie. aerial photography and natural resource mapping throughout Amazonia) at the 1:1,000,000 scale and a soils and agricultural aptitude survey at the 1:250,000 scale, contracted by the Government of Rondonia to EMBRAPA, for the entire territory and which was expected to be completed by 1984. The specific actions to be implemented under POLONOROESTE were: (i) more detailed studies at the 1:50,000 scale, contracted by INCRA for smaller areas tentatively identified as suitable for agricultural settlement, as a basis for infrastructure and land use planning and plot allocation in future settlements; and (ii) the identification and demarcation of Amerindian reserves. Additional actions would be taken by ASTER-RO and EMBRAPA at the farm level, including operation of a soils analysis laboratory by the latter, in order to improve information regarding land capability and on-farm planning.

23. Within the agricultural research component of the Settlement Consolidation subproject, funds would be allocated to initiate land capability mapping. According to the SAR, these "operational zoning measures" would be complemented within the Environmental Protection subproject by several "special steps" leading to the identification, formal creation and protection of forest reserves. It likewise observes that "adequately implemented, these various measures would considerably improve the land use planning of areas developed under this project" and that similar measures would be sought in future settlement and rural development projects. Also in this connection, the federal and territorial governments formally agreed to "take all necessary measures to discourage the agricultural exploitation of areas recognized as unsuitable for agricultural development or of yet unproved suitability and to prevent the occupation of areas which have been legally defined as reserves."²²

24. Specific subproject components (with their estimated total costs net of contingencies) were included in the program under these subprojects for national forests (approximately US\$ 1.3 million), forestry control (US\$ 2.4 million), natural reserves (US\$ 3.6 million), ecological stations (US\$ 1.6 million) and ecological research (US\$ 7.0 million). With respect to national forests, the SAR indicated that, although "proposals for setting up a national forest where sustained commercial operations could be undertaken" were still at

²¹ Ibid., para. 4.05 (present paragraph divisions OED).

²² Ibid., para. 4.19 (emphasis OED). These assurances were formalized with the federal and territorial governments in Section 3.13 of the Loan Agreement and Section 2.07 of the Project Agreement for the Agricultural Development and Environmental Protection Project respectively.

an early stage, a forestry development planning team had been set up in IBDF to, in collaboration with INCRA, locate national forest sites on future block reserves and/or on independent areas for leasing to large agro-industries or to promote forestry settlements. One area of some 300,000 ha to the east of the Guapore Biological Reserve had already been tentatively identified for forestry development purposes and IBDF was expected to proceed with preliminary demarcation and inventory activities followed by preparation of detailed plans for installation and administration of a forestry management project. This prospective project would not itself be financed under the present component, which would, however, fund preparatory activities including consultant services, transport and mapping costs, demarcation and the protection of potential national forest areas from encroachment.²³

25. In the area of forestry control, in turn, the project would reinforce IBDF's offices in Cuiaba and Porto Velho and establish tree nurseries at these locations. In addition, forest control posts would be set up in Pimenta Bueno and Ariquemes in Rondonia and in Aripuana and Vila Bela in Mato Grosso, while existing posts at Vilhena, Barra do Bugres and Caceres would be strengthened. These control posts were to monitor the shipment of wood products, supervise forestry extension activities and provide technical assistance to existing and potential forestry operators.

26. In relation to natural reserves, the project would help establish and protect the Pacaas Novos National Park and the Guapore and Jauru Biological Reserves. For the Pacaas Novos National Park (approximate area 765,000 ha), this would include construction and installation of on-site administration and residential facilities, control posts and landing strips, as well as the acquisition of ground and air transport equipment, aerial photography and the financing of personnel and operating costs over the five year implementation period. Since part of the Pacaas Novos National Park had been interdicted by FUNAI pending full contact with the Uru-eu-wau-wau Indians who inhabited the area, IBDF and FUNAI would enter into a specific agreement (convenio) detailing their respective responsibilities in the protection of the park.²⁴ Surveillance and protection measures for the Guapore (500,000 ha) and Jauru (roughly 268,000 ha) Biological Reserves would be largely similar and the Government committed itself to define and legally establish the Guapore Biological Reserve by March 31, 1982.²⁵ A third biological reserve in the program region (Cara-Cara), located in the Pantanal area and occupying some 70,000 ha, was expected to be incorporated into a larger (250,000 ha) Pantanal National Park at some unknown future date and, thus, was not specifically supported under the operation.

²³ Ibid., para. 4.20. A number of specific agreements were reached with the Borrower in relation to implementation of this component (see Sections 3.06 and 3.07 of the Loan Agreement), while, according to the SAR, the federal government would subsequently "undertake all the necessary steps to implement appropriately controlled forestry development plans."

²⁴ Section 3.08(b) of the Loan Agreement refers specifically to this.

²⁵ Section 3.08(a) of the Loan Agreement.

27. The project would likewise assist SEMA to establish or expand four ecological stations. SEMA would oversee the use of these facilities by universities which would undertake previously approved research. One of the stations, Ique, occupying about 200,000 ha in the municipality of Aripuana was outside the official boundaries of the Northwest region, but was included under the component because of the alleged importance of this area for understanding the regional environment. The other reserves were located at Serra das Araras (about 24,800 ha) in a forest/savannah transition area between Barra do Bugres and Caceres in Mato Grosso, at Taima (12,000 ha) in the Pantanal area near Caceres and at Cunia (some 100,000 ha) on the Madeira River north of Porto Velho in an area of tropical Amazonian rainforest. Assurances were received from the Government that the Cunia station would be delimited by the end of March 1982 and legally established thereafter. ²⁶

28. The Ecological Research subproject, finally, would be carried out under the supervision of CNPq, which would subcontract the implementation of specific studies to selected research institutes and universities giving preference to those located in or near the program region. Research activities were expected to include: (i) establishment of a hydrometeorology and biogeochemistry monitoring system in Rondonia; (ii) development of a system for the inventory and collection of flora and fauna in the Territory; and (iii) small-scale research projects, possibly including studies on the minimum size of ecosystems and appropriate technologies for the region.

3. Other Subprojects

29. The remaining project components (and their estimated costs at appraisal excluding contingencies) consisted of: (i) land tenure regularization and titling (US\$ 8.6 million) in all the major areas of small-farmer settlement expected to be directly benefitted under the Phase II Mato Grosso Rural Development Project, including discrimination of some 5.3 million ha and demarcation of an estimated 600,000 ha; (ii) detailed soil surveys (US\$ 0.5 million) covering roughly 70,000 ha in the Urupa area south of Ouro Preto and 100,000 ha in the Machadinho region northeast of Ariquemes as a basis for the planning of new settlement projects to be implemented by INCRA in Phase III of the program; and (iii) funding of the equipment and operating costs of program coordination activities at SUDECO (US\$ 10.1 million), including monitoring, mid-term and final impact evaluations, ad hoc studies on issues arising during implementation and the identification of future projects of relevance to development of the Northwest region. ²⁷

²⁶ Section 3.09(a) of the Loan Agreement.

²⁷ Given the complexity of the project, it was decided that a mid-term evaluation should be undertaken prior to June 30, 1984. This was formalized in Section 3.15(d) of the Loan Agreement. In addition, under Section 3.04(b) of the same agreement, SUDECO was to "enter into, by March 31, 1982, contractual arrangements with independent consultants...for purposes of assisting the Borrower in the continuous evaluation of POLONOROESTE in its entirety..., such evaluation to be carried out on the basis of plans and procedures satisfactory to the Bank." The "qualifications, experience and terms and conditions of

D. The Health Project ²⁸

30. At the time POLONOROESTE was appraised, accelerated migration to the Northwest had already resulted in a broad range of public health problems due to low standards of living and poor nutrition intake among both rural and urban populations in the region. The inability of existing health services to cope with heavy in-migration and the exposure of large numbers of migrants to ecological conditions that favored the spread of disease, especially malaria, were identified as among the most serious health problems in the Northwest. As a consequence, public health conditions in Rondonia were worse than those in most of the rest of Brazil. ²⁹

31. The incidence of malaria in the region was particularly high, with more than 62,000 cases being reported in 1980, resulting in the loss of about one million work days and corresponding to roughly one-third of all cases reported in the country in that year. According to the SAR, these figures probably understated the actual gravity of the situation such that it was probably "safe to say that every family living in Rondonia today has at least one member who has or has had malaria during the last year." ³⁰ Furthermore, the situation was becoming worse, since, having come from malaria-free areas, many new migrants possessed no immunity to the disease. There was also some evidence that resistance to the principal anti-malaria drug, chloroquine, had increased over the preceding two years. As a result, the SAR affirmed that "the human suffering caused by malaria and its adverse economic effects in a rapidly developing area...are increasingly serious and have led the territorial government to declare a state of health emergency in Rondonia." ³¹

32. Gastro-intestinal and respiratory diseases caused largely by inadequate water supply, sewage disposal and rural housing conditions, in turn, were the next most serious types of illness after malaria, together accounting for roughly 75% of the 180,000 cases treated at health centers in Rondonia in 1980. They were also major contributors to both infant and adult mortality. According to the SAR, "again, it is difficult to find a rural family in Rondonia which is not affected by these diseases and others, such as measles, diarrhea

employment" of the consultants to be selected for this activity were also required, under Section 3.02 of the Loan Agreement, to be "satisfactory to the Bank."

²⁸ Most of the discussion in this section is based on the SAR for the Northwest Health Project (Report No. 3537b-BR, dated November 9, 1981).

²⁹ This was exemplified by the infant mortality rate which was 128 per thousand live births in the Territory as compared with 92 per thousand for the country as a whole.

³⁰ Ibid., para. 3.06.

³¹ Ibid., para. 3.06 (emphasis OED). The SAR also observed that "many adults die from malaria in the absence of full and adequate drug treatment."

and infectious hepatitis." ³² In addition, local health authorities reported that other diseases, including leishmaniasis and schistosomiasis, also had the potential of becoming major health problems in the region.

33. Despite these significant and rapidly growing problems, at the time POLONOROESTE was initiated, health care infrastructure in Rondonia remained highly precarious. Basic health care services were available only to the approximately 40% of the Territory's population residing in Porto Velho and other urban centers. Except for polio immunization, vaccinations reportedly reached only one-fifth of all children at risk. The level of health services in rural areas, in short, was much lower than that in towns and cities and was especially poor in those areas which were growing fastest (i.e. the municipalities of Ariquemes, Cacoal, Ji-Parana, Jaru, Ouro Preto and Presidente Medici).

34. In an effort to come to terms with these health problems and infrastructure deficiencies, the Government of Rondonia had adopted a basic health services policy in June 1980 that gave primary emphasis to combatting malaria and reinforcing the rural health care network. The Health Project, supported by Loan 2061-BR, was designed to help implement this policy by: (i) intensifying malaria control activities in the Territory; (ii) strengthening and expanding primary and second level health care for the rural population living in the vicinity of the NUARs to be installed under the Settlement Consolidation subproject of the Agricultural Development and Environmental Protection Project; and (iii) strengthening research capacity.

35. Institution building, which was considered to be particularly important at a time when Rondonia was about to become a state and a number of new municipalities had recently been created, was a more general project objective. As in the case of the agricultural development components of the program, design of the Northwest Health Project relied heavily on previous experience gained from the rural health components of earlier Bank-assisted integrated rural development projects in Brazil. Total cost of the project was estimated at appraisal to be US\$ 37.7 million, of which the Bank would finance US\$ 13.0 million, or 34%.

