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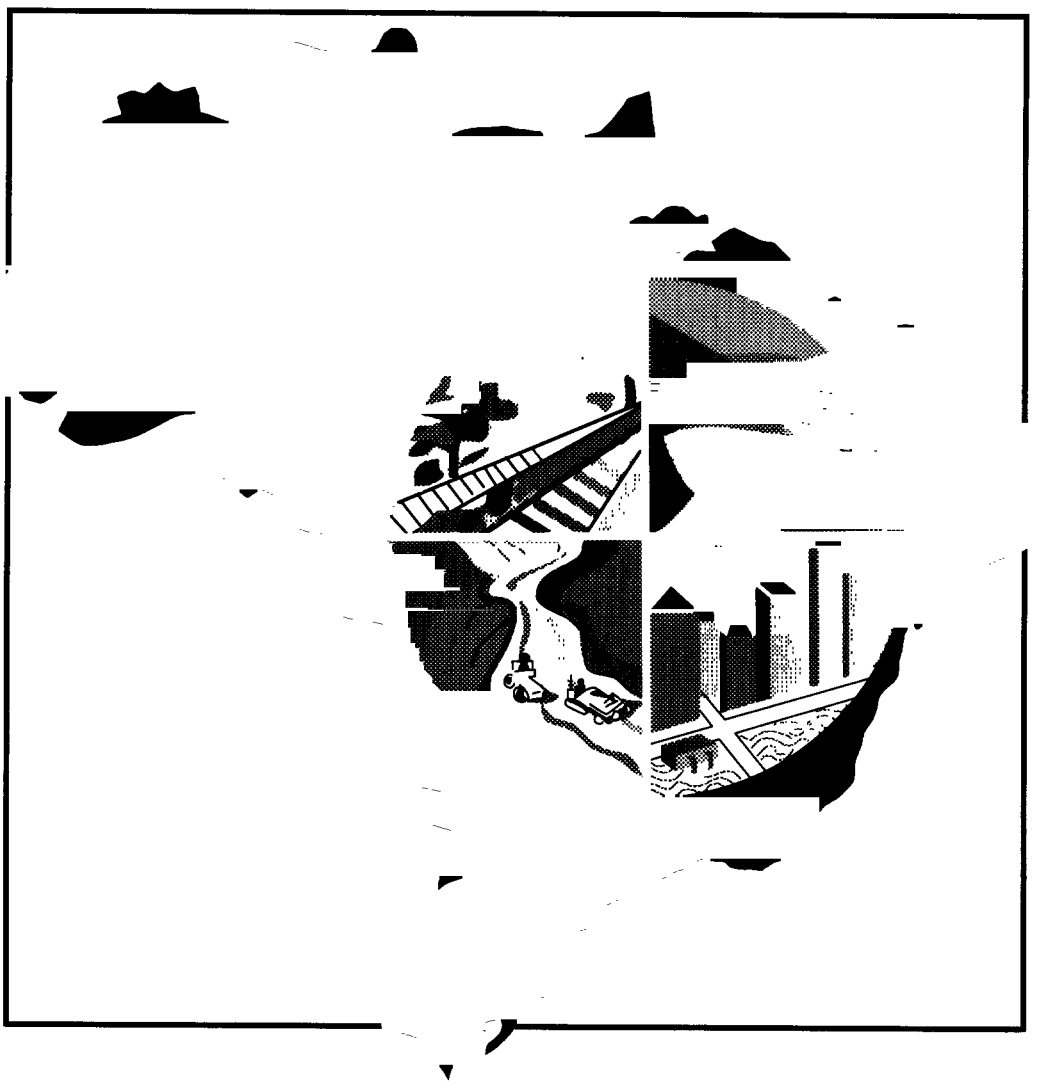
World Bank Approaches to the Environment in Brazil

A Review of Selected Projects

John Redwood III



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John Redwood III

The World Bank
Washington, D.C.

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John Redwood III coordinated the overall study. It is based on four detailed case studies, which were drafted by or with the assistance of the following World Bank staff and consultants: (a) Pollution Control in São Paulo—John Redwood III; (b) Carajas Iron Ore Project—Anthony L. Hall, Eneas Salati (consultants), Shelton H. Davis (Amerindian Protection), and John Redwood III; (c) selected projects in the Middle and Lower São Francisco River Valley—Anthony L. Hall, Eneas Salati, and John Redwood III; and (d) POLONORESTE Program—George Martine, Eneas Salati, Daniel Gross (Amerindian Protection), and John Redwood III. Jennifer Bravinder and Roberto Martin provided valuable research assistance, and Maria de Lourdes Davies de Freitas (consultant) participated in the initial stages of the study.

Preface

This study is part of OED's efforts to assess World Bank performance in the environmental arena. (Other recent OED studies that have focused on Bank Environmental performance are OED 1989; OED 1991; and OED 1992). The topic was chosen because of the importance and diversity of environmental issues confronted in Bank operations in Brazil in the 1970s and 1980s, some of them controversial, and because of the impact that this experience has had—and could continue to have—on the Bank's environmental operations worldwide, as well as on policies and practices in Brazil.

The projects surveyed in the study include: urban and industrial pollution control operations in São Paulo; power, involuntary resettlement, and irrigation projects in the middle and lower São Francisco River valley in the impoverished Northeast; a major rail, port, and iron ore mining operation in the eastern part of the vast Amazon region (Carajas); and a large-scale highway and rural development program in western Amazonia (POLONOROESTE). Among the issues raised by these projects are: urban environmental management; intersectoral water resource use at the river basin level; tropical deforestation and associated soil erosion, biodiversity loss, and possible climate change; forced resettlement; and the impact of major infrastructure investments and associated "induced development" on indigenous populations and other vulnerable social groups.

The government of Brazil agreed to the study in July 1988, and it was carried out with the active participation of Brazilian technical personnel. Joint undertaking of the study reflected the government's decision to institute a new and strengthened internal evaluation capability and its desire to work with the Bank toward the common objective of increasing awareness about the environmental and social consequences of large investment projects. For this purpose, the Environmental Analysis Unit (CAA) and the Institute of Social and Economic Research (IPEA/ INPES) of the former federal planning ministry (SEPLAN)[1] were designated as OED's technical counterparts under the overall coordination of the Secretariat (now Department) of International Affairs (DEAIN) of the same ministry. It was agreed, moreover, that OED and SEPLAN would prepare independent case studies and final reports.

To help finance the exercise, OED obtained the assistance of the Canadian International Development Agency (CIDA) and the Brazilian office of the United Nations Development Programme (UNDP). In Brazil, the São Paulo State Environmental Sanitation Technology Company (CETESB), the Rio Doce Valley Company (CVRD), the Northeast Hydroelectric Company (CHESF), the São Francisco Valley Development Company (CODEVASF), and the Superintendency for the Development of the Center-West (SUDECO) actively participated in and provided transport and other essential support for the OED/SEPLAN field visits.[2] The approach paper and above mentioned arrangements for the study were approved by the Joint Audit Committee of the World Bank's Executive Board in June 1989.

In addition to visits to the areas of influence of the case study projects and contacts with executing agencies, the study entailed a comprehensive survey of documents and interviews with Bank staff involved in each of the major operations examined. The Bank documents reviewed included Staff Appraisal and President's Reports; Loan, Project, and Guarantee Agreements; minutes of Board meetings at which the various operations were approved; economic and sector reports; project correspondence files; and—

1. SEPLAN was merged with the Ministry of Finance to form the present Ministry of Economy, Finance, and Planning (MEFP) in March 1990.

2. Field visits averaging two to three weeks were made to São Paulo and the eastern part of the Amazon region (Carajas) in March-April 1989, followed by missions to the lower and middle São Francisco River valley in July-August 1989 and the POLONOROESTE Program area in the western part of Amazonia in September-October 1989.

where they existed—project completion and performance audit reports. Non-Bank documents reviewed included planning, scientific, and impact evaluation studies; research reports; published articles and books; unpublished papers; and other materials. During the field visits, OED/SEPLAN met with federal, state, and municipal agencies; universities and research institutes; project beneficiaries and other affected populations; private industrial interests; and a range of nongovernmental organizations.

Comments by the Secretariat of Regional Development of the Presidency of the Republic (SDR-PR) and CHESF on an earlier draft have been considered in preparing the present version of this report. The comments of the federal Ministries of Economy, Finance, and Planning (MEFP) and Infrastructure, CETESB, CODEVASF, CVRD, and the National Indian Foundation (FUNAI) on one or more of the individual case studies on which this report is based have also been taken into account. The invaluable contributions of the Brazilian government members of the OED/SEPLAN team and the helpful comments and suggestions of Bank operational and environmental staff in all phases of the study are gratefully acknowledged.

Robert Picciotto
Director General
Operations Evaluation
June 1993

Prefácio

O presente estudo, efetuado pelo OED, faz parte do seu trabalho de avaliação do desempenho do Banco Mundial no setor do meio ambiente. (O desempenho do Banco no setor do meio ambiente foi objeto de outros estudos recentes do OED, sob OED 1989; OED 1991; e 1992). A seleção do assunto deveu-se à importância e à diversidade dos problemas ambientais que cercaram as operações do Banco no Brasil durante os anos 70 e 80, algumas delas controversas, e ao impacto que esta experiência exerceu —e continua a exercer— sobre as operações ambientais do Banco em escala mundial e sobre políticas e práticas adotadas em relação ao Brasil.

O estudo analisou os seguintes projetos: operações de controle da poluição urbana e industrial em São Paulo; reassentamento involuntário e projetos de irrigação no baixo e médio vale do São Francisco, área situada no Nordeste do país, uma região pobre; uma extensa operação ferroviária, portuária e de mineração de ferro na zona leste da vasta região amazônica (Carajás); e um grande programa rodoviário e de desenvolvimento rural no oeste da Amazônia (POLONOROESTE). Estes projetos suscitaram, entre outros, questões e manejo ambiental urbano; uso interssetorial de recursos hídricos ao nível de bacias fluviais; derrubada de matas tropicais e seus problemas conexos de erosão do solo, perda de diversidade biológica e possíveis alterações climatológicas; reassentamento forçado; e o impacto dos grandes investimentos em infra-estrutura e, por associação, do "desenvolvimento induzido", sobre populações indígenas e outros grupos sociais vulneráveis.

Em julho de 1988, o governo do Brasil aceitou a idéia deste estudo, que foi efetuado com a ativa participação de técnicos brasileiros. A realização conjunta do estudo refletiu a decisão do governo no sentido de instituir uma nova e fortificada capacidade de avaliação interna e sua intenção de trabalhar com o Banco em prol do objetivo comum de gerar maior consciência a respeito das implicações ambientais e sociais de grandes projetos de investimento. Com esse propósito, a Comissão de Análise Ambiental (CAA) e o Instituto de Planejamento Econômico e Social (IPEA/INPES), da antiga Secretaria Geral do Planejamento da Presidência da República (SEPLAN)[1] foram designados como contrapartes técnicas, sob a coordenação geral da Secretaria (atual Departamento de Assuntos Internacionais (DEAIN), do mesmo Ministério. Além disso, acordou-se em que o OED e a SEPLAN prepararíam estudos de casos e relatórios finais independentes.

Para ajudar a financiar esse processo, o OED obteve a assistência da Agência Canadense de Desenvolvimento Internacional (CIDA) e do escritório brasileiro do Programa das Nações Unidas para o Desenvolvimento (PNUD). No Brasil, a Companhia Estadual de Tecnologia de Saneamento Básico (CETESB), de São Paulo, a Companhia Vale do Rio Doce (CVRD), a Companhia Hidro-Elétrica do São Francisco (CHESF), a Companhia de Desenvolvimento do Vale do São Francisco (CODEVASF) e a Superintendência do Desenvolvimento do Centro-Oeste (SUDECO) tiveram ativa participação e proporcionaram transporte e outros apoios essenciais para as visitas de campo do OED/SEPLAN.[2] Os termos de referência e os mencionados preparativos para o estudo foram aprovados pela Comissão Conjunta de Auditoria em junho de 1989.

Além das visitas às áreas de influência dos projetos incluídos no estudo de casos e dos contatos com entidades executoras, o estudo deu margem a uma ampla revisão de documentos e a entrevistas com o pessoal do Banco participante desses grandes projetos. A revisão de documentos do Banco incluiu os Relatórios de Avaliação Técnica e os Acor-

1. Em março de 1990, com a fusão da SEPLAN e o Ministério da Fazenda, formou-se o atual Ministério da Economia, Finanças e Planejamento (MEFP).

2. Em março e abril de 1989, realizaram-se visitas de campo a São Paulo e à zona leste da região amazônica (Carajás), com a duração média de dois a três semanas, seguidas, em julho e agosto, de missões ao baixo e médio vale do São Francisco e, em setembro e outubro do mesmo ano, de visitas à área do POLONOROESTE, na zona oeste da Amazônia.

dos de Empréstimo, Projeto e Garantia, as atas das reuniões da Diretoria em que as diferentes operações foram aprovadas, relatórios econômicos e setoriais, arquivos de correspondência e —quando existentes— relatórios de conclusão e auditoria de desempenho de projetos. Também foram revisados documentos externos ao Banco, tais como estudos de planejamento e de avaliação científica e de impacto, relatórios de pesquisa, artigos e livros publicados, trabalhos inéditos e outros materiais. Durante as visitas de campo, o pessoal do OED/SEPLAN avistou-se com funcionários de órgãos federais, estaduais e municipais e de universidades e institutos de pesquisa, beneficiários de projetos e outros grupos afetados, dirigentes de empresas industriais privadas e uma série de organizações não-governamentais.

Na preparação da presente versão deste estudo foram levados em consideração os comentários da Secretaria de Desenvolvimento Regional da Presidência da República (SDR-PR) e da CHESF a respeito de uma versão anterior. Também foram levados em conta os comentários dos Ministérios da Economia, Fazenda e Planejamento (MEFP) e da Infra-Estrutura, bem como da CETESB, da CODEVASF, da CVRD e da Fundação Nacional do Índio (FUNAI) a respeito de um ou mais estudos de casos individuais em que se baseia o presente estudo. Registramos a agradecemos as valiosas contribuições do pessoal do governo brasileiro da equipe OED/SEPLAN e os úteis comentários e sugestões formulados pelo pessoal de operações e meio ambiente do Banco durante todas as fases do estudo.

Robert Picciotto
Diretor-Geral
Avaliação de Operações
Junho de 1993

Prefacio

El presente estudio forma parte de las actividades emprendidas por el Departamento de Evaluación de Operaciones para evaluar la actuación del Banco Mundial en la esfera del medio ambiente. (Otros estudios recientes del Departamento de Evaluación de Operaciones acerca de la actuación del Banco en materia ambiental son OED 1989; OED 1991; y OED 1992). Se eligió este tema debido a la importancia y diversidad de las cuestiones ambientales a que se vio enfrentado el Banco en el curso de sus operaciones en el Brasil en las décadas de 1970 y 1980, algunas de ellas conflictivas, y debido a las repercusiones que ha tenido —y podría seguir teniendo— esa experiencia en las operaciones que el Banco ejecuta en el plano ambiental en todo el mundo, así como en las políticas y prácticas del Brasil en la materia.

En el estudio se examinan las operaciones de reducción de la contaminación urbana e industrial en São Paulo; los proyectos de energía eléctrica, reasentamiento involuntario y riego en el valle intermedio e inferior del río São Francisco, situado en la empobrecida zona del noreste; una importante operación ferroviaria, portuaria y de explotación de mineral de hierro en la parte oriental de la extensa región del Amazonas (Carajas), y un programa en gran escala de construcción de carreteras y desarrollo rural en la Amazonia occidental (POLONOROESTE). Entre los problemas planteados por esos proyectos se cuentan la ordenación del medio urbano; el uso intersectorial de los recursos hídricos a nivel de la cuenca fluvial; la deforestación de los bosques tropicales y los problemas conexos de erosión del suelo, pérdida de la diversidad biológica y posible cambio climático; el reasentamiento forzoso, y los efectos de las grandes inversiones en infraestructura, y del "desarrollo inducido" que éstas conllevan, en las poblaciones indígenas y demás grupos sociales vulnerables.

En julio de 1988, el gobierno del Brasil convino en la realización del estudio, el que se llevó a efecto con la activa participación de personal técnico brasileño. La realización conjunta del estudio se debió a la decisión del gobierno de establecer una nueva y fortalecida capacidad de evaluación interna y a su deseo de colaborar con el Banco en la consecución del objetivo común de aumentar la conciencia de las consecuencias ambientales y sociales de los grandes proyectos de inversión. Con ese propósito, la Unidad de Análisis Ambiental (CAA) y el Instituto de Investigación Social y Económica (IPEA/INPES) del antiguo ministerio federal de planificación (SEPLAN)[1] fueron designados organismos técnicos de contrapartida del Departamento de Evaluación de Operaciones, bajo la coordinación general de la Secretaría (actualmente Departamento) de Asuntos Internacionales (DEAIN) del mismo ministerio. Se convino, además, en que el Departamento de Evaluación de Operaciones y la SEPLAN prepararían estudios de casos prácticos e informes finales separados.

Para ayudar a financiar el estudio, el Departamento de Evaluación de Operaciones obtuvo asistencia de la Agencia Canadiense de Desarrollo Internacional (CIDA) y de la oficina del Programa de las Naciones Unidas para el Desarrollo (PNUD) en el Brasil. En ese país, la Compañía de Tecnología de Saneamiento Ambiental del Estado de São Paulo (CETESB), la Compañía del Valle del Río Doce (CVD), la Compañía Hidroeléctrica del Noroeste (CHESF), la Compañía de Desarrollo del Valle de São Francisco (CODEVASF), y la Superintendencia para el Desarrollo del Centro-Oeste (SUDECO), participaron activamente en las visitas sobre el terreno de funcionarios del Departamento de Evaluación de Operaciones y la SEPLAN y proporcionaron transporte y otros elementos esenciales de apoyo a las mismas[2]. El documento sobre enfoques y los arreglos anteriormente mencionados para la realización del estudio

1. En marzo de 1990 la SEPLAN y el Ministerio de Hacienda se unieron y formaron el actual Ministerio de Economía, Hacienda y Planificación (MEFP).

fueron aprobados por el Comité Conjunto de Auditoría en junio de 1989.

Además de realizar visitas a las zonas de influencia de los proyectos sobre estudios de casos prácticos y de establecer contacto con los organismos de ejecución, se pasó revista a una cantidad de documentos y se celebraron entrevistas con el personal del Banco que participó en cada una de las grandes operaciones examinadas. Los documentos del Banco que se consultaron fueron los informes de evaluación inicial preparados por el personal y los informes del Presidente, los convenios de préstamo, convenios sobre los proyectos y convenios de garantía, las minutas de las reuniones del Directorio en que se aprobaron las distintas operaciones, los informes económicos y sectoriales, los archivos de la correspondencia sobre los proyectos, y —cuando los había— los informes de terminación de los proyectos y de evaluación de los resultados. Los documentos ajenos al Banco que se examinaron fueron estudios de planificación, estudios científicos y estudios de evaluación de los efectos, informes de investigación, artículos y libros publicados, documentos sin publicar, y otros materiales. Durante las visitas sobre el terreno, los funcionarios del Departamento de Evaluación de Operaciones y de la SEPLAN estuvieron en contacto con organismos federales, estatales y municipales, universidades e institutos de investigación, beneficiarios de los proyectos y otras poblaciones afectadas, intereses industriales y privados, y una variedad de organizaciones no gubernamentales.

En la preparación de la presente versión del informe, se tuvieron en cuenta las observaciones de la Secretaría de Desarrollo Regional de la Presidencia de la República y de la CHESF sobre un borrador anterior. Los comentarios de los ministerios federales de Economía, Hacienda y Planificación y de Infraestructura, y de la CETESB, la CODEVASF, la CVRD y la Fundación Nacional Indígena (FUNAI) sobre uno o más de los distintos estudios de casos prácticos en que se basa el presente informe también se tuvieron en cuenta. Reconocemos con agradecimiento la valiosa colaboración de los miembros del gobierno brasileño que integraban el equipo del Departamento de Evaluación de Operaciones y la SEPLAN, y los útiles comentarios y sugerencias aportados por el personal del Banco que se ocupa de las operaciones y el medio ambiente en todas las etapas del estudio.

Robert Picciotto
Director General
Evaluación de Operaciones
Junio de 1993

2. En marzo y abril de 1989 se realizaron visitas sobre el terreno de entre dos y tres semanas de duración a São Paulo y a la parte oriental de la región del Amazonas (Carajas), seguidas de misiones al valle intermedio e inferior del río São Francisco en julio y agosto de 1989 y a la zona del programa POLONOROESTE, situada en la parte occidental de la Amazonia, en septiembre y octubre de 1989

Préface

La présente étude s'inscrit dans le cadre des efforts consentis par l'OED pour évaluer les résultats obtenus par la Banque mondiale dans le domaine de l'environnement. (Parmi les autres études récentes de l'OED portant sur les résultats obtenus par la Banque en matière d'environnement, il faut citer OED 1989; OED 1991; et OED 1992.) Le choix du sujet s'explique par l'importance et la diversité des problèmes environnementaux auxquels a été confrontée la Banque au Brésil dans les années 70 et 80 — certains prêtant largement à controverse — et par l'impact qu'une telle expérience a pu avoir — et continue d'avoir — sur les opérations de la Banque à travers le monde, ainsi que sur les politiques et pratiques au Brésil.

Parmi les projets étudiés ici, il faut citer : la lutte contre la pollution urbaine et industrielle à São Paulo; les projets d'équipement électrique, de réinstallation forcée de populations et d'irrigation dans le bassin moyen et inférieur du fleuve São Francisco dans le Nordeste appauvri; une grande opération ferroviaire, portuaire et minière (minerai de fer) dans l'est de l'Amazonie (Carajas); et un vaste programme de développement rural et de construction de routes dans l'ouest de l'Amazonie (POLONOROESTE). Ces projets soulevaient divers problèmes : gestion du milieu urbain, répartition entre les secteurs des ressources en eau à l'échelle du bassin, destruction de la forêt tropicale, avec pour conséquence l'érosion des sols, réduction de la biodiversité et changements climatiques possibles, réinstallation forcée de populations, impact des grands projets d'infrastructures et du développement ainsi « induit » sur les populations indigènes et autres groupes sociaux vulnérables.

Le gouvernement brésilien a souscrit à cette idée d'étude en juillet 1988 et celle-ci a été menée à bien avec la participation active du personnel technique brésilien. Cette collaboration procède de la décision du gouvernement brésilien de se doter des moyens nouveaux et renforcés à nouveau de moyens d'évaluation internes et de son désir de travailler avec la Banque à un objectif commun, à savoir sensibiliser la population aux conséquences écologiques et sociales des grands projets d'équipement. Dans cette optique, le Service d'analyse de l'environnement (CAA) et l'Institut de recherche sociale et économique (IPEA/INPES) de l'ancien Ministère fédéral de la planification (SEPLAN) [1] ont été désignés comme les homologues techniques de l'OED, la coordination générale des travaux étant assurée par le Secrétariat (aujourd'hui Direction) des affaires internationales (DEAIN) de ce même ministère. Il a en outre été convenu que l'OED et le SEPLAN mèneraient des études de cas et établiraient des rapports finals indépendamment.

Pour cette étude, l'OED a obtenu le concours financier de l'Agence canadienne de développement international (ACDI) et de l'antenne brésilienne du Programme des Nations Unies pour le développement (PNUD). Au Brésil, la Société de l'Etat de São Paulo pour l'assainissement (CETESB), la Société de la vallée du Rio Doce (CVRD), la Société hydroélectrique du Nordeste (CHESF), la Société pour le développement de la vallée du São Francisco (CODEVASF) et la Superintendance pour le développement du Centre-Ouest (SUDECO) ont participé activement aux visites sur le terrain de l'OED/SEPLAN pour lesquelles ils ont fourni les moyens de transport et un soutien essentiel [2]. La synthèse sectorielle et les accords précités, passés en vue de l'étude, ont été approuvés par le Comité mixte d'audit en juin 1989.

Outre des visites dans les zones d'influence des projets retenus pour l'étude de cas et une prise de contact avec les

1. Le SEPLAN a fusionné avec le Ministère des finances pour former l'actuel Ministère de l'économie, des finances et de la planification (MEFP) en mars 1990.

2. Des visites d'une durée moyenne de deux à trois semaines ont été effectuées sur le terrain, à São Paulo et en Amazonie orientale (Carajas), en mars et avril 1989; elles ont été suivies de l'envoi de missions dans la vallée inférieure et moyenne du São Francisco en juillet-août 1989 et dans la zone du programme POLONOROESTE, dans l'ouest de l'Amazonie, en septembre-octobre 1989.

organismes d'exécution, l'étude impliquait un dépouillement de documents et des entretiens avec les membres du personnel de la Banque qui avaient participé à chacune des grandes opérations examinées. Parmi les documents de la Banque examinés figuraient les rapports d'évaluation et les rapports du Président, les Accords de prêt, de projet et de garantie, les comptes rendus des réunions du Conseil des Administrateurs au cours desquelles les différentes opérations avaient été approuvées, les rapports économiques et sectoriels, les dossiers de correspondance relatifs aux projets, ainsi que les éventuels rapports d'achèvement et d'évaluation rétrospective. Parmi les documents d'autre provenance qui ont été examinés figuraient des études de planification, scientifiques, d'évaluation de l'impact, des rapports de recherche, des articles et des ouvrages publiés, des rapports inédits ainsi que d'autres documents. A l'occasion de leurs visites sur le terrain, l'OED/SEPLAN ont eu des contacts avec des organismes fédéraux, fédérés et municipaux, des universités et des instituts de recherche, les bénéficiaires des projets et d'autres groupes de population affectés, des entreprises industrielles privées et différentes organisations non gouvernementales.

La présente étude dans sa version actuelle tient compte des remarques formulées par le Secrétariat de la Présidence de la République pour le développement régional (SDR-PR) et par la CHESF à propos d'une version antérieure. Ont été également prises en considération les remarques formulées par les Ministères fédéraux de l'économie, des finances et de la planification (MEFP) et des infrastructures, de la CETESB, de la CODEVASF, de la CVRD et de la Fondation indienne nationale (FUNAI) à propos d'une ou plusieurs études de cas sur lesquelles s'appuie le présent rapport. Nous exprimons nos remerciements aux membres de l'administration centrale brésilienne qui faisaient partie de l'équipe OED/SEPLAN pour leur précieuse contribution et au personnel du service des opérations et de l'environnement de la Banque qui nous a aidés de ses commentaires et suggestions à tous les stades de l'étude.

Robert Picciotto
Director général
Evaluation rétrospective des opérations
Juin 1993

Abbreviations and Acronyms

AMZA	Amazonia Mineracões, S.A. (Amazon Mining Inc.)
CETESB	Companhia de Technologia de Saneamento Ambiental (Environmental Sanitation Technology Company)
CHESF	Companhia Hidro-electrica do São Francisco (San Francisco Hydroelectric Company)
CIDA	Canadian International Development Agency
CODEVASF	Companhia de Desenvolvimento do Vale do São Francisco (San Francisco Valley Development Company)
CONAMA	Conselho Nacional de Meio Ambiente (National Environmental Council)
CVRD	Companhia Vale do Rio Doce (Rio Doce Valley Company)
ELETROBRAS	Centrais Electricas 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	Fundacão Nacional do Indio (National Indian Foundation)
GDP	Gross Domestic Product
GEF	Global Environment Facility
GNP	Gross National Product
HA	Hectare(s)
IBAMA	Instituto Brasileiro do Meio Ambiente e Recursos Naturais Renovaveis (Brazilian Institute for the Environment and Renewable Natural Resources)
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association

IDB	Inter-American Development Bank
IFC	International Finance Corporation
INCRA	Instituto Nacional de Colonizacão e Reforma Agraria (National Colonization and Agrarian Reform Institute)
INPES	Instituto Nacional de Pesquisas Económicas e Sociais, IPEA (National Economic and Social Research Institute, IPEA)
IPEA	Instituto de Pesquisa Económica Aplicada (Institute of Applied Economic Research)
NGO	Nongovernmental organization
OAS	Organization of American States
OECD	Organization for Economic Cooperation and Development
OED	Operations Evaluation Department, World Bank
PGC	Programa Grande Carajas (Greater Carajas Program)
PLANVASF	Plano de Desenvolvimento do Vale do São Francisco (Development Plan for the San Francisco Valley)
POLONORESTE	Programa de Desenvolvimento Integrado do Noroeste do Brasil Northwest Integrated Development Program
POLOSINDICAL	(Rural labor union confederation, lower-middle São Francisco valley)
PROCOP	Programa de Controle de Poluicão, 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 Asuntos Internacionais, SEPLAN (International Affairs Secretariat, Ministry of the Interior)
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 Planejemanto, Presidencia da Republica (Secretariat of Planning, Presidency of the Republic)
SISNAMA	Sistema Nacional do Meio Ambiente (National Environmental System)
SPMA	São Paulo Metropolitan Area
SUDECO	Superintendencia de Desenvolvimento do Centro-Oeste (Superintendency for the Development of the Center-West)
UNDP	United Nations Development Programme

Contents

Executive Summary

This study examines how the Bank approached environmental concerns in several large projects in Brazil, so as to draw lessons for future Bank operations involving environmental protection, assessment, and management and for the guidelines and procedures that shape these activities. The study also illustrates the evolution of environmental awareness both in the Bank and in Brazil and the growing integration of environmental concerns into Bank-assisted projects over the past two decades.

The study defined "environmental issues" in a way consistent with Bank policies, and has thus examined both the physical and human environmental dimensions and consequences of the operations surveyed. It attempted to trace the main direct and indirect impacts of the investments involved on both the natural resource base and existing communities, new settlements, and productive activities and to assess the adequacy and effectiveness of planned mitigatory measures. This approach is justified since any project's ultimate impact on the environment will be a function of its compounded effects on migration, human settlement, productive activities, and related natural resource use over time.

As it focuses on Bank approaches, the study did not attempt to measure project environmental impacts. It merely identified these impacts and pointed to the relationships between them insofar as this was necessary to understand where the emphasis of Bank approaches should have been. As a result, no attempt was made to compare environmental and other project costs and benefits. Finally, while it confirmed that significant progress has been made both conceptually and substantively in the way the Brazilian government and the Bank have approached environmental concerns over the past five years, because the study was essentially limited to completed operations, it did not explore more recent events in detail.

Chapter 1 describes the context of the projects studied and provides a brief overview of Bank activities in relation to the environment in Brazil since 1970. Projects in different sectors and parts of the country are examined through four case studies, briefly summarized in Chapters 2 and 3. Each case study focuses on a particular region or area of influence that is large and ecologically heterogeneous and whose population and economy were growing rapidly at the time the Bank-assisted operations were undertaken. The projects examined in detail were approved in 1974–87 (see Annex 1), and most were completed in 1983–88. They involved total approved Bank financing of some $1.15 billion.

Urban and Industrial Pollution Control in São Paulo

São Paulo state produces about half of Brazil's industrial output, has a per capita income roughly twice the national average, and contains the country's largest metropolis. Rapid urban and industrial growth, largely unregulated and unsupported by adequate sanitation services, explains much of the deterioration in air and water quality that occurred over the past several decades. Water in urban areas is polluted by increasing industrial effluents and domestic sewage discharge; air pollution is primarily associated with motor vehicles and industrial emissions.

Two Bank-supported operations approved during the 1970s, the São Paulo Water Supply and Pollution Control Project (1971) and the Greater São Paulo Sewage Treatment Project (1978), had environmental betterment among their goals but did not succeed in improving water pollution control in the metropolitan area. Execution delays, shortfalls in counterpart funding, internal political differences, and rapidly growing population limited their achievements. Most domestic sewage in metropolitan São Paulo remains untreated.

Two more recent industrial pollution control operations (1980 and 1987) have fared better. They combine a credit line for industrial pollution control equipment and treatment facilities with technical assistance to the state environ-

mental agency, CETESB. The first project experienced difficulties early on, but, as reformulated in 1984, clearly helped to improve air quality, particularly in the heavily industrialized city of Cubatão. It has also played a broader catalytic role. For much local industry, the existence of a specific funding source for pollution abatement, together with the possibility of fines and negative publicity for noncompliance with state environmental regulations, was reportedly sufficient to induce firms to install pollution control equipment with or without loans supported by the project.