36. Project components (and their estimated total costs net of contingencies) were as follows:

- (i) Malaria Control Program (US\$ 13.3 million): this would involve significant expansion of SUCAM's malaria control operations in Rondonia by providing equipment, vehicles, consulting services, DDT and drugs and financing incremental salaries and operating costs.
- (ii) Health Services Development (US\$ 8.4 million): (a) construction of one health center in each of 39 NUARs in the municipalities covered under the Settlement Consolidation subproject of the Agricultural Development and Environmental

³² Ibid., para. 3.07.

Protection Project; (b) equipment and staffing of 50 health posts to be constructed by rural communities in these same municipalities; and (c) establishment of referral health centers in the new municípios of Jarú, Ouro Preto and Presidente Medici, each including offices, laboratory, wards for in-patients and delivery and operating rooms.

- (iii) Training and Supervision (US\$ 1.0 million): training for 100 rural health workers and 200 health auxiliaries to be assigned to the aforementioned 50 health posts and 39 health centers, respectively, consultant services to the territorial Health Secretariat (STS) on training and the administration of health services and the provision of vehicles and travel expenses for field supervisors.
- (iv) Research and Evaluation (US\$ 2.6 million): (a) research on malaria and other major health problems³³ and (b) technical assistance for the monitoring of project components.

37. The malaria control program would consist of the identification of transmission areas, surveillance of malaria incidence, the reduction of infected mosquitoes and treatment of the sick. The project would permit SUCAM to recruit another 330 field workers and organize fifty-five additional 6-man field operation teams, as well as to finance some seventy epidemiological surveillance guards who would collect blood samples from about 1,500 malaria notification posts set up in existing houses at the village level. Infected people would be treated either at the notification posts or other health care facilities. Altogether, SUCAM's staff would be increased by about 480 persons, including management and supervisory personnel, about 800 tons of DDT would be used and an estimated US\$ 400,000 of spraying and other equipment and US\$ 226,000 of drugs would be purchased, together with vehicles, motorcycles and bicycles for field operation staff. The NUAR health centers and rural health posts, in turn, would be built according to standard STS designs and were expected to serve a total of 360,000 and 120,000 people respectively by the late 1980's. Each of the three urban referral centers, in turn, was expected to benefit an estimated 120,000 people starting in 1985.

E. The Mato Grosso Rural Development Project³⁴

38. This project, approved some three months after the initial Bank loans in support of POLONOROESTE, constituted the second phase of the program. The project area covered roughly 61,500 km² in the southeastern part of the Mato

³³ The areas tentatively identified for malaria research included: (i) the distribution and transmission potential of different anopheles vectors and mosquito biting patterns; (ii) insecticide alternatives to DDT; (iii) the cost-effectiveness of control measures; (iv) the chloroquine resistance of malaria parasites; and (v) alternative drug treatments.

³⁴ The description of this project is drawn from the corresponding SAR, Report No. 3635-BR, op. cit.

Grosso portion of the program region including parts or all of the municipalities of Caceres, Mirassol d'Oeste, Tangara da Serra, Barra do Bugres, Quatro Marcos, Rio Branco, Araputanga, Jauru and Salto do Ceu. The five latter municípios were created in January 1981 as a result of the dismemberment of Caceres and Mirassol d'Oeste. Total population in the project area in 1980 was on the order of 217,000, of which close to 60% were rural.

39. The project's origin and underlying rationale were described in the SAR as follows:

The proposed rural development project is a portion of the integrated POLONOROESTE regional development program, conceived with the objective of obtaining a rational, agriculturally and ecologically sound use of the natural resources of an area of Brazil's agricultural frontier. Economic development in the area would soon be reinforced through the improvement of the Cuiaba-Porto Velho highway to paved, all-weather standards, which would lower transportation costs. Although it is expected that the extraction of mineral resources from the region would also increase with the improvement of the road, the thrust of the program is towards the increase of sustainable agricultural production in those areas appropriate for this type of exploitation, through the establishment of stable small farmer production systems. In this way, gainful occupation would be offered to small farmers displaced from other regions of the country due to drought, frost, erosion, limited access to land, increasingly mechanized and capital intensive forms of agricultural production, or changes in cropping patterns, among other factors.³⁵

40. Declared project objectives were to: (i) raise the incomes and living standards of some 17,500 small-farm families with holdings under 200 ha, giving priority attention to 10,000 of the least developed small farmers in the area; (ii) promote a sustainable and rational development of agricultural production, primarily through increases in productivity, but also with some additional expansion of the area in crops; and (iii) improve agricultural and social services in the area, expand and strengthen physical infrastructure and improve the Government's capacity to plan and execute similar area development projects in other parts of the state. Project activities would focus on some thirty rural communities which were "gathering points and service centers" for most of the small farmers in the area. These communities were located in the northern section of the municipality of Caceres, throughout Mirassol d'Oeste and the five newly created municípios and in the eastern half of Barra do Bugres and Tangara da Serra. No project investments, however, were initially programmed for the Pantanal area in the southern portion of Caceres, where large cattle ranching operations predominated.

³⁵ Ibid., para. 4.01.

41. Total project costs over a five year investment period were estimated to be on the order of US\$ 76.8 million equivalent, of which Bank Loan 2116-BR for US\$ 26.4 million would finance roughly 34%. The project was divided into four major types of interventions, each having one or more components, which (together with their estimated costs excluding contingencies) can be briefly described as follows:

(i) Agricultural Services (US\$ 17.1 million)

(a) Agroecological Zoning (US\$ 1.3 million): in support of longer-term development planning, this component would continue existing efforts to identify the natural resource potential of the area, undertake general agricultural aptitude studies and collect and analyze environmental data with a view to preserving the ecological equilibrium of the region. It would be executed by EMPA-MT, the state agricultural research agency.

(b) Rural Extension (US\$ 11.0 million): the state agricultural extension agency, EMATER-MT, would provide direct technical assistance to some 10,000 small farmers, including both owners and non-owners, to improve their agricultural production techniques, giving particular attention to crop diversification and increasing on-farm productivity. A larger group of some 17,500 farmers would benefit from agricultural orientation through farmers' groups, community organization and education in the fields of nutrition, sanitation and home economics.

(c) Adaptive Agricultural Research (US\$ 4.4 million): undertaken by EMPA-MT, agricultural research would concentrate on the adaptation and selection of crop varieties and cultivation techniques appropriate to the logistical and ecological conditions of the project area. Research would include investigation into locally appropriate crop rotation and diversification, use of livestock as part of a mixed farming system, farm management and alternative farming systems.

(d) Input Supply (US\$ 0.5 million): the supply of agricultural inputs would be improved through the establishment of a supply store and three nurseries in the project area. The executing agency would be the state agricultural development company, CODAGRI.

(ii) Production Infrastructure (US\$ 17.7 million)

(a) Drying and Storage (US\$ 6.8 million): implemented by the state agricultural storage company, CASEMAT, existing 3,000 ton warehouses would be consolidated and 15

ton/hour grain dryers installed adjacent to them in Jauru and Rio Branco, a new 6,000 ton warehouse and grain drier complex would be constructed in Araputanga, together with a grain dryer in Tangara da Serra and a grain weighing and drying unit in Salto do Ceu. An additional 18,000 tons of storage and complementary grain drying capacity, as well as three further grain weighing and drying stations, would be installed at other locations which remained to be defined at the time of appraisal.

- (b) Municipal Roads (US\$ 10.9 million): under the coordination of CODEMAT, improvements of some 1,470 km of municipal roads would be undertaken and a system to provide routine road maintenance would be established in the project area.

(iii) Social Development (US\$ 17.1 million)

- (a) Education (US\$ 12.2 million): coordinated by the state Secretariat of Education and Culture (SEC), this component would seek to increase access to rural schools and improve the quality of rural primary education through the construction and equipment of 126 new schools, renovation of 122 existing schools, the training of teachers and administrative personnel and improvements in curricula, among other interventions.
- (b) Rural Water Supply (US\$ 1.5 million): the project would finance the construction and equipment of about twenty-four simplified rural water systems and start-up costs for the establishment of maintenance capabilities for existing systems. The executing agency would be the state water supply company, SANEMAT.
- (c) Health and Sanitation (US\$ 3.1 million): under the state Secretariat of Health (SES), the component would improve the coverage and quality of primary health care services in the project area through the construction and equipment of seven health centers and thirty health posts, the expansion of an existing health center in Caceres, the training of health personnel, the provision of vehicles to be used as ambulances and for the distribution of medicines and field supervision and the installation of some 5,400 latrines.
- (d) Community Organization (US\$ 0.4 million): the component would construct six community centers, support the organization of community councils and provide training to community level agents of the rural extension, health and education components. EMATER-MT would be the executing agency.

- (iv) Project Management and Coordination (US\$ 2.5 million): overall project management would be the responsibility of a newly-created unit in the state Cabinet for Planning and Coordination (GPC) which would coordinate planning, budgeting and policy decisions, as well as monitor and evaluate the attainment of project targets and objectives. This component would finance equipment, vehicles, salaries of incremental staff and consultant services for the Project Management Unit (PMU) including the operation of field offices in Caceres and Barra do Bugres.

42. As in Rondonia, rural credit and improved seeds were to be provided in parallel to the project. Credit requirements for the 10,000 farmers to be directly assisted under the project were estimated to be on the order of US\$ 28 million for incremental seasonal credit and US\$ 15 million for medium and long-term investment credit. As in the case of the first phase Rondonia agricultural development project, assurances were given by the federal government that "it would take all necessary steps to ensure the timely availability of adequate working capital and investment credit to the project's small and medium-sized farmers (including sharecroppers and tenants)." ³⁶ Assurances were likewise given by the state government that a seed supply program would be established based on plans developed by the state agricultural planning commission (CEPA-MT). ³⁷ Finally, assurances were received from both the federal and state governments that they would take all measures necessary to maintain existing crop purchase and financing mechanisms operated by the Commission for the Financing of Agricultural Production (CFP) based on minimum prices specifically set for the region. ³⁸

F. The New Settlements Project ³⁹

43. Unlike the Phase I and II rural development projects in Rondonia and Mato Grosso which sought to consolidate existing areas of small-farmer production, the Phase III New Settlements Project was intended to promote the agricultural occupation of previously uninhabited areas. Accordingly, the SAR for this project described its area of intervention as covering about 1.1 million hectares in the (by then) state of Rondonia, "consisting mostly of publicly owned and undeveloped lands, mainly virgin forest, where, besides some

³⁶ Ibid., para. 4.29. (emphasis OED). This was formalized in Section 4.01 of the respective Loan Agreement, signed on May 12, 1972.

³⁷ This was specifically contemplated in Section 3.02 of the Project Agreement signed by the Government of Mato Grosso on May 12, 1982.

³⁸ This was formally covered by Section 4.02 of the Loan Agreement and Section 2.11 of the Project Agreement.

³⁹ This section is largely based on Report No. 4424-BR.

wild rubber tapping, limited mineral prospecting and few dispersed extractive forestry operations, no systematic economic activity is yet taking place." ⁴⁰

44. The population in the area to be covered by the project at the time it was appraised (January 1983) was reported as "practically nil." The SAR did indicate, nonetheless, that undeveloped land in private ownership in some parts of the area would have to be recovered by INCRA through the application of existing legislation. Much of the area to be developed was not yet served by roads which, on the one hand, "considerably reduces the potential for undesired squatting," but, on the other, also limited "access for survey or planning purposes." As a result, most of the detailed surveying and planning would need to be carried out "in parallel to the opening of main access roads within the settlement sites and would be rapidly followed by plot allocation to selected settlers." ⁴¹

45. Three of the six sites proposed for the establishment of new settlements (Urupa I and Machadinho I and II, covering some 600,000 ha) had "already been studied in considerable detail," according to the SAR, while civil works had already been initiated at Urupa I and Machadinho I. A second site at Urupa which had also previously been studied in some detail, however, had already been claimed by a forestry company and it was, thus, likely that INCRA would have to turn to an alternative location at Cujubim, north of Ariquemes. Two additional sites, Capitaio Silvio and Marmelo, situated along the unpaved section of the BR-364 road west of Porto Velho, had also been identified "as possibly having suitable soils" and were undergoing more detailed investigation at the time the project was appraised. The SAR further indicated that, if detailed surveys later revealed that substantial segments of these proposed sites were inappropriate for settlement, the "discarded segments" would be replaced by areas such as Cujubim which remained to be studied in detail. ⁴²

46. In describing the origin and rationale of the project, the SAR critiqued earlier colonization efforts in Rondonia and indicated various improvements that had been specifically introduced in planning the proposed new settlement schemes. These observations merit reproducing in some detail.