Bank support of environmental improvement in the São Paulo metropolitan area has expanded over time. Even though the results are generally quite positive, several key sources of environmental pollution, including road dust and vehicle emissions, have not yet been fully confronted. The experience emphasizes that, to be effective, urban environmental management needs to be comprehensive, encompassing national policy measures such as vehicle emissions control, together with local regulations, public investments, and institutional development efforts.

Power, Involuntary Resettlement, and Irrigation in the São Francisco Valley

Hydropower development at Sobradinho, associated irrigation facilities on the lower São Francisco polders, and resettlement in connection with the Itaparica empoundment have had a profound impact on the middle and lower São Francisco valley in Northeast Brazil. The projects have benefitted hundreds of thousands of northeasterners by providing increased electricity and irrigated land, but they have also displaced tens of thousands of people and had other significant socioeconomic impacts. Irrigated agriculture, much of it producing commercial and export crops, has stimulated growth in agroindustry, served by increasingly sophisticated transport and communications networks. At the same time, it has contributed to the replacement of subsistence smallholders by commercially-oriented larger farmers. Rapid urbanization in the middle valley, in turn, contrasts with the stagnation of several urban centers in the lower-middle São Francisco and near the mouth of the river.

Construction of the Sobradinho regulating dam as part of the Paulo Afonso IV Hydroelectric Project (1974) displaced some 70,000 people. Even though urban resettlement at Sobradinho was fairly successful, the rural resettlement program was not. An official colonization scheme, which was expected to accommodate half the displaced rural population, in fact attracted a much smaller share, many of whom later abandoned the area. Most of the affected population chose to remain near the reservoir but received inadequate social and production support. *Agrovilas* (villages) established near the reservoir did not prosper as farmers frequently lacked the credit and support services needed to overcome problems caused by poor soils, incomplete irrigation facilities, changing water levels, and increased distances to markets.

Regulation of the São Francisco River by the Sobradinho dam also resulted in a large increase in the minimum flow in the lower valley, threatening to flood some 9,000 ha of fertile rice paddy. The Lower São Francisco Polders and Second Irrigation Projects (1975, 1979) were "emergency" operations to protect the floodplains near the mouth of the river through a series of dikes and pumping stations and to establish irrigated polders on some 25,000 ha. They also aimed to promote the economic and social advancement of the rural poor by providing them with access to land tenure, credit, and technology. The schemes absorbed about 20,000 people, whose incomes, on average, reportedly more than tripled. Altogether, however, some 50,000 rural residents, mainly itinerant sharecroppers, were displaced in the lower valley between 1975 and 1980. Unlike Sobradinho, no wider resettlement strategy was devised.

In the Itaparica Project (1987), dam and reservoir construction (not financed by the Bank) were accompanied by a comprehensive Bank-funded resettlement program in which representatives of the local population were heard. Bank intervention was guided by its policy on involuntary resettlement, first adopted in 1980—largely in response to the experience at Sobradinho—and further elaborated in 1986. Some 40,000 people were relocated during 1987–88 with about half opting for *agrovilas* and the rest moving to four new urban centers to replace towns that were to be flooded. The final cost of rural resettlement at Itaparica is likely to exceed $63,000 per family. Although people were successfully transferred, agricultural production has had to await the slow completion of irrigation facilities. Prolonged idleness, limited local opportunities for work, and occasional shortcomings in the provision of social services have contributed to a climate of uncertainty and frustration. Due largely to CHESF's advance planning to institute appropriate physical, biological, and sociocultural controls, however, ecological impacts of Itaparica have thus far been modest.

Iron Ore Mining and Transport Infrastructure in Eastern Amazonia (Carajas)

In the 1960s and 1970s, the Brazilian government took ambitious steps to integrate Amazonia into its rapidly expanding economy. Highways were built and settlement programs drawn up, while growth pole strategies and fiscal incentives were expected to draw private capital to the region. Large-scale hydroelectric and industrial projects were undertaken in eastern Amazonia. At the same time, large

numbers of small farmers and rural workers were being displaced in south-central Brazil by agricultural modernization and land concentration and in the Northeast by demographic pressures, recurrent droughts, and poverty. Their need to find gainful employment added impetus to directed settlement programs in Amazonia. The Carajas Iron Ore Project and the POLONOROESTE Program were key elements in the government's strategy to promote productive occupation of the Amazonian frontier.

The Carajas Project supported major investments in transport infrastructure and mining, together with smaller components for urban development and environmental and Amerindian protection, along a 900 kilometer corridor in the states of Para and Maranhao. This corridor connects one of the world's richest mineral deposits to a port terminal near the northeastern city of São Luis. Significant economic benefits accrued from development of the mining, rail, and port complexes: creation of jobs in construction, mining, and metallurgical industries, as well as in related commercial and service activities, rail and road transport, and some urban infrastructure.

The area of influence of the Carajas operation, however, is one of the parts of Amazonia that has experienced the highest rates of deforestation and environmental degradation over the past two decades. Implementation of the iron ore project and associated developments attracted construction workers and other settlers to the area. The new transport corridors facilitated access to extensive and previously remote parts of the region. Land speculators moved in along the roads and railway, while land clearing along the Carajas corridor increased significantly over the past two decades. In addition to providing the lumber needed to build the railway, other project facilities, and local housing, in more recent years native timber has been felled to produce charcoal for pig iron smelters. Much of the area cleared has been converted to pasture for low-density grazing. But, usually within a decade after first clearing, weeds and other second-growth vegetation that are difficult to control lead ranchers to abandon the land. This encourages further land clearing. Rural settlement and related deforestation have also resulted in some loss of native fauna.

When the Bank loan for the Carajas Project was approved (1982), these processes were already underway in parts of the region. CVRD, Brazil's largest state-owned mining company, was already pressing ahead with construction on several fronts. Most design decisions had already been taken and were being implemented. Specific provision was made for environmental control at the mine and port sites and along the immediate railway line, as well as for Amerindian protection, but the broader environmental consequences of the iron ore operation, together with other development tendencies affecting its area of influence, were not adequately foreseen. Unanticipated events, such as efforts by another government agency to set up an agricultural settlement project on the edge of CVRD's mining concession and the proliferation of gold prospecting in the area, induced further occupation of the western part of the Carajas rail corridor with associated environmental damage.

The project's environmental component—mostly to contain soil erosion along the railway and provide drainage and effluent control at the mine and port sites—was implemented successfully. However, outside the areas under CVRD's control, environmental protection measures were almost entirely lacking.

The Amerindian Special Project, in turn, provided land demarcation, health, economic development, and education services. The Bank supported CVRD in its attempts to induce the National Indian Foundation (FUNAI) and the federal government to implement agreed activities under the Special Project and loan guarantee agreements. Execution difficulties nonetheless led CVRD to suspend disbursements for the Special Project in 1986. Although the Special Project did result in significantly improved conditions in terms of health care and land demarcation, several unresolved land issues remained at the time the iron ore operation closed. CVRD continues to take actions on behalf of local indigenous peoples using its own resources, but with the continuing expansion of rural settlement, the sustainability of Amerindian protection efforts is in doubt.

Road Improvements and Rural Development in Western Amazonia (POLONOROESTE)

In 1981 the government launched the Northwest Region Integrated Development Program, or POLONOROESTE, in the agricultural frontier areas of Rondonia and northwestern Mato Grosso. Having an estimated cost of $1.6 billion, the program's principal objective was to absorb the population influx by expanding infrastructure and raising agricultural productivity, rural incomes, and social welfare. The Bank's six loans supported pavement of the federal highway between Cuiaba and Porto Velho, extension of the feeder road network, consolidation of existing settlement schemes and support for the establishment of new ones, improvement of rural social—especially health—services, and measures to protect the natural environment and indigenous peoples. As in the case of Carajas, the government financed a Special Amerindian Project within a framework agreed with the Bank.

Under the circumstances, it was inevitable that road building would stimulate additional migration. Fueling the process, the start of POLONOROESTE coincided with one of the most acute economic crises in postwar Brazil. Large numbers of urban dwellers, adding to the continuing flow of rural migrants, headed for the Northwest in the early and mid-1980s. Rondonia, in particular, was made even more

attractive by the rapid expansion of gold prospecting, cassiterite mining, and commercial timber extraction.

POLONOROESTE's design incorporated what were, at the time and in the Amazonian frontier context, progressive environmental and social concerns, and the Bank tried to build safeguards into the program. However, program preparation and appraisal did not sufficiently consider alternative scenarios with respect to the rate of migration into the area, or their implications for natural resource use. Much of the environmental degradation that has subsequently been associated with POLONOROESTE reflects the government's inability to control the expansion of rural and urban settlement and thus to keep incoming migrants from attempting to exploit the very areas that the program was originally designed to protect. Forest clearing in areas of poor soils, for example, has led to the destruction of sensitive nutrient-recycling mechanisms, causing the loss of soil fertility and increasing erosion. Conversion of tropical forests into farmland, pasture, and second-growth vegetation has also resulted in some loss of biodiversity.

Road investments under POLONOROESTE were implemented successfully, providing settlers improved access to markets and services. But agricultural support services, community facilities, and environmental and Amerindian protection measures lagged behind. A comprehensive midterm review in late 1984 highlighted the differences between design assumptions and the conditions under which POLONOROESTE was being implemented: many more migrants than projected; inadequate and late disbursements of counterpart funds because of a deteriorating national fiscal situation; absence of the investment credit needed to install perennial crops; overly centralized project management; and ineffective integration of participating agencies. As a result, the Bank informally suspended disbursements for the program in March 1985. Funding was resumed in August 1985 after federal authorities took steps to protect vulnerable Amerindian areas and agreement was reached on an agenda for redirection of the program.

As originally designed, POLONOROESTE contained ambitious forestry, environmental, and ecological research subcomponents, but implementation during the early years was frustrated by inadequate technical knowledge, an unsupportive policy environment, weak institutional capacity, and shortages of counterpart funding. Reorientation of the program following the suspension of disbursements, however, resulted in institutional changes and new environmental initiatives in the region. State environmental protection agencies were established and supported with program resources. Corrective measures taken to improve forestry control included higher taxes on forest exploitation, larger fines on illegal timber extraction, and establishment of a Forestry Military Police to strengthen enforcement and a State Forest Institute to provide extension services.

The Amerindian Special Project, on balance, has been effective thus far. However, given the chronic underfunding and understaffing of FUNAI, the weak status of Amerindians in Brazilian society, and their particularly vulnerable situation in advancing frontier areas, as in the case of Carajas, the longer-run sustainability of the Indian reserves established under the program requires continued external support.

Bank Performance (Chapter 4)

The Bank approached the projects examined with a concern for the environment. The case studies contain various examples of pioneering efforts on the Bank's part to broaden its traditional approach to project development, including a preappraisal environmental "reconnaissance" of Sobradinho, a multidisciplinary survey mission to the Northwest region, and the participation of Bank and consultant anthropologists and ecologists in the appraisal and supervision of the Amerindian and environmental protection components of Carajas and POLONOROESTE, and, more recently, in the preparation, appraisal, and supervision of the Itaparica Resettlement Project.

In some instances, changes took forms that could not have been fully anticipated by the borrower and the Bank, or were on a considerably larger scale than expected, with consequences that proved contrary to project environmental goals. Factors and events beyond the control of project authorities, including sharp deterioration of the national economic situation, were a major cause. No amount of strategic planning could have offset all of the adverse impacts of these contingencies. It should also be recalled that prevailing practices and safeguards in relation to the environment in the 1970s and early 1980s were less stringent than those followed today either by the Bank or in Brazil. In the specific case of POLONOROESTE, additionally, to its credit, once the Bank clearly perceived that program execution was seriously imbalanced, disbursements were suspended and the operation was reformulated. Mid-course reorientation of the first São Paulo industrial pollution control operation played a similarly positive role.

These considerations notwithstanding, in retrospect, some of the choices made at the design and appraisal stages of the projects examined appear to have been inadequate. In various instances, the Bank and borrower did not take sufficient account of the likely environmental or social impacts of the investments proposed. In addition, as in other countries to which the Bank has lent, the processing of these operations did not adequately address intersectoral and interregional issues or the effects of parallel policy incentives and market forces on natural resource use and envi-

ronmental quality in project areas of influence. In the case of Carajas, moreover, project loan covenants were not specific on the subject, making it difficult to know what environmental precautions were required or how the Bank should monitor their implementation. More generally, design of these operations did not make sufficient allowances for risks that were plausible at the outset (for example, higher volumes of migration to the Northwest region). These shortcomings were due in part to insufficient knowledge about the context into which the Bank was lending, a gap that could have been at least partly filled by more comprehensive *ex ante* environmental assessment.

The case studies reveal instances both where Bank supervision was insufficient and others where it made a vital contribution to a positive outcome. Where supervision was poor, however, one major reason seems to have been the initial lack of appreciation of the complexities and dynamics of the project areas involved. Bank approaches, furthermore, were not consistent across projects. Thus, while the Northwest was the object of a multidisciplinary survey and POLONOROESTE contained rural development, health, and environmental protection components, the operation in the equally sensitive Carajas corridor was far more narrow, even though it was appraised at roughly the same time. And even though indigenous populations were a matter of Bank concern in both POLONOROESTE and Carajas, other vulnerable social groups affected by project investments did not receive similar attention.

There were also cases where project interventions were improperly sequenced. In POLONOROESTE, for example, where roads were built on time but services for the resulting influx of migrants were slow to develop, institutional strengthening, especially with respect to environmental protection, should have preceded infrastructure improvements, while site-specific studies of soil and other natural resources should have preceded decisions to undertake new colonization projects. In the São Francisco valley projects, preparation and execution of resettlement measures and irrigation schemes were constrained by the scheduling of larger physical infrastructure investments.

In several instances, finally, the Bank's relatively late participation in project preparation may have precluded more effective handling of environmental or social issues. In the Carajas Project, all major design decisions related to ore transport were taken before the Bank became effectively involved, with no attention given to the potential environmental costs of the transport alternatives considered. Unlike Sobradinho and POLONOROESTE, moreover, the Bank did not press for environmental assessment and the definition of mitigatory measures at the regional level prior to loan approval. The Bank's involvement in Itaparica, in turn, which occurred only when the situation had reached near-crisis proportions, appears to have translated into high-cost solutions for rural resettlement.

In synthesis, the Bank's record in terms of how environmental and social issues were approached in the operations surveyed in the study was clearly a mixed one. However, it must be recognized that, as time progressed, the Bank's contribution improved, reflecting not only increased knowledge but reinvestment of the experience gained in Bank environmental policy and in the more recent phase of its operations in Brazil. It must also be recognized—and welcomed—that many of the lessons summarized below are already being applied in Brazil. They nonetheless bear repeating to ensure that they are kept in memory and because of their likely applicability to other countries.

Lessons for Environmental Protection (Chapter 5)

On the basis of the case studies, cross-cutting lessons can be drawn in three overlapping areas: environmental protection; environmental assessment and management; and Bank activities and procedures. The main findings of the study with respect to the preconditions for effective environmental protection are the following.

Policy, Legal, and Regulatory Framework. Environmental protection requires an adequate policy, legal, and regulatory framework. Brazil has explicit policies for environmental and Amerindian protection, but its federal system allows states and municipalities considerable discretion in the way environmental norms and sanctions are applied. Environmental protection performance, in fact, differs considerably among states, and there is a continuing need to strengthen legal and regulatory frameworks in many parts of the country. National policies still need to be developed in some areas, particularly in relation to involuntary resettlement.

Institutional and Technical Capacity. Adequate institutional and technical capabilities at both the national and subnational levels are also needed, including proper inspection and enforcement procedures, together with sufficient equipment and laboratory facilities, logistical support, and human resources to effectively monitor and control environmental degradation. The Bank should continue to support the strengthening of environmental agencies in Brazil and elsewhere.

Political Commitment and Accountability. Unequivocal political support to environmental objectives must also be secured, and political accountability must be built into the system to ensure that the administrative and technical apparatus, once established, properly responds to its legal mandate. In São Paulo, the strong commitment of a popularly-elected governor to "cleaning up" Cubatão played a

major role in the reorientation and subsequent positive results of the first Industrial Pollution Control Project. In the early years of POLONOROESTE, in contrast, limited political support at both the federal and state levels made it difficult to pursue environmental protection goals. With greater local commitment over the past few years, marked progress has reportedly been made.

Public Awareness and Community Participation. Generating the political commitment and accountability needed to attain environmental goals, finally, requires both a high level of public awareness and active popular and community participation in support of these goals. The Bank should, thus, continue to support environmental education programs and encourage community associations and other NGOs to participate in environmental monitoring. Since the difficulties of establishing effective environmental protection institutions and enforcement mechanisms are likely to be greatest in lower-income regions such as those cut by the São Francisco River, the Carajas railway, and the Cuiaba-Porto Velho highway, these, together with heavily populated and industrialized areas, such as metropolitan São Paulo, should receive priority attention.

Regulations and Economic Incentives. Where the benefits of taking such measures clearly outweigh their costs, pollution control and other forms of environmental protection require a mix of regulations and economic instruments including taxes, charges, and other incentives. Brazil, like many other countries, has traditionally relied primarily on regulations. The case studies suggest, however, that, especially in areas such as the Carajas corridor and the Northwest region, effective enforcement of environmental regulations is likely to be expensive and that there should be greater reliance on economic incentives. The Bank and the state government are currently attempting this in Rondonia by combining a technical planning instrument to direct public and private investments (agroecological zoning) with incentives and disincentives to encourage sustainable natural resource use. Similarly, a frequently proposed alternative for industrial pollution control is to rely on market-based approaches such as tradeable emissions permits. Efforts to adopt such measures in Brazil and elsewhere should be carefully monitored and assessed.

Lessons for Environmental Assessment and Management (Chapter 6)

Understanding the Context. The most obvious lesson from the case studies with respect to the handling of similar projects in the future is the need to carry out a full *ex ante* environmental assessment and to reflect its results in project design and implementation. Developing an adequate understanding of the specific settings involved is particularly important and difficult in areas that are large, ecologically heterogeneous, demographically dynamic, and/or socioeconomically complex. The lessons which follow are all related to this general conclusion.

Maintaining a Spatial Focus. A spatial approach to environmental assessment and natural resource management is indicated for several reasons: (1) investments and productive activity at one location often affect environmental quality and resource use elsewhere; (2) many environmental effects are indirect or may only become evident over the long run; and (3) project investments interact with market forces and other public interventions—such as road building and fiscal incentives in the case of Carajas—to affect natural resource use at the local and regional levels. Having a "spatial unit of account," such as a river basin or the area of influence of a major transport investment, will facilitate the identification and monitoring of these effects.

Adopting a Cross-sectoral and Multidisciplinary Approach. For many of the same reasons indicated in the previous paragraph, the case studies confirm the need to take a cross-sectoral and multidisciplinary approach to environmental assessment and management. The participation of ecologists, social scientists other than economists, and institutional development specialists is of particular importance.

Considering Induced Development Impacts. Several of the operations reviewed, especially Sobradinho, Carajas, and POLONOROESTE, had significant induced development impacts, that were not sufficiently anticipated during project preparation and appraisal. These impacts should be identified wherever possible and mitigatory measures taken, when necessary, either as an integral part of the larger project itself or through appropriately designed and executed parallel operations.

Taking Interregional Considerations into Account. A key aspect of environmental assessment concerns the linkages between local development and that occurring elsewhere in the country. In Brazil, for example, comprehending these relationships is critical both to an understanding of the extent and nature of the demographic pressures on the Northwest region and in order to devise policy alternatives to continued unsustainable forms of land occupation in western Amazonia.

Assessing Unintended Policy Consequences. The case studies also highlight the significant impact that policies not explicitly concerned with renewable resource use (such as credit and fiscal incentives) can have on resource use and environmental quality more generally. Any policy that af-

fects population distribution, settlement patterns, productive activities, and, thus, natural resource use will affect the human and physical environment. The potential environmental and social consequences of macroeconomic (including trade and fiscal) and sectoral policies should not be ignored, and mitigatory measures should be taken if necessary. The environmental implications of policies for the agricultural, industrial, power, and transport sectors should receive especial attention.

Recommendations for Bank Operations (Chapter 7)

The 1987 reorganization, the adoption of environmental assessment guidelines in 1989, and their updating in 1991 have already moved the Bank along many of the lines suggested above. The findings of the case studies lend strong support to the steps the Bank has taken in recent years. Nonetheless, there are several areas where further improvement is desirable.

Integrating the Environment into Economic and Sector Work. The Bank can influence natural resource management and environmental protection through its ongoing country policy dialogue and economic and sector work (ESW). This includes both activity specifically concerned with environmental issues and that which is addressed to other—including macroeconomic—questions. Substantial progress has been made Bankwide with respect to the former in recent years, but much can still be done to better integrate environmental concerns into ESW in Brazil and elsewhere.

Strengthening Country Institutions. Supporting and strengthening national and subnational institutional and technical capabilities for environmental management are of particular importance. Where necessary, further attention should be devoted to developing or consolidating the policy, legal, regulatory, and administrative frameworks and the information systems, monitoring tools, and enforcement mechanisms required for more sustainable renewable resource use and effective environmental protection. The need to increase public awareness of environmental problems, their causes, and potential solutions through public education programs, media campaigns, NGO participation, and other means so as to ensure greater accountability in local and national decision making with respect to environmental issues should be specific concerns both of Bank country policy dialogue and its lending operations.

Upgrading Ex ante Environmental Assessment. The Bank should routinely seek a thorough understanding of the ecological potentials and constraints and underlying socioeconomic, political, and institutional processes that affect ongoing development in the geographic areas where its projects are located. Particular attention should be given to environmental impacts that may be irreversible and to areas with sensitive ecosystems or large concentrations of population. Based on past experience in Brazil, among the "country factors" that should be considered in any such assessment are: (1) *demographic and economic factors,* including the possible impact of alternative demographic scenarios, macroeconomic instability, and policies designed for other purposes on natural resource use and the effectiveness of environmental protection measures; (2) *governance factors,* including the extent of borrower commitment to environmental objectives, the degree of public awareness and community participation, and the likely positive and negative effects of political-administrative decentralization; and (3) *institutional capacity constraints.*

Refining Project Design. The case studies point to four areas where improvements in project design could be made: (1) better integration of the "country factors" mentioned above; (2) better balance and timing of physical versus policy and institution-related project components, particularly those for environmental protection; (3) improved design of environmental covenants; and (4) more extensive risk analysis and greater allowance for uncertainty. Environmental covenants and other instruments recording areas of agreement for project implementation should clearly spell out the nature and timing of the environmental precautions and mitigatory measures to be taken in conjunction with Bank projects. Risk analysis and allowance for uncertainty should be integrated into the preparation of large-scale operations having long-term and possibly irreversible impacts on affected populations and/or the physical environment, drawing on two simple principles: (1) select project designs which offer greater flexibility over ones that are excessively rigid; and (2) base project design on a forward-looking set of costs, benefits, and probabilities in order to increase their "robustness" in the face of one or several possible adverse conditions in terms of country macroeconomic performance, policies, governance, and institutional capabilities.

Strengthening Supervision. The case studies identified situations where Bank supervision was both insufficient and of critical importance to ensure a positive outcome. On balance, however, the results of the study suggest a need to strengthen the supervision of project environmental and social components. Especially in large, complex, or risky operations that may have substantial environmental and/or social impacts, during supervision, the Bank should systematically monitor both project performance and any relevant contextual changes so as to "flag" any significant alterations in the basic parameters assumed at appraisal and to permit the introduction of necessary modifications in project design in as timely a fashion as possible. Compre-

hensive mid-term reviews should likewise be undertaken in such cases.

Improving Monitoring, Reporting, and Evaluation. Also important is the need for independent, multidisciplinary monitoring and evaluation of project performance in relation to environmental and social goals, issues, and impacts. Wherever feasible, the participation of responsible local, national, or international NGOs in environmental monitoring activities should be encouraged. Current Bank reporting requirements with respect to project environmental components and consequences at the completion stage should be further elaborated and included as part of the PCR guidelines. Finally, *ex-post* evaluation of project environmental performance and impacts should be expanded on the part of both borrowers and the Bank.

Suggestions for Internal Resource Deployment. Applying the lessons of the study is likely to require additional time and resources for economic and sector work, environmental assessment, project preparation and appraisal, supervision, evaluation, and so on. The activities entailed, as well as the additional resources and the staff skill mix required, will vary from country to country and should be the subject of more specific analysis by Bank operational and environmental staff. Since the incremental expenditures are in the direct interest of its borrowers as well as the Bank, the necessary funding should be drawn from a range of sources including the project preparation facility, engineering and technical assistance loans, environmental trust funds, the GEF, and new lending operations in addition to the Bank's administrative budget. However, particularly in countries like Brazil, where the environmental portfolio is large and rapidly growing and/or where current operations are likely to have significant human and physical environmental impacts, the Bank should consider placing one or more staff members or long-term consultants in the field to assist in the preparation and intensify the supervision of environmental operations, improve communication with borrowers, and clearly signal Bank concern with ecological and social issues.

Resumo

O presente estudo examina o critério utilizado pelo Banco em relação ao aspecto ambiental de grandes projetos no Brasil, com a finalidade de extrair lições para futuras operações do Banco que incluam componentes de proteção, avaliação e manejo do meio ambiente, bem como procedimentos que conformem tais atividades. O estudo também ilustra a evolução da consciência ambiental tanto no Banco como no Brasil, e a crescente incorporação dos aspectos ambientais em projetos financiados pelo Banco nas duas últimas décadas.

O estudo definiu as "questões ambientais" de modo compatível com as políticas do Banco e, assim sendo, examinou tanto as dimensões ambientais físicas e humanas, como as conseqüências das operações estudadas. Nesse sentido, procurou investigar os impactos diretos e indiretos exercidos pelos pertinentes investimentos sobre a base de recursos naturais e sobre comunidades existentes, novos assentamentos e atividades produtivas, bem como avaliar a adequação e eficiência das medidas de atenuação planejadas. Este critério é justificado, porque o impacto final de qualquer projeto será uma função dos seus efeitos compostos sobre a migração, os núcleos humanos, as atividades produtivas e os recursos naturais conexos utilizados com o correr do tempo.

Ao focalizar os critérios do Banco, o estudo não procurou aferir impactos ambientais de projetos, limitando-se a identificá-los e a indicar o relacionamento entre os mesmos, na medida do necessário para determinar qual deveria ter sido a ênfase dos critérios adotados pelo Banco. Em conseqüência, não se procurou comparar os custos ambientais com outros custos e benefícios do projeto. Finalmente, embora tenha confirmado o significativo progresso conceptual e substantivo registrado pelo governo brasileiro e o Banco em seus critérios ambientais nos últimos anos, o estudo, por se ter limitado a operações concluídas, não explorou eventos mais recentes em maiores detalhes.

O Capítulo 1 descreve o contexto dos projetos estudados e apresenta, em breves palavras, uma visão geral das atividades desenvolvidas pelo Banco em relação ao meio ambiente no Brasil, desde 1970. Os capítulos 2 e 3 resumem quatro estudos de casos, referentes a projetos em diferentes setores e áreas do país. Cada estudo de caso focaliza uma região ou área de influência em particular, caracterizada por sua grande dimensão e sua heterogeneidade ecológica e pelo seu rápido crescimento populacional e econômico na época das operações assistidas pelo Banco. Os projetos detalhadamente examinados foram aprovados no período 1974–87 (v. Anexo 1),e, em sua maioria, foram concluídos no período 1983–88. No total, representaram aproximadamente $1,15 bilhão em financiamentos aprovados pelo Banco.

Controle da Poluição Urbana e Industrial em São Paulo

O Estado de São Paulo gera cerca de metade da produção industrial do Brasil, registra uma renda *per capita* cerca de duas vezes maior do que a média nacional e sua capital é a maior metrópole do país. O rápido crescimento urbano e industrial, em grande parte carente de regulamentação e não apoiado por adequados serviços de saneamento, serve de principal explicação para a deterioração da qualidade do ar e da água ocorrida nas últimas décadas. Nas áreas urbanas, a água é cada vez mais poluída por efluentes industriais e descargas de esgoto doméstico; a poluição aérea associa-se principalmente às emissões de indústrias e de veículos a motor.

Duas operações de financiamento aprovadas pelo Banco na década de 70 —o Projeto de Abastecimento de Água e Controle da Poluição de São Paulo (1971) e o Projeto de Tratamento de Esgotos do Grande São Paulo (1978)— continham, entre outras, metas de melhoramento ambiental, mas não conseguiram melhorar o controle da poluição hídrica na área metropolitana. Atrasos de execução, carências

de fundos de contrapartida, divergências políticas internas e o rápido crescimento populacional limitaram seus resultados. Em sua maior parte, o esgoto doméstico da área metropolitana de São Paulo ainda não é tratado.

Duas operações mais recentes de controle da poluição industrial (1980 e 1987) registraram mais êxito. As operações combinaram uma linha de crédito para equipamento de controle da poluição industrial e instalações de tratamento, e a prestação de assistência técnica à CETESB, o órgão estadual do meio ambiente. O primeiro projeto, embora tenha passado por dificuldades iniciais, foi reformulado em 1984 e resultou em clara melhoria da qualidade do ar, principalmente em Cubatão, cidade altamente industrializada. O projeto também desempenhou papel catalisador mais amplo. Para grande parte da indústria local, a existência de uma fonte específica de recursos para a redução da poluição, juntamente com a possibilidade de aplicação de multas e de publicidade negativa por inobservância de normas estaduais em matéria de meio ambiente, teria bastado para induzir as firmas a instalar equipamento de controle da poluição, independentemente da disponibilidade de empréstimos auspiciados pelo projeto.

O apoio do Banco à melhoria do meio ambiente na área metropolitana de São Paulo tem-se expandido com o passar dos anos. Embora os seus resultados sejam, em geral, muito positivos, várias fontes básicas de poluição ambiental, entre as quais a poeira rodoviária e as emissões de veículos a motor, ainda não foram inteiramente enfrentadas. A experiência reafirma que, para ser eficiente, o manejo do meio ambiente urbano deve ser abrangente, incluindo políticas nacionais de controle de emissão de veículos a motor, juntamente com regulamentos locais, investimentos públicos e iniciativas de desenvolvimento institucional.

Energia, Reassentamento Involuntário e Irrigação no Vale do São Francisco

O desenvolvimento hidrelétrico de Sobradinho, as instalações conexas de irrigação no baixo São Francisco e o reassentamento vinculado à represa de Itaparica exerceram profundo impacto sobre o baixo e médio vale do São Francisco. Os projetos beneficiaram centenas de milhares de nordestinos ao proverem eletricidade e terra irrigada, mas também deslocaram dezenas de milhares de pessoas e exerceram outros importantes impactos sócio-econômicos. A agricultura irrigada, grande parte da qual dedicada a cultivos comerciais e de exportação, estimulou o crescimento da agroindústria, servida por redes de transportes e comunicações cada vez mais modernas. Ao mesmo tempo, contribuiu para substituir pequenos agricultores por produtores de maior orientação comercial. Por sua vez, a rápida urbanização no médio vale contrasta com a estagnação de vários centros urbanos no baixo e médio São Francisco e na sua desembocadura.

A construção da represa reguladora de Sobradinho como parte do Projeto Hidrelétrico Paulo Afonso IV (1974) deslocou 70.000 pessoas. Embora o reassentamento urbano em Sobradinho tenha alcançado bastante êxito, o mesmo não ocorreu com o programa de reassentamento rural. Um plano oficial de colonização, que deveria resultar na acomodação de metade da população rural deslocada, atraiu parcela realmente muito menor, grande parte da qual, mais tarde, abandonou a área. A maioria da população afetada preferiu permanecer nas imediações do reservatório, mas o apoio social e de produção que recebeu não foi adequado. As agrovilas estabelecidas nas imediações do reservatório não prosperaram, porque os agricultores careceram freqüentemente do crédito e dos serviços de apoio necessários para superar problemas causados pela pobreza do solo, instalações de irrigação incompletas, alteração dos níveis de água e maiores distâncias aos mercados.