Since 1970, INCRA has established a large number of settlement areas in Rondonia, mostly along the yet unpaved BR-364. These settlements were generally established without preliminary soil surveys and along a standard orthogonal layout, without consideration of

⁴⁰ Ibid., para. 2.01

⁴¹ Ibid., para. 2.01 (emphasis OED).

⁴² Ibid., para. 2.01. The SAR adds that no Amerindians were known to dwell in the proposed settlement sites. However, reserves did exist near the proposed Machadinho II and Capitaio Silvio sites such that "measures to avoid the expansion of settlement areas through spontaneous squatting beyond official limits will be required from FUNAI and state government authorities, within the context of the overall Northwest Program."

topographical or ecological factors. Roads were poorly built and soon became impassable during the rainy season. The few available services were concentrated along BR-364 exclusively, although secondary roads were built up to 40 km away from the highway and subsequently extended as far as 80 km into the forest as a result of spontaneous settlement. No mechanisms were planned for the gradual transfer of administrative responsibilities from INCRA to the local authorities. Lots of 100 ha each, including individual legal reserves of 50 ha, were given at highly subsidized prices.

The long preparation phase of the proposed project has already allowed INCRA, with assistance from the FAO and Bank missions, to gradually define and start to apply improved settlement methods, including the selection of ecologically favorable areas; road and plot layouts suited to the local topography; road standards allowing effective maintenance; decentralized semi-urban centers [i.e. NUARs] providing settlers with financial, commercial, education and health services; agglomeration of individual legal reserves into large, collective blocks on segments of the settlement areas less suitable for agricultural practices, with parallel strengthening of the planning and extension capability of IBDF; coordination with state authorities for an efficient transfer of administrative responsibilities; and cost recovery procedures reducing the project's impact on the government budget. Furthermore, the introduction of rubber plots in some 40% of the farms to be established, with extensive technical and financial assistance to the farmers, would orient settlers to new perennial cropping opportunities adapted to local soils, emphasizing a crop of strategic importance for a rapidly industrializing country.⁴³

47. In this context, specific project objectives, as stated in the SAR, were to: (i) help INCRA settle up to 15,000 immigrant farmer families with improved physical planning and settler selection criteria in six areas in Rondonia possessing adequate agricultural potential by 1989; (ii) provide settlers with a level and variety of infrastructure and services comparable to those offered under Phase I of the program including roads, warehouses, health and education facilities, agricultural extension and social services; (iii) develop salvage logging procedures in areas cleared for agriculture and, in the longer term, collective sustained forestry operations; (iv) generate farmer involvement in less traditional tree crops which are suitable to local soils; and (v) improve government capacity to plan and execute similar settlement projects in other parts of the Amazon region. The 15,000 families would each receive 25 to 40 ha of agricultural land, depending on relative soil quality in

⁴³ Ibid., paras. 3.06-3.07.

the different localities to be settled, and an equal amount of forest land within agglomerated blocks. Project beneficiaries were expected to produce a mixture of subsistence and commercial crops including rice, maize, beans and cassava, together with cash crops such as rubber, fruits and coffee.

48. With respect to the size of the project's target population, the S/R observed that INCRA had originally intended to settle some 60,000 families in the Northwest region during a four year period. However, "in view of the complexity of settlement in the tropical jungle and financial and institutional limitations," this target was gradually reduced to 20,000 families to be settled over a period of seven years, three-quarters of which (ie. 15,000) were to be assisted through the present project. "The target number of families to be settled annually under the program, accordingly, decreased very significantly from 15,000 to less than 3,000 families per year (ie. from 60,000 families in four years to 20,000 families over seven years). Interestingly, the final target was only half of the 30,000 families which the Bank initially expected to be accommodated in new settlement areas over a five to six year period (or some 5 to 6,000 families per year) in both Rondonia and Mato Grosso.

49. Total project costs over a six year implementation period were estimated at appraisal to be US\$ 182.0 million equivalent, of which Bank Loan No. 2353-BR would finance US\$ 65.2 million, or roughly 35%. As appraised, project components (together with their estimated costs net of contingencies) were:

(1) Production Infrastructure

- (a) Land Use Planning, Settlement Layout, Demarcation and Titling (US\$ 8.7 million): this component, to be carried out by INCRA, would include: (i) preliminary zoning of proposed settlement sites on about 900,000 ha for potential agricultural and forest reserve areas; (ii) preliminary layouts of feeder, access and penetration roads and settlement plots; (iii) field evaluation of land use capabilities to confirm and, where necessary, correct the preliminary zoning exercise; (iv) detailed settlement designs based on the plot sizes and block reserve arrangements indicated above; and (v) cadastral

" Ibid., para. 3.09 (emphasis OED). The document also notes that "if migration into Rondonia were to continue more or less at the past rate of 1,000 families per month, half of which declare an interest in agricultural employment, the project would attend a little less than half of the potential settlers arriving in the region during the project implementation period. The others would find work opportunities as sharecroppers or laborers in already established farms." (Emphasis OED)

surveys and demarcation of individual plots and reserves. ⁴⁵

- (b) Rural Roads (US\$ 29.1 million): some 1,550 km of primary and 1,450 km of secondary farm access roads would be constructed and state and municipal road maintenance capabilities would be strengthened. ⁴⁶ INCRA would be the implementing agency and the municipalities and DER-RO would be responsible for subsequent maintenance activities.
- (c) NUAR and Satellite Infrastructure (US\$ 7.1 million): under this component, also to be implemented by INCRA, seven NUARs would be established and, as in Phase I, each provided with administrative, service, commercial and recreation areas and some 200 lots for private houses. Office facilities for public agencies (ie. INCRA, SUDHEVEA, IBDF and state government entities involved in rural development) would also be established in each one, as would a guest house, staff housing, a public water supply system and a electricity distribution network. Four of the NUARs would also be furnished with a simple landing strip and a training facility, while all would have a secondary school and a health post or referral center. The project would likewise fund basic social infrastructure (including a one-classroom school and a health post) in roughly 71 satellite centers.
- (d) Adaptive Agricultural Research (US\$ 2.1 million): studies already being carried out in connection with Phase I would be complemented by research into annual and perennial crop production techniques tailored to local soil conditions in the new settlement areas. The component would support installation of an experimental substation at Machadinho I and 150 farmer-operated fruit tree and annual crop demonstration plots. The Rondonia unit (UEPAE-RO) of EMBRAPA would be the executor.

⁴⁵ Land use capability surveys for an additional 190,000 ha in Urupa I and II and Machadinho I had been financed and implemented under Loan 2060-BR and more detailed land use planning and settlement layouts had reportedly already been completed for these sites at the time the present project was approved. SUDHEVEA was, nevertheless, expected to carry out further field surveys in order to determine the areas best suited for rubber cultivation.

⁴⁶ In addition, construction of some 750 km of feeder roads linking NUARs to the main highway and 200 km of farm access roads at Urupa I would be undertaken by the Army's Civil Engineering Battalion (BEC), but the corresponding costs were not included in the project.

- (e) Technical Assistance to Farmers (US\$ 11.3 million): the Rondonia rural extension agency, ASTER-RO, would assist project settlers in the improvement of their agricultural production techniques, giving particular emphasis to soil conservation and the promotion of new perennial crops. SUDHEVEA would likewise provide assistance to rubber farmers and tappers. Seven new rural extension offices would be installed and some 750 farmer leaders and 110 general and 80 rubber extensionists would be trained.
- (f) Crop Drying and Storage (US\$ 3.5 million): construction and equipment of seven 2,000 ton warehouses, each accompanied by a 5-ton/hour grain dryer. The INCRA-built warehouses would be designed to meet local climatic and agricultural production conditions.
- (g) Input Supply (US\$ 1.0 million): the project would finance the construction and equipment of and working capital for three nurseries to produce seedlings of tropical fruit trees (eg. guarana, Brazilnut, cashew nut, mango, etc.) and of seven small input supply posts to be operated by CODARON.
- (h) Forestry Development (US\$ 6.1 million): the component would consist of: (i) rapid forest inventories by IBDF of some 570,000 ha of agricultural plots and the establishment of salvage logging procedures for the some 350,000 ha expected to be cleared in the new settlement areas over a 15-year period; (ii) detailed inventories by IBDF of some 500,000 ha of legal reserves and preparation of management plans for the permanent exploitation of some twenty block reserves within these areas; (iii) the installation of and vehicles and equipment for seven forestry extension offices to be subsequently transferred to the State Forestry Institute which was to be created in Rondonia; (iv) training, salaries and other operation costs for some 26 forestry extensionists and central staff during the project implementation period; (v) construction of and working capital for two pilot sawmills to be operated by CODARON; (vi) construction, equipment and operating costs of three IBDF forestry control posts; (vii) establishment and equipment of control bases in Costa Marques (on the Guapore River) and Ariquemes, to be owned by IBDF and operated by the Forestry Battalion of Rondonia, for the protection of natural parks and reserves, water sources and endangered species; (viii) market studies for wood species with favorable characteristics, but which had not traditionally been processed in the region; and (ix) consultant services to IBDF to help it define salvage logging procedures,

prepare and implement management plans for forest reserves and strengthen its environmental control capacity.

(ii) Social Infrastructure

- (a) Education (US\$ 3.4 million): construction and furnishing of seven four-classroom schools (in the NUARs) and about 223 single classroom multi-grade schools to be equipped, operated and maintained by the state Secretariat of Education with the assistance of municipal authorities. A total of 20,000 new student places would be created.
 - (b) Health (US\$ 4.0 million): complementing the Phase I Health Project described above, INCRA would construct seven large health posts in the project NUARs and 71 small health posts in surrounding satellite villages. Two of the larger health posts would later be expanded by the state Secretariat of Health (SES-RO) into referral health centers. Various vehicles, including ambulances, as well as the training of 113 health professionals and auxiliaries, would also be financed. All health facilities would be operated and maintained by SES-RO.
 - (c) Social Organization (US\$ 1.5 million): in line with earlier experience in Rondonia, the project would help establish farmer organizations and develop community labor through local agents of the state Secretariat of Labor and Social Promotion, working in collaboration with ASTER-RO. Some twenty settler groups would be organized in the area of influence of each NUAR to receive training on health and nutrition and participate in school construction and maintenance.
- (iii) On-farm Investments (US\$ 46.8 million): this component would finance part of the estimated total cost (US\$ 89.4 million) of the establishment of rubber (US\$ 29.3 million), coffee (US\$ 8.9 million) and Amazon fruit tree plantations (US\$ 31.5 million) and the acquisition of livestock and farm implements (US\$ 19.7 million) by new settlers over the project execution period.⁴⁷

⁴⁷ Coffee and livestock financing, specifically, would not be covered by the project. Government credit lines were expected to finance some US\$ 60.8 million for the installation of rubber and fruit trees, while the remaining US\$ 28.6 million for coffee and livestock would come from private banks. Seasonal credit requirements, estimated to reach US\$ 6.1 million annually by year 6 of the project, however, would be met by official banks. Rubber installation loans would be provided through funds allocated to SUDHEVEA's national Rubber Development Program (PROBOR), administered by the Bank of Brazil.