A regularização, pela represa de Sobradinho, das águas do São Francisco também resultou em grande incremento no fluxo mínimo do rio no baixo vale, ameaçando inundar cerca de 9.000 ha de férteis arrozais de sequeiro. Os pôlderes do baixo São Francisco e os Projetos de Irrigação II (1975 e 1979) representaram operações de "emergência" para proteger as várzeas próximas à embocadura do rio mediante a construção de uma série de diques e estações de bombeamento, e para estabelecer pôlderes irrigados em aproximadamente 25.000 ha. Também visavam a promover o progresso econômico e social da população rural pobre, mediante oportunidades de acesso à posse da terra, ao crédito e à tecnologia. Os planos absorveram mais de 20.000 pessoas, cuja renda média, teria mais do que triplicado. Mas, de modo geral, cerca de 50.000 moradores do baixo vale, muitos deles meeiros itinerantes, foram deslocados dessa área rural entre 1975 e 1980. Em contraste com o caso de Sobradinho, não se preparou uma estratégia de reassentamento mais amplo.

No Projeto de Itaparica (1987), as obras da barragem e do reservatório (o Banco não as financiou) foram acompanhadas de um amplo programa de reassentamento, financiado pelo Banco, do qual participaram representantes da população local. A intervenção do Banco baseou-se na sua política em matéria de reassentamento involuntário, inicialmente adotada em 1980 —devido em grande parte à experiência de Sobradinho— e adicionalmente expandida em 1986. Aproximadamente 40.000 pessoas foram reassentadas durante o período 1987–88, metade das quais optaram por agrovilas e as demais mudaram-se para quatro novos centros urbanos, construídos para substituir as localidades a serem inundadas. É provável que custo final do reassentamento rural em Itaparica seja superior a $63.000 por família. Embora a transferência da população tenha alcançado êxi-

to, a produção teve que esperar pela lenta conclusão das obras de irrigação. A desocupação prolongada, as limitadas oportunidades de trabalho local e as insuficiências periódicas de serviços sociais contribuíram para gerar um clima de incerteza e frustração. Contudo, devido em grande parte ao planejamento antecipado da CHESF no sentido de instituir controles físicos, biológicos e sócio-culturais apropriados, até agora os impactos ecológicos do Projeto de Itaparica têm sido modestos.

Mineração de Ferro e Infra-estrutura dos Transportes no Leste da Amazônia (Carajás)

Nas décadas de 60 e 70, o governo brasileiro lançou-se à ambiciosa tarefa de integrar a Amazônia na economia nacional, em rápida expansão. Abriram-se estradas e se prepararam planos de colonização, na expectativa de que a adoção de estratégias de pólos de crescimento e incentivos fiscais atraíssem capital privado para a região. Grandes projetos hidrelétricos e industriais foram iniciados no leste da Amazônia. Simultaneamente, grande número de pequenos produtores e trabalhadores rurais vinham sendo deslocados pela modernização da agricultura e a concentração de terras no centro-sul do Brasil, e por pressões demográficas, secas periódicas e empobrecimento no Nordeste. Sua necessidade de emprego remunerado impulsionou ainda mais os programas de colonização orientada na Amazônia. O Projeto de Mineração de Ferro em Carajás e o Programa POLONOROESTE foram elementos essenciais da estratégia oficial de promoção da ocupação produtiva da fronteira amazônica.

O Projeto de Carajás apoiou importantes investimentos de infra-estrutura dos transportes e mineração, juntamente com componentes menores de desenvolvimento urbano e de proteção ambiental e da população ameríndia ao longo de um corredor de 900 km nos estados do Pará e do Maranhão. Esse corredor liga um dos maiores depósitos de minério do mundo a uma terminal portuária próxima à cidade de São Luiz, no Nordeste. O desenvolvimento da mineração e os complexos ferroviário e portuário geraram significativos benefícios econômicos: oferta de emprego nas indústrias da construção, mineração e metalurgia e nas atividades comerciais e de serviços correlatas, transporte ferroviário e rodoviário e certa infra-estrutura urbana.

Todavia, a área de influência da operação de Carajás é uma das que registra os índices mais altos de desmatamento e degradação ambiental na Amazônia durante as duas últimas décadas. A implementação do projeto da mineração de ferro e as atividades a este associadas atraíram trabalhadores da indústria da construção e outros colonos para a área. Os novos corredo res de transporte facilitaram o acesso a extensas zonas da região, antes remotas. Os especuladores de terras avançaram ao longo das estradas e da ferrovia, e o amanho de terras ao longo do corredor de Carajás registrou significativo aumento nos últimos 20 anos. Além de proporcionarem a madeira necessária para as obras da ferrovia e outras instalações do projeto e para a construção de habitações locais, as árvores nativas têm sido abatidas nos últimos anos como fonte de carvão para fornos de fundição de ferro-gusa. Grande parte da área foi aberta e convertida em pastagens de baixa densidade. Mas, decorridos geralmente dez anos do primeiro amanho do solo, o crescimento de ervas daninhas e um segundo brote de vegetação difícil de controlar levam os plantadores a abandonar suas terras. Isso estimula o preparo de novas terras. A colonização rural e o desmatamento a ela associado também resultaram em certas perdas de fauna nativa.

Ao ser aprovado o empréstimo do Banco para o Projeto de Carajás (1982), esses processos já estavam em andamento em certas partes da região. A CVRD, a maior empresa estatal de mineração do Brasil, já estava avançando suas obras de construção em diversas frentes. Em sua maioria, as decisões referentes a desenho já tinham sido tomadas e estavam sendo implementadas. Adotaram-se disposições específicas em matéria de controle ambiental na mina e no porto e ao longo da linha férrea imediata, bem como para a proteção dos ameríndios, mas as conseqüências mais gerais da operação de mineração sobre o meio ambiente, juntamente com outras tendências de desenvolvimento que afetavam sua área de influência não foram adequadamente previstas. Acontecimentos imprevistos, tais como as iniciativas de outro órgão governamental no sentido de implantar um projeto de colonização agrícola à margem da concessão de mineração da CVRD e a proliferação da mineração de ouro na área, induziram a ocupação adicional da zona oeste do corredor ferroviário de Carajás, com seus conseqüentes prejuízos ao meio ambiente.

O componente ambiental do projeto —principalmente a contenção da erosão do solo ao longo da ferrovia e a drenagem e o controle de efluentes na mina e no porto— foi executado com êxito. Contudo, fora das áreas controladas pela CVRD, praticamente não existiam medidas de proteção ambiental.

Por sua vez, o Projeto Especial para os Indígenas propiciou a demarcação de terras e a prestação de serviços de saúde, desenvolvimento econômico e educação. O Banco apoiou as iniciativas da CVRD no sentido de induzir a Fundação Nacional do Indio (FUNAI) e o governo federal a implementar atividades acordadas no âmbito do Projeto Especial e dos contratos de empréstimo e garantia. Não obstante, dificuldades de execução levaram a CVRD a suspender os desembolsos para o Projeto Especial em 1986. Embora o Projeto Especial tenha resultado em significativa melhoria de condições em termos de saúde e demarcação de terras, diversas questões de terra ainda estavam por ser resolvidas ao se encerrarem as operações relativas à mine-

ração de ferro. A CVRD continua a empreender, com recursos próprios, ações em benefício de grupos indígenas locais, mas a contínua expansão da colonização rural suscita dúvidas quando à capacidade de sustentação das iniciativas de proteção aos indígenas.

Melhoramentos Rodoviários e Desenvolvimento Rural no Oeste da Amazônia (POLONOROESTE)

Em 1981, o governo lançou o Programa de Desenvolvimento de Áreas Integradas do Noroeste (POLONOROESTE), na fronteira agrícola de Rondônia e no noroeste de Mato Grosso. Ao custo estimado de $1,6 bilhão, o programa tinha por objetivo principal absorver o influxo populacional mediante a expansão da infra-estrutura e o aumento da produtividade agrícola, da renda rural e do bem-estar social. Os seis empréstimos concedidos pelo Banco apoiaram a pavimentação da rodovia federal entre Cuiabá e Porto Velho, a extensão da rede de estradas alimentadoras, a consolidação dos planos de colonização existentes e a preparação de novos planos, a melhoria dos serviços sociais rurais —especialmente no setor da saúde— e medidas de proteção do meio ambiente natural e das populações indígenas. Tal como no caso de Carajás, o governo financiou um Projeto Especial para os Indígenas, dentro de parâmetros acordados com o Banco.

Nessas circunstâncias, era inevitável que as obras rodoviárias estimulassem adicionalmente a migração. Alimentando o processo, o início do POLONOROESTE coincidiu com uma das crises econômicas mais agudas sofridas pelo Brasil desde a Segunda Guerra Mundial. Grande números de moradores de cidades, além do contínuo influxo de migrantes rurais, partiram para o Noroeste no começo e em meados da década de 80. Rondônia, em particular, passou a ser ainda mais atrativa, devido à rápida expansão de prospecção de ouro, da mineração de cassiterita e da extração de madeira comercial.

Os planos do POLONOROESTE incorporavam aquilo que, naquela época e no contexto da fronteira amazônica, eram aspectos ambientais e sociais progressistas, e o Banco procurou introduzir salvaguardas no programa. Contudo, a preparação e avaliação do programa não deram suficiente consideração a cenários alternativos referentes ao índice de migração para a área ou suas implicações para o uso dos recursos naturais. Grande parte da degradação ambiental que foi posteriormente atribuída ao POLONOROESTE reflete a incapacidade governamental de controlar a expansão da colonização rural e urbana e, assim, de impedir que os novos migrantes procurassem explorar as próprias áreas que, originariamente, deveriam ser protegidas pelo programa. O desmatamento em áreas de solos pobres, por exemplo, resultou na destruição de mecanismos sensíveis de reciclagem de nutrientes, ocasionando a perda da fertilidade do solo e intensificando a erosão. A conversão de matas tropicais em terras agrícolas e pastagens e o rebrote de vegetação também resultaram em certa perda da diversidade biológica.

Os investimentos rodoviários no âmbito do POLONOROESTE alcançaram êxito, propiciando aos colonos melhor acesso a mercados e serviços. Todavia, os serviços de apoio à agricultura, as instalações comunitárias e as medidas de proteção do meio ambiente e dos indígenas não tiveram o mesmo êxito. Uma revisão geral de meio-termo, realizada em fins de 1984, revelou as diferenças entre os pressupostos do desenho e as condições em que o POLONOROESTE vinha sendo implementado: um número de migrantes muito maior do que o projetado; inadequação e atrasos dos desembolsos de fundos de contrapartida, devido ao agravamento da situação fiscal nacional; ausência do crédito de investimento necessário para instalar lavouras perenes; gestão do projeto excessivamente centralizada; e integração ineficiente dos órgãos participantes. Em conseqüência, o Banco suspendeu informalmente os desembolsos para o programa em março de 1985. O financiamento foi reiniciado em agosto de 1985, depois que as autoridades federais adotaram medidas para proteger as áreas indígenas vulneráveis e que foi acordada uma agenda para o redirecionamento do programa.

Em seu desenho original, o POLONOROESTE incluía ambiciosos subcomponentes de pesquisa florestal, ambiental e ecológica, mas a inadequação do conhecimento tecnológico, o ambiente político pouco propício, a fraqueza da capacidade institucional e as carências de fundos de contrapartida frustraram sua implementação durante os primeiros anos. Contudo, o redirecionamento do programa após a suspensão dos desembolsos resultou em mudanças institucionais e novas iniciativas em prol do meio ambiente na região. Estabeleceram-se órgãos estaduais de proteção ambiental, apoiados por recursos do programa. As medidas corretivas adotadas para melhorar o controle florestal incluíram o aumento dos impostos de exploração florestal, multas mais severas para a extração ilegal de madeira e a criação de uma polícia militar florestal para melhor garantir a observância de leis e de um instituto florestal estadual para prestar serviços de extensão.

Até agora, o Projeto Especial para os Indígenas tem registrado saldo positivo. Contudo, em razão da crônica falta de recursos e de pessoal da FUNAI, do baixo *status* dos indígenas na sociedade brasileira e da sua situação particularmente vulnerável ao avanço das áreas de fronteira, tal como no caso de Carajás, a sustentabilidade a prazo mais longo das reservas indígenas estabelecidas no âmbito do programa requer contínuo apoio de fontes externas.

O Desempenho do Banco (Capítulo 4)

O Banco adotou, em relação aos projetos examinados, um critério de interesse pelo meio ambiente. Os estudos de casos contêm vários exemplos de esforços pioneiros desenvolvi-

dos pelo Banco no sentido de ampliar sua abordagem tradicional do processo de preparação de projetos, entre os quais um "reconhecimento" ambiental prévio à avaliação do projeto de Sobradinho, uma missão de observação multidisciplinar à região Noroeste e a participação de antropólogos e ecologistas, tanto consultores como do Banco, na avaliação e supervisão dos componentes de proteção do meio ambiente e dos ameríndios no projeto de Carajás e no POLONOROESTE e, mais recentemente, na preparação, avaliação e supervisão do Projeto de Reassentamento de Itaparica.

Em certos casos, as mudanças assumiram formas que não poderiam ter sido inteiramente previstas pelo mutuário e pelo Banco, ou sua escala foi consideravelmente maior do que a esperada, com conseqüências que se entrechocaram com as metas ambientais do projeto. Fatores e acontecimentos impossíveis de controlar pelas autoridades do projeto, entre os quais a aguda deterioração da situação econômica nacional, muito contribuíram para isso. Nenhum planejamento estratégico, por mais abundante que fosse, poderia ter neutralizado todos os impactos adversos dessas contingências. Deve-se recordar também que as práticas e salvaguardas vigentes em matéria ambiental na década de 70 e no começo dos anos 80 eram menos rigorosas do que as atualmente adotadas pelo Banco ou pelo Brasil. Além disso, no caso específico do POLONOROESTE, e para crédito do Banco, uma vez percebidos com clareza os graves desequilíbrios na execução do programa, os desembolsos foram suspensos e a operação foi reformulada. A reorientação de meio-termo imprimida à primeira operação de controle da poluição industrial em São Paulo desempenhou papel similarmente positivo.

Em retrospecto, não obstante essas considerações, algumas das opções escolhidas nas fases de desenho e avaliação dos projetos examinados parecem ter sido inadequadas. Em diversas ocasiões, o Banco e o mutuário não levaram em suficiente conta os prováveis impactos ambientais ou sociais dos investimentos propostos. Além disso, tal como em outros países que receberam empréstimos do Banco, o processamento dessas operações não abordou adequadamente certas questões interssetoriais e inter-regionais ou os efeitos de incentivos de política paralelos ou das forças do mercado sobre o uso de recursos naturais e a qualidade ambiental nas áreas de influência dos projetos. E, ainda mais no caso de Carajás, o documento de empréstimo para o projeto não continha cláusulas específicas sobre o assunto, o que dificultou o conhecimento das precauções ambientais que eram necessárias ou de como o Banco deveria acompanhar sua implementação. De modo mais geral, o desenho dessas operações não levou em suficiente consideração os riscos que eram plausíveis no seu início (p. ex., migração mais intensa para a região Noroeste). Essas lacunas deveram-se, em parte, ao insuficiente conhecimento do contexto em que o Banco estava concedendo seus empréstimos, falhas que poderiam ter sido sanadas pelo menos parcialmente por meio de uma avaliação ambiental *ex ante* mais completa.

Os estudos de casos revelam instâncias em que a supervisão do Banco foi insuficiente, e outras em que o Banco fez uma contribuição essencial para um resultado positivo. Mas, nos casos em que faltou supervisão, uma das razões principais para tanto parece ter sido a pouca compreensão inicial das complexidades e da dinâmica das respectivas áreas de projeto. Além disso, o Banco não dispunha de critérios consistentes aplicáveis a todos os projetos. Assim, enquanto o Noroeste era objeto de um levantamento multidisciplinar e o POLONOROESTE continha componentes de desenvolvimento rural, saúde e proteção ambiental, a operação no corredor de Carajás, igualmente delicado, foi muito menos abrangente, ainda que este projeto tenha sido avaliado praticamente na mesma época. E, embora o Banco tenha levado em conta as populações indígenas tanto no POLONOROESTE como em Carajás, outros grupos sociais vulneráveis, afetados pelos investimentos dos projetos, não mereceram igual atenção.

Também houve casos em que as intervenções do projeto não ocorreram na seqüência apropriada. Por exemplo: no POLONOROESTE, cujas estradas foram construídas dentro do prazo, mas cujos serviços para o resultante influxo de migrantes tardaram a se desenvolver, o fortalecimento institucional, especialmente em matéria de proteção ao meio ambiente, deveria ter precedido as melhorias de infra-estrutura, ao passo que os estudos específicos de solos locais e de outros recursos naturais deveriam ter precedido a decisão de preparar novos projetos de colonização. Nos projetos do vale do São Francisco, a preparação e a execução de medidas de reassentamento e planos de irrigação foram limitadas pelo planejamento de maiores investimentos em infra-estrutura física.

Finalmente, em diversas instâncias, a participação relativamente tardia do Banco na preparação ade projetos talvez tenha impedido uma gestão mais eficiente de problemas ambientais ou sociais. No Projeto de Carajás, todas as decisões de desenho mais importantes foram adotadas antes da efetiva participação do Banco, sem qualquer consideração do potencial de custos ambientais das alternativas de transporte examinadas. Além disso, ao contrário de Sobradinho e do POLONOROESTE, o Banco não insistiu na realização de avaliações ambientais e na definição de medidas de migração a nível regional antes da aprovação do empréstimo. Por sua vez, a participação do Banco no Projeto de Itaparica, que só ocorreu quando a situação assumira proporções de quase-crise, parece haver-se traduzido em soluções de alto custo para o reassentamento rural.

Em síntese, o desempenho do Banco em termos de abordagem de questões ambientais e sociais nas operações revisadas pelo presente estudo foi claramente ambíguo. Cumpre reconhecer, porém, que a contribuição do Banco

melhorou com o passar do tempo, refletindo não apenas um melhor conhecimento, como também o reinvestimento da experiência adquirida pela política ambiental e durante a fase mais recente das suas operações no Brasil. Deve-se também reconhecer —e registrar com satisfação— que muitas das lições adiante resumidas já estão sendo aplicadas no Brasil. Não obstante, elas justificam uma repetição tanto para que não sejam esquecidas, como pelo seu potencial de aplicabilidade em outros países.

Lições em Matéria de Proteção do Meio Ambiente (Capítulo 5)

Na base do estudo de casos, podem-se extrair lições que cruzam três áreas superpostas: proteção do meio ambiente; avaliação e manejo do meio ambiente; e atividades e procedimentos do Banco. Constam a seguir as conclusões principais a que chegou o estudo a respeito das condições prévias para uma efetiva proteção do meio ambiente.

Leis, Políticas e Regulamentos. A proteção do meio ambiente requer uma adequada estrutura de leis, políticas e regulamentos. No Brasil, existem políticas explícitas em matéria de proteção do meio ambiente e dos ameríndios, mas o sistema federal permite aos estados e municípios o exercício de considerável discrição na aplicação das normas e sanções ambientais. De fato, a proteção do meio ambiente revela desempenho consideravelmente diferente entre os estados, e o fortalecimento da estrutura de leis e regulamentos é uma necessidade constante em muitas regiões do país. Ainda é necessário desenvolver políticas nacionais em certas áreas, principalmente as referentes ao reassentamento involuntário.

Capacidade Institucional e Técnica. Tanto o nível nacional como o regional também carecem de adequada capacidade institucional e técnica, incluindo adequados procedimentos de inspeção e aplicação, juntamente com equipamento e instalações de laboratório, apoio logístico e recursos humanos suficientes para um eficiente acompanhamento e controle da degradação ambiental. Deve o Banco continuar a apoiar o fortalecimento dos órgãos ambientais do Brasil e de outras naçes.

Compromisso e Responsabilidade Política. Além da necessidade de assegurar o apoio político inequívoco aos objetivos ambientais, também é necessário introduzir, no sistema, um elemento de responsabilidade que assegure que, uma vez estabelecido, o aparelho administrativo e técnico responda adequadamente ao seu mandato legal. Em São Paulo, o forte cometimento de um governador populista no sentido de "limpar" Cubatão representou um fator preponderante no redirecionamento e na subseqüente obtenção de resultados positivos do Projeto de Controle da Poluição Industrial I. Em contraste, nos primeiros anos do POLONOROESTE, o limitado apoio político tanto em nível federal como estadual dificultou a obtenção das metas de proteção do meio ambiente. Com maior compromisso local nos últimos anos, registrou-se marcante progresso.

Conscientização do Público e Participação Comunitária. Em última análise, a geração do compromisso político e da responsabilidade indispensáveis para alcançar as metas ambientais requerem alto nível de conscientização do público e de participação comunitária em apoio a essas metas. Assim, o Banco deve continuar a apoiar programas de educação ambiental e estimular a participação de associações comunitárias e outras ONG no controle do meio ambiente. Por ser provável que as dificuldades em estabelecer eficientes instituições de proteção ambiental e seus mecanismos de aplicação sejam maiores em regiões de baixa renda, como as que são atravessadas pelo rio São Francisco, a ferrovia de Carajás e a rodovia Cuiabá-Porto Velho, estas, assim como áreas de grande população e industrialização, como o Grande São Paulo, devem receber atenção prioritária.

Regulamentos e Incentivos Econômicos. Quando os benefícios da adoção dessas medidas superam claramente os seus custos, o controle da poluição e outras formas de proteção ambiental requerem uma combinação de regulamentos e instrumentos econômicos, incluindo impostos, taxas e outros incentivos. O Brasil, tal como muitos outros países, tem-se baseado tradicional e fundamentalmente em regulamentos. Contudo, os estudos de casos sugerem que, especialmente em áreas como a do corredor de Carajás e da região Noroeste, é provável que a efetiva aplicação de normas ambientais seja dispendiosa e que se deveria confiar em maior escala nos incentivos econômicos. O Banco e o governo de Rondônia estão procurando aplicar esta última opção, combinando um instrumento de planejamento técnico para orientar os investimentos públicos e privados (zoneamento agroecológico) com incentivos e desincentivos para estimular o uso sustentável de recursos naturais. Da mesma forma, uma alternativa freqüentemente proposta para o controle da poluição industrial consiste em adotar abordagens de orientação de mercado, tais como licenças de emissão negociáveis. As iniciativas de adoção dessas medidas no Brasil e em outras naçes devem ser cuidadosamente acompanhadas e avaliadas.

Lições Para a Avaliação e o Manejo Ambiental (Capítulo 6)

A Compreensão do Contexto. A lição mais óbvia extraída dos estudos de casos, referente ao manejo de futuros proje-

tos similares, é a necessidade de efetuar uma completa avaliação ambiental *ex ante* e de incorporar seus resultados ao desenho e à implementação dos projetos. O desenvolvimento de uma adequada compreensão dos cenários específicos envolvidos é de particular importância em áreas extensas, ecologicamente heterogêneas, demograficamente dinâmicas e/ou social e economicamente complexas. As lições comentadas a seguir guardam relação com essa conclusão geral.

Manutenção de um Enfoque Espacial. Um critério espacial para avaliação ambiental e o manejo de recursos naturais é indicado pelas seguintes razões: (a) freqüentemente, os investimentos e a atividade produtiva em determinado local afetam a qualidade do meio ambiente e o uso de recursos naturais em outros locais; (b) muitos efeitos ambientais são indiretos ou só se revelam a longo prazo; e (c) os investimentos em projetos interagem com forças do mercado e outras intervenções públicas —tal como ocorreu com as obras rodoviárias e os incentivos fiscais no caso de Carajás— afetando o uso de recursos naturais no nível local e regional. A existência de uma "unidade de conta espacial", como uma bacia hídrica ou a área de influência de um grande investimento em transportes, facilitará a identificação e o acompanhamento desses efeitos.

Adoção de Uma Abordagem Setorial Cruzada e Multidisciplinar. Por muitas das mesmas razões indicadas no parágrafo anterior, os estudos de casos confirmam a necessidade de adotar um critério setorial cruzado e multidisciplinar em matéria de avaliação e manejo do meio ambiente. A participação de ecologistas, de cientistas sociais que não seja economistas e de especialistas em desenvolvimento institucional reveste especial importância.

Consideração de Impactos Ambientais Induzidos. Várias das operações examinadas, especialmente os projetos de Sobradinho e Carajás e o POLONOROESTE, exerceram significativos impactos de desenvolvimento induzidos, que não foram suficientemente previstos durante a preparação e a avaliação dos projetos. Sempre que possível, cumpre identificar esses impactos e, sempre que necessário, adotar medidas de atenuação, quer como parte integrante do próprio projeto mais amplo, quer mediante operações paralelas adequadamente desenhadas e executadas.

Consideração de Aspectos Inter-regionais. Um aspecto essencial da avaliação ambiental refere-se aos nexos entre o desenvolvimento local e o que ocorre em outras regiões do país. No Brasil, por exemplo, a compreensão desse relacionamento é crítica tanto para entender o alcance e a natureza das pressões demográficas exercidas sobre a região Nordeste, como para idealizar alternativas de política para as formas de ocupação contínua e insustentável de terras no oeste da Amazônia.

Aferição de Conseqüências Políticas Não-programadas. Os estudos de casos também ilustram o significativo impacto que as políticas não relacionadas especificamente com o uso de recursos renováveis (tais como os incentivos fiscais e de crédito) podem exercer, de modo mais geral, sobre o uso dos recursos e a qualidade do meio ambiente. Qualquer política que afete a distribuição populacional, os padrões de colonização, as atividades produtivas e, assim, os recursos naturais, afetarão o ambiente humano e físico. O potencial de conseqüências ambientais e sociais de políticas macroeconômicas e setoriais (incluindo as de caráter comercial e fiscal) não deve ser desprezado, adotando-se, se necessário, medidas de atenuação. As implicações ambientais de políticas para os setores da agricultura, indústria, energia e transportes devem merecer atenção especial.

Recomendações Aplicáveis às Operações do Banco (Capítulo 7)

A reorganização de 1987, a adoção de normas de avaliação ambiental em 1989 e sua atualização em 1991 já colocaram o Banco em linha com muitas das sugestões acima formuladas. As conclusões dos estudos de casos sustentam solidamente as medidas que o Banco adotou nos últimos anos. Não obstante, existem diversas áreas cuja melhoria adicional é aconselhável.

Integração do Meio Ambiente na Atividade Econômica e Setorial. O Banco pode exercer influência sobre o manejo de recursos naturais e a proteção ambiental por meio do seu diálogo permanente sobre políticas nacionais e das suas atividades econômicas e setoriais (ESW). Isso inclui tanto as atividades especificamente ligadas a questões ambientais como as que se referem a outras questões — inclusive as macroeconômicas. Em relação a estas últimas, embora o Banco em geral tenha registrado substancial progresso nos últimos anos, ainda existe muito a fazer no sentido de melhor integrar as questões ambientais nas ESW no Brasil e em outras nações.

Fortalecimento de Instituições Nacionais. O apoio e o fortalecimento da capacidade institucional e técnica nacional e subnacional revestem importância particular. Quando necessário, deve-se dedicar mais atenção ao desenvolvimento ou à consolidação das estruturas políticas, legais, reguladoras e administrativas e aos sistemas de informação, meios de acompanhamento e mecanismos de coerção necessários para o uso mais sustentável de recursos renováveis e a efetiva proteção do meio ambiente. A necessidade de maior conscientização do público a respeito dos problemas ambientais, suas causas e suas possíveis

soluções mediante programas de educação pública, campanhas de mídia, participação de ONG e outros meios, de modo a imprimir maior responsabilidade ao processo decisório local e nacional em matéria ambiental deve ser uma preocupação específica do diálogo que o Banco mantém sobre políticas nacionais e das suas operações de empréstimo.

Melhoria da Avaliação Ambiental ex Ante. O Banco deve empenhar-se, como atividade de rotina, em procurar compreender integralmente os potenciais e as restrições ecológicas e os processos sócio-econômicos, políticos e institucionais subjacentes que afetam a continuidade do desenvolvimento nas áreas geográficas em que se localizam os seus projetos. Particular atenção deve ser atribuída a impactos ambientais possivelmente irreversíveis e a áreas com sistemas ecológicos delicados ou grande concentração populacional. Com base na experiência do Brasil, devem-se considerar, entre outros, os seguintes "fatores nacionais" : (1) *fatores demográficos e econômicos*, incluindo o possível impacto de cenários demográficos alternativos, da instabilidade econômica e de políticas destinadas a outros propósitos, sobre o uso de recursos naturais e a eficácia de medidas de proteção ambiental; (2) *fatores de governação*, incluindo o grau do compromisso do mutuário para com objetivos ambientais, o grau de conscientização do público e de participação comunitária e os prováveis efeitos positivos e negativos da descentralização política e administrativa; e (3) *limitações da capacidade institucional.*

Aperfeiçoamento do Desenho de Projetos. Os estudos de casos indicam quatro áreas que se prestariam a melhoramentos de desenho de projetos: (1) melhor integração dos "fatores nacionais" acima citados; (2) melhor equilíbrio e conexão cronológica entre os componentes físicos de um projeto e seus componentes institucionais e de políticas; (3) melhoria das disposições contratuais sobre meio ambiente; e (4) análise de risco mais extensa e maior provisão para contingências. As disposições sobre meio ambiente e outros instrumentos relativos a áreas de acordo sobre a implementação de projetos devem explicar claramente a natureza e o momento das medidas ambientais de precaução e atenuação a serem adotadas em conexão com projetos do Banco. A análise de risco e a provisão para contingências devem integrar-se na preparação de grandes operações que exerçam impacto a longo prazo e possivelmente irreversível sobre populações afetadas e/ou o ambiente físico, com base em dois simples princípios: (1) escolher os desenhos de projetos que ofereçam maior flexibilidade em relação a outros excessivamente rígidos; e (2) basear o desenho do projeto num conjunto de projeções de custo, benefício e probabilidades, a fim de melhorar sua "robustez" em face de uma ou mais possíveis condições adversas, em termos de desempenho macroeconômico, políticas, governação e capacidade institucional de um país.

Fortalecimento da Supervisão. Os estudos de casos identificaram situações em que a supervisão do Banco tanto foi insuficiente como de crítica importância para assegurar um resultado positivo. Contudo, o saldo de resultados dos estudos sugere a necessidade de fortalecer a supervisão dos componentes ambiental e social dos projetos. Especialmente no caso de operações grandes, complexas ou de maior risco, capazes de exercer substancial impacto ambiental e /ou social, o Banco, durante a supervisão, deveria acompanhar sistematicamente o desempenho do projeto e quaisquer mudanças relevantes no seu contexto, de modo a "sinalizar" quaisquer alterações significativas nos parâmetros básicos adotados na avaliação e a permitir a introdução, da maneira mais oportuna possível, das necessárias modificações no desenho do projeto. Nesses casos, também se deveriam efetuar revisões gerais de meio-termo.

Melhoria do Acompanhamento, dos Relatórios e da Supervisão. Também é importante a necessidade de acompanhamento e avaliação independente e multidisciplinar do desempenho do projeto, abrangendo suas metas, seus problemas e seus impactos ambientais. Quando viável, deve-se incentivar a participação de ONG locais, nacionais e internacionais responsáveis nas atividades de acompanhamento ambiental. Os requisitos atuais do Banco em matéria de componentes e conseqüências ambientais na fase de conclusão de um projeto devem ser mais especificados e incluídos como parte das normas de PCR. Finalmente, a avaliação *ex post* do desempenho e dos impactos ambientais do projeto deve ser expandida tanto pelos mutuários como pelo Banco.

Sugestões Para a Distribuição de Recursos Internos. A aplicação das lições do estudo provavelmente exigirá tempo e recursos adicionais para o trabalho econômico e setorial, a avaliação ambiental e, entres outras atividades, as de preparação, avaliação e supervisão de projetos. As atividades necessárias, os recursos adicionais e a combinação de pessoal técnico variarão de um país a outro e representam o assunto de uma análise mais específica do pessoal de operações e meio ambiente do Banco. Já que as despesas adicionais são do interesse direto dos mutuários e do próprio Banco, os recursos adicionais devem ser obtidos, além do orçamento administrativo, junto a uma série de fontes,

entre as quais o serviço de preparação de projetos, empréstimos de engenharia e assistência técnica, fundos ambientais em administração, GEF e novas operações de empréstimo. Todavia, particularmente no caso de países como o Brasil, em que a carteira ambiental é vultosa e cresce com rapidez, e/ou em que as operações atuais provavelmente exercerão significativo impacto humano e sobre o ambiente físico, o Banco deveria considerar a designação, para trabalhos de campo a longo prazo, de um ou mais funcionários ou de consultores, encarregados de prestar assistência na preparação das operações e intensificar a supervisão ambiental, melhorar a comunicação com os mutuários e transmitir uma clara mensagem sobre o interesse do Banco pelos problemas ecológicos e sociais.