- (iv) Special Activities (US\$ 1.7 million): this component would include assistance to the federal government to review development possibilities and production techniques for a number of crops, including coconuts, babacu, oil palm, guarana, cashew nuts, Brazilnuts and tropical fruit trees which were extensively grown in the region and/or had favorable market prospects, but which had received little formal institutional support. The subproject would be coordinated by SUDECO and the Ministry of Agriculture with the participation of various specialized agencies involved in agricultural and environmental research and development. Funds would also be made available to support the preparation of new regional development projects in the Northwest, including possible future operations already under consideration by the state governments of Mato Grosso and Rondonia and a possible project by INCRA in some 400,000 ha of land under federal jurisdiction in the Mato Grosso portion of the Guapore valley.⁴⁸
- (v) Project and Program Coordination and Management (US\$ 6.5 million): considering its key role in the execution of the present operation, the project would support the institutional strengthening of INCRA's central operations in Brasilia, as well as those of its regional delegation in Porto Velho, together with the adequate staffing of field units to supervise civil works and the settlement of new farmers. Support was also to be provided under this component for the continuation of overall program evaluation and coordination beyond the end of 1986.

50. As in the earlier rural development projects in the Northwest region, a number of activities were carried out in parallel to the New Settlements operation. The most important of these were the construction and maintenance of feeder roads, together with some NUAR infrastructure (in Urupa I), to be undertaken by the Army as indicated in the footnote to the section on rural roads in the previous paragraph. Other parallel activities were to include the routine maintenance of all roads, the operation of education and health facilities and the improved supply of seeds by state agencies. UEPAE-RO and CODARON, in particular, would be responsible for seed production and distribution. The final set of interventions expected to be carried out in

⁴⁸ Ibid., para. 3.25. It was noted, however, that "the presence of various Amerindian tribes in parts of the valley, combined with locally complex cadastral situations and soils which have good physical and topographical features, but low fertility...make it necessary that (a) detailed surveys be conducted to identify areas specifically suited for small farmer settlement; and (b) sophisticated agricultural production and management techniques be developed, with a corresponding emphasis on the selection of more competent farmers than those usually settled on INCRA lands."

parallel to Phase III as well as Phases I and II of the program, finally, was the non-Bank financed Amerindian Special Project.

G. The Amerindian Special Project ⁴⁹

51. As indicated in Chapter III, accelerated occupation of the Northwest was expected to lead directly to increasing pressure on Amerindian communities because of growing competition with settlers over tribal lands, together with the increased risk of their exposure to contagious diseases to which they possessed very limited immunity. As noted in the SAR for the Phase I Agricultural Development and Environmental Protection Project, "in the very worst case, the cultural or even physical extinction of Amerindian groups living in the area could be feared if development were not carefully controlled." ⁵⁰ In light of this eventuality, the Brazilian Government, through FUNAI, ⁵¹ formally committed itself to strengthen its capacity to protect tribal populations in the POLONOROESTE region, giving emphasis to the protection of Amerindian lands and the provision of health care services.

52. Many of the investments under the Special Project concentrated mainly on improving FUNAI's physical and administrative infrastructure at the regional and local levels, together with the training of its field staff. At the Government's insistence, the Special Project was financed exclusively with domestic resources. Its activities were to be monitored by national authorities, but would also be periodically reviewed by the Bank. In order to protect designated (ie. interdicted, delineated or demarcated) tribal reserves in the program region, it was expected that FUNAI would demarcate or upgrade existing demarcation lines in all such reserves and would promptly evict illegal trespassers and squatters from these areas.

53. Amerindian health care, in turn, would be improved by expanding and upgrading the operations of existing mobile health units and establishing new health posts in the Guapore valley, with back-up support to be provided by the hospital in Vilhena. FUNAI would also provide full immunization coverage and intensified assistance in outbreaks of communicable diseases and maintain

⁴⁹ This section is based largely on para. 6.03 of Report No. 3512b, op. cit. See Annex 8 of the same report for further details.

⁵⁰ Ibid., para. 6.03 (emphasis OED).

⁵¹ As indicated in Chapter III, considerable disagreement existed both within the Bank and (outside the Government) in Brazil with respect to FUNAI's capacity to adequately protect the region's Amerindian populations. One Bank anthropological consultant, for example, specifically recommended against entrusting Amerindian support measures to FUNAI (see Price, op. cit., Chapter 11), while several Bank staff members expressed strong doubts about FUNAI's capacity to deal with the "threats of development" in the area, as one December 1980 internal memorandum put it. Despite these concerns, however, at the Brazilian Government's insistence and due to the lack of any clear alternative, the Bank eventually, if reluctantly, agreed to FUNAI's carrying out the proposed Special Project.

adequate medical supplies at all Indian posts. Specific lines of action were also to be defined with respect to Amerindian education and the promotion of small-scale economic development projects. Finally, FUNAI and DNER were expected to enter into a specific agreement regarding the protection of Amerindians against possible negative effects associated with highway construction activities.⁵²

54. Although the Loan Agreements for the Phase I POLONOROESTE loans do not themselves textually contain these commitments, according to the SAR for the Agricultural Development and Environmental Protection Project, the federal government "would: (a) ensure timely provision of appropriate funds, staff and other resources, authorizations and permits required for the implementation of the [Amerindian] protection measures; (b) upgrade the organization and operations of its institutions entrusted with implementation of the [Amerindian protection] program; (c) provide the Bank with a reasonable opportunity to periodically review in the field progress on the implementation of these protective measures; and (d) present to the Bank such information as the Bank may require on the carrying out and impact of the protection program."⁵³ It was likewise observed in this document that it was FUNAI's intention to enter into a contract by May 31, 1982 with a Brazilian institution or experts to assist them in their monitoring and evaluation activities related to the Special Project."⁵⁴ Finally, the SAR informs that legal acts ("portarias") delimiting all Amerindian areas in the Guapore valley had been formally executed by the Brazilian Government and that the additional personnel, equipment and operating resources required by FUNAI had already been provided in the program region.

⁵² Section 4.01 of the Loan Agreement for the Highway Project, signed December 15, 1981, specifically indicated that "the Borrower shall cause DNER and FUNAI to enter into appropriate arrangements to protect the Amerindian communities from harm associated with the construction works on the Highway."

⁵³ Report No. 3512b-BR, op. cit., para. 6.03.

⁵⁴ Ibid., para. 6.03. This was eventually carried out by part of the multi-disciplinary team at the University of Sao Paulo that was hired by SUDECO to undertake the on-going evaluation of the program as a whole.

ANNEX IVRECENT EVOLUTION OF AGRICULTURAL ACTIVITY IN NORTHWESTERN MATO GROSSO

1. To complement the project-specific findings of the PCR for the Phase II Mato Grosso Rural Development Project discussed in Chapter IV, a more general empirical examination of rural development tendencies leaves little doubt as to the direction of overall trends with respect to the evolution of agricultural activity in the Mato Grosso portion of the POLONOROESTE region. The direction of such trends, moreover, appears to be diametrically opposed to the overall objectives of the program. The figures in Tables IV-1, IV-2 and IV-3, which present census data on the evolution of agricultural activity and rural land distribution in the nine municipalities covered under the project between 1980 and 1985, illustrate several aspects of these broader tendencies.

2. First of all, as Table IV-1 reveals, the number of rural establishments suffered a sizeable decrease in eight of the nine municipalities in the project area during the first half of the 1980's. Only in Caceres was there an increase in the number of farm units during the period and this increase was very small. For the project region as a whole, however, the number of farm units fell by nearly 15% between 1980 and 1985, while the total area occupied by these establishments rose by roughly 20%. As a result, the average size of rural establishments increased in all nine municipalities. This tendency was particularly dramatic in Araputanga where the average size of farm establishments more than tripled over the period. When the project region municipalities are considered as a whole, average farm size rose by an impressive 49%, from 216 to 321 hectares, between 1980 and 1985.

3. The figures in Table IV-2, in turn, confirm that there was a clear tendency toward the increased concentration of rural land holdings in medium and large establishments in the Mato Grosso Rural Development Project region during the first half of the 1980's. Indeed, while the number of very small farm units (ie. those having less than 10 hectares) declined by 30% between 1980 and 1985, the number of establishments between 1,000 and 10,000 hectares increased by 40%. Furthermore, the percentage of the area in rural establishments having 100 ha or less declined from 6.8% of the total in 1980 to 5.3% in 1985, while the share in establishments with more than 10,000 ha increased from 42.4% to 45.7%.

4. Perhaps even more telling is the fact that the number of people engaged in agricultural activities decreased in all but one of the municipalities in the project region. The only exception was Quatro Marcos which, however, experienced a total increase of only 121 rural laborers, while the project area as a whole lost a total of some 22,000 agricultural workers over the five year period. The results of efforts to promote perennial crops in the project region during the early 1980's also clearly fell short as the area planted in perennials fell from some 36,800 ha in 1980 to roughly 29,300 ha in 1985. Only Caceres, which incorporated nearly half a million hectares in rural establishments during the period, registered a significant increase in the area under permanent crops.

Table IV-1 - Changes in the Structure of Agricultural Production in Municipalities
Under Polonoroeste, Mato Grosso, 1980-85: Selected Indicators

Year and Municipality	No. of Establishments	Total Area	Average Area (in ha.)	Area Under Permanent Crops	Area Under Temporary Crops	No. of Persons in Agricultural Activities	No. of Tractors	Cattle
Caceres 1980	4.003	2.176.297	543.7	3.536	34.855	23.529	274	380.113
1985	4.031	2.647.956	656.9	7.026	55.762	22.186	925	480.152
Mirassol d'Oeste 1980	1.318	72.232	54.8	3.897	9.560	6.171	95	30.911
1985	1.283	91.413	71.2	3.210	9.730	5.990	203	49.611
Tangara da Serra 1980	2.855	528.921	185.3	11.612	26.364	9.476	164	90.503
1985	2.351	783.438	333.2	6.407	35.979	7.930	469	113.105
Barra do Bugres 1980	1.069	549.098	513.7	1.247	11.770	7.718	133	217.017
1985	903	530.079	587.0	1.042	18.484	4.290	296	130.164
Quatro Marcos 1980	1.987	62.200	31.3	6.959	8.637	7.246	49	26.234
1985	1.728	79.808	46.2	7.050	9.896	7.367	143	39.994
Rio Branco 1980	1.724	108.330	62.8	1.994	9.251	9.734	45	51.601
1985	1.338	115.792	86.5	1.416	7.212	4.640	71	46.437
Araputanga 1980	2.506	183.345	73.2	3.228	11.849	12.952	59	113.181
1985	1.050	253.805	241.7	1.458	5.772	5.860	67	165.173
Jauru 1980	1.834	196.646	107.2	2.200	11.161	7.409	53	62.202
1985	1.238	187.094	151.1	811	9.156	6.403	46	98.252
Sal do Céu 1980	1.507	182.962	121.4	2.160	9.269	8.156	47	57.072
1985	1.127	143.063	126.9	919	6.227	5.837	53	65.495
Total 9 municipalities 1980	18.803	4.060.031	215.9	36.833	132.716	92.391	919	1.028.834
1985	15.049	4.832.448	321.1	29.339	158.218	70.503	2.273	1.188.383
Remainder of State 1980	45.580	30.494.518	669.0	92.967	1.290.732	248.067	10.237	4.214.210
1985	63.321	33.129.987	523.2	106.143	1.834.681	279.499	16.953	5.315.336
Total Mato Grosso 1980	63.383	34.554.549	545.2	129.800	1.423.448	318.570	11.156	5.243.044
1985	78.370	37.962.435	484.4	135.482	1.992.899	350.002	19.226	6.503.719

Source: IBGE - Censos Agropecuário, 1980 and Sinopse Preliminar do Censo Agropecuário, 1985

5. Both annual crops and ranching, in contrast, revealed a positive growth tendency, with the cattle population increasing by approximately 15% over the period. Based on the figures in Table IV-1, however, the expansion of cattle raising activities appears to have been quite uneven in a geographic sense, with herds growing substantially in some municipalities (eg. Araputanga, Jauru and Mirassol d'Oeste and Tangara da Serra), but declining significantly in others (particularly Caceres and Barra do Bugres). On the other hand, a very sharp increase in the number of tractors, which jumped from 919 to 2,273 units, occurred in the region between 1980 and 1985, suggesting a tendency for the rapid mechanization of agricultural production. Interestingly, however, most of the increased number of tractors was in Caceres, where, as already noted, the total area in farms grew significantly, while the cattle population decreased in the early 1980's. It is likely that these tendencies reflect the expansion of mechanized soybean production in the municipality during this period.