Resumen

En el presente estudio se examina la forma en que el Banco abordó las cuestiones ambientales en varios grandes proyectos ejecutados en el Brasil, con el fin de sacar conclusiones que puedan ser de utilidad para las futuras operaciones que entrañen protección, evaluación y ordenación del medio ambiente y para las directrices y procedimientos que dan forma a esas actividades. En el estudio también se da a conocer la evolución de la conciencia ambiental tanto en el Banco como en el Brasil, y la integración cada vez mayor de las cuestiones ambientales en los proyectos ejecutados con asistencia del Banco en las últimas dos décadas.

En el estudio se definieron los "problemas ambientales" en forma consecuente con las políticas del Banco, razón por la cual se examinaron las dimensiones y las consecuencias para el medio físico y humano de las operaciones estudiadas. Se intentó determinar cuáles fueron las principales consecuencias directas e indirectas de las inversiones realizadas en la base de recursos naturales y en las comunidades existentes, los nuevos asentamientos y las actividades productivas, y de evaluar la suficiencia y eficacia de las medidas de mitigación previstas. Este enfoque se justifica debido a que el efecto último de cualquier proyecto en el medio ambiente se mide en función de sus efectos combinados en la migración, los asentamientos humanos, las actividades productivas y el uso conexo de los recursos naturales a través del tiempo.

Debido a que el presente estudio está centrado en los criterios aplicados por el Banco, no intentó medir los efectos ambientales de los proyectos, sino que se limitó a determinar cuáles fueron esos efectos y a señalar las relaciones existentes entre ellos, en la medida en que era necesario para entender en qué aspectos debió el Banco hacer hincapié. Como resultado de ello, no se hizo ningún intento de comparar los costos y beneficios ambientales con los costos y beneficios de otra índole de los proyectos. Por último, debido a que el estudio abarcó esencialmente operaciones terminadas, no se estudiaron en detalle los acontecimientos más recientes, si bien se confirmó que se habían realizado importantes avances tanto conceptuales como sustantivos en lo que respecta a la forma en que el gobierno del Brasil y el Banco han abordado las cuestiones ambientales en los últimos cinco años.

En el Capítulo 1 se describe el contexto de los proyectos estudiados y se presenta una breve reseña de las actividades del Banco en relación con el medio ambiente en el Brasil a partir de 1970. Se examinan proyectos ejecutados en distintos sectores y partes del país a través de cuatro estudios de casos prácticos, que se resumen brevemente en los Capítulos 2 y 3. Cada estudio de casos prácticos se refiere a una región o zona de influencia determinada, de grandes dimensiones y ecológicamente heterogénea, cuya población y economía se hallaban en rápido crecimiento en la época en que se emprendieron las operaciones con asistencia del Banco. Los proyectos examinados en detalle fueron aprobados entre 1974 y 1987 (véase el Anexo 1) y la mayoría quedaron terminados entre 1983 y 1988. El financiamiento total aprobado por el Banco para esos proyectos fue de unos $1.150 millones.

Reducción de la Contaminación Urbana e Industrial en São Paulo

El estado de São Paulo aporta alrededor de la mitad de la producción industrial del Brasil, su ingreso per cápita alcanza aproximadamente al doble del promedio nacional y en él se encuentran las metrópolis más grandes del país. El rápido crecimiento urbano e industrial, en su mayor parte no sujeto a reglamentación y carente del apoyo de servicios de saneamiento adecuados, explica en gran medida el deterioro de la calidad del aire y del agua ocurrido en las últimas décadas. El agua de las zonas urbanas está contaminada por una cantidad cada vez mayor de efluentes industriales y de aguas residuales domésticas; la contami-

nación del aire proviene principalmente de las emisiones de los vehículos motorizados y las industrias.

Dos operaciones aprobadas durante los años setenta a que prestó asistencia el Banco, el proyecto de abastecimiento de agua y reducción de la contaminación en São Paulo (1971) y el proyecto de tratamiento de aguas residuales del Gran São Paulo (1978), contaban entre sus objetivos el mejoramiento del medio ambiente, pero no lograron un control mejor de la contaminación del agua en la zona metropolitana. Las demoras en la ejecución, la insuficiencia de los fondos de contrapartida, las diferencias políticas internas, y el rápido crecimiento de la población limitaron los resultados. La mayor parte de las aguas residuales domésticas de la zona metropolitana de São Paulo permanece sin tratar.

Dos operaciones de reducción de la contaminación industrial ejecutadas más recientemente (en 1980 y 1987) han dado mejores resultados. Cuentan con una línea de crédito para equipos de reducción de la contaminación industrial y para instalaciones de tratamiento, a lo que se suma la prestación de asistencia técnica a la CETESB, organismo estatal encargado del medio ambiente. El primer proyecto experimentó dificultades al comienzo, pero después de haber sido reformulado en 1984, contribuyó manifiestamente a mejorar la calidad del aire, especialmente en la ciudad fuertemente industrializada de Cubatão. El proyecto ha desempeñado también una función catalizadora más amplia. Según se ha informado, para muchas industrias locales la existencia de una fuente de financiamiento para el fin específico de reducir la contaminación, junto con la posibilidad de recibir multas y publicidad negativa por el no cumplimiento de la reglamentación estatal del medio ambiente, fueron motivos suficientes para inducirlas a instalar equipos de reducción de la contaminación, con o sin préstamos apoyados por el proyecto.

El apoyo del Banco al mejoramiento del medio ambiente de la zona metropolitana de São Paulo se ha ampliado con el tiempo. Aunque sus resultados son en general bastante positivos, aún no se han atacado a fondo varias fuentes importantes de contaminación ambiental, como por ejemplo, el polvo de los caminos y las emisiones vehiculares. La experiencia enseña que, para ser eficaz, la ordenación del medio urbano debe ser global y debe comprender medidas de política a nivel nacional, como la reducción de las emisiones vehiculares, además de reglamentación local, inversiones públicas y medidas orientadas al desarrollo institucional.

Energía Eléctrica, Reasentamiento Involuntario y Riego en el Valle del Río São Francisco

El aprovechamiento de la energía hidroeléctrica en Sobradinho, el establecimiento conexo de sistemas de riego en los pólder del valle inferior del São Francisco, y el reasentamiento resultante del embalse de Itaparica tuvieron efectos profundos en el valle intermedio e inferior de São Francisco en el nordeste del Brasil. Los proyectos han beneficiado a cientos de miles de habitantes del nordeste al proporcionarles más electricidad y tierras de regadío, pero también han desplazado a decenas de miles de personas y producido otros importantes efectos socioeconómicos. La agricultura de regadío, en gran parte dedicada a la producción de cultivos comerciales y de exportación, ha estimulado el crecimiento de la agroindustria, a la que presta servicios una red cada vez más compleja de transporte y comunicaciones. Al mismo tiempo, ha contribuido al reemplazo de los pequeños agricultores de subsistencia por agricultores más grandes, orientados a la producción comercial. La rápida urbanización del valle intermedio contrasta, a su vez, con el estancamiento de varios centros urbanos situados en el valle intermedio-inferior del São Francisco y en las proximidades de la desembocadura del río.

La construcción de la presa reguladora de Sobradinho como parte del proyecto de energía hidroeléctrica Paulo Afonso IV (1974) desplazó a unas 70.000 personas. Si bien el reasentamiento urbano en Sobradinho dio resultados bastante satisfactorios, no ocurrió lo mismo con el programa de reasentamiento rural. Un plan oficial de colonización, que se esperaba que atrajera a la mitad de la población rural desplazada, atrajo en la práctica a una proporción mucho menor, y muchos de los colonos abandonaron posteriormente la zona. La mayor parte de la población afectada optó por permanecer cerca del embalse, pero recibió apoyo insuficiente en materia social y de producción. Las *agrovilas* (aldeas) establecidas cerca del embalse no prosperaron debido a que los agricultores con frecuencia carecían del crédito y de los servicios de apoyo necesarios para superar los problemas causados por la pobreza de los suelos, las instalaciones de riego incompletas, las variaciones del nivel de las aguas y las mayores distancias hasta los mercados.

La regulación del río São Francisco mediante la presa de Sobradinho también dio como resultado un fuerte aumento del caudal mínimo en el valle inferior, que amenazaba con inundar unas 9.000 hectáreas de tierras fértiles destinadas a arrozales. El proyecto de construcción de pólder en el valle inferior de São Francisco y el segundo proyecto de riego (1975, 1979) fueron operaciones de "emergencia" destinadas a proteger los terrenos aluviales próximos a la desembocadura del río mediante una serie de diques y estaciones de bombeo y a establecer pólder de regadío en unas 25.000 hectáreas. También tenían por objeto promover el adelanto económico y social de los pobres de las zonas rurales dándoles acceso a la tenencia de la tierra, al crédito y a la tecnología. Los proyectos absorbieron aproximadamente a 20.000 personas, cuyos ingresos, según se ha informado, aumentaron en promedio a más del triple. En total, sin embargo, alrededor de 50.000 residentes rurales, principalmente aparceros itinerantes, resultaron desplazados del valle infe-

rior entre 1975 y 1980. A diferencia del caso de Sobradinho, esta vez no se elaboró una estrategia de reasentamiento más generalizado.

En el proyecto de Itaparica (1987), la construcción de la presa y el embalse (no financiada por el Banco) se acompañó de un amplio programa de reasentamiento financiado por el Banco, para el que se escuchó la opinión de representantes de la población local. La intervención del Banco estuvo guiada por su política de reasentamiento involuntario, adoptada por primera vez en 1980 —en gran parte como reacción a la experiencia de Sobradinho— y elaborada con más detalle en 1986. Durante 1987 y 1988 se procedió a reasentar a unas 40.000 personas, de las cuales alrededor de la mitad optó por irse a las *agrovilas* y el resto por trasladarse a cuatro nuevos centros urbanos que reemplazarían a los pueblos que quedarían anegados. El costo final del reasentamiento rural en Itaparica probablemente llegue a ser superior a $63.000 por familia. Aunque se trasladó con éxito a la población, la producción agrícola ha tenido que esperar a que termine la lenta instalación de equipo de riego. El ocio prolongado, las pocas oportunidades de encontrar trabajo en el lugar y las ocasionales deficiencias en el suministro de servicios sociales han contribuido a crear un clima de incertidumbre y frustración. Sin embargo, debido en gran parte a la planificación anticipada de la CHESF, orientada a instituir controles adecuados en los planos físico, biológico y sociocultural, las consecuencias ecológicas de Itaparica han sido escasas hasta el momento.

Explotación del Mineral de Hierro e Infraestructura de Transporte en la Amazonia Oriental (Carajas)

En los años sesenta y setenta, el gobierno del Brasil tomó ambiciosas medidas orientadas a integrar a la Amazonia en su economía en rápida expansión. Se construyeron carreteras y se elaboraron programas de asentamiento, en tanto que mediante estrategias de fomento del crecimiento y de incentivos fiscales se esperaba atraer capitales privados hacia la región. Se emprendieron proyectos hidroeléctricos e industriales en gran escala en la Amazonia oriental. Al mismo tiempo, un gran número de pequeños agricultores y trabajadores rurales estaban siendo desplazados de la zona sudcentral del Brasil por la modernización agrícola y la concentración de tierras y de la zona nororiental por las presiones demográficas, las sequías periódicas y la pobreza. La necesidad de los desplazados de encontrar empleo remunerado dio nuevo impulso a los programas de asentamiento dirigido en la Amazonia. El proyecto de explotación del mineral de hierro de Carajas y el programa POLONOROESTE fueron elementos fundamentales de la estrategia aplicada por el gobierno para promover la ocupación productiva del territorio no desarrollado de la Amazonia.

El proyecto de Carajas prestó apoyo a grandes inversiones en infraestructura de transporte y actividades mineras, así como también a componentes más pequeños de desarrollo urbano y de protección del medio ambiente y la población amerindia a lo largo de una franja de 900 kilómetros en los estados de Pará y Maranhão. Esa franja une a uno de los depósitos de mineral más ricos del mundo con una terminal portuaria próxima a la ciudad nororiental de São Luis. El establecimiento de los complejos minero, ferroviario y portuario produjo importantes beneficios económicos: creación de empleos en las industrias de la construcción, la minería y la metalurgia, así como en las actividades comerciales y de servicios conexas, el transporte ferroviario y caminero, y parte de la infraestructura urbana.

Sin embargo, la zona de influencia de la operación de Carajas es una de las partes de la Amazonia que ha experimentado las tasas más altas de deforestación y degradación ambiental de las últimas dos décadas. La ejecución del proyecto de explotación del mineral de hierro y la urbanización que la acompañó atrajeron a la zona a trabajadores de la construcción y otros colonos. Los nuevos corredores de transporte facilitaron el acceso a extensas zonas de la región, que anteriormente estaban aisladas. Se instalaron especuladores en tierras a lo largo de los caminos y las vías férreas, en tanto que el desbroce de tierras a lo largo del corredor de Carajas aumentó considerablemente en las últimas dos décadas. Además de proporcionar la madera necesaria para construir la vía férrea, las demás instalaciones del proyecto y las viviendas locales, en años más recientes la tala del monte nativo ha tenido por objeto producir carbón de leña para los fundidores de hierro en lingotes. Gran parte de la zona talada ha sido convertida en pastizal para pastoreo de baja densidad. Pero, generalmente dentro de los diez años siguientes al primer desbroce, la aparición de malezas y otros tipos de vegetación de segunda generación difíciles de mantener bajo control induce a los ganaderos a abandonar la tierra. Esto a su vez estimula el desbroce de nuevas tierras. La colonización de las zonas rurales y la deforestación que trae consigo también han dado como resultado cierta reducción de la fauna autóctona.

Cuando se aprobó el préstamo del Banco para el proyecto de Carajas (1982), esos procesos ya estaban en marcha en algunas partes de la región. La CRVD, la empresa minera de propiedad estatal más grande del Brasil, estaba ya apresurando la construcción en varios frentes. La mayoría de las decisiones relativas al diseño ya se habían tomado y se estaban poniendo en práctica. Se estipularon medidas concretas de control ambiental en el sitio de la explotación minera y en el puerto, así como en las inmediaciones de la línea férrea, además de medidas de protección de la población amerindia, pero las consecuencias ambientales de carácter más general derivadas de la operación relativa al mineral de hierro, junto con otras tendencias del desarrollo que

afectaban a la zona de influencia de la operación, no se previeron. Acontecimientos imprevistos como los intentos de otro organismo gubernamental de ejecutar un proyecto de asentamiento agrícola en el borde de la concesión minera de la CVRD y la proliferación de la prospección de oro en la zona, fomentaron todavía más la ocupación de la parte occidental del corredor ferroviario de Carajas, con el consiguiente daño al medio ambiente.

El componente ambiental del proyecto —que consistía principalmente en mantener bajo control la erosión del suelo a lo largo de la vía férrea y proporcionar drenaje y reducir los efluentes en los emplazamientos de la mina y el puerto— fue ejecutado satisfactoriamente. No obstante, fuera de las zonas controladas por la CVRD, prácticamente no existían medidas de protección del medio ambiente.

A su vez, el proyecto especial para la población amerindia proporcionó servicios de demarcación de la tierra, salud, desarrollo económico y educación. El Banco apoyó a la CVRD en sus esfuerzos por inducir a la Fundación Nacional Indígena (FUNAI) y al gobierno Federal a poner en práctica las actividades acordadas en virtud del convenio sobre el proyecto especial y del convenio de garantía del préstamo. Con todo, la CVRD suspendió en 1986 los desembolsos para el proyecto especial debido a problemas de ejecución. Aunque el proyecto especial efectivamente mejoró las condiciones en materia de atención de la salud y demarcación de la tierra, al momento de cerrarse la operación sobre el mineral de hierro quedaban sin resolver varias cuestiones relativas a la tierra. La CRVD sigue tomando medidas en favor de la población indígena local utilizando sus propios recursos, pero debido a la constante expansión de los asentamientos rurales, la perdurabilidad de los esfuerzos por proteger a los amerindios está en duda.

Mejoramiento de Caminos y Desarrollo Rural en la Amazonia Occidental (POLONOROESTE)

En 1981 el gobierno inició el Programa de Desarrollo Integrado de la Región Noroeste, o POLONOROESTE, en las zonas agrícolas límites de Rondônia y el noroeste del Matto Grosso. Con un costo estimado de $1.600 millones, el objetivo principal del programa era absorber la afluencia de población mediante la ampliación de la infraestructura y el aumento de la productividad agrícola, los ingresos rurales y el bienestar social. Los seis préstamos del Banco prestaron apoyo a la pavimentación de la carretera federal entre Cuiabá y Porto Velho, la ampliación de la red de caminos secundarios, la consolidación de los planes de asentamiento existentes y el establecimiento de otros nuevos, el mejoramiento de los servicios sociales rurales —en especial de salud— y la aplicación de medidas para proteger el medio ambiente natural y las poblaciones indígenas. Como en el caso de Carajas, el gobierno financió un proyecto especial para la población amerindia dentro de un marco convenido con el Banco.

En esas circunstancias, era inevitable que la construcción de caminos diera impulso a nuevas migraciones. Como incentivo del proceso, el inicio del programa POLONOROESTE coincidió con una de las crisis económicas más agudas del Brasil de la posguerra. Grandes cantidades de residentes urbanos, que se sumaron a la corriente ininterrumpida de migrantes de las zonas rurales, se dirigieron rumbo al noroeste a comienzos y mediados de la década de 1980. Rondônia, especialmente, resultaba todavía más atractiva debido a la rápida expansión de la prospección de oro, la minería de casiterita y la extracción de madera de construcción con fines comerciales.

En el diseño del programa POLONOROESTE se incorporaron cuestiones sociales y ambientales que, en esa época y en el contexto de las tierras no explotadas de la Amazonia, eran progresistas, y el Banco intentó establecer salvaguardias dentro del programa. Sin embargo, ni en la preparación ni en la evaluación previa se tuvieron suficientemente en cuenta distintas hipótesis sobre la tasa de migración hacia la zona ni sobre sus consecuencias para el uso de los recursos naturales. Gran parte de la degradación ambiental que posteriormente ha sido relacionada con el programa es resultado de la incapacidad del gobierno de mantener bajo control la expansión de los asentamientos rurales y urbanos y, por ende, de impedir que los inmigrantes trataran de explotar precisamente aquellas zonas cuya protección era uno de los objetivos originales del programa. La tala de bosques en las zonas de suelos pobres, por ejemplo, ha causado la destrucción de delicados mecanismos de reciclado de nutrientes, lo que ha provocado la pérdida de la fertilidad del suelo y un aumento de la erosión. La conversión de los bosques tropicales en tierras agrícolas, pastizales y vegetación de segunda generación también ha dado como resultado cierta disminución de la diversidad biológica.

Las inversiones en caminos previstas en el programa POLONOROESTE se ejecutaron satisfactoriamente, lo que permitió a los asentados mayor acceso a los mercados y servicios. Pero los servicios de apoyo agrícola, los servicios comunitarios y las medidas de protección del medio ambiente y de la población amerindia se quedaron atrás. Una detallada supervisión realizada a fines de 1984 a mediados del período de ejecución puso de relieve las diferencias entre las hipótesis formuladas en el diseño y las condiciones en las que se estaba ejecutando el programa, a saber, un número de migrantes muy superior al proyectado; desembolsos insuficientes y tardíos de los fondos de contrapartida debido al deterioro de la situación fiscal nacional; falta del crédito de inversión necesario para establecer cultivos perennes; centralización excesiva de la administración del proyecto, e integración ineficaz de los organismos participantes. Como resultado de ello, el Banco suspendió extraoficialmente los

desembolsos para el programa en marzo de 1985. El financiamiento se reanudó en agosto de 1985 después de que las autoridades federales hubieron tomado medidas para proteger las zonas vulnerables habitadas por amerindios y se hubo llegado a un acuerdo sobre la forma de dar una nueva orientación al programa.

Según su diseño original, el programa POLONOROESTE tenía ambiciosos subcomponentes de silvicultura, medio ambiente e investigación ecológica, pero su ejecución durante los primeros años se vio frustrada debido a que los conocimientos técnicos eran insuficientes, el medio normativo poco favorable, la capacidad institucional inadecuada y los fondos de contrapartida escasos. Sin embargo, como resultado de la nueva orientación que se dio al programa después de la suspensión de los desembolsos, se pusieron en práctica reformas institucionales y nuevas iniciativas en materia ambiental en la región. Se establecieron organismos estatales de protección del medio ambiente y se les prestó apoyo con recursos del programa. Se adoptaron medidas correctivas orientadas a controlar mejor la explotación forestal, como impuestos más altos a la explotación de los bosques, multas más elevadas a la extracción ilegal de madera y establecimiento de una Policía Militar Forestal para reforzar el cumplimiento de las medidas y de un Instituto Forestal del Estado para proporcionar servicios de extensión.

En suma, el proyecto especial para la población amerindia ha resultado eficaz hasta el momento. No obstante, debido a la crónica escasez de fondos y de personal de la FUNAI, la situación de desventaja de los amerindios en la sociedad brasileña y su situación especialmente vulnerable en las zonas de avance de las fronteras, como en el caso de Carajas, la sustentabilidad a más largo plazo de las reservas indígenas establecidas en virtud del programa requiere apoyo externo constante.

Actuación del Banco (Capítulo 4)

El Banco abordó los proyectos examinados con preocupación por el medio ambiente. En los estudios de casos prácticos hay varios ejemplos de medidas adoptadas por el Banco a título experimental con objeto de ampliar el enfoque adoptado tradicionalmente para la elaboración de proyectos, entre ellas, el "reconocimiento" ambiental realizado en Sobradinho durante la evaluación preliminar, una misión de estudio multidisciplinaria en la región del noroeste, y la participación del Banco y de consultores antropólogos y ecólogos en la evaluación y supervisión de los componentes de protección de la población amerindia y del medio ambiente del proyecto de Carajas y del programa POLONOROESTE y, más recientemente, en la preparación, evaluación y supervisión del proyecto de reasentamiento de Itaparica.

En algunos casos, los cambios tomaron una forma que no podría haber sido prevista totalmente por el prestatario ni por el Banco, o se produjeron en una escala mucho mayor que la esperada, con consecuencias que resultaron ser contrarias a los objetivos ambientales del proyecto. Una de las causas principales de ello fueron los factores y acontecimientos que escaparon al control de las autoridades del proyecto, como el grave deterioro de la situación económica del país. No hay planificación estratégica que hubiera podido compensar todos los efectos adversos de esos imprevistos. Cabría recordar también que en los años setenta y comienzos de los ochenta las prácticas y salvaguardias corrientes en relación con el medio ambiente eran menos estrictas que las aplicadas actualmente por el Banco o en el Brasil. Además, en el caso concreto del programa POLONOROESTE, el Banco, con muy buen criterio, una vez que percibió claramente que había un grave desequilibrio en la ejecución del proyecto, suspendió los desembolsos y la operación fue reformulada. La reorientación, a mediados del período de ejecución de la primera operación de reducción de la contaminación industrial en São Paulo, produjo efectos igualmente positivos.

A pesar de esas consideraciones, al dar una mirada retrospectiva a algunas de las decisiones adoptadas en las etapas de diseño y evaluación de los proyectos examinados, éstas parecen haber sido inadecuadas. En varios casos, ni el Banco ni el prestatario tuvieron debidamente en cuenta las probables consecuencias ambientales o sociales de las inversiones propuestas. Además, al igual que en otros países a los que el Banco ha concedido préstamos, en el procesamiento de esas operaciones no se abordaron adecuadamente las cuestiones intersectoriales e interregionales ni los efectos paralelos de los incentivos de política y las fuerzas del mercado en el uso de los recursos naturales y en la calidad del medio ambiente en las zonas de influencia de los proyectos. Fuera de eso, en el caso de Carajas, las estipulaciones del préstamo para el proyecto no hacían referencia concreta al tema, por lo que era difícil saber qué precauciones ambientales era necesario tomar o en qué forma debía el Banco vigilar su aplicación. En términos más generales, el diseño de esas operaciones no dejaba margen para riesgos que eran verosímiles desde el primer momento (por ejemplo, mayor volumen de migraciones hacia la región noroeste). Esas deficiencias se debieron en parte al conocimiento insuficiente del contexto al que se aplicarían los préstamos del Banco, laguna que se habría podido llenar al menos en parte mediante una evaluación previa más completa del aspecto ambiental.

De los estudios sobre casos prácticos se desprende que hubo casos en que la supervisión del Banco fue insuficiente y otros en que contribuyó en forma decisiva a que los resultados fueran satisfactorios. En los casos de supervisión insuficiente, una de las razones principales parece haber sido

la falta de apreciación inicial de las complejidades y la dinámica de las zonas que abarcarían los proyectos. Además, el Banco no siempre aplicó los mismos criterios a los distintos proyectos. Así como el noroeste fue objeto de un estudio multidisciplinario y el programa POLONOROESTE tenía componentes de desarrollo rural, salud y protección ambiental, la operación ejecutada en el igualmente delicado corredor de Carajas fue mucho más limitada, si bien fue objeto de evaluación más o menos al mismo tiempo que las otras. Y aunque las poblaciones indígenas fueron objeto de la preocupación del Banco tanto en el programa POLONOROESTE como en el proyecto de Carajas, otros grupos sociales vulnerables afectados por las inversiones de los proyectos no recibieron la misma atención.

También hubo casos en que las intervenciones de los proyectos no se realizaron en la secuencia adecuada. En el caso del programa POLONOROESTE, por ejemplo, en que los caminos se construyeron a tiempo pero los servicios para la corriente resultante de migrantes tardaron en establecerse, el fortalecimiento institucional, especialmente en lo que respecta a la protección del medio ambiente, debió haber precedido al mejoramiento de la infraestructura, en tanto que la realización de estudios del suelo y otros recursos naturales propios del lugar debió haber precedido a la decisión de emprender nuevos proyectos de colonización. En los proyectos del valle de São Francisco, la preparación y ejecución de las medidas de reasentamiento y los planes de riego se vieron obstaculizadas por la programación de inversiones más grandes en infraestructura física.

Por último, en varios casos la participación relativamente tardía del Banco en la preparación de los proyectos tal vez haya impedido que se trataran más eficazmente las cuestiones ambientales o sociales. En el proyecto de Carajas, todas las principales decisiones de diseño relacionadas con el transporte del mineral se tomaron antes de que el Banco iniciara efectivamente su participación, y no se prestó atención a los posibles costos ambientales de los distintos medios de transporte considerados. Además, a diferencia de los proyectos de Sobradinho y POLONOROESTE, el Banco no insistió en que se hiciera una evaluación ambiental ni en que se definieran las medidas de mitigación a nivel regional antes de la aprobación del préstamo. A su vez, la participación del Banco en el proyecto de Itaparica, que se produjo sólo después de que la situación prácticamente había alcanzado proporciones de crisis, parece haberse traducido en soluciones de alto costo para el reasentamiento rural.

En síntesis, la actuación del Banco en cuanto a la forma en que se abordaron las cuestiones ambientales y sociales en las operaciones examinadas en el estudio fue claramente desigual. Sin embargo, es preciso reconocer que, a medida que pasaba el tiempo, la contribución del Banco mejoraba, como resultado no sólo del aumento de los conocimientos, sino de la aplicación de la experiencia adquirida en materia de política ambiental y en la etapa más reciente de sus operaciones en el Brasil. Es preciso reconocer también —y celebrar— que muchas de las lecciones aprendidas, que se resumen a continuación, se están aplicando ya en el Brasil. Con todo, merece la pena repetirlas para tener la seguridad de que se quedarán en la memoria y debido a que es probable que se apliquen en otros países.

Conclusiones en Materia de Protección Ambiental (Capítulo 5)

Sobre la base de los estudios de casos prácticos, se pueden sacar conclusiones a través de tres esferas que se superponen: la protección ambiental; la evaluación y ordenación del medio ambiente, y las actividades y procedimientos del Banco. Las conclusiones principales del estudio con respecto a las condiciones previas para una protección eficaz del medio ambiente son las que se enuncian a continuación.

Marco Normativo, Jurídico y Reglamentario. La protección del medio ambiente requiere un marco normativo, jurídico y reglamentario adecuado. El Brasil tiene políticas explícitas para la protección ambiental y de la población amerindia, pero su sistema federal permite a los estados y municipalidades considerable discreción en cuanto a la forma en que se aplican las normas y sanciones relativas al medio ambiente. De hecho, los resultados de la protección ambiental difieren considerablemente entre estados y existe una necesidad constante de fortalecer al marco jurídico y reglamentario en muchas partes del país. Aún quedan por elaborar políticas nacionales en algunas esferas, especialmente en relación con el reasentamiento involuntario.

Capacidad Institucional y Técnica. También se necesitan capacidades institucionales y técnicas adecuadas tanto en el plano nacional como en el subnacional, lo que incluye procedimientos apropiados de inspección y coacción, conjuntamente con equipos e instalaciones de laboratorio, apoyo logístico y recursos humanos suficientes para observar y controlar de manera eficaz la degradación ambiental. El Banco debería seguir prestando apoyo al fortalecimiento de los organismos que se ocupan del medio ambiente tanto en el Brasil como en otros lugares.

Compromiso y Responsabilidad Política. También es preciso obtener apoyo político inequívoco para los objetivos ambientales e incorporar la responsabilidad política al sistema para tener la seguridad de que el aparato administrativo y técnico, una vez establecido, responderá adecuadamente a su mandato legal. En São Paulo, la profunda dedicación de un gobernador elegido por votación popular a la "limpieza" de Cubatão jugó un importante papel en la reorienta-

ción y posteriores resultados favorables del primer proyecto de reducción de la contaminación industrial. En los primeros años del programa POLONOROESTE, por el contrario, el limitado apoyo político con que contaba tanto a nivel federal como estatal hizo difícil la consecución de los objetivos de protección ambiental. Debido a que en los últimos años ha habido un compromiso mayor a nivel local, se ha logrado un progreso notable, según se ha informado.

Conciencia Pública y Participación de la Comunidad. Para generar la voluntad y responsabilidad políticas necesarias para alcanzar los objetivos ambientales se requiere, por último, tanto un elevado nivel de conciencia de la población como una activa participación popular y comunitaria en apoyo de esos objetivos. Por consiguiente, el Banco debería continuar su apoyo a los programas de educación ambiental y alentar a las asociaciones comunitarias y otras organizaciones no gubernamentales a participar en la vigilancia del medio ambiente. Como es probable que las dificultades para establecer instituciones de protección ambiental y mecanismos de aplicación eficaces sean mayores en las regiones de bajos ingresos como las atravesadas por el río São Francisco, la línea férrea de Carajas y la carretera Cuiabá-Porto Velho, éstas, junto con las zonas densamente pobladas y fuertemente industrializadas como la zona metropolitana de São Paulo, deberían recibir atención prioritaria.

Reglamentación e Incentivos Económicos. Cuando los beneficios de la reducción de la contaminación y demás formas de protección del medio ambiente son claramente superiores a los costos, la adopción de tales medidas requiere una combinación de reglamentación e instrumentos económicos como impuestos, gravámenes y otros incentivos. El Brasil, al igual que muchos otros países, tradicionalmente ha recurrido más que nada a la reglamentación. Los estudios de casos prácticos indican, sin embargo, que especialmente en zonas como el corredor de Carajas y la región noroeste, es probable que la aplicación eficaz de la reglamentación ambiental resulte costosa, por lo que se debería hacer mayor uso de los incentivos económicos. El Banco y el gobierno estatal están actualmente tratando de hacerlo en Rondônia a través de la combinación de un instrumento de planificación técnica para dirigir las inversiones públicas y privadas (zonificación agroecológica), con incentivos y desincentivos para fomentar el uso sostenible de los recursos naturales. De modo similar, una opción que se propone con frecuencia para reducir la contaminación industrial es el uso de métodos basados en el mercado como los permisos de emisiones comercializables. Los esfuerzos tendientes a adoptar ese tipo de medidas en el Brasil y en otros lugares deberían ser objeto de cuidadosa observación y evaluación.

Conclusiones en Materia de Evaluación y Ordenación del Medio Ambiente (Capítulo 6)

Comprensión del contexto. La conclusión más evidente que se desprende de los estudios de casos prácticos con respecto al tratamiento de proyectos similares en el futuro es la necesidad de llevar a cabo una completa evaluación ambiental *ex ante* e incorporar sus resultados en el diseño y la ejecución de los proyectos. La adquisición de conocimientos suficientes sobre el medio específico de que se trata es especialmente importante y difícil cuando las zonas son grandes, heterogéneas desde el punto de vista ecológico, demográficamente dinámicas o socioeconómicamente complejas. Todas las conclusiones que se exponen a continuación están relacionadas con esta conclusión de carácter general.

Mantenimiento de un Enfoque Espacial. La aplicación de un criterio espacial a la evaluación del medio ambiente y a la ordenación de los recursos naturales se recomienda por varias razones: a) las inversiones y la actividad productiva realizadas en un lugar determinado generalmente afectan la calidad del medio ambiente y el uso de los recursos en algún otro lugar; b) muchos efectos ambientales son indirectos o puede que se manifiesten sólo a largo plazo; y c) el uso de los recursos naturales en los planos local y regional se ve afectado por la interacción de las inversiones de los proyectos con las fuerzas del mercado y con otras intervenciones públicas —como la construcción de caminos y los incentivos fiscales en el caso de Carajas. Si se dispone de una "unidad de cuenta espacial", como una cuenca hidrográfica o la zona de influencia de una importante inversión en transporte, se facilitará la identificación y vigilancia de esos efectos.

Aplicación de un Criterio Multisectorial y Multidisciplinario. Por muchas de las mismas razones indicadas en el párrafo que antecede, los estudios de casos prácticos confirman la necesidad de abordar la evaluación y ordenación del medio ambiente con criterio multisectorial y multidisciplinario. La participación de ecólogos, teóricos de las ciencias sociales distintos de los economistas, y especialistas en desarrollo institucional, es especialmente importante.

Consideración de los Efectos del Desarrollo Inducido. Varias de las operaciones examinadas, especialmente Sobradinho, Carajas y POLONOROESTE, produjeron considerables efectos propios del desarrollo inducido que no se previeron lo suficiente durante la preparación y evaluación previa de los proyectos. Tales efectos se deberían determinar cada vez que fuera posible y habría que adoptar medidas de mitigación, cuando procediera, ya sea como parte integrante del proyecto principal mismo o mediante operaciones paralelas debidamente diseñadas y ejecutadas.

Consideración de los Aspectos Interregionales. Un aspecto fundamental de la evaluación ambiental se refiere a los vínculos entre el desarrollo local y el desarrollo de otras partes del país. En el Brasil, por ejemplo, el conocimiento de esas relaciones es esencial tanto para comprender el alcance y la naturaleza de las presiones demográficas en la región del noroeste, como para idear alternativas de política para las formas insostenibles de ocupación de la tierra que persisten en la Amazonia occidental.

Evaluación de las Consecuencias de Política no Deseadas. Los estudios de casos prácticos también ponen de relieve las considerables repercusiones que las políticas no relacionadas expresamente con el uso de los recursos renovables (como el crédito y los incentivos fiscales) pueden tener en el uso de los recursos y la calidad del medio ambiente en términos más generales. Toda política que afecte la distribución de la población, las tendencias de asentamiento, las actividades productivas, y, por ende, el uso de los recursos naturales, afectará al medio físico y humano. Las posibles consecuencias ambientales y sociales de las políticas macroeconómicas (entre éstas las comerciales y fiscales) y las políticas sectoriales no deberían pasarse por alto, y se deberían adoptar medidas de mitigación en caso necesario. Las consecuencias ambientales de las políticas para los sectores agrícola, industrial, de energía eléctrica y transporte deberían ser objeto de especial atención.

Recomendaciones para las Operaciones del Banco (Capítulo 7)

La reorganización de 1987, la adopción de directrices para la evaluación de los efectos ambientales en 1989, y la actualización de éstas en 1991 han llevado ya al Banco a seguir muchas de las indicaciones anteriores. Las conclusiones de los estudios de casos prácticos sirven de fuerte apoyo a las medidas que el Banco ha adoptado en los últimos años. No obstante, hay varias esferas en que sería conveniente un ulterior mejoramiento.

Integración del Medio Ambiente en la Labor Económica y Sectorial. El Banco puede influir en la ordenación de los recursos naturales y la protección del medio ambiente a través del diálogo sobre políticas que mantiene con los países y a través de su labor económica y sectorial. Ello incluye tanto actividades específicamente relacionadas con cuestiones ambientales, como actividades relacionadas con otros temas, entre ellos, los macroeconómicos. Se han realizado avances considerables a nivel de todo el Banco con respecto a las primeras en los últimos años, pero aún se puede hacer mucho por integrar mejor las cuestiones ambientales en la labor económica y sectorial en el Brasil y en otros lugares.

Fortalecimiento de las Instituciones Nacionales. El apoyo y fortalecimiento de las capacidades institucionales y técnicas nacionales y subnacionales para la ordenación del medio ambiente tiene especial importancia. Si es necesario, se debe dedicar más atención a la elaboración o consolidación del marco normativo, jurídico, reglamentario y administrativo, y de los sistemas de información, los instrumentos de vigilancia y los mecanismos de coacción necesarios para un uso más sostenible de los recursos renovables y para la protección eficaz del medio ambiente. La necesidad de concienciación de la población en lo que respecta a los problemas ambientales, sus causas y posibles soluciones a través de programas de educación del público, campañas en los medios de información, participación de las organizaciones no gubernamentales, y otros medios, con el fin de lograr que las autoridades locales y nacionales sean más responsables en lo atinente a las cuestiones ambientales, debería ser un tema de interés específico tanto en el diálogo sobre políticas del Banco con los países como en las operaciones crediticias de éste.

Mejoramiento de la Evaluación Ambiental ex ante. El Banco debería tratar sistemáticamente de enterarse de las posibilidades y las limitaciones ambientales y los procesos socioeconómicos, políticos e institucionales subyacentes que afectan el desarrollo en marcha en las zonas geográficas en que están situados sus proyectos. Debería prestarse especial atención a aquellos efectos ambientales que podrían resultar irreversibles y a aquellas zonas con ecosistemas delicados o grandes concentraciones de población. Sobre la base de anteriores experiencias en el Brasil, entre los "factores propios del país" que habría que considerar al efectuar una evaluación estarían: 1) *los factores demográficos y económicos,* entre ellos los posibles efectos de otras hipótesis demográficas, de la inestabilidad macroeconómica, y de las políticas diseñadas para otros fines, en el uso de los recursos naturales y en la eficacia de las medidas de protección ambiental; 2) *los factores de gobierno,* como el grado de compromiso del prestatario con los objetivos ambientales, el grado de conciencia de la población y participación comunitaria, y los probables efectos positivos y negativos de la descentralización administrativa; y 3) *las limitaciones de la capacidad institucional.*

Perfeccionamiento del Diseño de los Proyectos. De los estudios de casos prácticos se desprende que hay cuatro aspectos del diseño de los proyectos que se podrían mejorar: 1) la integración de los factores propios del país mencionados anteriormente; 2) el equilibrio y la secuencia cronológica de los componentes físicos en relación con los componentes relativos a instituciones de los proyectos; 3) la formulación de las estipulaciones relativas al medio ambiente; y 4) el análisis de los riesgos y el margen para imprevistos. Las estipu-

laciones relativas al medio ambiente y los demás instrumentos en que se registran los aspectos que son objeto de acuerdo para la ejecución de los proyectos deberían enunciar claramente la naturaleza de las precauciones ambientales y las medidas de mitigación que se han de adoptar conjuntamente con los proyectos y el momento en que se deben adoptar. El análisis de los riesgos y el margen para imprevistos deberían estar integrados a la preparación de las operaciones en gran escala que tengan consecuencias a largo plazo y posiblemente irreversibles para las poblaciones afectadas o para el medio físico, sobre la base de dos sencillos principios: 1) selección de los diseños de proyectos que ofrezcan más flexibilidad que otros excesivamente rígidos; y 2) diseño de los proyectos sobre la base de un conjunto de costos, beneficios y probabilidades orientados hacia el futuro, a fin de intensificar su "robustez" frente a una o varias condiciones adversas posibles en lo que respecta al desempeño macroeconómico, las políticas, el gobierno y las capacidades institucionales del país.

Fortalecimiento de la Supervisión. Los estudios de casos prácticos revelaron que había situaciones en que la supervisión del Banco era insuficiente y otras en que era de importancia decisiva para que el proyecto diera resultados satisfactorios. En general, sin embargo, los resultados del estudio indican que es necesario mejorar la supervisión de los componentes ambientales y sociales de los proyectos. Especialmente cuando se trata de operaciones grandes, complejas o riesgosas que pueden tener considerables efectos ambientales o sociales, durante la supervisión el Banco debería vigilar sistemáticamente tanto los resultados del proyecto como cualquier cambio contextual de importancia, a fin de "señalizar" cualquier alteración importante de los parámetros básicos supuestos en la evaluación previa y permitir la introducción de las modificaciones necesarias al diseño del proyecto en la forma más oportuna posible. En tales casos, también deberían realizarse supervisiones detalladas a mediados del período de ejecución.

Mejoramiento de la Vigilancia, la Presentación de Informes y la Evaluación. También es importante llevar a cabo un seguimiento y evaluación independientes y multidisciplinarios de los resultados del proyecto en relación con los objetivos, los problemas y los efectos en materia ambiental y social. Cada vez que sea posible, se debe fomentar la participación de organizaciones no gubernamentales locales, nacionales e internacionales responsables en las actividades de vigilancia ambiental. Sería necesario perfeccionar ulteriormente los actuales requisitos del Banco en materia de presentación de informes con respecto a los componentes y las consecuencias ambientales de los proyectos en la etapa de terminación, e incluirlos como parte de las directrices relativas a los informes de terminación de proyectos. Por último, debería ampliarse la evaluación *ex post* de los resultados y efectos de los proyectos en materia ambiental, tanto por parte de los prestatarios como del Banco.

Sugerencias para el Despliegue de Recursos Internos. La aplicación de las conclusiones del estudio probablemente requiera más tiempo y recursos con destino a la labor económica y sectorial, evaluaciones ambientales, preparación y evaluación inicial de los proyectos, supervisión, evaluación *ex post*, y así sucesivamente. Las actividades involucradas, así como los recursos adicionales y la composición del personal necesario, serán diferentes de un país a otro y deberían ser objeto de un análisis más específico por parte del personal del Banco que se ocupa de las operaciones y las cuestiones ambientales. Como el aumento de los gastos sirve a los intereses de los prestatarios así como a los del Banco, el financiamiento necesario se debería obtener de una variedad de fuentes, entre ellas, el Servicio de financiamiento para preparación de proyectos, préstamos para obras de ingeniería y para asistencia técnica, fondos fiduciarios para el medio ambiente, el Fondo para el Medio Ambiente Mundial, y nuevas operaciones de crédito además del presupuesto administrativo del Banco. Sin embargo, especialmente en países como el Brasil, en que la cartera de inversiones en materia ambiental es grande y está aumentando con rapidez, o en que las operaciones en marcha probablemente produzcan efectos considerables en el medio físico y humano, el Banco debería considerar la posibilidad de asignar uno o más funcionarios o consultores a largo plazo sobre el terreno con el fin de prestar asistencia en la preparación de las operaciones relativas al medio ambiente e intensificar la supervisión de las mismas, mejorar la comunicación con los prestatarios y dar muestras inequívocas de la precupación del Banco por las cuestiones ecológicas y sociales.

Résumé

La présente étude analyse la démarche adoptée par la Banque dans plusieurs grands projets au Brésil, afin d'en tirer des enseignements qui puissent la guider à l'avenir dans ses opérations de protection, d'évaluation et de gestion de l'environnement, ou dans l'établissement de directives et de procédures s'y rapportant. L'étude met également en lumière la sensibilisation croissante aux problèmes d'environnement tant à la Banque qu'au Brésil, ainsi que la prise en compte progressive, au cours des deux dernières décennies, des préoccupations écologiques dans les projets financés par la Banque.

Partant d'une définition des problèmes d'environnement qui s'inscrit dans le droit fil des politiques de la Banque, l'étude analyse les conséquences des opérations considérées sur le milieu tant physique qu'humain. Elle tente de déterminer l'impact qu'ont pu avoir, directement ou non, les investissements réalisés sur les ressources naturelles et les communautés existantes, sur les nouvelles zones de peuplement et les activités productives, et de mesurer l'adéquation et l'efficacité des palliatifs prévus. Une telle démarche se justifie dans la mesure où l'impact de tout projet sur l'environnement est fonction en dernier ressort des effets cumulés des migrations, du peuplement humain, des activités productives et de l'utilisation corrélative des ressources humaines au fil des ans.

Ayant pour thème central l'approche de la Banque, l'étude ne tente pas de mesurer l'impact des projets sur l'environnement. Elle se contente de démêler les incidences et de dégager les interrelations dans la mesure où c'est nécessaire pour comprendre quelles auraient dû être les priorités de la Banque. Elle ne tente donc pas de comparer les coûts et avantages écologiques et autres des projets. Enfin, si elle confirme que l'Etat brésilien et la Banque ont fait au cours des cinq dernières années de grands progrès dans leur approche tant conceptuelle que pratique des problèms d'environnement, elle n'examine pas en détail les faits les plus récents puisqu'elle s'est limitée pour l'essentiel aux opérations menées à terme.

Le Chapitre 1 décrit le contexte dans lequel s'inscrivent les projets étudiés et donne une vue d'ensemble des opérations menées par la Banque au Brésil en matière d'environnement depuis 1970. Intéressant des secteurs et des régions diverses, les projets sont examinés au travers de quatre études de cas brièvement résumées (Chapitres 2 et 3). Chaque étude de cas porte sur une région ou une zone d'influence particulière qui est vaste, écologiquement hétérogène, et dont la population et l'économie progressaient rapidement au moment du démarrage des opérations financées par la Banque. Les projets examinés en détail ont été approuvés pendant la période 1974–87 (Annexe 1) et la plupart ont été achevés entre 1983 et 1988. Le financement total approuvé par la Banque pour l'ensemble de ces projets se montait à quelque 1,15 milliard de dollars.

Lutte Contre la Pollution Urbaine et Industrielle à São Paulo

L'Etat de São Paulo assure la moitié environ de la production industrielle brésilienne, a un revenu par habitant deux fois supérieur à la moyenne nationale et a pour capitale la plus grande ville du pays. Le développement urbain et industriel rapide, largement sauvage, sans expansion parallèle des services d'assainissement, explique en grande partie la dégradation de la qualité de l'air et de l'eau enregistrée au cours des dernières décennies. En milieu urbain, l'eau est polluée par des quantités croissantes d'effluents industriels et d'eaux usées d'origine domestique; la pollution atmosphérique est principalement liée à la circulation automobile et aux rejets industriels.

Approuvés dans les années 70, le Projet d'alimentation en eau de São Paulo et de lutte contre la pollution (1971) et le Projet de traitement des eaux usées du Grand São Paulo (1978), tous deux financés par la Banque, avaient entre

autres pour but d'améliorer la qualité du milieu, mais ils n'ont marqué aucun progrès dans la lutte contre la pollution de l'eau. Les retards dans l'exécution, l'insuffisance des fonds de contrepartie, les dissensions politiques internes et la croissance démographique rapide en ont diminué les retombées. L'essentiel des eaux usées domestiques n'est toujours pas traité dans l'agglomération de São Paulo.

Deux opérations plus récentes de lutte contre la pollution industrielle (1980 et 1987) ont donné de meilleurs résultats. Elles associent l'ouverture d'une ligne de crédit pour des unités de traitement et du matériel de lutte contre la pollution industrielle à l'octroi d'une assistance technique à l'agence publique pour l'environnement (CETESB). Après des difficultés initiales, le premier projet, reformulé en 1984, a manifestement contribué à une amélioration de la qualité de l'air, en particulier dans la ville très industrialisée de Cubatão. Il a également joué un rôle plus large de catalyseur. L'existence d'une source de financement particulière pour la lutte contre la pollution a, autant que la menace d'amendes et d'une publicité négative pour non-respect des réglementations, suffi, semble-t-il, à convaincre les industriels locaux d'installer des dispositifs antipollution avec ou sans prêts financés par le projet.

L'aide accordée par la Banque pour l'amélioration de la qualité du milieu dans l'agglomération de São Paulo a augmenté avec le temps. Si les résultats sont généralement satisfaisants, plusieurs sources essentielles de pollution restent à combattre, comme la poussière des routes et les gaz d'échappement des véhicules. L'expérience montre que, pour être efficace, la gestion du milieu urbain doit jouer sur divers registres : mesures nationales (sur les gaz d'échappement, par exemple), réglementations locales, investissements publics, efforts de développement institutionnels.

Electricité, Réinstallation Forcée de Populations et Irrigation dans la Vallée du São Francisco

La construction de centrales hydroélectriques à Sobradinho, qui est allée de pair avec le développement de l'irrigation dans les polders du cours inférieur du São Francisco, et la réinstallation de populations imposée par la mise à eau du bassin de retenue de l'Itaparica ont eu un impact profond sur le bassin moyen et supérieur du São Francisco dans le Nordeste du Brésil. Les projets ont profité à des centaines de milliers d'habitants du Nordeste à qui ils ont procuré électricité et terres irriguées, mais ils ont aussi provoqué le déplacement de dizaines de milliers de personnes et ont eu d'autres incidences socio-économiques importantes. Les cultures irriguées cultures commerciales et d'exportation en grande partie ont favorisé le développement d'une industrie agroalimentaire, servie par un réseau de transports et de communications de plus en plus complexe. L'opération a en revanche contribué au remplacement des petits exploitants voués à une agriculture de subsistance par de gros exploitants pratiquant des cultures commerciales. L'urbanisation rapide du cours moyen du São Francisco tranche sur la stagnation de plusieurs centres urbains situés plus en aval et près de l'embouchure du fleuve.

La construction du barrage de Sobradinho dans le cadre du Projet hydroélectrique Paulo Afonso IV (1974) a amené le déplacement de quelque 70.000 personnes. Si la réinstallation de populations dans la ville de Sobradinho s'est bien passée, il n'en est pas allé de même de la réinstallation dans les zones rurales. Un programme officiel de colonisation qui devait assurer la réinstallation de la moitié des personnes déplacées n'a attiré qu'un nombre bien moindre, dont beaucoup ont quitté ultérieurement la zone. La plupart des personnes touchées ont choisi de rester auprès du bassin de retenue et n'ont reçu qu'une aide sociale et à la production insuffisante. Les *agrovilas* (villages) n'ont pas prospéré, parce que les agriculteurs n'avaient pas les crédits ni les services d'aide nécessaires pour venir à bout des problèmes dus à la pauvreté des sols, à des systèmes d'irrigation incomplets, à la variation du niveau de l'eau et à l'éloignement des marchés.

La régularisation du cours du São Francisco par le barrage de Sobradinho a aussi entraîné une forte augmentation du débit minimum dans son cours inférieur, menaçant d'inondations quelque 9.000 ha de rizières fertiles. Le projet de polders dans le bassin inférieur du São Francisco et le deuxième projet d'irrigation (1975, 1979) étaient des « opérations d'urgence » destinées à protéger les plaines inondables situées à l'embouchure du fleuve par une série de digues et de stations de pompage et à aménager des polders irrigués d'une superficie de 25.000 ha environ. Ils visaient également à améliorer la condition socio-économique des populations rurales pauvres en leur donnant accès à la terre, au crédit et à la technologie. Les programmes ont touché environ 20.000 personnes, dont les revenus ont en moyenne triplé. Cependant, ce sont au total 50.000 personnes environ, essentiellement des métayers itinérants, qui ont été déplacées dans la vallée inférieure du São Francisco de 1975 à 1980. A la différence de ce qui s'est passé pour Sobradinho, il n'y a pas eu de programme d'envergure pour la réinstallation des populations.

Dans le projet d'Itaparica (1987), l'aménagement du barrage et du bassin de retenue (qui n'était pas financé par la Banque) s'est accompagné d'un programme complet de réinstallation à la charge de la Banque, programme qui prévoyait l'audition des représentants des populations locales. La Banque a été guidée dans son action par la politique qu'elle avait arrêtée en 1980 en matière de réinstallation forcée — largement en relation avec l'expérience de Sobradinho — et qu'elle avait précisée en 1986. Quelque 40.000 personnes ont été réinstallées en 1987–88, la moitié environ optant pour les *agrovilas* et le reste pour les quatre villes

nouvelles qui avaient été construites pour remplacer les anciennes qui devaient être submergées. Le coût final de la réinstallation des populations en zones rurales à Itaparica pourrait dépasser les 63.000 dollars par famille. Bien que le transfert se soit déroulé dans de bonnes conditions, la reprise des travaux agricoles a été retardée par la lenteur de l'aménagement des systèmes d'irrigation. L'oisiveté prolongée, des possibilités d'emploi limitées sur place et une déficience momentanée des services sociaux ont créé un climat d'incertitude et de frustration. Cependant, en raison en grande partie des efforts faits par la CHESF pour maîtriser, en planifiant, les facteurs physiques, biologiques et socioculturels, l'impact écologique du projet d'Itaparica a été jusqu'à présent modeste.

Mines de Fer et Infrastructures de Transport en Amazonie Orientale (Carajas)

Dans les années 60 et 70, le gouvernement brésilien a pris des mesures ambitieuses pour intégrer l'Amazonie dans une économie en croissance rapide. Des routes ont été aménagées et des programmes de réinstallation élaborés, tandis qu'étaient adoptées la stratégie des pôles de croissance et des incitations fiscales pour attirer les capitaux privés dans la région. D'importants projets hydroélectriques et industriels ont été lancés dans l'est de l'Amazonie. Dans le même temps, de nombreux petits agriculteurs et ouvriers agricoles étaient déplacés dans le Centre-Sud brésilien par suite de la modernisation de l'agriculture et de la concentration des terres, ainsi que dans le Nordeste du fait des pressions démographiques, des sécheresses récurrentes et de la pauvreté. Leurs besoins d'emplois rémunérateurs ont donné une impulsion nouvelle aux programmes de réinstallation dirigée en Amazonie. Le projet d'exploitation du minerai de fer de Carajas et le programme POLONORESTE étaient des éléments essentiels de la stratégie de développement de l'occupation productive de la région frontière amazonienne poursuivie par le gouvernement.

Le projet de Carajas a permis d'investir dans les infrastructures de transport et l'exploitation minière ainsi que, secondairement, dans le développement urbain et dans la protection de l'environnement et des Amérindiens dans un couloir de 900 km de long traversant les Etats de Para et de Maranhao. Ce couloir relie un des gisements de minerai les plus riches du monde à un port situé à proximité de la ville de São Luis au nord-est. Le développement de complexes miniers, ferroviaires et portuaires a eu des effets économiques bénéfiques importants : création d'emplois dans le BTP, les mines et la métallurgie, ainsi que dans le secteur du commerce et des services connexes, le transport ferroviaire et routier et certaines insfrastructures urbaines.

Cependant, la zone d'influence de l'opération de Carajas se trouve être l'une des régions d'Amazonie qui a connu le plus fort taux de déboisement et de dégradation du milieu au cours des deux dernières décennies. La réalisation du projet d'exploitation de minerai de fer et les développements connexes ont attiré dans la zone des ouvriers du BTP ainsi que d'autres colons. Les nouveaux couloirs de transport ont facilité l'accès à de vastes zones auparavant isolées. Les spéculateurs fonciers ont progressé le long des routes et voies ferrées, tandis que les défrichages se sont sensiblement multipliés au cours des deux dernières décennies dans le couloir de Carajas. Des arbres de haute futaie ont été abattus non seulement pour construire des voies ferrées, d'autres équipements prévus dans le projet et des logements, mais aussi, au cours des dernières années, pour produire le charbon de bois nécessaire à la production de fonte brute. Une grande partie des zones défrichées ont été transformées en pâturages pour un élevage très extensif. Cependant, il est courant que, dans les dix ans qui suivent le défrichage, les mauvaises herbes et les repousses, difficiles à extirper, poussent les éleveurs à abandonner la terre. Il s'ensuit de nouveaux défrichages. La réinstallation de populations en milieu rural et les déboisements qui s'en sont suivis ont également provoqué un appauvrissement de la faune locale.

En 1982, lorsque l'octroi par la Banque d'un prêt pour le financement du projet de Carajas a été approuvé, le processus était déjà engagé dans certaines parties de la région. La CVRD, la plus grande société minière publique du pays, progressait dans ses travaux de construction, sur plusieurs fronts. La plupart des plans avaient été arrêtés et étaient en voie de réalisation. Des dispositions étaient prises pour protéger les Amérindiens et sauvegarder l'environnement sur les sites portuaires et miniers ainsi qu'aux abords immédiats de la voie ferrée, mais on a mal apprécié les conséquences sur l'environnement de l'exploitation de minerai de fer et les autres aspects du développement affectant sa zone d'influence. Des faits imprévus, comme l'opération de colonisation agricole menée par une autre agence publique à la limite de la concession minière de la CVRD et la prolifération des chercheurs d'or dans la région, ont entraîné une plus large occupation de la partie occidentale du couloir ferroviaire de Carajas avec tout ce que cela peut impliquer comme atteintes à l'environnement.

La composante « environnement » du projet — qui visait principalement à enrayer l'érosion des sols le long de la voie ferrée, à assurer le drainage et à lutter contre les effluents sur les sites miniers et portuaires — a été réalisée comme prévu. Cependant, en dehors des zones contrôlées par la CVRD, pratiquement aucune mesure n'a été prise pour la protection de l'environnement.

Le Projet spécial amérindien a permis une délimitation des terres, une amélioration de l'état sanitaire, un développement économique et la création d'établissements d'enseignement. La Banque a appuyé la CVRD dans les efforts

qu'elle a entrepris pour persuader la Fondation nationale indienne (FUNAI) et l'Etat fédéral d'engager les actions convenues dans le cadre de l'Accord de projet spécial et de l'Accord de garantie de prêt. Les difficultés d'exécution ont néanmoins conduit la CVRD à suspendre les décaissements pour le projet spécial en 1986. Bien que le projet se soit traduit par une amélioration sensible des soins de santé et de la délimitation des terres, plusieurs problèmes fonciers étaient encore en suspens au moment de la clôture du projet. La CVRD continue de prendre des mesures en faveur des populations indigènes en puisant pour cela dans ses propres ressources mais, compte tenu des progrès constants de la colonisation rurale, leur impact à long terme n'est pas assuré.

Amélioration des Routes et Développement Rural en Amazonie Occidentale (POLONOROESTE)

En 1981, le gouvernement a lancé le Programme de développement intégré de la région Nord-ouest (POLONOROESTE) dans les zones agricoles frontières du Rondonia et du nord-ouest du Mato Grosso. D'un coût estimé à 1,6 milliard de dollars, le programme avait principalement pour objet de favoriser l'intégration des populations migrantes par un développement des infrastructures et par un relèvement de la productivité agricole, des revenus et de la protection sociale. Les six prêts consentis par la Banque ont servi à financer l'asphaltage de la route fédérale reliant Cuiaba à Porto Velho, l'extension du réseau de routes de desserte, la consolidation des programmes de peuplement existants et le lancement de nouveaux, l'amélioration des services sociaux ruraux — en particulier sanitaires — et des mesures pour protéger le milieu naturel et les populations indigènes. Comme dans le cas de Carajas, le Gouvernement a financé un Projet amérindien spécial aux conditions fixées d'un commun accord avec la Banque.

En la circonstance, il était inévitable que l'aménagement de routes favorise un accroissement des flux migratoires. Circonstance aggravante, le POLONOROESTE a été lancé en période de crise, la plus grave crise économique qu'ait connue le Brésil depuis la dernière guerre. Au début et au milieu des années 80, un grand nombre de citadins sont venus gonfler le flot continu des migrants ruraux qui se portaient vers le Nord-Ouest. Le pouvoir d'attraction du Rondonia, en particulier, était encore renforcé par le développement rapide de la prospection d'or, de l'exploitation de la cassitérite et de la production commerciale du bois d'oeuvre.

Le POLONOROESTE prenait en compte, dans sa conception, ce qui était, à l'époque et dans la situation particulière de la zone frontière amazonienne, des préoccupations écologiques et sociales progressistes; la Banque s'est efforcée d'insérer des dispositifs de sauvegarde dans le programme. Cependant, lors de la préparation et de l'évaluation du programme, on n'a pas suffisamment prêté attention aux autres scénarios possibles, qu'il s'agisse du taux d'immigration ou de leurs implications pour l'utilisation des ressources naturelles. Les atteintes au milieu qui ont été ultérieurement imputées au POLONOROESTE sont dues en grande partie à l'incapacité des pouvoirs publics de contrôler les flux migratoires ruraux et urbains et de dissuader les immigrants d'exploiter les zones mêmes que le programme était censé initialement protéger. Le défrichage de terres pauvres a ainsi compromis le recyclage des nutriments, provoquant un appauvrissement et une érosion des sols. La conversion de zones boisées tropicales en terres agricoles, pâturages et friches a également entraîné un appauvrissement de la biodiversité.

Les équipements routiers prévus dans le POLONOROESTE ont été effectivement réalisés, assurant aux colons un meilleur accès aux marchés et aux services. Cependant, les services d'aide à l'agriculture, les équipements communautaires, la protection de l'environnement et des Amérindiens n'ont pas suivi. Fin 1984, l'examen à mi-parcours, très complet, a mis en lumière le décalage entre les hypothèses de départ et les conditions dans lesquelles le POLONOROESTE était réalisé : immigration beaucoup plus importante que prévu; décaissements tardifs de fonds de contrepartie insuffisants en raison de la dégradation de la situation budgétaire nationale; pas de crédits d'équipement dégagés pour assurer l'aménagement de cultures pérennes; gestion du budget hypercentralisée; mauvaise intégration des organismes participants. Conséquence, la Banque a de manière informelle suspendu ses décaissements en mars 1985. Les décaissements ont repris en août 1985, lorsque les autorités fédérales ont pris des mesures pour protéger les zones amérindiennes, vulnérables, et qu'un accord est intervenu sur la réorientation du programme.

Dans sa conception initiale, le POLONOROESTE comprenait d'ambitieux projets de recherche en matière de foresterie, d'environnement et d'écologie, mais leur mise en oeuvre s'est heurtée dans les premières années au faible niveau de connaissances techniques, à un climat défavorable, à la faiblesse des moyens institutionnels, à l'insuffisance des fonds de contrepartie. La réorientation du programme qui a suivi la suspension des décaissements a toutefois débouché sur des réformes institutionnelles et de nouvelles initiatives en matière d'environnement dans la région. Au niveau des Etats, des agences pour la protection de l'environnement ont été créées, financées sur les ressources du programme. Parmi les mesures prises pour améliorer la protection des forêts, il faut citer le relèvement des impôts sur l'exploitation forestière, des amendes pour production illégale de bois d'oeuvre, ainsi que la création d'une police militaire des forêts chargée de faire appliquer plus stricte-

ment que par le passé les textes et d'un institut public de la forêt responsable de la vulgarisation.

Dans l'ensemble, le Projet spécial amérindien a été jusqu'à présent efficace. Cependant, compte tenu du manque chronique de crédits et de personnel dont souffre la FUNAI, du statut des Amérindiens dans la société brésilienne et de leur vulnérabilité dans des zones frontières mouvantes comme à Carajas, la pérennisation des réserves indiennes créées dans le cadre du programme suppose le maintien d'une aide externe.

Prestations de la Banque (Chapitre 4)

La Banque a pris en compte les problèmes d'environnement dans la préparation, l'évaluation et la supervision des projets examinés. Les études de cas donnent divers exemples des efforts nouveaux faits par la Banque pour élargir son approche traditionnelle : « reconnaissance » du milieu à Sobradinho dans le cadre d'une préévaluation, mission d'études multidisciplinaire dans le Nord-Ouest, participation d'anthropologues et d'écologistes, membres du personnel de la banque et consultants, à l'évaluation et à la supervision des composantes « protection de l'environnement et des Amérindiens » du projet de Carajas et du POLONOROESTE et, plus récemment, à la préparation, à l'évaluation et à la supervision du Projet de réinstallation d'Itaparica.