Table IV-2

Evolution of Rural Land Distribution in Northwestern Mato Grosso, 1980-85 (%)

<u>Size Class</u>	<u>1980</u>		<u>1985</u>	
	<u>Establishments</u>	<u>Area</u>	<u>Establishments</u>	<u>Area</u>
<10 ha	46.3	0.9	37.8	0.6
10-100 ha	39.5	5.9	42.7	4.7
100-1,000 ha	10.9	13.5	14.3	13.7
1,000-10,000 ha	2.9	37.3	4.8	35.2
>10,000 ha	0.4	42.4	0.4	45.7
TOTAL	100.0	100.0	100.0	100.0

Source: IBGE, Agricultural Census, 1980, 1985 (data for Caceres, Jauru, Salto do Ceu, Rio Branco, Mirassol d'Oeste, Quatro Marcos, Araputanga, Barra do Bugres and Tangara da Serra)

6. The significance of these trends is further highlighted when they are compared with the evolution of the same variables in the rest of the state over the same period. This can be illustrated by a brief comparison of annual average growth rates for agricultural establishments, the total area in farms and ranches, the area in permanent and temporary crops, rural employment, tractors and the cattle population, as presented in Table IV-3 for the project area, the rest of the state and Mato Grosso as a whole between 1980 and 1985. That part of Mato Grosso not included in the POLONOROESTE region, for instance, witnessed a positive increment in the number of rural establishments and, even though the average farm size was much larger here than in the POLONOROESTE area (ie. 523 ha versus 321 ha in 1985), it decreased significantly during the 1980-85 period, rather than increasing as occurred in the project region. In sharp contrast to the tendency in the project region, moreover, the area in permanent crops increased when the rest of Mato Grosso is considered as a whole. Both the area in annual crops and the cattle population, furthermore, grew much more

rapidly in the rest of the state than in the project region. The number of tractors, in contrast, while expanding rapidly throughout Mato Grosso in the early 1980's, grew even faster in the project area. Finally, the amount of employment in the agricultural sector in the rest of the state increased by 2.4% a year, as compared with a 5.3% average annual decrease in the project region.

Table IV-3

Mato Grosso: Annual Growth of Selected Agricultural Indicators, 1980-85 (%)

<u>Indicator</u>	<u>Project Region</u>	<u>Rest of State</u>	<u>Mato Grosso</u>
Agricultural Establishments	-4.4	6.8	4.3
Total Area in Farms & Ranches	3.5	1.7	1.9
Area Planted in Perennial Crops	-4.4	1.9	0.9
Area Planted in Temporary Crops	3.6	7.3	7.0
Rural Employment	-5.3	2.4	1.9
Tractors	19.9	10.6	11.5
Cattle Population	2.9	4.8	4.4

Source: IBGE, Agricultural Census, 1980, 1985; Table 12 above

7. In short, preliminary data from the 1985 Agricultural Census complement the PCR in painting a fairly somber picture with respect to the achievement of POLONOROESTE's objectives in northwestern Mato Grosso during the first half of the 1980's. Although it might be objected that the program's activities had only recently begun in the area at the time the 1985 data were gathered or that the preliminary census data may be incorrect, neither objection appears to hold much weight. The main impact of POLONOROESTE came from the paving of the BR-364 highway which occurred several years before the census data were gathered (first semester of 1986). Furthermore, the definitive figures for the last three agricultural census surveys have not differed significantly from the preliminary ones. While the final version of the 1985 data, expected for early 1990, and the preliminary data from the 1990 census, not expected before late 1991, will unquestionably provide a more secure basis for assessing the impact of POLONOROESTE on agricultural production and rural development, significant deviations from the picture presented above are not likely.

8. On the basis of the information currently available, therefore, it can be concluded that the early 1980's constituted a period of heavy out-migration from rural areas in the municipalities covered by the Mato Grosso Rural Development Project, much of which is likely to have gone to areas of recent settlement in Rondonia. At first glance, this outcome is somewhat perplexing and ironic in light of the fact that the number of persons occupied in agricultural activities in other parts of the state not specifically targeted with small-farmer oriented rural development investments increased over the same period. This is even more intriguing considering that, unlike the situation in the project area, the number of small agricultural establishments in much of the rest of the country, as well as in the remainder of Mato Grosso, grew substantially between 1980 and 1985, for the first time since agricultural

modernization began to intensify during the 1960's. The increase in the number of small rural establishments during the early 1980's, in turn, is largely attributable to the impact of the serious economic recession on the urban-industrial sector's capacity to absorb rural migrants, a factor which likewise spurred migration to the Rondonian frontier.

9. Although the opposite tendency in the Mato Grosso project area cannot be attributed to the effects of POLONOROESTE alone, the possible relationship between the program and the observed trends toward increasing land concentration and a parallel reduction in the rural labor force is a subject that merits additional study. One hypothesis worth entertaining in this connection is that the amount of resources destined by the program to small-farmer consolidation in Mato Grosso was quite small in comparison to that invested in road-building, especially pavement of the Cuiaba-Porto Velho highway, which, by stimulating higher land values and associated land speculation, clearly worked in an opposite direction. The relative importance of road improvements within the Mato Grosso rural development project itself, moreover, in all likelihood, reinforced this tendency at the level of the program as a whole.¹ This imbalance in physical infrastructure versus direct agricultural production and social service investments, coupled with the relative ineffectiveness of the project's small-farmer assistance measures as documented in the PCR, may help to explain the rather startling tendencies illustrated in Table IV-1.

10. As concerns the evolution of extractive (ie. mining and logging) activities, not explicitly contemplated by POLONOROESTE, in turn, it would appear that the recent situation in Mato Grosso has been largely similar to that in Rondonia, which will be discussed in a later chapter, at least in relation to gold prospecting. That is, such activities, which were greatly facilitated by the improved feeder road network in the region, increased spectacularly during the 1980's, in the process attracting a substantial, although unquantified, labor force. In fact, it is likely that one of the reasons for the decrease in the agricultural labor force in northwestern Mato Grosso in the early 1980's (ie. in addition to increasing rural land concentration and the attraction of Rondonia) was precisely the rapid growth of prospecting activities in the area. Based on direct observations during the September-October 1989 OED/SEPLAN field visit, on the other hand, unlike the situation in Rondonia, logging activity appears to be on the decline in much of the area covered by the Mato Grosso Rural Development Project as much of this region has already been either completely deforested or at least subject to the selective extraction of higher value timber.

¹ According to the PCR (op. cit., Table 5, pg. 26), total cost of the Mato Grosso operation on completion was US\$ 43.8 million, as compared with a projected US\$ 76.4 million at the time of appraisal. Of actual total cost, US\$ 17.8 million (or 41%) was spent on municipal road improvements, while only US\$ 10.3 million (23%) and US\$ 7.0 million (16%) were spent on agricultural services (ie. agro-ecological zoning, rural extension, adaptive research and input supply) and social development (ie. education, rural water supply, health and sanitation and community organization), respectively. Agricultural services and social development, moreover, were initially expected to receive 31% and 32% of project resources, while road improvements were to receive only 20%.

11. Finally, it would appear that, at least in one respect, future agricultural development prospects may still be greater in northwestern Mato Grosso than in Rondonia. In addition to having reasonably large patches of relatively good soils on flat topography, the region north of Caceres is hundreds of kilometers closer to Cuiaba and to southern Brazilian markets more generally when compared with Rondonia. Particularly in view of Cuiaba's recent solid and diversified growth, this relative proximity may make a difference in terms of future rural development activities in this part of the POLONOROESTE region. On the basis of current tendencies, however, it does not seem likely that such development would primarily benefit the class of farmers which POLONOROESTE hoped to assist.

ANNEX VRECENT EVOLUTION OF AGRICULTURAL ACTIVITY IN RONDONIAA. General Rural Development Tendencies

1. The significant dynamism and principal characteristics of recent rural development in Rondonia can be illustrated empirically with reference to the 1985 Agricultural Census. Table V-1 presents data on the evolution of total population, rural establishments, farm labor force, the total area in rural establishments, the total area in crops and in perennial and annual crops respectively, the cattle population and tractors in Rondonia between 1980 and 1985. It also indicates the percentage share of the growth experienced by each of these variables over the 1970-85 period that occurred between 1980 and 1985. This latter set of figures clearly highlights the importance of the post-1980 period with respect to the very substantial expansion of population and agricultural and ranching activity occurring in Rondonia since 1970.

Table V-1

Evolution of Rural Development Tendencies in Rondonia, 1970-85

<u>Variable</u>	<u>1980</u>	<u>1985</u>	<u>1980-85/1970-85</u>
Total Population	491,000	909,000	52.3%
Rural Establishments	48,371	81,582	44.6%
Rural Labor Force	176,934	325,086	48.7%
Tot. Area in Rural Estab. (ha)	5,223,631	6,090,471	19.4%
Total Area in Crops (ha)	373,431	539,126	35.5%
Area in Perennial Crops (ha)	170,178	229,800	25.3%
Area in Annual Crops (ha)	203,253	315,326	39.6%
Cattle	251,419	768,411	69.4%
Tractors	570	1,007	45.8%

Sources: IBGE, Anuario Estatístico do Brasil, 1989, and Agricultural Census, 1985 (Preliminary Synopsis)

2. These figures reveal that more than half of the growth in total population occurring in Rondonia between 1970 and 1985 took place after 1980, as did 40% or more of the growth in the number of rural establishments, the rural labor force, the area planted in annual crops and the number of tractors. The relative expansion of the cattle population (or the phenomenon known in Brazil as "pecuarização") was even more dramatic during this period, since nearly 70% of the total increment observed between 1970 and 1985 occurred after 1980. The principal reasons for this tendency are discussed elsewhere in this report, but one factor undoubtedly was the greatly improved transport linkage between Rondonia and Mato Grosso and points further south and east as a result of the pavement of the Cuiaba-Porto Velho highway. More recent data indicate that the tendency for rapid pecuarização has continued at least through 1987, at which

time the total cattle population was estimated to exceed one million. In this connection, additionally, it is significant that the largest increment in the livestock population during the 1980-1987 period occurred between 1982 and 1984, when the amount of cattle in Rondonia doubled from roughly 347,000 to 694,000 heads.