Dans certains cas, les changements ont déjoué, tant par leur nature que par leur ampleur, les prévisions de l'emprunteur et de la Banque, entraînant des conséquences contraires aux buts recherchés en matière d'environnement. Ces changements sont à mettre au compte, pour l'essentiel, de facteurs et de faits qui échappaient au contrôle des responsables du projet, notamment de la grave dégradation de la situation économique nationale. Aucune planification stratégique n'aurait pu conjurer tous les effets néfastes de ces imprévus. Il convient aussi de rappeler qu'en matière d'environnement les normes et protections pratiquées dans les années 70 et au début des années 80 n'étaient pas aussi strictes que celles que suivent aujourd'hui la Banque et le Brésil. Il faut en outre mettre au crédit de la Banque d'avoir suspendu ses décaissements et reconsidéré ses opérations dès qu'elle a clairement perçu un grave déséquilibre dans l'exécution du POLONOROESTE. La réorientation à mi-parcours du premier Projet de lutte contre la pollution industrielle à São Paulo a eu le même effet bénéfique.

Il apparaît néanmoins rétrospectivement que certains choix opérés au stade de la conception ou de l'évaluation des projets étaient contestables. En différentes occasions, la Banque et l'emprunteur n'ont pas pris suffisamment en compte l'impact probable sur l'environnement ou les retombées sociales possibles des investissements envisagés. En outre, comme dans d'autres pays auxquels elle a consenti des prêts, la Banque n'a pas suffisamment tenu compte des problèmes intersectoriels ou interrégionaux, ou de l'impact des incitations parallèles et des forces du marché, sur l'utilisation des ressources naturelles et la qualité de l'environnement dans les zones d'influence des projets. Dans le cas du projet de Carajas, il était difficile, faute de clauses sur le sujet dans les accords de prêt, de savoir quelles mesures de précaution étaient nécessaires en matière d'environnement ou comment la Banque contrôlerait leur application. Plus généralement, il n'avait pas été suffisamment tenu compte, dans la conception des projets, des risques qui étaient d'entrée de jeu prévisibles (par exemple, par le renforcement des flux migratoires vers le Nord-Ouest). Ces lacunes s'expliquent en partie par une certaine méconnaissance du contexte dans lequel s'inscrivaient les projets, ce qu'une étude préalable d'impact plus complète aurait permis d'éviter.

Les études de cas révèlent qu'en certaines occasions la supervision de la Banque a été insuffisante mais, qu'en d'autres, elle a été pour beaucoup dans les bons résultats des projets. Si la supervision a pu en certaines occasions laisser à désirer, c'est, semble-t-il, parce qu'on avait à l'origine mal apprécié la complexité du problème et les forces en jeu dans les zones de projet concernées. De surcroît, l'approche de la Banque a varié d'un projet à l'autre. Ainsi, si une étude multidisciplinaire a été menée dans le Nord-Ouest et si le POLONOROESTE touchait au développement rural, à la santé et à la protection de l'environnement, l'approche suivie pour le couloir de Carajas, zone également sensible, a été plus étroite, bien que le projet ait été évalué sensiblement à la même époque. En outre, la Banque a porté beaucoup plus d'attention au sort des populations indigènes qu'à celui des autres groupes vulnérables affectés par le POLONOROESTE et par le projet de Carajas.

Il y a eu également des cas où différentes actions prévues au projet ont été mal synchronisées. Pour ce qui est du POLONOROESTE, par exemple, les routes ont été construites dans les délais, mais la mise en place des services rendus nécessaires par l'afflux d'immigrants a pris du retard et il aurait fallu renforcer les institutions, notamment dans le domaine de la protection de l'environnement, avant d'améliorer les infrastructures, et effectuer des études ponctuelles sur les sols et les autres ressources naturelles avant de lancer de nouveaux projets de colonisation. S'agissant des projets de la vallée du São Francisco, le rythme de préparation et d'exécution des mesures de réinstallation des populations et des programmes d'irrigation a été commandé par le calendrier des travaux d'infrastructure, plus importants.

Dans plusieurs cas, enfin, l'intervention plus précoce de la Banque dans la préparation du projet aurait sans doute permis une meilleure gestion des problèmes sociaux et d'environnement. S'agissant du projet de Carajas, la Banque n'est intervenue qu'après que toutes les grandes déci-

sions relatives au transport du minerai eurent été prises sans égard au coût pour l'environnement des différentes solutions envisagées. Qui plus est, la Banque n'a pas imposé — comme pour le projet de Sobradinho et pour le POLONOROESTE — d'étude d'impact, ni l'adoption de palliatifs au niveau régional préalablement à l'approbation du prêt. La Banque n'est, par ailleurs, intervenue à Itaparica qu'en situation de crise pratiquement, ce qui a renchéri le coût des réinstallations de population en milieu rural.

En bref, le bilan de la Banque est contrasté pour ce qui est de son approche des problèmes sociaux et d'environnement. Cependant, il faut reconnaître qu'avec le temps la Banque, tirant parti non seulement d'une meilleure connaissance des problèmes mais aussi de l'expérience acquise dans sa politique de l'environnement et à la faveur des opérations plus récentes menées au Brésil, a marqué des points. Il faut admettre et se féliciter du fait que nombre des enseignements résumés ici ont d'ores et déjà été appliqués au Brésil. Il est néanmoins bon de les rappeler afin qu'on ne les oublie pas et parce qu'ils sont sans doute valables pour d'autres pays.

Enseignements à Tirer pour la Protection de l'Environnement (Chapitre 5)

A la lumière des études de cas, on peut tirer des leçons dans trois domaines qui se recoupent : protection de l'environnement, étude d'impact et gestion du milieu, activités et procédures de la Banque. Les principaux enseignements qui se dégagent de l'étude concernant les conditions préalables à une protection efficace de l'environnement sont les suivants.

Cadre d'Action/Cadre Légal et Réglementaire. La protection de l'environnement exige un cadre d'action adapté ainsi que des lois et réglements appropriés. Le Brésil a une politique de protection de l'environnement et des Amérindiens explicite, mais son système fédéral donne aux Etats et aux communes un large pouvoir d'appréciation dans l'application des normes et sanctions. La protection de l'environnement est, en fait, très inégalement effective d'un Etat à l'autre et il faudrait encore renforcer le cadre légal et réglementaire dans de nombreuses régions. Reste à définir une politique nationale dans certaines domaines, en particulier en matière de réinstallation forcée.

Capacités Institutionnelles et Techniques. Il faudrait des capacités institutionnelles et techniques adéquates tant au niveau national que subnational, notamment des procédures d'inspection et de coercition appropriées, ainsi que des laboratoires et du matériel, un appui logistique et des ressources humaines suffisants pour suivre et enrayer effectivement la dégradation du milieu. La Banque continuera à apporter son appui pour le renforcement des organismes, brésiliens ou autres, chargés de la protection de l'environnement.

Engagement et Responsabilisation. Un soutien sans équivoque doit être apporté aux objectifs fixés en matière d'environnement, et le principe de responsabilité politique doit trouver sa sanction dans le système afin que l'appareil administratif et technique, une fois mis en place, remplisse bien la mission qui lui est impartie par la loi. A São Paulo, la ferme volonté de « purifier » Cubatão, exprimée par un gouverneur élu à une large majorité, a joué un rôle important dans la réorientation et, subséquemment, le succès du premier Projet de lutte contre la pollution industrielle. Dans les premières années de l'application du POLONOROESTE, en revanche, le faible soutien du pouvoir fédéral et fédéré a rendu problématique la réalisation des objectifs fixés en matière de protection de l'environnement. La détermination des pouvoirs locaux s'affirmant au cours des dernières années, des progrès sensibles ont été accomplis.

Sensibilisation du Public et Participation de la Communauté. L'engagement et la responsabilisation des pouvoirs publics nécessaires à la réalisation des objectifs fixés en matière d'environnement supposent à la fois un haut degré de sensibilisation du public et une participation active de la population et de la communauté. La Banque devrait donc continuer à apporter son soutien aux programmes d'éducation écologique et encourager les associations communautaires et les autres ONG à participer à la surveillance de l'environnement. Elle devrait accorder le maximum d'attention aux régions traversées par le São Francisco, la voie ferroviaire de Carajas et la route Cuiaba-Porto Velho, ainsi qu'aux régions très peuplées et industrialisées comme l'agglomération de São Paulo, car c'est dans les régions à faible revenu qu'il est le plus difficile de mettre en place des organes de protection de l'environnement et des mécanismes de coercition efficaces.

Réglementations et Incitations Economiques. La lutte contre la pollution et les autres formes de protection de l'environnement obligent à jouer tout à la fois des réglementations et d'instruments économiques tels que les taxes, les redevances et autres incitations, pour autant que les avantages de telles mesures n'excèdent pas leur coût. Comme beaucoup d'autres pays, le Brésil a surtout eu recours aux réglementations. Cependant, les études de cas laissent à penser que l'application effective des réglementations existant en matière d'environnement peut être coûteuse, en particulier dans des zones comme le couloir de Carajas et le Nord-Ouest et qu'il faudrait jouer davantage des incitations économiques. C'est ce que tentent actuellement la Banque et l'état fédéré au Rondonia en usant à la fois de la planifica-

tion technique pour orienter les investissements publics et privés (zonage agroécologique) et des mesures de persuasion et de dissuasion pour encourager une utilisation des ressources naturelles durable. De même, une autre solution fréquemment envisagée pour lutter contre la pollution industrielle consiste à faire jouer les lois du marché comme dans le cas des permis d'émission négociables. Il faudrait suivre et évaluer soigneusement les efforts faits pour adopter de telles mesures au Brésil et ailleurs.

Enseignements Tirés pour l'Evaluation et la Gestion de l'Environnement (Chapitre 6)

Comprendre le Contexte. La leçon la plus évidente qui se dégage des études de cas quant à la conduite de projets similaires à l'avenir est la nécessité de procéder préalablement à des études d'impact complètes et de tenir compte de leurs résultats dans la conception et l'exécution du projet. Il est tout particulièrement important et difficile de bien appréhender le milieu dans les zones qui sont étendues, écologiquement hétérogènes, démographiquement dynamiques et/ou socio-économiquement complexes. Les leçons qui suivent dérivent toutes de cette conclusion générale.

Garder une Approche Spatiale. Il est bon d'adopter une approche spatiale dans l'étude d'impact et la gestion des ressources naturelles, et ce pour plusieurs raisons : a) les investissements réalisés et la production assurée en un lieu déterminé ont souvent des répercussions sur la qualité de l'environnement et l'utilisation des ressources en d'autres lieux; b) les effets sur l'environnement, souvent indirects, peuvent ne se faire sentir qu'avec beaucoup de retard; et c) les investissements réalisés dans le cadre du projet interfèrent avec les forces du marché et les autres interventions publiques — telles que la construction d'une route ou des incitations fiscales dans le cas de Carajas — dans l'utilisation des ressources naturelles au niveau local et régional. Il est bon d'avoir une « unité spatiale de référence » telle que le bassin d'une rivière ou la zone d'influence d'un grand projet d'infrastructure de transport pour pouvoir cerner et surveiller ces effets.

Adopter une Approche Multisectorielle et Multidisciplinaire. Pour beaucoup des raisons indiquées au paragraphe précédent, les études de cas confirment la nécessité d'adopter une approche multisectorielle et multidisciplinaire pour l'évaluation et la gestion de l'environnement. Il importe tout particulièrement d'y associer des écologistes, des spécialistes du dévelopement institutionnel et des sciences sociales autres que l'économie.

Considérer les Effets Induits sur le Développement. Plusieurs des opérations examinées, en particulier celles de Sobradinho, de Carajas et du POLONOROESTE, ont eu des effets induits non négligeables sur le développement, effets qu'il aurait fallu mieux prévoir lors de la préparation et de l'évaluation des projets. Il faudrait identifier ces effets dans la mesure du possible et prendre si nécessaire des mesures pour y remédier dans le cadre soit du projet lui-même, soit d'opérations parallèles bien conçues et bien menées.

Prendre en Compte les Considérations Interrégionales. Fait essentiel, les études d'impact touchent aux interférences entre le développement local et le développement dans le reste du pays. Au Brésil, par exemple, il est essentiel de saisir ces interférences pour comprendre l'importance et la nature des pressions démographiques qui s'exercent dans le Nord-Ouest et pour concevoir des alternatives aux formes d'occupation, non viables, des terres de l'Amazonie occidentale.

Evaluer les Conséquences non Délibérées de Certaines Politiques. Les études d'impact font également ressortir l'impact, non négligeable, que des politiques qui n'ont explicitement rien à voir avec l'utilisation des ressources renouvelables (telles que le crédit et les incitations fiscales) peuvent avoir sur celle-ci et, plus généralement, sur la qualité de l'environnement. Toute politique qui affecte la répartition de la population, les modes de peuplement, les activités productives et, partant, l'utilisation des ressources naturelles a une incidence sur le milieu humain et physique. Il ne faudrait pas méconnaître les conséquences écologiques et sociales possibles des politiques macroéconomiques (y compris commerciale et budgétaire) et sectorielles; il faudrait au besoin adopter des palliatifs. Il conviendrait d'accorder une attention toute spéciale à l'impact sur l'environnement des politiques agricoles, industrielles, de l'électricité et des transports.

Recommandations pour les Opérations de la Banque (Chapitre 7)

La réorganisation de 1987, l'adoption, en 1989, des directives sur les études d'impact et leur mise à jour en 1991 vont largement dans le sens suggéré plus haut. Les résultats des études de cas légitiment largement les mesures que la Banque a prises au cours des dernières années. Cependant, il est des domaines où des améliorations seraient souhaitables.

Intégrer la Dimension Environnementale dans les Travaux Economiques et Sectoriels. Par le dialogue qu'elle entretient avec les pouvoirs publics autant que par ses travaux économiques et sectoriels, la Banque peut peser sur la gestion des ressources naturelles et sur la protection de l'environnement. Cela vaut autant pour les actions en relation avec les problèmes d'environnement que pour les autres (y compris celles en rapport avec les questions macroéconomiques). Sous ce rapport, des progrès sensibles ont été faits dans

l'ensemble des services de la Banque au cours des dernières années, mais il est encore possible de faire davantage pour mieux prendre en compte les problèmes d'environnement dans les travaux économiques et sectoriels, que ce soit pour le Brésil ou ailleurs.

Renforcer les Institutions Nationales et Subnationales. Il est tout particulièrement important de renforcer les moyens institutionnels et techniques, nationaux et subnationaux, de gestion de l'environnement. Il faudrait au besoin accorder davantage d'attention à la mise sur pied ou à la consolidation des cadres d'action, des dispositifs légaux, réglementaires et administratifs, des systèmes informatiques, des outils de contrôle et des mécanismes de coercition nécessaires pour une utilisation plus durable des ressources renouvelables et une protection efficace de l'environnement. Le dialogue de politique générale engagé par la Banque et ses opérations de prêt devraient traduire le souci de sensibiliser davantage le public aux problèmes d'environnement, à leurs causes et aux solutions possibles par des programmes d'éducation, des campagnes dans les médias, la participation des ONG, etc., de façon à amener les pouvoirs locaux et nationaux à rendre davantage compte de leurs décisions.

Améliorer les Etudes Préalables d'Impact. La Banque devrait systématiquement chercher à comprendre parfaitement les potentialités et contraintes écologiques, ainsi que les processus socio-économiques, politiques et institutionnels fondamentaux qui affectent le développement des zones géographiques où s'inscrivent les projets. Il faudrait accorder une attention particulière aux effets irréversibles sur l'environnement et aux zones qui ont un écosystème fragile ou une forte concentration de population. Il ressort des opérations menées au Brésil que toute étude d'impact devrait considérer les « facteurs pays », à savoir : 1) *les facteurs démographiques et économiques,* notamment l'impact que les autres scénarios démographiques envisageables, l'instabilité macroéconomique et les politiques conçues à d'autres fins pourraient avoir sur l'utilisation des ressources naturelles et l'efficacité des mesures de protection de l'environnement; 2) *les facteurs relevant de la gouvernance,* notamment la volonté plus ou moins affirmée de l'emprunteur de réaliser les objectifs fixés en matière d'environnement, le degré de sensibilisation du public et le niveau de participation de la communauté, et les effets possibles, favorables ou non, de la décentralisation politico-administrative; et 3) *les obstacles tenant aux capacités institutionnelles.*

Améliorer la Conception des Projets. Les études de cas font apparaître quatre domaines où des améliorations pourraient être apportées à la conception des projets : 1) meilleure intégration des « facteurs-pays » évoqués plus haut; 2) rééquilibrage et meilleure synchronisation des composantes matérielles et des composantes politico-institutionnelles, en particulier de celles qui visent à la protection de l'environnement; 3) meilleure formulation des clauses relatives à l'environnement; et 4) analyse des risques plus complète et meilleure prise en compte des aléas. Les clauses relatives à l'environnement et les autres instruments recensant les points d'accord pour l'exécution du projet devraient clairement préciser la nature et le calendrier des mesures de précaution à prendre et des palliatifs à adopter dans le cadre des projets de la Banque. L'analyse des risques et la « provision pour aléas » devraient être intégrées dans la préparation des opérations de grande ampleur qui ont un impact à long terme, peut-être irréversible, sur les populations affectées et/ou sur le milieu physique, la règle étant : 1) de choisir les variantes qui offrent le maximum de souplesse de préférence à celles qui sont excessivement rigides; et 2) d'asseoir le projet sur une analyse clairvoyante des coûts, des avantages et des probabilités de façon à mieux en assurer la « solidité » dans l'éventualité de conditions difficiles, que celles-ci résultent des résultats macroéconomiques, des politiques, de la gestion des affaires publiques ou des capacités institutionnelles.

Renforcement de la Supervision. Les études de cas ont fait apparaître des situations où la supervision de la Banque était insuffisante et pourtant essentielle pour assurer le succès du projet. Dans l'ensemble, toutefois, les résultats de l'étude portent à conclure à la nécessité de renforcer la supervision des composantes sociales et « environnement » des projets. En particulier dans les opérations importantes, complexes ou risquées qui peuvent avoir un impact sur l'environnement et/ou des retombées sociales, la Banque devrait suivre systématiquement à la fois les résultats du projet et l'évolution du contexte de façon à « signaler » toute modification notable des paramètres posés au stade de l'évaluation et à réviser le projet en conséquence dans les délais les plus brefs possibles. De même, il faudrait entreprendre en pareil cas un examen complet à mi-parcours.

Améliorer le Suivi, les Comptes Rendus et l'Evaluation Rétrospective. Non moins important est le besoin d'un suivi et d'une évaluation multidisciplinaires et indépendants des résultats du projet, pour ce qui est de la réalisation des objectifs, de l'impact et des problèmes sociaux et d'environnement. Il conviendrait d'encourager dans la mesure du possible les ONG responsables locales, nationales et internationales à participer à la surveillance de l'environnement. La Banque devrait préciser, dans ses directives sur le rapport d'achèvement, les obligations de l'emprunteur quant à l'établissement de rapports sur les composantes « environnement » du projet et leurs conséquences au moment de l'achèvement du projet. Enfin, l'évaluation a posteriori des résultats du projet en matière d'environnement et de son

impact sur le milieu devrait être élargie tant à l'initiative des emprunteurs que de la Banque.

Suggestions pour le Déploiement des Ressources Internes. Il faudra sans doute du temps et des ressources supplémentaires pour appliquer les enseignements tirés de l'étude dans les travaux économiques et sectoriels, les études d'impact, la préparation, l'évaluation, la supervision et l'évaluation rétrospective des projets, etc. Les activités que cela implique varient d'un pays à l'autre, tout comme les besoins en ressources et en personnel supplémentaires; il reviendra au personnel de la Banque responsable des opérations et de l'environnement de les préciser. L'intérêt tant des emprunteurs que de la Banque étant directement en jeu, le financement des dépenses supplémentaires devrait être assuré par une pluralité de sources au nombre desquelles figurent le mécanisme de financement de la préparation des projets, les prêts d'ingénierie et d'assistance technique, les fonds fiduciaires pour l'environnement, le FEM et de nouvelles opérations de prêt, ainsi que le budget administratif de la Banque. Cependant, en particulier dans des pays comme le Brésil, où le portefeuille « environnement », important, s'accroît rapidement et/ou les opérations actuelles risquent d'avoir un impact non négligeable sur le milieu humain et physique, la Banque devrait songer à détacher sur le terrain un ou plusieurs membres de son personnel ou des consultants recrutés sur la base de contrats de longue durée, pour aider à la préparation et renforcer la supervision des opérations à finalité écologique, améliorer la communication avec les emprunteurs et clairement marquer son intérêt pour les problèmes sociaux et d'environnement.

1. The Bank and the Environment in Brazil

The Bank has become increasingly concerned with environmental issues over the past two decades and with the impact of the projects it finances on both the human and the physical environments. In this context, the present study has attempted to assess how the Bank approached environmental issues and problems in several large infrastructure and regional development projects in one particular country, Brazil. The study also attempted to draw conclusions and lessons from this experience to help orient future efforts—both in Bank operations and more generally—to deal with environmental matters in that country and elsewhere.

Brazil was selected for several reasons. The Bank has financed a large number of projects in Brazil, corresponding to nearly 10 percent of its total lending over the past thirty years. Some of these operations have had significant environmental components and consequences, contributed directly to the evolution of environmental policies within the Bank, and stirred considerable controversy over the Bank's role. Partly as a result of the growing attention which such questions have received, the Brazilian government has recently prepared or is currently preparing a number of major new environmental initiatives for possible Bank financing. A review of the Bank's experience in dealing with the environment in selected past projects in Brazil was, therefore, considered opportune.

Study Scope and Methodology

The study defined "environmental issues" in a way consistent with Bank policies and thus examined both the physical and human environmental dimensions and consequences of the projects surveyed. It attempted to trace the main direct and indirect impacts of the investments involved on both the natural resource base (soils, vegetation, hydrology, fauna, climate, and so on) and existing communities, new settlements, and productive activities, as well as to assess the adequacy of mitigatory measures. This approach is justified since any project's full impact on the environment will be a function of its compounded effects on migration, human settlement, productive activities, and related natural resource use over time. From this perspective, longer-term and indirect impacts may ultimately be more significant—as well as more difficult to anticipate—than immediate and direct ones.

As the study focused on Bank approaches, it did not systematically assess the development and environmental impacts of the projects under review. It merely identified these impacts and pointed to the relationships between them insofar as this was necessary to understand where the emphasis of Bank approaches should have been. Since the study was not an impact evaluation, moreover, it did not attempt to measure—let alone place a monetary value on—project environmental impacts, and no attempt was made to compare environmental with other project costs and benefits. Furthermore, the study did not assume that the environmental impacts discussed in the following chapters were necessarily negative, of sufficient magnitude to require remedial action, or that the benefits to be obtained from taking such measures would necessarily be greater than their potential costs.

The study recognizes that the operations under review have generated important economic, social, and other benefits. However, because its focus was on their physical and human environmental aspects and consequences, it did not attempt to make an overall assessment of these operations. Similarly, while it confirmed that considerable progress has been made over the past five years in the way both the Brazilian government and the Bank have approached environmental concerns because the study was essentially limited to completed operations, it did not explore these recent changes in detail.

The Bank's approach to the environment in the lending operations reviewed is reflected primarily in project identification, design, appraisal, and supervision, especially the

ex ante assessment of environmental impacts and the monitoring of project environmental components and effects during implementation. In examining these aspects, the quality of the Bank's analysis is evaluated in terms of its relevance, depth, and breadth in relation to the environmental issues and impacts involved. The projects are assessed here first with respect to the Bank's goals, criteria, procedures, and practices at the time they were prepared and secondly with reference to the emerging framework which became Bank policy in the late 1980s.

Bank concern with the environmental effects of its projects began in the early 1970s and has evolved markedly over the ensuing years. These concerns initially emphasized "brown" issues raised mainly by industrial and infrastructure projects over "green" ones associated with renewable resource development. As a result, during the 1970s and early 1980s, attention was focused primarily on environmental mitigation at the project site in accordance with sector specific guidelines and practices. While identification and management of broader impacts were not absent, they were not pursued as systematically as they are today. Accordingly, it should be kept in mind that the transition to more environmentally and socially sensitive criteria for Bank interventions did not occur until the mid- and late 1980s when most of the projects examined in the study were already completed or well past the initial design and appraisal stages.

To set the broader context of the study, the balance of this chapter summarizes the territorial and demographic characteristics and the recent macroeconomic and political tendencies that underpin the relationship between development and the environment in Brazil over the past two decades. It then briefly describes the emerging environmental policy and institutional framework in both Brazil and the Bank and discusses the evolution of Bank involvement in environmental activities in Brazil.

The rest of the report is divided into two parts. Part A, consisting of Chapters 2 and 3, summarizes, for each of the four case studies, the project context, their principal features, and their main development and environmental impacts, including, where applicable, a brief assessment of their environmental and indigenous peoples protection components. The São Paulo and São Francisco Valley cases are presented first. Discussion of the Carajas Iron Ore Project and the POLONOROESTE Program follows under the common heading of "Amazonia."

Part B contains four chapters on Bank performance and the lessons derived from these operations. Chapter 4 evaluates the approaches taken by the Bank on the basis of the aforementioned methodology. The most relevant cross-cutting lessons with respect to environmental protection, management, and impact assessment are summarized in Chapters 5 and 6. The report closes with Chapter 7 which translates the lessons learned into recommendations for future Bank operations.

Country Background

Brazil is the fifth largest country in the world in land area and the sixth largest in population. It contains important natural and manmade features including the Amazon and São Francisco River basins and several very large cities. The Amazon releases more fresh water than the world's next eight largest rivers combined, and the region that forms its drainage basin houses the largest tropical rainforest on earth. In São Paulo and Rio de Janeiro, Brazil has two of the fastest growing "megacities" on the globe, while São Paulo state holds the largest industrial park in South America.

Brazil has a land area of more than 8.5 million square kilometers, making it the largest country in Latin America. For statistical purposes, the national territory is divided into five regions having distinctly different ecological, demographic, and socioeconomic characteristics. The largest of these is the North, or Amazon, region whose land areas exceeds that of all of the countries of Latin America except Brazil. In 1985, however, the North held just 6 percent of the Brazilian population. Most of the region has an equatorial climate and is covered by tropical rainforest.

The second largest region (roughly the size of Indonesia) is the Center-West which, like the North, is an area of comparatively recent occupation, triggered by transfer of the federal capital to Brasilia and the installation of a major interregional road network starting in the mid-1950s. Much of the region is covered by *cerrado* (savannah) grasslands, but its northern sections include large areas of tropical forest, while southwestern Mato Grosso and northwestern Mato Grosso do Sul house the ecologically rich Pantanal wetlands.

The third largest region in land area and second largest in terms of population is the Northeast. This primarily semiarid region, which is larger than Italy, Spain, and Portugal combined, has the lowest levels of urbanization and average income in Brazil. It is bisected by the São Francisco River which crosses or forms the border between five states. Except for fertile lands located along the margins of the river itself and the humid coastal zone near its mouth, much of the extensive backland area (*sertao*) cut by the São Francisco is covered by scrub vegetation known as *caatinga*. Most of this region is characterized by low levels of rainfall, periodically made even scarcer by devastating droughts.

Finally, the South and Southeast with 19 percent of the national territory jointly contained an estimated 59 percent of the total population in 1985. These two regions are generally characterized by a temperate climate and non-tropical vegetation. Together with the Northeast, they have historically been the principal areas of both agricultural and

industrial development and thus of both rural and urban settlement in Brazil. Among the five regions, the level of urbanization is highest in the Southeast (nearly 83 percent in 1980), reflecting the presence of three major metropolitan areas and a large number of secondary cities.

In mid-1990, the Brazilian population was estimated to be on the order of 150.4 million. Since 1980, it has grown at an average of 2.2 percent a year, a significant decrease from the rates registered between 1950 and 1980. The population in urban areas, however, continues to grow considerably more rapidly than that of the country as a whole. As a result, more than 75 percent of the total population now resides in towns and cities, as compared with 50 percent in 1965.

These demographic trends reflect the significant structural changes that have occurred in the Brazilian economy over the past several decades. These transformations include policy-induced agricultural modernization and the substitution of small-farmer coffee and food production by large-scale export-oriented soybean and import-substituting sugar cane and wheat production, particularly in south-central Brazil. They also include the progressive road-based expansion of the agricultural frontier, first from southern to central and more recently from central to northern Brazil.

On the urban side, these modifications reflect the policy-induced consolidation of Brazilian industry since 1950, first through import substitution and later through manufactured export promotion. Recent structural changes also include the significant expansion of tertiary sector activities both in areas of traditional settlement and in former and contemporary frontier regions. As a result, agriculture's share of GDP fell from 19 percent in 1965 to 10 percent in 1990, while that of industry rose from 33 to 39 percent.

Brazil's per capita GNP in 1990 ($2,680) was the highest in Latin America. Income and other inequalities, however, remain significant, with the impoverished Northeast and the demographically dynamic North and Center-West possessing average income levels well below those registered in the more developed South and Southeast. The wealthiest 10 percent of the population claimed 46 percent of national income in 1983 (the most recent year for which such data are available), while the lowest 20 percent received just 2.4 percent. These regional and interpersonal income disparities are mirrored across the full range of social indicators from infant mortality and adult literacy rates to the availability of physical infrastructure and community services. These imbalances also underlie many of the increasing pressures on Brazil's natural environment described elsewhere in this report.

The two decades during which the projects surveyed in this study were prepared and largely implemented were a period of considerable macroeconomic instability in Brazil. Prior to the first oil price shock, the early 1970s witnessed the height of the so-called "Brazilian economic miracle," with GDP growth rates reaching nearly 13 percent a year between 1971–73. Expansion of GDP continued at a lower but still highly respectable 7 to 8 percent annual rate between 1974 and 1980. After the 1979 petroleum price hike, however, it fell to –2 percent a year between 1981 and 1983. GDP again grew at an average of over 7 percent a year between 1984 and 1986. High rates of inflation began in the mid-1970s and, with few exceptions, continued for each successive year after 1975. Increases in annual inflation were particularly significant in 1979–80, 1982–83, and 1986–87, culminating in a rate well over 1,000 percent in 1989.

In response to balance of payment constraints and the increasing burden of external debt, the government took steps to promote primary and manufactured exports and reduce fuel and other imports. These initiatives contributed to the structural changes and population distribution tendencies summarized in the previous section. These adjustments and the macroeconomic situation during the 1970s and early 1980s also help to explain the Bank's support for several large government initiatives, including the Paulo Afonso IV hydropower expansion and the export-oriented Carajas Iron Ore Project, among others. Bank motives for assisting these ventures included the desire to help Brazil increase its foreign capital inflows, promote exports, and substitute energy and other imports, while at the same time rationalizing public investment, assisting the poor, and modernizing its institutional structure. The economic crisis of the early 1980s and rising inflation from the mid-1970s onward, however, also directly affected the implementation performance and environmental results of most of the operations reviewed in the study.

The Brazilian political panorama has changed dramatically since the mid-1970s. At the federal level, self-appointed military governments have been succeeded by civilian administrations since 1985. At the state and local levels, indirectly elected or appointed executives were progressively replaced by directly elected ones in the early and mid-1980s. Like the "economic miracle" of the late 1960s and early 1970s and the economic and financial difficulties of the 1980s, redemocratization has had a significant impact on the way in which environmental and social issues have been dealt with by the Brazilian government over the past two decades.

Environmental Policy and Institutional Changes

Brazil

Environmental legislation and institutions are a relatively recent phenomenon in Brazil, as elsewhere. The first major federal initiative was creation of a Special Secretariat of the Environment (SEMA) in the Ministry of the Interior in October 1973. SEMA's mandate evolved over the years to

include: (1) rationalization of the use of the country's natural resources and the environment; (2) development of pollution control norms and standards; (3) coordination of federal pollution control activities; and (4) orientation and provision of assistance to state environmental agencies, most of which were established during the early and mid-1980s.

Although federal laws enacted in the 1970s were primarily concerned with air and water pollution control, ecological stations administered by SEMA were established and an existing system of national parks was expanded. Federal legislation passed in August 1981 formally defined a national environmental policy and established a "national environmental system" (SISNAMA) headed by SEMA and composed of state agencies such as CETESB in São Paulo, which took its present form in 1975. This legislation also created the National Environmental Council (CONAMA), composed of representatives of numerous federal agencies, state governments, and the private sector. Among the policy instruments instituted or reaffirmed at that time were environmental quality standards and zoning, impact assessments, and the licensing, monitoring, and control of polluting activities.

The law establishing CONAMA was regulated by federal decree in June 1983, which authorized the Council to define the conditions under which productive activities would be required to present environmental impact assessment reports (known as RIMAs) to state or federal authorities. The circumstances under which RIMAs would be required, as well as the basic characteristics and coverage of these documents, however, were not specified until January 1986, while a national vehicle pollution control program was not enacted by CONAMA until May 1986.

Following the return to civilian rule, a new Constitution containing specific chapters on the environment and Amerindians was approved in October 1988. In addition to environmental assessment, the responsibilities attributed to the public sector under the present Constitution are: (1) preservation and restoration of essential ecological processes and the management of species and ecosystems; (2) preservation of the country's genetic endowment; (3) definition of ecologically sensitive areas to be protected by law; (4) control of the production, marketing, and use of technologies, methods and, substances that represent a risk to human life, the quality of life, or the environment; (5) promotion of environmental education and public awareness of the need for environmental preservation; and (6) protection of flora and fauna and legal prohibition of practices that endanger their ecological function, provoke species extinction, or submit wildlife to cruelty. The Constitution identified the Amazon forest, the Serra do Mar mountains, the Pantanal, and the coastline as "national endowment" whose use would be regulated to ensure their preservation.

The chapter on indigenous peoples recognizes "the social organization, customs, languages, beliefs, and traditions and the rights of Indians over the lands which they traditionally occupy" and affirms that it is the Union's responsibility "to demarcate, protect, and make others respect all their possessions." Among its provisions are that "lands traditionally occupied by Indians are destined to their permanent possession [including] exclusive use of the resources of the soil, rivers, and lakes existing on them." In addition, the chapter indicates that exploitation of subsoil resources and use of water resources for hydropower generation or other purposes on Indian lands can only take place with the explicit authorization of the Congress, after hearing the affected communities, and only if these populations participate in the proceeds of any extractive activities that subsequently occur.

On the institutional front, in turn, the government merged SEMA and three other agencies (including those for forestry and fisheries development) to form the Brazilian Institute for Renewable Natural Resources and the Environment (IBAMA) in January 1989. In March 1990, the newly inaugurated federal administration established a Secretariat of the Environment (SEMAM) in the Presidency of the Republic,[1] to which IBAMA was shifted from the Interior Ministry, which was abolished.

In terms of environmental policy, finally, the government launched an initiative entitled "Nossa Natureza" ("Our Nature") in October 1988. Associated with this program was the immediate suspension of fiscal incentives for agro-ranching activities in forested parts of Amazonia and intensification of federal efforts to monitor and control forest burning. The present administration continues to limit fiscal incentives for the region and has taken steps to improve environmental protection, particularly in Amazonia.

The World Bank

Environmental concerns first became a part of World Bank assistance in 1970 when the position of Environmental Advisor was established with the dual purposes of assessing possible environmental consequences of projects submitted for funding and elaborating environmental guidelines for the preparation of future operations. In taking this step, the Bank became the first international development assistance agency to systematically screen projects for their environmental impacts. In Fiscal 1974, the Executive Directors endorsed a proposal permitting the Bank to lend for free-standing environmental projects. Other Bank environment-related activities during the 1970s included: (1) more detailed assessment of projects found by the initial

1. A Secretariat of Regional Development (SDR) was also created to improve coordination of public interventions at the regional level.

screening to have significant potential environmental effects;[2] (2) the monitoring of lending operations with environmental components to determine their effectiveness and any need for remedial actions; (3) technical assistance to governments on how to incorporate environmental dimensions into sectoral planning; (4) liaising with other UN agencies and nongovernmental organizations (NGOs) on environmental matters; and (5) environmental education and training.

In 1975, the post of Environmental Advisor was expanded into the Office of Environmental Affairs. Prior to the Bank's reorganization in mid-1987, this office went through several other changes in name and function. However, at no time did it have more than five full-time environmental staff. The 1987 reorganization instituted a central Environment Department and Environment Divisions in each of the regional Technical Departments, leading the way to a significant increase in Bank environmental personnel. Since 1987, the main institutional milestone has been creation, in November 1990, of the Global Environmental Facility (GEF), jointly implemented by the World Bank, the United Nations Development Programme (UNDP), and the United Nations Environment Programme (UNEP).

Bank environmental policies and assessment procedures have evolved significantly over the past decade. The first internal instructions to Bank staff on a human or physical environmental question concerned social issues associated with involuntary resettlement in February 1980. This was followed by an Operational Manual Statement (OMS) on tribal peoples in Bank operations in February 1982 and a policy statement on environmental aspects of the Bank's work more generally in May 1984. Subsequent environment-related policy directives included: the selection and use of pesticides (March 1985); protection and management of wildlands (June 1986); protection of cultural property (September 1986); collaboration with NGOs (August 1988); environmental effects of dams and reservoirs (April 1989); and environmental assessment (October 1989, revised October 1991).

Observing that economic development required sound management of natural, especially renewable, resources and systematic attention to its impact on the environment, the policy in effect when many of the projects examined in this study were under implementation affirmed that the Bank interprets environmental concerns "broadly as those pertaining to the natural and social conditions surrounding all organisms, particularly mankind, and including future generations." Many development projects were recognized as having potentially serious environmental consequences, especially in the agriculture, industry, energy, power, transport, and urban sectors. While rejecting the adoption of fixed environmental standards, Bank policy was based on such principles as: (1) the Bank would endeavor to ensure that projects affecting renewable natural resources would not exceed the regenerative capacity of the environment; (2) the Bank would not finance projects that cause severe or irreversible environmental deterioration or that displace people or seriously disadvantage certain vulnerable groups, without acceptable mitigatory measures; and (3) the Bank would endeavor to ensure that projects having unavoidable adverse environmental consequences would be located in areas where the damage would be minimized. Environmental issues and impacts, finally, were to be considered during all stages of the project cycle, but particularly during preparation, appraisal, and implementation.

Since 1984, and especially since 1987, Bank environmental policies have become increasingly forceful, culminating with the environmental assessment requirements first issued in October 1989. Even though the 1984 OMS provided for the environmental assessment of all relevant projects, it did not specify clear procedural steps, and the Bank had too few environmental staff to monitor compliance effectively. Among the provisions of the present policy which strengthen the integration of environmental concerns in project design are the requirements: (1) that borrowers undertake environmental assessments in consultation with the affected populations; (2) that these evaluations be presented prior to project appraisal; and (3) that environmental assessment reports for prospective Bank operations enter the public domain, thus permitting a greater element of accountability.

The Environmental Challenge and Bank Involvement

Concerns have arisen in Brazil, as elsewhere, about whether environmental constraints will limit development, and whether development will continue to have serious environmental consequences, in turn reducing the quality of life of present and future generations. These concerns are appropriate. At the same time, development remains the greatest challenge for Brazil as millions still live in poverty and have inadequate access to the resources required to give them a chance for a better life. Fortunately, there are strong "win-win" opportunities whereby poverty alleviation measures also address environmental concerns and policies for efficient growth complement those for environmental protection (for example, the elimination of subsidies on fuels and water). Yet it must also be recognized that, in

2. Under these procedures, over a third of the more than 1,300 World Bank and IFC projects approved between July 1971 and June 1978 were found to involve potentially adverse environmental consequences. Of this subtotal, more than one fifth had problems sufficiently serious to require additional studies by outside specialists and/or the incorporation of specific safeguards in project design as a condition of Bank lending. Most of the projects assessed in this study were in the latter category.

many cases, difficult tradeoffs must be made between income generation and environmental protection goals. This is particularly true in Brazil where a major source of growth is the country's vast endowment in natural resources.

Much of this study is about tradeoff as they occur in the design and operation of infrastructure, energy, industry, and agriculture projects. These tradeoff generally balance increases in the cost of "doing business" in the short run with long-term benefits which are not always evident in a narrow project context but appear in the assessment of the development policies of which they are a manifestation. For example, restraints and mitigatory measures in natural resource exploitation and industry help to achieve sustainability, a broad tradeoff between short and long-term outcomes. As another example, a successful resettlement program associated with the construction of a dam for a hydropower project may be the key to seizing multiple "win-win" opportunities: first, a chance to revitalize and perhaps better protect the area around the reservoir and second, the generation of much-needed electricity at a lower cost and with environmental consequences that are far better than those associated with the thermoelectric solutions (for example, imported coal or nuclear) that are available to a country like Brazil.

Brazil is one of the Bank's largest borrowers. When IBRD loans and IDA credits are considered together, it was the Bank's third largest client, after India and Indonesia, in terms of the number of operations approved (189) and followed only India and Mexico in terms of total lending/credit volume (nearly $19 billion) at the end of FY 1991. Approved loans to Brazil constitute 9.3 percent of accumulated IBRD lending worldwide through June 1991. For a general overview of the Bank's activity in Brazil since the 1950s, see World Bank 1990a. Bank operations in Brazil, moreover, have included a number of pioneering projects or project components in terms of environmental and indigenous peoples protection and of involuntary resettlement, many of which are assessed in the present study. Lending to Brazil has also been closely associated with the emergence of Bank policies and operational guidelines in these areas.

The Paulo Afonso IV (Sobradinho) Hydroelectric Project, approved in June 1974, constituted one of the Bank's earliest experiences both in terms of *ex ante* environmental assessment and involuntary resettlement. Appraisal of this project, which took place in July-August 1973, was preceded by an environmental "reconnaissance" following procedures utilized in connection with several earlier Bank-funded hydropower operations, particularly the São Simão Project in Brazil, approved in May 1972. The difficulties associated with resettlement of the rural population at Sobradinho, in turn, were a key factor underlying preparation of the Bank's subsequent policy statements on this issue.

As concerns environmental protection, in turn, the Bank has been involved in water pollution control through sewerage operations since the early 1960s and has routinely given attention to pollution abatement in industrial projects. The São Paulo Industrial Pollution Control Project, approved in 1980, however, was the first Bank operation ever to address both industrial air and water pollution problems. Similarly, while many Bank-assisted agricultural projects have been concerned with rural land and other natural resource use issues, the POLONOROESTE Program, approved in 1981–83, was one of the first to contain an environmental protection component seeking to combine forest management with ecological preservation and research in a large tropical area.

POLONOROESTE was also a pioneering venture in terms of indigenous peoples protection. This program was the prime catalyst for preparation of the Bank's operational policy in this area, first set out in February 1982. One of the first concrete applications of this policy, moreover, was the Carajas Iron Ore Project, approved in August 1982. The environmental protection component of the Carajas Project likewise borrowed some of its features from the nearly contemporaneous POLONOROESTE, while adopting pollution control measures drawn from the Bank's earlier experience in large-scale mining operations, including the MBR Iron Ore Project in Brazil, approved in August 1971.

In many of the projects reviewed in the study, additionally, the Bank made appropriate—albeit in some cases belated—reformulations in response to implementation and other problems of environmental concern and attempted to incorporate lessons learned and its evolving directives with respect to the handling of environmental issues. More generally, as a result of the increasing emphasis given by the Bank to such concerns since 1987, the number of country environmental strategies and action plans and free-standing environmental projects and project components has grown very rapidly in recent years. For more detailed accounts of the World Bank's environmental activities since 1987, see World Bank 1988, 1989a, 1989b, 1990b, and 1991. World Bank 1989b provides additional information. Also see Rich, 1990.

In Brazil, finally, since 1987, Bank economic and sector work has increasingly addressed such issues as the impact of past government policies on tropical deforestation,[3] environmental aspects of Amazonian development, and pollution problems and monitoring and control capacity in various states. The Bank has also approved one or more operations for industrial and urban pollution control, resettlement, forestry development, metropolitan flood reconstruction and prevention, rural land management, malaria control (in the Amazon basin), electricity conservation, and municipal development with environmental components. The earlier Electric Power Sector Loan (June 1985),

3. See Mahar, 1989; and Binswanger, 1989.

the National Environmental Project (February 1990), and Bank assistance to the government in preparing its proposal to the G-7 countries to help protect Brazil's tropical rainforests (July 1991) should be especially highlighted in this context. Key features of some of these operations are further described in Annex 2.

Part A: Case Studies

2. São Paulo and the São Francisco Valley

The present review consists of four case studies involving Bank-supported investments in different sectors in ecologically distinct parts of Brazil. Several of these operations had specific environmental, tribal peoples protection, or involuntary resettlement components or parallel programs, or are themselves free-standing pollution control or resettlement projects. Most, if not all, have also had significant human and physical environmental impacts. After reviewing some of the principal features of the four case studies, the projects surveyed in São Paulo and the São Francisco valley will be briefly described in this chapter. Those examined in eastern and western Amazonia will be discussed in Chapter 3.

Basic Characteristics

Each of the case studies covers one or more projects involving investments in a particular region or area of influence which is territorially extensive and ecologically heterogeneous. The São Paulo Industrial Pollution Control Project was initially designed to focus on the São Paulo metropolitan area (SPMA). However, it was later extended to the entire state which has an area of nearly 250,000 square kilometers and a population of some 30 million.

The São Francisco River flows for some 2,700 kilometers through five states. Its drainage basin covers 640,000 square kilometers—an area larger than Spain and Portugal combined—more than half of which is located in the so-called "Drought Polygon" which has average precipitation levels less than 600 mm a year and highly irregular rainfall. Most of the lower and middle valley, which extends some 1,200 kilometers, is situated in areas where rainfall varies between 400 and 600 mm a year. Traditional economic activities include subsistence agriculture, fishing, and extensive livestock raising. Since the 1970s, irrigated agriculture has led to the development of agroindustries and rapid urban growth, making the middle valley increasingly attractive to migrants from the surrounding backlands. The principal manmade feature of the region is the Sobradinho reservoir, which covers some 4,150 square kilometers, making it the largest inland water body in South America after Lake Titicaca.

The two remaining case studies concern critical parts of the vast Amazon region. The Carajas iron, manganese, and copper mines are situated at the heart of the Greater Carajas region. The latter was officially established in 1980 and occupies parts of three states and a land area of some 900,000 square kilometers. Most of the region is covered by tropical forest and, except for its eastern section, was still sparsely populated in 1970. The area of influence of the iron ore operation, as defined in connection with the parallel Amerindian Special Project, involves a corridor some 300 kilometers wide along either side of the railway which extends for 900 kilometers between the Carajas mines in east-central Para and São Luis, Maranhão, as well as outward from the mine. This is an area of roughly 292,000 square kilometers. The rail corridor passes through several ecologically distinct subregions including the Carajas highlands, the depression formed by the Araguaia-Tocantins River valleys, the Maranhão sedimentary plateau, and coastal marshlands near São Luis. Total population in the municipalities cut by the railway, which occupied an area of 81,500 square kilometers, was just over 1.1 million, slightly less than half of which lived in towns and cities, in 1980.

As officially defined, the "Northwest region," which includes all of Rondonia and the northwestern part of Mato Grosso, covers 410,000 square kilometers, or an area larger than Paraguay. It too contains a variety of ecosystems ranging from the northern part of the Pantanal wetlands and savannah grasslands in the southern and south-central sections of the region to dense tropical forest in much of Rondonia and northern Mato Grosso. The principal manmade feature is the BR-364 highway which extends for close to 1,500 kilometers between the capital cities of Cuiaba and

Porto Velho. Regional population in 1980 was just under 1.1 million, of whom just under half resided in urban areas.

Even though their relative territorial and demographic proportions were significantly different, the four case study areas shared another important feature: they were all growing rapidly in both population and economic terms. The two Amazonian subregions were areas of advancing frontier settlement based on a combination of extractive, small-scale agriculture, and large-scale ranching activities. At the time the Carajas iron ore mine and railway were installed, parts of its area of influence were already subject to the influence of several major highway projects, a major hydroelectric dam (Tucurui), and increasing competition for land. The Northwest region, in turn, was already receiving an increasing number of migrants over an existing unpaved highway from southern Brazil, where large-scale mechanized agriculture was rapidly expanding. The São Francisco valley was the focus of increasing irrigation-based agricultural and agroindustrial development. Equally important, urban centers were growing at least as rapidly as rural settlement in all four regions.

In addition, all of the case study areas were undergoing socioeconomic transformations directly associated with rapid population growth and the structural and policy changes mentioned in the previous chapter. In most cases, the Bank-assisted projects examined in the study contributed to the acceleration of these transformations, even though this was not always their principal or conscious objective. Finally, most of the undertakings assessed in detail in the study were both large in financial terms and complex. The Paulo Afonso IV Hydropower Project had an estimated total cost of $693 million and was cofinanced by the Bank, the Inter-American Development Bank, and other lenders. Similarly, the Carajas Project was supported by a variety of lenders who approved total financing of $2.7 billion for an operation initially expected to cost $4.5 billion. POLONOROESTE, in turn, was approved to receive Bank funding of $434 million for an investment program having an estimated cost of nearly $1.6 billion. In most of these operations, several different sectors and executing agencies were involved.

Urban-Industrial Pollution Control in São Paulo

São Paulo provides a dramatic illustration of the types and dimensions of environmental problems that frequently result from rapid and largely uncontrolled urban-industrial expansion in developing countries. São Paulo state produces approximately half of Brazil's industrial output and value added, roughly 70 percent of which are generated in the SPMA, and has a per capita income twice the national average. The metropolitan population, which exceeded 15 million in 1985, is projected to surpass 20 million by the year 2000. Rapid industrial and urban growth in the state, especially since 1950, have been accompanied by increasingly serious environmental problems, particularly air and water pollution. Given their demographic size and the concentration, scale, and composition of the industrial activities within their boundaries, the principal areas of concern from an environmental standpoint are the SPMA and the Santos lowlands, particularly Cubatão, some 70 kilometers east of the metropolitan area.

In addition to agricultural run-off in parts of the state, water pollution in São Paulo is the result of increasing industrial effluents and domestic sewage discharged into local rivers and other water bodies. Air pollution, especially in the SPMA, is associated with the large and rapidly growing motor vehicle fleet, the unpaved peripheral road network, and industrial emissions. Rapid urban-industrial growth, occurring largely in the absence of land use and transportation planning, locational controls, and pollution abatement measures, together with the insufficient provision of basic sanitation services, explains much of the deterioration in air and water quality in the metropolitan region and elsewhere in the state over the past several decades. Rising levels of urban-industrial pollution are also associated with increased public health problems. The urban poor and other vulnerable groups are among those most adversely affected.

The Projects

The industrial pollution control projects approved in 1980 and 1987 were part of broader basic sanitation and pollution abatement efforts by the state government in the SPMA since 1970. These included such earlier Bank-financed interventions as the São Paulo Water Supply and Pollution Control Projects, approved in May 1971, and the Greater São Paulo Sewage Treatment Project, approved in February 1978. The first industrial pollution control operation was largely intended to finance pretreatment of liquid effluents prior to their being discharged into an upgraded metropolitan sewerage system supported under the 1978 sewage treatment project. Given the increasing deterioration of air quality in the SPMA during the 1970s, the other major objective of the first industrial pollution control operation was to reduce particulate matter emissions in the metropolitan region.

Neither of the above mentioned (that is, 1971 and 1978) basic sanitation projects succeeded in improving water pollution control in the SPMA. Although environmental betterment was included among their objectives, execution delays, shortfalls in counterpart funding, internal political differences, and rapidly growing population in the metropolitan area effectively limited their achievements. As a result, most domestic sewage in the SPMA remains untreated. Similarly, delays caused in part by national economic diffi-

culties in the early 1980s led to postponement of expected federal vehicle emission control measures.

The 1980 industrial pollution control project, in contrast, has made a significant contribution to environmental protection in São Paulo. This operation combined a line of credit, known as PROCOP, for industrial pollution control equipment and pretreatment facilities with technical assistance to CETESB, the state environmental agency. At first, the project experienced implementation difficulties due to the economic crisis, insufficient federal and state counterpart funding, and an initial lack of demand, which was partly the result of its own administrative complexity. After substantial reorientation in 1984, however, disbursement of PROCOP resources proceeded much more rapidly and the extended June 1986 closing date was easily met. Originally limited to pretreatment of liquid industrial wastes and reduction of industrial particulate matter emissions in the SPMA, reformulation of the project entailed: (1) expansion in scope to include full treatment of effluents, control of sulfur dioxide emissions, and disposal of industrial solid wastes; (2) extension of its geographic coverage to the entire state; and (3) greater flexibility in subproject appraisal procedures and subloan financing conditions.

Environmental Impacts

The revised industrial pollution control project clearly had a positive effect in environmental terms. Air and water quality indicators in the areas most affected by the operation reveal significant reductions in industrial pollution. The project's direct impact was greatest in Cubatão and in terms of air pollution. The comparative ineffectiveness of the water pollution component, in turn, was due largely to factors beyond the control of either CETESB or the Bank, particularly the delays experienced in the execution of the sewage treatment project mentioned above.

Even though the 1980 project's original objectives were only partly met, the mid-course changes in its design and operating procedures permitted it to address a broader set of industrial pollution issues, thus ultimately amplifying its impact. Furthermore, even though the project's direct effect on pollution levels in the metropolitan area was smaller than initially anticipated, its indirect consequences appear to have been substantial. The PROCOP credit line has played an important catalytic role, particularly in the SPMA, where the mere existence of a specific funding source for pollution abatement, together with the possibility of being fined and receiving negative publicity for not complying with state air and water quality standards, was reportedly sufficient to induce many industries to install pollution control equipment using their own or other non-PROCOP resources.

The project's technical assistance component strengthened CETESB's analytical and operational capabilities and promoted development of a long-term pollution control strategy for the SPMA and other parts of the state, including key river basins. Improved inter-institutional coordination was also attained through the operation. Other important by-products were the second (that is, 1987) industrial pollution control project, which, through IBAMA, has begun to extend efforts in São Paulo to the national level, and a third such operation, currently under appraisal, which would move even further in this direction.

In synthesis, the experience in São Paulo demonstrates the value of applying a "carrot and stick" approach to pollution control through which effective enforcement efforts are combined with credit and technical assistance. It also demonstrates the importance of a strong legal, regulatory, and institutional framework and of an agency possessing sufficient technical capacity and determination to systematically monitor and control industrial polluters. As concerns institutional "determination" more specifically, the critical role of local public awareness and unequivocal political support for CETESB's initiatives[1] cannot be overemphasized. Consistent Bank assistance to CETESB since the late 1970s has also contributed to the generally positive industrial pollution control experience in São Paulo to date. These lessons are further discussed in Chapter 5.

Power Generation, Involuntary Resettlement, and Irrigated Agriculture in the São Francisco Valley

Since the 1950s, the Brazilian Northeast has witnessed a series of regional programs designed to promote rural development which have met with only partial success. In view of the relatively unimpressive performance of dryland-based initiatives, the tapping of relatively scarce hydrological resources for energy and agricultural production has been perceived as an increasingly important means of promoting economic growth in the region. In the midst of a much larger area which has consistently suffered from erratic rainfall distribution and periodic and often catastrophic droughts, the comparatively privileged São Francisco valley has become a focal point for the expansion of both hydropower generation and irrigated commercial agriculture.

A relatively concentrated rural and urban population had, over the centuries, become established in the region by virtue of ready access to water for domestic, industrial, irrigation, and transportation purposes, complemented by the availability of fertile alluvium-rich soils along the valley floor. Land ownership and tenure arrangements, however,

1. Project performance improved dramatically after a popularly elected state governor decided to use it to "clean up" Cubatão, resulting in its reformulation and effective implementation after 1983.

led to a concentration of wealth and political power with correspondingly poor living standards and low income levels for the vast majority of farmers. Few formal employment opportunities were provided in the region's towns and cities. The Bank-supported projects considered in the study have played a key role in the dramatic transformations that have taken place in the middle and lower São Francisco valley since 1970.

The first significant attempt to use the São Francisco's generating potential was completed in 1955 (Paulo Afonso I) with the Bank's assistance. By 1974, CHESF, the regional power company, had an installed capacity of 1,346 MW, which grew to 6,076 MW by 1984. In the early 1970s, hydroelectric development in the São Francisco valley was determined to be the least-cost alternative for meeting rapid regional demand growth and a multi-year expansion program was proposed consisting of a large regulating dam at Sobradinho and progressive construction of hydropower plants at Moxoto (400 MW), Paulo Afonso IV (1,900 MW), and Xingo (4,000 MW), to be followed at a later date by the installation of generating capacity at Sobradinho dam. However, given the sharp increase in petroleum prices in 1973–74, it was decided to accelerate the generating plant at Sobradinho, which was undertaken in parallel to, but not financed by, the Bank-assisted hydropower operation described below.

The Projects

In 1974, the Bank and other lenders approved financing to assist CHESF with the Paulo Afonso IV Hydropower Project. This operation comprised construction of the Sobradinho dam, installation of additional generating capacity near Paulo Afonso falls some 500 kilometers downstream, expansion of transmission lines, and other components. The project resulted in economic and social benefits for much of the Northeast. It also had a number of less positive effects, the most serious of which was the displacement of some 70,000 people in the area inundated by the Sobradinho reservoir.

The Lower São Francisco Polders and Second Irrigation Projects were "emergency" operations prompted by the increase in the minimum flow resulting from installation of the Sobradinho dam some 800 kilometers upstream. Bank loans totalling more than $66 million were approved in 1975 and 1979 to protect the floodplains near the mouth of the river through a series of dikes and pumping stations and to establish five irrigated "polders" on some 25,000 ha. This area was to be expropriated and redistributed in small plots to roughly 4,600 local farmers. Bank operational staff considered the solution adopted to be the only feasible one given physical, economic, and institutional constraints. The projects were executed under considerable time pressure and social tension due to completion of Sobradinho dam, over which the executing agency, CODEVASF, had no control.

In addition to solving the "emergency," the lower São Francisco projects also aimed at promoting the economic and social advancement of the rural poor. Their land redistribution component represented a pioneering attempt to secure land ownership for formerly landless farmers, providing them with access to credit and technology at a time when the political situation in Brazil was not conducive to such activities. These operations were also among the first externally supported efforts to raise rural living standards on an area-specific basis. As such, they were the direct precursors of a large number of poverty-oriented rural development projects supported by the Bank in the region in the 1970s and 1980s.

The experience at Itaparica marks a significant development in dealing with large-scale population displacement in the Northeast. Unlike the situation at Sobradinho and in the lower valley, dam and reservoir construction, which were not financed by the Bank, were—because of conditionalities in the 1986 Power Sector Loan—accompanied by a comprehensive resettlement program in which representatives of the resettled population were heard. This participation was limited and had to be actively fought for by the rural trade union consortium, POLOSINDICAL. Bank intervention was guided by its involuntary resettlement policy, first adopted in 1980, largely in response to Sobradinho, and further elaborated in 1986. Following appraisal of the Power Sector Loan in 1985,[2] the Bank approved $132 million in 1987 and a supplemental loan of $100 million in early 1990 to fund irrigation schemes, agricultural production services, and rural and urban infrastructure in or near five irrigation projects in connection with Itaparica dam, whose reservoir was filled in 1988.

The campaign for a comprehensive resettlement program at Itaparica was initiated by POLOSINDICAL in 1979 soon after plans for the dam were announced. As CHESF was slow in presenting a clear plan for reestablishment of the rural communities to be displaced by the reservoir, POLOSINDICAL organized mass demonstrations which received widespread public attention. As a result, it was able to exert some influence over resettlement arrangements. A written agreement was negotiated with CHESF in 1986 covering such crucial aspects as the size of the plots to be provided in the irrigation subprojects, the size and quality of housing, and the size of maintenance payments to relocated rural families pending operation of these schemes.

2. In appraising this loan, the Bank and borrower agreed on a policy-based reform to tackle environmental issues related to power development by enhancing the sector's capability to deal systematically with these concerns through the enactment of adequate guidelines and institutional strengthening. The results of this approach are reportedly among the operation's principal achievements.

Despite minor problems with compensation procedures, relocation of some 40,000 people went smoothly during 1987–88, with about half of the total opting for resettlement in rural villages (or *agrovilas*) equipped with health, sanitation, and educational infrastructure. The other half were resettled in four new towns, close to the sites of the previous communities. These new urban centers are now functioning smoothly. About 5,200 farm families were transferred to six future irrigation schemes covering 20,000 ha.[3] However, as of 1991, the irrigation facilities were not yet operational. The first of these schemes is expected to come on stream in early 1992, several years behind schedule. The project has yet to move into the production stage.

Regional Impacts

The Paulo Afonso IV Hydropower (Sobradinho) Project successfully expanded electric energy generation and transmission, particularly to support urban-industrial growth in the Salvador and Recife metropolitan areas. It also had an important, but largely unforeseen, impact on local development in the middle São Francisco valley, especially in the area around Sobradinho, where increased energy supply and improved river flow regulation contributed directly to the rapid expansion of irrigated agriculture and associated agroindustrial and urban development.

The projects examined, in short, have contributed to broader development tendencies in the São Francisco valley as a whole. Creation of Lake Sobradinho and increased local power generation have facilitated the expansion of capital-intensive irrigated agriculture (some 177,000 ha in 1988, about half of which was in private hands). Much of this production is oriented toward higher value commercial and export crops and is concentrated in the area around Petrolina and Juazeiro near Sobradinho. There has been a corresponding growth of agroindustrial processing enterprises served by increasingly sophisticated transport and communications networks. This has had an important multiplier effect, helping to stimulate local commerce and creating employment, especially for temporary wage labor.

The impressive economic growth in the middle valley over the past two decades has been accompanied by transformations in land tenure as well as land use. There has been some tendency for the concentration of land ownership as small farming has become less viable and land values have risen, encouraging land sales and rural outmigration. The previously prevailing subsistence smallholders are gradually being replaced by more capitalized and commercially-oriented larger farmers. Although it is difficult to predict how far this process will advance, traditional tenure relations such as sharecropping are finding a place in the new production systems.

Recent agrarian changes have also contributed to rapid urbanization in the middle valley, where the largest centers have probably quadrupled in size since 1970. As is occurring elsewhere in the Northeast, much of this expansion is accounted for by the spread of low-income settlements characterized by poor housing and community services and significant underemployment. The geographic distribution of urban impacts along the valley, moreover, has been uneven. While Petrolina-Juazeiro and smaller centers near Sobradinho have benefitted from the industrial and commercial spin-off generated by irrigated agriculture, several towns and cities in the lower-middle valley and near the mouth of the river appear to have stagnated due to the relocation of population.

Social and Environmental Impacts

Paulo Afonso IV/Sobradinho. Even though urban relocation at Sobradinho was successful, planning for the rural resettlement program was seriously flawed. It was initially assumed that half of the rural displacees would opt for relocation to an official colonization project some 1,000 kilometers upstream, while only a small minority would choose to remain near the reservoir. The reverse, in fact, occurred. The colonization scheme in the upper São Francisco valley proved to be a failure and was subsequently abandoned by most of the settlers from Sobradinho, who were thus deprived of vital social and production support.

Similarly, the lakeside *agrovilas* have not prospered, with farmers frequently lacking the credit and support services necessary to overcome problems caused by poor soils, incomplete irrigation facilities, changing water levels, and increased distances to markets. Social infrastructure in the *agrovilas* was often also inadequate. Many resettled families have subsequently left the area, some selling their land to larger commercial farmers, thus contributing to the concentration of rural holdings.

Many of the problems experienced by small farmers near Sobradinho more than a decade after their original displacement can be traced to inadequate compensation policies through which only those possessing legal titles were paid for the loss of their lands. This was harmful to a number of long-standing producers who lacked legal title to the land they farmed and whose former livelihood as riverine cultivators and subsistence fishermen was wiped out by the project. In addition, resettlement was a traumatic experience for many, occasionally associated with confrontations in which local populations were forced to rapidly abandon the areas to be flooded.

Sobradinho's physical environmental impacts were also significant. Downstream regulation of the São Francisco

3. Five of these schemes are supported by Bank financing: Borda do Lago, Bahia; Borda do Lago, Pernambuco; Brigida; Pedra Branca; and Caraibas.

River resulted in a large increase in the lowflow, thus threatening to flood some 9,000 ha of fertile rice-paddy and necessitating the lower valley "emergency" and irrigation projects. Upstream of the dam, riverine farmland was lost and there has been some siltation and overfishing with illegal methods. Increased evaporation from the large reservoirs at Sobradinho and Itaparica, together with the proposed expansion of irrigated agriculture, are likely to place greater pressure on water resources in the valley, possibly heightening inter-sectoral competition for river water use over the coming decades.