3. It is also noteworthy that roughly 70% (or close to 23,000 units) of the increment in the number of rural establishments in Rondonia between 1980 and 1985 was accounted for by establishments between 10 and 100 hectares, while those having 10 ha or less (or roughly 10,500 units) made up most ¹ of the rest of the total of more than 33,000 new establishments over the period. As a result, the average size of rural establishments in the state decreased from 108 hectares in the former year to roughly 75 hectares in the latter. Despite this tendency, however, the approximately 0.5% of all units having 1,000 hectares or more continued to occupy nearly 30% of the total land in farms and ranches in 1985, while the 28% of all establishments occupying 10 hectares or less accounted for less than 2% of the area in farms and ranches. Establishments between 10 and 100 hectares, in turn, increased their participation from 41% to nearly 53% of the total between 1980 and 1985, while their share of the area occupied rose from less than 23% to more than 33%.

B. Evolution of Ranching Activities

4. The Agricultural Census, in short, clearly reveals the importance of both directed and spontaneous rural settlement in Rondonia during the early 1980's. It likewise documents the comparatively greater dynamism of ranching over farming activities and of annual crop production over that of perennial crops. With respect to cattle raising in particular, as Table V-2 demonstrates, both the relative share of rural establishments possessing at least some cattle and the average amount of cattle per establishment increased for virtually all farm/ranch size classes in Rondonia between 1980 and 1985, thus indicating that pecuarizacao was a widespread phenomenon in the state.

5. More concretely, the number of rural establishments possessing some cattle in Rondonia increased from less than 19% in 1980 to more than 30% in 1985, or by more than 15,700 units, ² while the average number of cattle per establishment also increased slightly, from 28 to 30 heads, over the period. What is of particular interest, however, is that, even in the very smallest establishments (ie. those occupying less than 10 ha), both the percentage of units possessing some cattle and the average number of heads per establishment increased during the first half of the 1980's. At the other extreme (ie. units occupying more than 10,000 ha), the increase in the cattle population was

¹ While the number of rural establishments between 100 and 10,000 ha decreased by a total of more than 450 between 1980 and 1985, the number of very large establishments (ie. those over 10,000 ha) actually increased by more than 20%, from 24 to 29, during this period.

² Nearly 24,640 establishments reported having at least some cattle in 1985, as compared with only on the order of 8,900 in 1980.

considerably more dramatic, as the average herd size more than doubled to over 2,500 heads between 1980 and 1985.

Table V-2

Relative Importance of Ranching Activity in Rondonia, 1980-85

<u>Size Class</u>	<u>% of Units Raising Cattle</u>		<u>Average Number of Cattle Per Unit</u>	
	<u>1980</u>	<u>1985</u>	<u>1980</u>	<u>1985</u>
< 10 ha	5.4	12.7	4.7	6.4
10-100 ha	21.5	33.2	13.8	17.0
100-1,000 ha	23.5	46.6	27.5	42.5
1,000-10,000 ha	46.6	68.5	239.0	435.4
> 10,000 ha	95.8	93.1	1,178.4	2,536.7
Total	18.4	30.2	28.2	30.2

Source: IBGE, Agricultural Census, 1985 (Preliminary Synopsis)

6. Also as a result of these tendencies, establishments under 100 hectares increased their share of the total cattle population in Rondonia from less than 25% to nearly 34% between 1980 and 1985, while the largest share (roughly 40% of the total in both years) continued to be accounted for by establishments between 100 and 1,000 hectares. In short, the expansion of cattle raising activities in Rondonia during the early and mid-1980's occurred both on small and medium-sized farms and on medium and large-sized ranches.³ This suggests that ranching activity has been economically advantageous, although perhaps for different reasons, to both small and large producers in the state.⁴

³ In addition, roughly 36% of all cattle in the state in 1985 were in herds of 50 heads or less, while 56% were in herds of 100 heads or less, thus indicating that much of the livestock in Rondonia was in relatively small herds in that year. In contrast, 24% of the total cattle population was in herds of 500 heads or more, involving 137 different establishments, as compared with 25% and 54 establishments in 1980, revealing that the number of large ranching operations also increased significantly over the period.

⁴ One reason for the generalized expansion of ranching activities in Rondonia and elsewhere in Amazonia during the 1980's, as described by Schneider (op. cit.), has to do with the northward and northwestward advance of the Brazilian livestock frontier, together with the rapid growth of urban markets for meat and dairy products within the region over the past several decades. Another important reason, which is more fully described in Chapter VII, concerns the importance of livestock in the "survival strategies" of small farmers in frontier areas such as Rondonia, especially in view of the comparatively limited capacity of Amazonian ecosystems to sustain many types of agricultural activity over time.

Given the reported additional increment of some 280,000 heads of cattle in the state between 1985 and 1987, it is likely that these tendencies have continued and perhaps even accelerated during the latter part of the decade.

C. Annual versus Perennial Crops

7. Agricultural output data for Rondonia reveal the very rapid growth of cocoa production between 1980 and 1986, as well as its subsequent decline. Coffee production, in contrast, expanded more slowly during the early and mid-1980's, but appears to have grown very rapidly toward the end of the decade. Annual crop production, in turn, while expanding less dramatically than that of perennial crops during the first half of the 1980's, has, nevertheless, grown impressively and in most cases consistently increased both in terms of area harvested and volume of output throughout the decade. In any case, by 1987, the total harvested area of the four major annual crops (444,000 ha) was more than two and a half times larger than that of the two principal perennial crops (172,000 ha). The relative share of coffee and cocoa in the total value of the state's output of the six major annual and perennial crops, in turn, declined from 69% in 1985 to 45% in 1987, after having risen dramatically from 37% in 1980.⁵

8. Using index numbers, Table V-3 illustrates the evolution of the area harvested and physical volume of output for each of the six major annual and perennial crops in Rondonia for selected years over the period between 1980 and 1989.⁶ For purposes of comparison, the evolution of the cattle population over most of the same years is also presented. The table confirms that cocoa production increased very substantially in terms of area harvested and even more impressively in terms of output between 1980 and 1985, particularly between 1984 and 1986.⁷ This tendency reflects the maturation of trees that were planted with the assistance of CEPLAC during the latter half of the 1970's and early 1980's. The table likewise shows the considerable decrease in cocoa production between 1986 and 1989.

9. The growth of coffee output follows a different trajectory, increasing far less rapidly than cocoa between 1980 and 1984, then oscillating around the same level between 1984 and 1987 and increasing significantly in 1988-89. It should be observed, however, that the much higher rate of growth of the area harvested in cocoa when compared with that in coffee during the early and

⁵ More specifically, cocoa's share of the total rose from only 4% in 1980 to 24% in 1985, then fell to 19% in 1987, while coffee's share increased from 33% in the former year to nearly 45% in 1985, before declining to 26% in 1987.

⁶ These data, collected by IBGE on an annual basis, are drawn from annex tables in Volume II of a recent World Bank sector study entitled Brazil - Agricultural Sector Review: Policies and Prospects, Report No.7798-BR, July 26, 1990.

⁷ As a result, Rondonia's share of the national total increased from less than 1% in 1980 to nearly 10% in 1987. The state's share of national coffee production, in turn, rose from 1.6% to 2.7% over the same period.

mid-1980's largely reflects the much smaller initial base of the former (6,700 ha) relative to the latter (24,700 ha) at the beginning of the decade. In absolute terms, in fact, the total area harvested in coffee grew by an even greater amount (roughly 39,100 ha) than that in cocoa (34,900 ha) between 1980 and 1985. Subsequently to 1985, furthermore, the area harvested in cocoa has fallen in absolute, as well as relative, terms (to an estimated 38,400 ha in 1989 as opposed to 41,600 ha in 1985), while that in coffee has reportedly increased very substantially (from 63,900 ha to an estimated 133,600 ha) over the same period.

Table V-3

Evolution of Perennial and Annual Crop Production in Rondonia, 1980-88

<u>Crop/Year</u>	<u>1980</u>	<u>1982</u>	<u>1984</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989*</u>
A. <u>Area Harvested</u>							
Cocoa	100	261	465	621	448	580	573
Coffee	100	182	258	233	277	431	540
Rice	100	103	111	146	126	142	138
Beans	100	236	293	322	264	400	377
Manioc	100	127	147	133	149	160	164
Corn	100	129	172	172	170	232	250
B. <u>Physical Output</u>							
Cocoa	100	272	446	1264	1202	1348	1021
Coffee	100	134	193	166	166	220	408
Rice	100	106	102	156	120	142	140
Beans	100	339	425	448	330	557	426
Manioc	100	142	159	137	148	162	324
Corn	100	128	149	177	162	225	245
C. <u>Cattle</u>							
	100	139	277	353	420	NA	NA

* Preliminary estimates

Sources: IBGE, as reported in IBRD Report No. 7798-BR, July 1990, and Anuario Estatístico do Brasil, 1989.

10. Among annual crops, the performance of beans is particularly noteworthy, both in terms of area harvested and the volume of output, while manioc and corn have also registered important increments. Like cocoa, the relatively more rapid growth rate of beans is as much a reflection of the comparatively small initial area planted (28,700 ha), as it is of the subsequent increment in the area harvested (just under 80,000 ha between 1980 and 1989), which, in fact, was lower than the absolute increment of the area harvested in

corn (95,000 ha) in the state over the same period. The absolute increments of the areas harvested in rice (41,000 ha) and manioc (12,000 ha) between 1980 and 1989 were substantially smaller. Table V-3 also confirms that the rate of growth of the cattle population in Rondonia between 1980 and 1987 was considerably higher than that of the area harvested and output of each of the major agricultural commodities except cocoa. While data on the expansion of pasture land per se are not presently available, it is likely that the total area dedicated to this type of land use has increased roughly in proportion to the size of the cattle population.

11. The data on output and area harvested, finally, also permit a rough assessment of the evolution of crop yields over time. For the six major crops surveyed above, however, with the exception of cocoa, where yields appear to have improved, and coffee, for which they appear to have declined, during the 1980's, no consistent tendencies are evident. In comparison with the average yields of these crops for Brazil as a whole, again no clear patterns emerge except for rice and manioc where yields in Rondonia during the 1980's tended to be consistently lower and consistently higher, respectively, than those in the rest of the country. Corn yields in the state were also slightly lower than those registered elsewhere in Brazil, while the comparative situation with respect to cocoa, coffee and beans varied considerably over the decade.⁸

D. Agricultural Production by Farm Size

12. Agricultural Census data on the distribution of annual and perennial cropland by farm size in 1985, in turn, suggest that the latter tended to be relatively more important on larger establishments. The Census also reveals that, while the share of all rural establishments planting annual crops increased from 75% in 1980 to 79% in 1985, that producing perennial crops decreased from 68% in the former year to 52% in the latter. Expressed somewhat differently, while the number of farms producing annual crops grew by more than 50% between 1980 and 1985, that producing tree crops increased by only 10%.⁹ It is, nevertheless, striking that fully half of all farms under 1000 ha produced some tree crops in 1985. Table V-4 further illustrates these tendencies by indicating the share of establishments producing annual or perennial crops, together with the average area dedicated to each type of crop, by size class in Rondonia in 1985.

⁸ The PCR for the Agricultural Development and Environmental Protection Project, op. cit., indicates (para. 6.09) that within the settlement areas directly affected by this operation, yield increases were registered for all major crops, but most dramatically for cocoa, coffee, rice and manioc. It likewise notes (para 6.07) that more area was actually planted in coffee, cocoa, beans and corn than projected at the time of appraisal, while a considerably smaller area was planted in rice, rubber and manioc.

⁹ In absolute terms, while the number of establishments producing perennial crops in Rondonia increased from roughly 32,800 in 1980 to 36,300 in 1985, that producing annual crops grew from 42,500 in the former year to 64,200 in the latter.

Table V-4

Agricultural Production by Farm Size in Rondonia, 1985

<u>Size Class</u>	<u>% of Units that Produce</u>		<u>Average Area (ha) in</u>	
	<u>Annual Crops</u>	<u>Perennial Crops</u>	<u>Annual Crops</u>	<u>Perennial Crops</u>
< 10 ha	74.2	50.0	3.1	3.1
10-100 ha	83.1	54.2	4.8	4.9
100-1,000 ha	74.3	50.2	6.8	8.2
1,000-10,000 ha	45.2	30.6	61.4	57.6
> 10,000 ha	48.3	41.4	131.8	187.8
Total	78.7	52.1	4.8	5.3

Source: IBGE, Agricultural Census, 1985 (Preliminary Synopsis)

13. The above table also reveals that, while for all size classes the share of establishments producing annual crops exceeded that producing perennial crops, the relative difference between the two was comparatively greater for units of 100 ha or less. In short, while roughly 80% of all rural establishments under 100 ha produced annual crops, only 53% produced tree crops. At the other extreme, while 45% of all units over 1,000 ha produced annual crops, 31% also produced perennial crops, including 41% of all units over 10,000 ha. The average area in tree crops was also considerably larger (188 ha) in very large farms than that in annual crops (132 ha). Furthermore, while, 71% of the total area planted in annual crops in 1985 was in establishments of 100 ha or under, 67% of that in perennials was in such establishments, suggesting that larger establishments were, indeed, somewhat more specialized in tree crop production than smaller ones.

14. Table V-4, finally, illustrates another key characteristic of rural development in Rondonia that merits comment. This refers specifically to the comparatively small amount of the total area occupied by rural establishments in the state that was dedicated to any agricultural production at all in 1985. In addition, the share of the total farm/ranch area in agricultural production decreases sharply in relative terms as the size of the rural establishment increases. Thus, while, on average, only 9.7 ha of the area in farms between 10 and 100 ha (which had an average size of 33 ha in 1985) or roughly 29% of the total was in annual and perennial crops, 119 ha in units between 1,000 and 10,000 ha (which occupied an average of 2,138 ha) or less than 6% of the total, was in crop land.¹⁰ The area not used for crop production in these establishments presumably consists primarily of active or abandoned pasture land, including areas formerly planted in annual crops, and, especially in larger units, as yet uncleared, but not necessarily unlogged, forest. Data that would

¹⁰ The corresponding figures for establishments between 100 and 1,000 ha and over 10,000 ha, in turn, were approximately 11% and only 1% respectively.

permit a better idea as to how non-farmed areas in rural establishments in Rondonia were divided between pasture and other uses in 1985, however, are not presently available.

15. It is likewise important to note that the total area in crops in farms of 10 ha and less in 1985, was not significantly smaller than that in units between 10 and 100 ha or even in those between 100 and 1,000 ha. The labor input coefficients (ie. the average number of persons occupied per establishment), in turn, were also relatively similar, as Table V-5 demonstrates, while those on larger establishments (ie. those over 1,000 ha) were, not surprisingly, considerably higher. Table V-5 also indicates, finally, that both average labor coefficients and the average areas in crops increased for all size classes of rural establishments between 1980 and 1985, suggesting that agricultural activity in Rondonia became somewhat more intensive, as well as considerably more extensive, during the first half of the 1980's.

Table V-5

Evolution of Farm Labor and Crop Area by Size Class in Rondonia, 1980-85

<u>Size Class</u>	<u>Persons Occupied per Establishment</u>		<u>Crop Area per Establishment (ha)</u>	
	<u>1980</u>	<u>1985</u>	<u>1980</u>	<u>1985</u>
< 10 ha	2.9	3.0	3.6	6.2
10-100 ha	3.6	4.2	7.1	9.7
100-1,000 ha	4.2	4.6	10.1	15.0
1,000-10,000 ha	8.3	10.7	48.4	119.0
> 10,000 ha	12.1	48.9	72.4	319.6
Total	3.7	4.0	7.7	10.1

Source: IBGE, Agricultural Census, 1985 (Preliminary Synopsis)

16. The above figures also reveal that labor inputs and the amount of area in crops increased most significantly, both in absolute and relative terms, in the very largest establishments between 1980 and 1985, suggesting that these were large-scale commercial farming, as well as ranching, operations.¹¹ Increased production on these units is probably a direct reflection of improved access as a result of the pavement of the Cuiaba-Porto Velho highway and expansion of the regional feeder road network and, thus, of POLONOROESTE, which suggests that medium and large farmers and ranchers may have benefitted from

¹¹ Not surprisingly, the number of tractors (as a proxy for mechanization, which was still comparatively incipient in the region in the latter year) also increased rapidly (from 175 to 293) on establishments over 100 ha between 1980 and 1985. The number of tractors in farms between 100 and 1,000, however, also increased substantially, from 224 to 428, while that on establishments under 100 ha expanded from 151 to 296 over the same period.

program infrastructure investments as much as, if not more than, its intended small-farmer target population. The much smaller labor coefficients for establishments under 1,000 ha, and especially those under 100 ha, finally, suggest that much of the employment on these farms consists of family labor and, that, therefore, the expansion of agricultural activity on units under 1,000 ha with the exception of those under 10 ha in 1985, was, in all likelihood, constrained in part by the availability of labor.

E. POLONOROESTE's Role in Incremental Agro-livestock Production

17. Data presented in the PCR for the Phase I Agricultural Development and Environmental Protection Project indicate that POLONOROESTE has, indeed, played a relevant role in the expansion of perennial crops in Rondonia during the 1980's. The PCR, more specifically, contains estimates of incremental cropped area in the farms benefitted by the operation at full development.¹² A comparison with IBGE figures for the state as a whole for 1980-88 suggests that farms assisted under the aforementioned project may account for as much as 60% of the incremental harvested area in cocoa and half of the incremental area harvested in coffee in Rondonia over this period. Given the relatively long period before tree crops enter into production, however, part of the increment observed in these establishments undoubtedly reflects investments made prior to the program's initiation in 1981.

18. As concerns annual crops, in turn, PCR data suggest that a substantially smaller share of the total incremental output in Rondonia was generated by direct program beneficiaries. Comparing project area and state-wide figures for the 1980-88 period, it appears that approximately 30% of the incremental area harvested in beans and much smaller shares of those in corn (less than 10%) and rice (roughly 5%) were accounted for by project farms. Given the widespread spontaneous occupation of rural areas in various parts of the state during the 1980's, it is not surprising that the predominant share of incremental annual crop production was generated by farmers who did not benefit from program agricultural support services, even though many of them may have benefitted from other program investments, particularly roads.

19. Finally, according to the PCR, cattle production also increased in the project area from less than 130,000 heads in 1981 to 780,000 in 1988, growing by over 350% during the first half of the decade and a much lower, but still respectable 36% from 1985 to 1988. Considering that there were just over one million cattle in Rondonia in 1987, this suggests that the project area may have absorbed on the order of two-thirds or more of the increment to the livestock population over the decade and probably an even higher share between 1981 and 1985. After the latter year, however, expansion of the cattle population was

¹² PCR, op. cit., para. 6.06. Presumably these farms were all located in the project area which covered the municipalities of Ariquemes, Cacoal, Ji-Parana, Jaru, Ouro Preto, Espigao D'Oeste, Presidente Medici and Rolim de Moura, the latter three of which were officially created after 1984 through the subdivision of other project municipalities. According to the state government, this area contained 65% of the state's rural population and 35% of its urban population in 1990.

relatively greater (145%) outside of the project area. Nevertheless, the absolute increase over the period and the project area's relative share in the state total are truly impressive.

20. The above figures indicate, in summary, that, despite the serious implementation problems discussed in Chapter IV, POLONOROESTE, indeed, appears to have played an important role in the expansion of cocoa and coffee production in Rondonia during the 1980's. On the other hand, it had a considerably smaller relative impact on annual crop output which also expanded significantly over the decade. Somewhat surprisingly, however, considering that this was not its objective, the program also seems to have contributed to the very substantial growth in livestock production in the area covered by the Phase I settlement consolidation subproject and thus in Rondonia more generally.

ANNEX VIRECENT EVOLUTION OF LAND DISTRIBUTION, VALUES AND TENURE IN RONDONIAA. Land Distribution

1. As in many other Bank-supported rural development projects approved during the 1970's and early 1980's, POLONOROESTE's agricultural components were designed to specifically benefit small farmers. Although access to land was, in fact, increased as a result of the program, POLONOROESTE appears to have been largely powerless to impede, although it probably slowed, the two main tendencies that have historically marked the evolution of rural land tenure distribution in Brazil, namely the growth of very small and very large establishments. While definitive figures from the 1985 Agricultural Census have not been published, preliminary information, reproduced in Table VI-1 below, indicate that many of the trends observed in Rondonia during the 1970's (eg. rapid growth and reduction in the average size of rural establishments) continued during the period that coincided with the early years of POLONOROESTE's execution. Because of the complexity of the tendencies involved, the recent evolution of rural land distribution and tenure in the state merits more detailed examination.

Table VI-1

Evolution of Rural Land Distribution in Rondonia, 1980-85

<u>Size Class</u>	<u>1980</u>			<u>1985</u>		
	<u>% Estab.</u>	<u>% Area</u>	<u>Av. Size</u>	<u>% Estab.</u>	<u>% Area</u>	<u>Av. Size</u>
< 10 ha	25.1	1.0	4.4	27.9	1.6	4.4
10-100 ha	40.9	22.0	58.0	52.5	33.2	33.2
100-1,000 ha	32.8	39.1	128.0	19.0	35.6	139.9
1,000-10,000 ha	1.1	21.7	2,105.0	0.5	15.6	2,138.3
> 10,000 ha	0.1	16.2	35,219.8	0.1	13.9	29,263.3
Total	100.0	100.0	108.0	100.0	100.0	74.8

Source: IBGE, Agricultural Census, 1985 (Preliminary Synopsis)

2. The above figures suggest that the number of very small rural establishments (ie. those having less than 10 hectares), as well as those between 10 and 100 hectares, increased substantially between 1980 and 1985. As noted in Chapter VI, the former size class, in fact, accounted for nearly one-third of all additional farms and ranches established in the state during this period, while the latter accounted for roughly 70% of this increment. Thus, the number of very small rural establishments increased significantly in Rondonia during the initial years of POLONOROESTE's implementation due largely to the combination

of the subdivision of earlier colonization plots and spontaneous settlement on small land parcels in areas outside these schemes.

3. The data in Table VI-1 also reveal, however, that, while the relative share of establishments between 100 and 1,000 hectares decreased significantly in terms of the total number of units in the state (from 33% in 1980 to 19% in 1985),¹ the decline in their share of the total area occupied by farm and ranch establishments decreased to a much lesser extent (from 39% to 36%).² As a result, the average size of the establishments within the 100-1,000 ha class actually increased slightly, from 128 to roughly 140 hectares per unit. Finally, while the number of rural units between 1,000 and 10,000 ha fell (from 539 to 445) in the first half of the 1980's, even though, as Table VI-1 shows, the average size of the remaining establishments in the class increased somewhat, as indicated in Annex V, the number of units with 10,000 ha or more increased in absolute terms (from 24 to 29) over the same period.

4. The census data, accordingly, suggest that, while the overall tendency was for the deconcentration of holdings in rural establishments in Rondonia between 1980 and 1985, several differing trends underlie the general pattern. These include: (i) a very substantial increase in the number of new rural establishments under 10 ha and, particularly, between 10 and 100 ha over the period; (ii) an increase in the number of, if not the total area occupied by, very large establishments (ie. those over 10,000 ha); and (iii) a tendency for average farm/ranch sizes to fall fairly significantly for units in the 10-100 ha and over 10,000 ha categories, but to rise for establishments between 100 and 10,000 ha. The decrease in average farm size for establishments between 10 and 100 ha (from 58 to 33 ha) in the first half of the 1980's is particularly noteworthy because, like the proliferation of very small farms, in all probability it reflects the subdivision of earlier colonization plots.

5. The hypothesis that land concentration within specific colonization projects may have occurred after 1980, in turn, is corroborated by a FIPE survey in directed settlement areas along the BR-364 highway.³ At the time when they were first distributed by INCRA, the 150 lots sampled in this study had an average size of 135 hectares. When visited in 1986, these same lots averaged 198 hectares apiece. A very small proportion of the total land area in these

¹ The number declined only very slightly in absolute terms, however, from 15,865 in 1980 to 15,581 in 1985, such that the decrease in the relative participation of this size category essentially reflects the much greater increase in the number of smaller establishments, rather than any significant subdivision of units between 100 and 1,000 ha per se. The apparent absence of a large number of subdivisions in this size class, however, does not preclude the possibility that a substantial number of these units may have changed hands without their dimensions having been significantly affected.

² This also represented a relatively slight increase in absolute terms, from approximately 2,040,000 ha in 1980 to 2,170,000 ha in 1985.

³ FIPE/USP, "Tendências da Estrutura Fundiária em Rondonia," mimeo, São Paulo, 1986.

plots, however, was under cultivation. The observed process of concentration is attributed by FIPE to increases in land values resulting largely from public investments in physical infrastructure and to land speculation.

B. Land Values

6. The occurrence of substantial land speculation in Rondonia appears to be borne out by data on the recent evolution of land prices in Rondonia presented in Table VI-2 below. This table reveals that, while land values oscillated in the state between 1978 and 1982, once the BR-364 highway neared completion in 1983, they began to increase rapidly, reaching a maximum in 1986. However, when both the availability of subsidized agricultural credit and migration flows declined dramatically in 1987, land prices fell correspondingly, reaching the low point for the period examined in 1988. A comparison of the evolution of land prices in the state with those in the North region as a whole indicates that, even though fluctuations of the latter run parallel to those observed for Rondonia, the magnitudes involved were considerably lower. In addition, the ratio between the two values increased progressively between 1982 and 1987, returning to pre-1982 levels in the second half of 1988.

Table VI-2

Average Price of Agricultural Land in Rondonia and the North Region
(Cz\$/hectare)*

<u>Year</u>	<u>Rondonia</u>	<u>North Region</u>	<u>Rondonia/North</u>
1978	164,617	142,851	1.2
1979	138,877	119,260	1.2
1980	132,012	111,084	1.2
1981	135,305	121,430	1.1
1982	149,631	138,383	1.1
1983	193,056	112,214	1.7
1984	213,850	117,793	1.8
1985	297,532	157,802	1.9
1986	632,521	295,673	2.1
1987	398,263	156,556	2.5
1988 **	176,041	109,130	1.6
1988 ***	96,667	88,023	1.1

Source: Centro de Estudos Agrícolas/IBGE/FGV; B. Reydon and R. Herbers, "Política Governamental para a Agropecuária na Amazonia e Degradação do Meio Ambiente", Reforma Agrária, Vol. 19, No. 1, 1989, Campinas

* Values corrected by the December 1989 General Price Index; ** First Semester; *** Second Semester.

7. As can be inferred from data presented in Annex V on trends in agricultural production, the significant increase in land values observed in

Rondonia between 1980 and 1986 does not exclusively reflect the expansion of crop production, nor even of cattle raising. Overall, increases in land values and land holdings in the state during the first half of the 1980's appear to have been linked as much, if not more, to expectations of profits from future land sales than from intensification of rural land use. Public investment in general and that associated with POLONORORESTE in particular, as well as continued heavy migration, contributed directly to such expectations.

8. The process leading to rapidly rising land values seems to have worked roughly as follows. The growing inflow of migrants increased pressure on the land. Potential investors believed that land would continue to increase in value as additional infrastructure was built, settlement expanded and output increased. A growing number of colonists, moreover, was forced to sell land to speculators in order to pay off debts resulting from expenses associated with malaria and/or other problems. Others sold because they initially acquired the land cheaply and the lump sums, and hence windfall profits, that they were offered would permit them to purchase even larger plots elsewhere on the frontier. Both were soon replaced by new settlers, hence the very high levels of plot turnover observed in the state.

9. In the process, grileiros and land speculators amassed fortunes through land transactions, part of which were used to further stimulate the rural real estate market. Booming extractive activities (eg. mahogany and other commercial hardwoods), in turn, attached new riches to land ownership in the region. Public and private investments also continued to increase in response to the demographic explosion and the apparent economic boom. As a result, the balloon of land valorization expanded at a rate that was completely out of kilter with real increases in agricultural output. Small farmers were the first to suffer the consequences.

10. The extent to which such tendencies continued during the latter half of the decade cannot be confirmed at present. On the whole, however, given declining migration rates and land values, it would seem highly unlikely. The relative decrease in public investments, the reduction of migration flows, the confirmation of Rondonia's shortcomings in terms of commercial agriculture (apparently except for coffee and to supply local markets) and the disappearance of subsidized credit and fiscal incentives would all tend to deflate speculation and other forces accelerating land concentration. While it is true that the intensification of logging activities continues to put pressure on the land, as does that of mining activities in some areas, while more fertile lands close to urban centers, such as those at Ouro Preto and Urupa, continue to have much higher values than poorer quality lands in outlying sections, as of late 1989 potential buyers were apparently showing little interest in land in Rondonia, to the point where the conservative landowners' union (UDR) was reportedly advising its member to sell their holdings to the state agrarian reform agency (INCRA/RO) since the latter was offering above-market prices.

C. Land Tenure

11. In addition to rural land distribution, the most recent Agricultural Census provides information on the evolution of land tenure in Rondonia during the first half of the 1980's. As Table VI-3 indicates, the most significant

change occurring over the period was the substantial increase in the relative number of and the share of total area occupied by owners and the corresponding decline in the participation of squatters in these totals. In absolute terms, the number of rural establishments occupied by owners increased from roughly 19,500 in 1980 to nearly 46,000 in 1985, while the total area covered by these establishments increased from less than 2.8 million ha to more than 4.8 million ha. In contrast, the number of establishments occupied by squatters decreased in absolute terms from approximately 24,500 in 1980 to 23,100 in 1985, while the total area in such units declined very dramatically, from roughly 2.4 million ha to just under 1.0 million ha. As a result, the average size of the establishments occupied by squatters fell from 97 ha in 1980 to 43 ha in 1985, while that of establishments occupied by owners declined from roughly 142 to 103 ha over the period.

Table VI-3

Evolution of Rural Land Tenure in Rondonia, 1980-85

<u>Status</u>	<u>1980</u>			<u>1985</u>		
	<u>% Estab.</u>	<u>% Area</u>	<u>Av. Size (ha)</u>	<u>% Estab.</u>	<u>% Area</u>	<u>Av. Size (ha)</u>
Owner	40.3	53.1	142.2	57.1	79.0	103.2
Tenant Farmer	4.0	0.8	22.9	2.1	0.6	22.5
Sharecropper	4.9	0.4	9.9	11.7	2.5	16.1
Squatter	50.8	45.6	97.0	28.4	16.4	43.0
Other	-	-	-	0.7	1.5	156.5
Total	100.0	100.0	108.0	100.0	100.0	74.7

Source: IBGE, Agricultural Census, 1985 (Preliminary Synopsis)

12. These tendencies can be largely attributed to INCRA's efforts both in the development of new colonization schemes and the promotion of "rapid settlement" through which plots occupied by squatters were granted formal title. The other notable feature of the figures in Table VI-3 is the growing importance of sharecroppers, whose share expanded from 5% to nearly 12% of all rural establishments in the state, while the average area occupied by such units increased from 10 to 16 ha, between 1980 and 1985. Among other factors, this reflects increasing demographic pressures and rising land values in the state, together with the inability of most owner-occupiers to fully exploit their plots with family labor alone.⁴

⁴ One recent study of rural land use patterns in Rondonia confirms that "the most important input into the production process at the initial stage of colonization is labor. The inherent household labor supply constraint [faced by the small farmer], which is often aggravated by malaria, [can be] partially overcome...[by tapping] a highly seasonal local labor market in two ways. First, hired labor is available, although expensive, during the peak deforesting season and can be rented with or without an accompanying chainsaw. Second, days of

13. The census data on land tenure can be further disaggregated by the size distribution of establishments to give an even better idea as to how the various categories of land occupation in Rondonia were differentiated in 1985. Table VI-4 indicates the percentage share of all establishments in each size class by condition of occupancy and the size distribution of all establishments within each category. These figures reveal that 70% or more of all tenant farmers and sharecroppers occupied establishments of less than 10 ha, while most owners and squatters occupied establishments between 10 and 100 ha. It also shows that squatters and sharecroppers together accounted for close to 80% of all farm units under 10 ha, while owners occupied 70% or more of all units over 10 ha, accounting for nearly 90% of those between 1,000 and 10,000 ha.

Table VI-4

Size Distribution of Establishments by Tenure Status in Rondonia, 1985

<u>Size Class/Status</u>	<u>Owner</u>	<u>Squatter</u>	<u>Tenant</u>	<u>Sharecropper</u>	<u>Total</u>
A. <u>Size Distribution within Each Tenure Category (%)</u>					
< 10 ha	8.5	41.8	72.7	80.2	27.9
10-100 ha	65.2	44.1	21.3	16.8	52.5
100-1,000 ha	25.4	13.9	5.9	2.7	19.0
1,000-10,000 ha	0.8	0.1	0.2	0.2	0.5
> 10,000 ha	0.0	0.0	-	-	0.0
Total *	100.0	100.0	100.0	100.0	100.0
B. <u>Tenure Category Share within Each Size Class (%) **</u>					
< 10 ha	17.4	42.6	5.6	33.6	100.0
10-100 ha	70.9	23.9	0.9	3.7	100.0
100-1,000 ha	75.9	20.7	0.7	1.7	100.0
1,000-10,000 ha	87.4	5.8	0.7	5.2	100.0
> 10,000 ha	79.3	13.8	-	-	100.0
Total	57.1	28.4	2.1	11.7	100.0

* Column totals may not add to 100% due to rounding

** Excludes "other" and "no declaration" categories; row totals, therefore, are less than 100%

Source: IBGE, Agricultural Census, 1985 (Preliminary Synopsis)

labor can be 'traded' across farms, a relatively inexpensive method of exploiting...strong economies of scale in deforestation." See Steve Vosti, "Land Use Patterns in the Humid Tropics: A Case Study of the Machadinho Colonization Project in Northwest Brazil," paper presented at the American Agricultural Economics Association Annual Meeting, Baton Rouge, Louisiana, July 30-August 2, 1989, pp. 3-4 (emphasis in the original).

14. The figures in Table VI-4 likewise show that there were a significant number of large squatters. Nearly 15% of all establishments over 10,000 ha in 1985 were occupied by squatters, as were more than 20% of those between 100 and 1,000 ha. Within the various size classes, furthermore, there were considerable differences in average farm/ranch size according to tenure status for nearly all classes over 10 ha. In the 10 to 100 ha class, for example, the average size of establishments occupied by owners (ie. those possessing legal title) was roughly 52 ha, while the average sizes of units occupied by squatters, tenant farmers and sharecroppers were 38, 29 and 22 hectares respectively. Again, this reflects the fact that many farm owners were occupants of colonization plots, while tenants and sharecroppers frequently rented or were ceded portions of such plots for temporary utilization.

Map: Northwest Region

(IBRD 14865R3)