The Lower São Francisco Valley. Prior to the construction of Sobradinho, several thousand itinerant farmers worked as sharecroppers on seasonally flooded lowlands in the lower São Francisco valley. Land concentration was very high and the incomes of the vast majority of farmers were very low. As the result of Sobradinho, annual fluctuations in the river level were greatly reduced, leading the government to build dikes and pumping stations under two Bank-assisted projects to make land that had previously been seasonally inundated available for year-round agricultural use and making it possible for many small farmers to settle permanently on irrigated plots. These polder/irrigation schemes absorbed approximately 20,000 people and farmer incomes, on average, have reportedly more than tripled as a result of the project.

Independent researchers, however, have estimated that some 50,000 rural dwellers were dislocated in the lower São Francisco valley during the second half of the 1970s,[4] resulting in a net displacement of as many as 30,000 people. Unlike Sobradinho, there was no attempt to devise a wider resettlement strategy for those affected, the absence of which may have contributed to significant outmigration. This is reflected in the low or negative rates of population growth in the area during the 1970s, which were atypical of the valley as a whole. Various factors appear to have contributed to the net displacement of population including extensive flooding and the rapid expansion of sugar cane production in parts of the region, together with delays of several years between land expropriation and operation of the new irrigation schemes, their relatively low labor absorption capacity, and CODEVASF's selective recruitment methods.

Performance of the five CODEVASF-run irrigation projects in the lower valley has been generally disappointing. The settlers' limited capacity to manage and operate intensive irrigated production systems and problems due to inadequate drainage, increasing salinity, and insufficient extension support have resulted in low cropping intensities and highly variable farmer incomes. Farmer indebtedness may be leading to abandonment of land in spite of considerable subsidies in the form of public sector provision for the operation and maintenance of the schemes. CODEVASF has taken steps to introduce irrigation cooperatives or associations in an effort to ensure administrative and financial autonomy ("emancipation") of these projects.

As concerns the physical environment, substitution of traditional floodplain agriculture by "polder" irrigation schemes has given rise to a number of problems despite the clear advantages of two rice harvests per year. The trapping of sediments upstream at Sobradinho, Itaparica, and Paulo Afonso has, predictably, reduced natural soil fertility in the lower valley, necessitating increased application of chemical correctives. Yields have also been affected by poor water quality in some of the São Francisco's affluents that cross the polders, leading to increased salinization from periodic flooding and inadequate drainage. The predominance of rice monoculture, finally, may aggravate risks of pest infestation and plant disease and is allegedly encouraging excessive use of agrotoxic substances by some farmers.

Itaparica. Although the physical transfer of people at Itaparica was carried out successfully, problems have subsequently arisen due to extensive delays in initiating agricultural production. Incidents of intra-communal violence, alcohol abuse, family disintegration, and low morale have occurred in various *agrovilas.* Prolonged idleness, limited local employment opportunities, and occasional shortcomings in the provision of social services have contributed to a climate of uncertainty and frustration. This has been exacerbated by the slowness to provide services to cope with the transition from traditional to more capital-intensive irrigated agriculture in the new projects.

The final cost of resettlement at Itaparica will be very high, probably exceeding $63,000 per family. This high cost appears to be largely a consequence of the comprehensive nature of the resettlement program adopted—which is consistent with current Bank policy—the contract negotiated between POLOSINDICAL and CHESF, and the time pressure under which the resettlement plan was devised. This contrasts with the earlier experiences at Sobradinho, where the full social and economic costs were not internalized by the implementing agency, and in the lower valley, where much of the displaced rural population was not accommodated in the new irrigation schemes.

Negative ecological impacts of Itaparica thus far seem to have been both modest and largely attenuated due to CHESF's advance planning to institute appropriate physical, biological, and sociocultural controls following negotiations with state environmental authorities in Bahia and

4. A study by the Joaquim Nabuco Foundation, whose findings were first published in 1983, reports that roughly 10,100 families were displaced from the areas expropriated in connection with the lower São Francisco projects between 1975 and 1980. Project completion reports (PCRs) indicate that less than 3,200 families—as compared with an appraisal target of 4,600—were actually benefitted by these operations.

Pernambuco. Such controls include land use and water quality monitoring, as well as an animal rescue plan and an aquatic fauna conservation program. On the evidence of Sobradinho and the lower valley, however, future problems could include some risk of lake contamination by chemicals used in agricultural activities, together with untreated urban and industrial wastes, while yields in the irrigation schemes may be undermined by increasing soil salinity. These phenomena, which can be mitigated, will require careful monitoring by state environmental agencies.

ment agency to set up an agricultural settlement project on the edge of CVRD's mining concession and the proliferation of prospecting activities in the area following the discovery of gold at nearby Serra Pelada induced further occupation of the western part of the corridor, with associated deforestation, river pollution, and other environmental effects.

Physical Environmental Impacts

The larger area of influence of the Carajas Project is one of the Amazonian subregions that has experienced the highest rates of deforestation and associated environmental degradation over the past two decades. (This is clearly illustrated in Mahar, 1989.) The iron ore operation contributed to these processes in the following, often interrelated, direct and indirect ways: (1) by attracting construction workers and other settlers to the region, many of whom remained to pursue prospecting, small farming, and urban employment opportunities; (2) by building and paving new roads and improving existing ones to provide access to the mine site and, in the process, to extensive and previously remote parts of the region; (3) through private land speculation along the corridors formed by the railway and project-related roads; (4) as a result of the lumber requirements for construction of the railway and other project facilities and to provide shelter and services for the population attracted to the area; and (5) through the use of fuelwood derived from the native forest to produce charcoal for pig iron smelters. Given the other influences on the natural environment at the time, however, it is impossible to quantify the impact of the Carajas operation in relation to previous and concurrent developments.

Partly as a result of these interventions, nonetheless, land clearing in the Carajas corridor has increased significantly over the past two decades. Much of the deforested area has been converted to pasture for low density grazing activity, which has expanded dramatically in the area since 1970. Associated with rapid deforestation in the Carajas corridor, as elsewhere in Amazonia, are alterations in soil[4] and water[5] quality. Experience in the Carajas corridor reveals that, within several years after the forest is converted to pasture, a proliferation of weeds and other second growth vegetation occurs which is both difficult and costly to control. As a result, pasture lands quickly become degraded and are frequently abandoned less than a decade after they are first cleared, fueling further deforestation. Rural settlement and associated deforestation have also led to a substantial, although unquantified, loss of fauna through the destruction of natural habitats, especially by fire—which is the traditional means employed both to clear virgin forest and to eliminate second growth vegetation—and predatory hunting and fishing practices.

Although the Carajas Project is not directly responsible for most of the environmental degradation that has occurred in its larger area of influence over the past several decades, it has indirectly contributed to this process by improving accessibility and helping to attract considerable numbers of migrants to the region. A more direct relation exists, however, in terms of the potential ecological damage that could occur in response to the installation or expansion of pig iron and other charcoal-consuming metallurgical industries in the Carajas corridor. Even though measures recently taken by the Brazilian government appear to lessen the threat from this source, the potential linkage between industrialization of the Carajas corridor and deforestation in the area should not be overlooked. Unless alternative fuel sources are utilized and enforcement of existing regulations is considerably strengthened, the most likely scenario may well be the continued use of charcoal from the native forest.

Environmental and Amerindian Protection

Environmental Protection. The project's environmental protection component consisted of air and water pollution monitoring and control at the Carajas mine and port sites, soil erosion control along the railway, environmental education, and ecological research, together with the establishment of conservation tracts, greenbelt buffer zones, ecological stations, and biotic inventories, inside or on the periphery of CVRD's mining concession, and an "environmental zoning" exercise for the larger Carajas region. To oversee the component, in-house environmental commissions were established at the mine and port and a blue ribbon panel of outside experts was set up to advise CVRD's senior management on environmental issues related to the company's operations, particularly Carajas.

For the most part, CVRD successfully implemented the environmental measures proposed in connection with the project, spending roughly $64 million on environmental control and protection between 1982 and 1987. Slightly over 60 percent of this total was used for "hydroseeding" and landscaping to avoid soil erosion along the railway. The sec-

4. In the case of soils, clearing the primary forest for crops or pasture in tropical areas has several consequences which limit possibilities for developing geographically sustainable agricultural and ranching activities. These include: decreasing soil fertility due to the loss of nutrients through leaching; disappearance of the most fertile upper layer of the soil as the result of erosion; reduction of the quantity of organic matter in the soil previously provided by the now absent forest; and an increase in soil densities through compaction, particularly when land is used for grazing or heavy machinery is utilized in connection with agricultural activity.

5. The contamination of surface waters is the result of changing land use, soil erosion, fertilizer and pesticide utilization, increasing urbanization, and rapidly expanding mineral extraction activities. Mercury pollution associated with gold prospecting is a particularly serious problem in the Carajas corridor, as in other parts of Amazonia.

ond largest expenditure involved drainage and effluent control at the mine and port sites.

The transport infrastructure installed through the project had important secondary effects and is likely to generate considerable benefits for agricultural and industrial development in the region, as anticipated at project appraisal. However, these investments have also indirectly had some negative environmental consequences at the regional level because of deforestation and soil erosion that were not anticipated at the time of project preparation and appraisal. Outside the areas under CVRD's control, environmental protection measures, which depended on other government entities, were almost entirely lacking, contributing to the environmental costs associated with the largely uncontrolled rural settlement and rapid urban growth described above.

"Environmental zoning" activities, which were to have been the project's principal intervention outside the areas directly controlled by CVRD, in practice consisted of little more than geo-ecological regionalization studies. Although of considerable scientific interest, they did not constitute a meaningful zoning exercise from an environmental planning, land use, or natural resource management standpoint, possibly because they were carried out in isolation from state and local authorities. As a result, the Brazilian government and the Bank missed an opportunity to encourage more rational land and other natural resource use in the Carajas corridor.

Amerindian Protection. The larger area of influence of the Carajas Project is presently estimated to contain roughly 14,000 Amerindians scattered among some 130 villages. Almost all of these communities were in contact with Brazilian rural society prior to the iron ore operation. This contact accelerated over the decades immediately preceding the project due to the rapid expansion of the agricultural and extractive frontier in eastern Amazonia. Prior to the operation, some of these groups suffered significant population losses due to disease and conflicts resulting from growing interaction with frontier settlers. Until the time the Carajas Project was undertaken, however, FUNAI was not very active in the area.

In order to mitigate the expected impacts of the iron ore operation, CVRD signed an agreement with FUNAI in mid-1982 for execution of an Amerindian Special Project to provide land demarcation, health, economic development, and educational services to indigenous communities. Despite CVRD's and the Bank's close supervision, implementation of the Special Project encountered numerous difficulties including frequent changes in FUNAI's top management and internal organization, substantial budget cuts, and the agency's persisting tendency to utilize Special Project resources to strengthen its own administrative and physical infrastructure. These problems led CVRD to suspend disbursements in March 1986 in order to force FUNAI to address unresolved land tenure issues, especially the demarcation of reserves and removal of illegal squatters from tribal areas.

Despite these problems, significant improvements in the conditions of indigenous communities occurred as a result of the Special Project, particularly with respect to health care and land demarcation. These achievements are especially evident when the situation in the project area is compared with that in other parts of Amazonia where FUNAI has not received the support of outside agencies such as CVRD and the Bank. These accomplishments are also noteworthy considering that Amerindian lands in the Carajas region have become increasingly coveted by loggers, ranchers, squatters, prospectors, and other interests, while bureaucratic and political obstacles continue to impede the rapid demarcation of tribal areas.

A number of unresolved land issues nevertheless persisted at the time the iron ore project closed, although the Special Project remained open for several years afterward and CVRD continues to take actions on behalf of Amerindians in the area using its own resources. Future threats to tribal reserves are likely to emerge from the continuing expansion of rural settlement, including the possibly increasing extraction of fuelwood for charcoal production. More generally, the long-term sustainability of efforts to protect local tribal populations under the Special Project is uncertain.

POLONOROESTE: Roads, Health, and Rural Development

In the 1960s and 1970s, Brazil adopted ambitious measures aimed at integrating Amazonia into its rapidly expanding economy. Highways were planned and implemented and settlement programs were drawn up, while growth pole strategies and fiscal incentives were expected to draw private investment to the region. Large-scale hydroelectric and industrial projects, most notably Tucurui and Carajas, were planned or initiated in eastern Amazonia. Concomitantly, large numbers of small farmers and rural workers were being expelled by agricultural modernization and land concentration in south-central Brazil and by demographic pressures, recurrent droughts, and poverty in the Northeast. The need to find gainful employment for these migrants lent additional impetus to attempts at directed Amazonian settlement.

Colonization programs carried out along the Transamazon highway in the state of Para in the early 1970s, however, fell short of their targets as complex settlement schemes proved incapable of developing sustainable agriculture in a poorly known tropical environment. Meanwhile, the conjunction of a number of factors including infrastructure—

especially road—construction and tax and credit incentives stimulated an increase in land values in more accessible parts of the region, leading to concentration of rural holdings and the *de facto* limitation of small farmer access to unoccupied land.

The discovery of fertile lands under public domain in Rondonia in western Amazonia appeared to provide a more promising outlet for the increasing number of migrants drawn to the region. While the attention of INCRA, the national colonization institute, was first directed to the area in response to a localized land conflict, several factors coalesced to turn Rondonia into the main focal point of the agency's activity. Government assistance soon expanded and news that reportedly good quality land was being freely distributed prompted the first significant waves of migration to Rondonia in the mid-1970s. By the late 1970s, Rondonia's population had more than quadrupled. Socioeconomic problems were mounting, deforestation was increasing, and the security of the Territory's indigenous inhabitants was seriously threatened.

The growing intensity of migration to Rondonia quickly increased the demand for roads, schools, health clinics, and agricultural services. Strong interests both inside and outside the region converged to channel these demands into a proposal by the federal government to reconstruct and pave the existing, but seasonally impassable, BR-364 highway. The proposed highway project, however, satisfied neither the Bank's policy for the Brazilian transport sector, which emphasized 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, arguing that the Bank should assist the government to improve production and living conditions in existing colonization areas. In response to these concerns, continuing Bank-Borrower dialogue led to formulation of a small-farmer oriented area development effort organized around a major transport improvement.

Subsequent discussions resulted in elaboration of an ambitious program to promote the "orderly human occupation" and development of the Northwest through government and Bank support for social and economic infrastructure and what were considered at the time to be environmentally sound smallholder activities. A complex institutional set-up was designed to implement the operation under the coordination of SUDECO, a regional development agency. Potential benefits both for small-farm families already in the region and expected future arrivals were thought to be significant. The program would also include pioneering environmental and Amerindian protection components intended to minimize the adverse effects of the expected acceleration of migration to the area in response to pavement of the highway. These measures, which were introduced largely at the Bank's insistence, were expected to offset many of the acknowledged risks of promoting further occupation of an ecologically sensitive area.

The Program

In May 1981, the Brazilian government formally launched a program of major investments in the agricultural frontier areas of Rondonia and western Mato Grosso. The Northwest Region Integrated Development Program, or "POLONOROESTE," sought to absorb the human influx in a sustainable manner by expanding infrastructure and increasing agricultural productivity, rural incomes, and social welfare. Major components of the program included pavement of the Federal highway between Cuiaba and Porto Velho, extension of the feeder road network, consolidation of existing settlement schemes and support for the establishment of new ones, improvement of social (especially health) services in rural areas, and measures to protect the natural environment and the indigenous population.

POLONOROESTE's activities, at a total cost of $1.6 billion, were to be financed by the federal government and the Bank (66 percent and 34 percent, respectively). The Bank approved five complementary projects for this Program. The first three Bank loans were approved in early December 1981, or less than a month before Rondonia was elevated to statehood. The principal component of the Bank-financed program was improvement of the 1,084 km central section of the Cuiaba-Porto Velho highway, which the Brazilian Army had already started to reconstruct, and construction of about 500 km of feeder roads in each of the two states. Also approved at this time were a loan for the consolidation of several existing agricultural colonization areas in Rondonia, together with environmental protection measures for the region as a whole, and a loan to improve rural health services and combat malaria in Rondonia.

Phase II of the program, approved in March 1982, consisted of a rural development project in existing small-farmer areas in northwestern Mato Grosso, while Phase III, approved in December 1983, was expected to help establish five new settlement areas in Rondonia. Execution of the three overlapping phases was estimated to require seven years. In parallel, and within a framework agreed with the Bank, the Brazilian government financed a Special Amerindian Project for the protection of the indigenous population in the POLONOROESTE Program area. The government also committed itself to finance rural credit, land titling, and several other activities to support settlement consolidation in Rondonia.

Even though reconstruction of the BR-364 highway was subsumed under a broader regional development concept, implementation of POLONOROESTE's various subprograms during the first few years was seriously imbalanced.

On the one hand, the trunk highway component and other physical infrastructure investments were executed satisfactorily. Most road construction activity was implemented within allotted budgets and in some cases, most notably the Cuiaba-Porto Velho highway itself, completed ahead of schedule. The trunk and feeder road components achieved their main objectives of reducing transport costs and improving access of existing settlers to markets and services.

On the other hand, execution of components such as agricultural support services, community facilities, and environmental and Amerindian protection, lagged behind. In 1982, moreover, Brazil embarked on an economic stabilization program which resulted in sharp cutbacks in the availability of subsidized credit. As a result, agricultural credit for planting and maintaining perennial tree crops was largely unavailable during the project period. Other measures relating to conservation units and the protection of indigenous peoples were implemented at a slower rate than road improvements, but ultimately exceeded their original targets.

Uneven implementation, however, exacerbated several other problems. Enhanced access to and within the region for a wide variety of economic actors in addition to the program's small-farmer target population, together with other incentives including fiscal incentives, subsidized credit, and infrastructure investments not financed by the program itself, helped to increase the profitability of logging, ranching, mining, and prospecting activities. This occurred in conjunction with accelerating migration—well beyond levels initially expected—and at a time when the public sector was increasingly unable to ensure environmental protection or respond to growing local demands for productive support and community services.

Transforming the original proposal for road improvement into a more complex regional development initiative, furthermore, challenged and strained the borrower's capacity to attain the program's social and environmental objectives. The institutional mechanisms initially established for POLONOROESTE's implementation proved inadequate. In addition, since most of the Bank's loan funds had been allocated to the program's transport components, whose execution proceeded more rapidly than other interventions, these resources were largely disbursed before the distortions in overall implementation became fully known.

A comprehensive mid-term review in late 1984 highlighted the differences between the assumptions under which the program was originally planned and those under which it was being implemented, due largely to circumstances beyond its planners' control: the rate and volume of migration,[6] the inadequacy and late disbursement of counterpart funds on account of the deteriorating fiscal situation, virtual disappearance of the investment credit needed to install perennial crops, overly centralized project management, and ineffective integration of participating agencies. In response to this situation, the Bank informally 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. Bank funding was resumed in August 1985 after federal authorities took steps to solve the problems identified by the mid-term review and to protect several Amerindian areas[7] and agreement was reached on an agenda for redirection of the remainder of the program. These changes resulted in significant improvements in POLONOROESTE's environmental and Amerindian protection performance (see below).

Human Environmental Impacts

Under the circumstances, intensive migration in response to road building was inevitable. However, the timing of POLONOROESTE, whose initial implementation coincided with one of the most acute economic crises in postwar Brazil, helped to further stimulate these flows. State government propaganda campaigns surrounding the program and the rapid increase in industrial unemployment in the large metropolitan areas in south-central Brazil motivated droves of urban dwellers, together with a continuing flow of rural migrants, to head for the Northwest during the early and mid-1980s. The attraction of Rondonia to non-rural migrants was further enhanced by the rapid expansion of gold prospecting, cassiterite mining, and commercial timber extraction. The two latter activities were inadvertently facilitated by program and non-program-supported extension of feeder roads in the state, as well as by other previously mentioned incentives. Much of the environmental degradation subsequently associated with POLONOROESTE is a reflection of the public sector's inability to control the expansion of rural and urban settlement and, thus, to keep incoming population from attempting to exploit the very areas that the program had originally been designed to protect.

In the face of growing rural settlement, other problems and shortcomings of the region were heightened. Low fertility soils in many areas outside those where the initial colonization projects were located, the difficulties of an unfamiliar, poorly understood, and, in many cases, outright hostile physical environment, together with the consider-

6. By 1985, migration into Rondonia was already on the order of 150,000 people a year, while largely uncontrolled rural settlement and environmentally damaging logging, ranching, and prospecting activities were spreading in various parts of the state, bringing increasing pressures both on lands having soils incapable of supporting sustained agricultural production and on official Amerindian and ecological reserves.

7. There was some ambiguity, however, in the Bank's legal agreements. While the Bank clearly expected that certain indigenous areas would be demarcated, the actual loan covenants specified only six such areas. By the end of the project, the specific requirements of the loan agreements in terms of the size and number of indigenous areas demarcated were exceeded by a large measure.

able distances to extra-regional markets, all reduced the feasibility of planned new colonization schemes. As a consequence, the original number of new settlements was reduced by half and agricultural activities in areas of poorer soils already deforested were redirected. Other hardships faced by small farmers included the rising incidence of malaria which forced many families to abandon the area altogether. A change in strategy during the last two years of the program, however, has reportedly led to a significant decrease in the incidence of malaria in recent years.

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 increasing urban social and environmental problems. Urban water pollution due to poor sanitation and effluent discharges by local industries, particularly sawmills, is especially a problem. As in other Amazonian frontier areas, most towns and the peripheries of larger cities presently lack adequate sanitation infrastructure and other public services, while municipal governments are poorly equipped to meet the rising demands upon them. This situation is exacerbated by the proliferation of local government jurisdictions in the region over the past two decades. Despite this fact, except for the installation of a number of "rural support nuclei" —some of which have subsequently become municipal seats—POLONOROESTE contained few provisions to support urban development or to deal with urban environmental problems.[8]

Physical Environmental Impacts

While considerable uncertainty and controversy exist as to the exact level and rate of deforestation in the Northwest, satellite images confirm both that land clearing proceeded very rapidly after 1975, particularly between 1985 and 1988, and that there is a strong correlation between those parts of the region which underwent rapid rural settlement and those experiencing rapid deforestation. The key role of road building in this process is illustrated by remote sensing images which reveal the "fishbone" pattern of land clearing along the trunk, feeder, and connector road networks, especially in Rondonia.

As in the Greater Carajas Region, forest clearing in areas of poor soils in the Northwest has resulted in the destruction of nutrient recycling mechanisms, causing the loss of soil fertility and increasing erosion. The planting of perennial crops, such as coffee, cocoa, and rubber, reduces these problems, especially in the areas of better soils which have been the principal focus of POLONOROESTE's interventions. However, insufficient investment credit and falling output prices over the past decade, together with the distance to market, forced many small farmers to continue to cultivate annual crops or to convert land into pasture, which is often eventually abandoned to second growth vegetation, known locally as *capoeira*.

The transformation of tropical forests into farmland, pasture, and *capoeira*, to which POLONOROESTE has strongly—if unintentionally—contributed since 1980, likewise resulted in some loss of local biodiversity. Beyond the scope of the program *per se*, mining activities and urban sewage have increased pollution in various of the region's main rivers, as well as along their margins, harming local ecosystems. As in the area around the Carajas Project, mercury contamination—which is a direct by-product of gold prospecting—is a particularly serious problem, representing a potential threat to human health. Regional prospecting activities also affect the stability of riverbanks and increase siltation and water turbidity. Until recently, moreover, the Pantanal wetlands, located just to the south of the Mato Grosso rural development project area, and their abundant wildlife were increasingly threatened by largely uncontrolled hunting and fishing practices, as well as by growing agricultural and agroindustrial run-off. Over the past several years, however, protection of this area has been stepped up, first under POLONOROESTE itself and now through the Bank-assisted National Environment Program.

Environmental and Amerindian Protection

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 the planting of tree crops—which was recognized to be a less environmentally damaging form of agricultural production than annual crops—in both existing and new small-farmer settlement areas. The third was to take specific measures to establish and maintain national park and forest reserves and ecological stations and to carry out a comprehensive regional ecological research program. These objectives were only partially achieved. The project also included measures aimed at controlling and mitigating the impacts of the road works on the immediate environment, which have generally been successful.

Due to the accelerated in-flow of population, settlement of rural areas in central Rondonia quickly outran government efforts to increase the supply of new colonization plots. The occupation of rural lands was further encouraged through the construction of penetration roads by logging interests and installation of a major new trunk highway, the

8. Some assistance was provided to Cuiaba, Porto Velho, and other cities under other Bank operations which were implemented in parallel to POLONOROESTE. The program's highway and health projects also benefitted these urban centers to some extent.

BR-429, by the state government using resources other than those of POLONOROESTE. One result was encroachment by squatters, ranchers, loggers, and prospectors in the Guapore River valley and various Amerindian and ecological reserves, which were either incapable of supporting sustained agricultural production or had been legally established for environmental or tribal protection purposes.

Prior to its reorientation in 1985, the program was also unable to consolidate the cultivation of perennial crops in official colonization and other small-farmer areas or to discourage the rapid expansion of annual crops and cattle production. This reflected a number of factors including the lack of investment credit for small farmers, declining commodity prices, increasing fertilizer and transport costs, plant diseases, and the need for settlers to produce annual crops and raise livestock in order to ensure their own physical and economic survival. These rural land use tendencies, in turn, were responsible for much of the deforestation witnessed in the Northwest over the program execution period.

As originally designed, POLONOROESTE contained ambitious forestry, environmental, and ecological research subprojects, but implementation in the early years was frustrated by inadequate technical knowledge, an unsupportive policy environment, weak institutional capacity, and limited availability of counterpart funding. Attempts to "salvage" potentially valuable timber cleared from colonization plots and to introduce rational forest management techniques were largely frustrated, while loggers progressively removed high-value commercial hardwoods such as mahogany, in the process disturbing the surrounding forest and helping to open up areas for occupation by squatters and land speculators.

On numerous occasions, national parks and ecological reserves, as well as smaller "block" reserve areas within official colonization schemes, were invaded by loggers and settlers, while, until the mid-term review, official efforts to limit such "invasions" and to restrict illegal timber extraction were ineffective. Only the ecological research component appears to have been comparatively problem-free, generating a variety of scientific studies that can be used as a basis for future natural resource management and environmental control in the region. However, their short-run policy impact was limited.

Reorientation of the program after the suspension of disbursements in 1985 resulted in important institutional changes and new environmental initiatives in the region. 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 with POLONOROESTE funds and measures were taken to step up the planting of tree crops in existing colonization areas in Rondonia. A large share of undisbursed program resources was used to support environmental monitoring and protection activities.

Corrective measures have been taken to improve forestry control, including higher taxes on forest exploration, greater fines on illegal exploration, the establishment of a Forestry Military Police to strengthen enforcement and of a State Forest Institute to provide forest extension services. Extensive agro-ecological zoning has been carried out to improve technical knowledge of the natural resource endowment and to serve as the basis for developing appropriate land use strategies for various sub-areas, revision of policies and regulations which influence land use patterns, redesign of enforcement strategies, and revision of federal and state government investment programs. In Rondonia specifically, the zoning has been reflected in the new state Constitution, and the state government has undertaken a major public education campaign using the mass media to provide information about its evolving environmental policies and to deter further migration to the region. Finally, an Emergency Program was initiated by the federal government with POLONOROESTE's assistance in 1988 to control deforestation and burning. These efforts have helped to reduce the rate of deforestation and burning[9] and are expected to lay the basis for additional improvements in the future.

On balance, POLONOROESTE's Amerindian Special Project has been reasonably effective thus far, even though inadequate execution of the Special Project was the principal declared reason for the Bank's suspension of disbursements for the program in early 1985. As in the case of Carajas, this component 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 and, only secondarily, on the institutional strengthening of FUNAI. Early implementation was slow, although nine indigenous areas were demarcated prior to the Bank's suspension of disbursements. FUNAI and Federal authorities also forcibly removed a number of illegal squatters on indigenous reservations during this period. However, some areas came under illegal timber extraction and encroachment by non-Amerindians, occasionally with the complicity of FUNAI staff.

As appraised by the Bank, the Special Project sought to provide assistance to 28 Amerindian reserves in Rondonia and Mato Grosso, estimated to include a total of 4,250 Indians. Its costs ($26.1 million) were not included among those for the Northwest Region Agricultural Development and Environmental Protection Project because the government did not wish the Bank to participate in its financing. Imple-

9. Declining migration after 1986, the downturn in economic activity, and a typical local rainfall patterns have also played a role in lowering the rate of forest burning in Rondonia and Amazonia more generally in recent years.

mentation of the Special Project was, however, a condition in the Loan Agreements for the program. During implementation, 39 additional areas and/or indigenous groups were identified, and the government extended activities included under the Special Project to several of them. As a result, 9,600 Amerindians living in an area of about 11 million ha were assisted under POLONOROESTE, and by project completion, most of the original physical targets agreed in the Special Project had been exceeded.[10] In spite of these accomplishments, the institutional and financial weaknesses of FUNAI resulted in underutilization of physical and social infrastructure and limited enforcement of Amerindian reserves.

As a result of POLONOROESTE, around 80 percent of the regional Amerindian population—which has stabilized and once again appears to be on the rise—now lives in legally demarcated reserves, compared with a much smaller percentage at the start of the program. Problems nevertheless remain in some reserve areas, particularly that for the Uru-eu-wau-wau Indians in central Rondonia, while health care and community development services need to be strengthened.

Among the factors contributing to the problems encountered with the Special Project were the frequent changes in senior management and orientation at FUNAI and the agency's chronic underfunding and understaffing already mentioned in connection with Carajas. These difficulties were further aggravated by the broader financial problems experienced by the federal government during much of the 1980s. Also important are the very 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 access to natural resources, some of which are located on or under tribal lands. Since many of these problems persist, as in the case of Carajas, the longer-run sustainability of Amerindian reserves and protection efforts in Northwest Brazil will only be assured if further assistance to FUNAI is forthcoming.

10. Altogether, about 9 million ha of reserves were established, 38 infirmaries and 32 schools were constructed and equipped, 1,000 ha of crops developed, and 63 Amerindian posts constructed or rebuilt.

Part B: Bank Performance and Lessons Learned

4. *Evaluation of Bank Performance*

This study set out to answer three basic questions. How did the Bank approach environmental issues and problems in several large infrastructure and regional development projects in Brazil? How well did it perceive and deal with these issues and problems? What lessons can be learned from this experience to help guide future efforts—particularly Bank projects—in Brazil and elsewhere in the areas of environmental protection, management, and impact assessment? By far the most important of these questions is the last one. The next three chapters will focus on the principal lessons that emerge from the study. Before doing so, however, its findings with regard to the first two questions should be briefly summarized. Bank performance will be assessed in terms of the adequacy of project preparation and appraisal, especially *ex ante* environmental assessment, and of project implementation and supervision.

As the case studies illustrate, the Bank has addressed social and environmental issues—including involuntary resettlement and indigenous peoples protection—in various ways ranging from specific loan covenants to environmental and Amerindian protection component or parallel "Special Projects" in conjunction with larger investment operations and to free-standing pollution control, resettlement, and, most recently, national environmental projects. Over the past two decades, moreover, there has been a clear evolution as to the relative importance given to environmental issues in Bank-supported projects in Brazil as elsewhere, while the focus of these operations has increasingly shifted to institutional strengthening at both the national and subnational levels. Bank policies have likewise evolved significantly since the early 1970s and lessons learned from many of the earlier projects reviewed in this study have provided key inputs into current Bank operational guidelines for dealing with environmental concerns. In this sense, the Bank's environmental experience in Brazil over the past two decades has already acted as an important catalyst for policy and institutional change within the Bank itself, as well as in Brazil.

In the following pages, Bank performance in selected projects is assessed taking into account its evolving policy and operational framework with respect to the handling of human and physical environmental issues, as briefly described in Chapter 1. In this connection, the environmental performance of projects designed one or two decades ago should not be judged solely on the basis of today's much greater awareness both inside and outside the Bank of the potential ecological and social repercussions of investments in different sectors, particularly since this awareness and the Bank's emerging environmental policies have themselves partially resulted from the experience with many of these same operations. It is likewise important to distinguish between the adequacy and effectiveness of *ex ante* Bank perceptions, analysis, and proposed mitigatory measures as viewed in hindsight and the adequacy and effectiveness of Bank responses to issues and problems as they occurred during the course of project implementation, especially in a context in which general awareness and performance standards have evolved significantly over the period under review.

Beyond this, responsibility for project performance and outcomes, including their environmental consequences, should not be attributed exclusively to either the borrower or the Bank. In many cases, largely unforeseen or uncontrollable factors and events, such as the severe economic recession and associated public sector fiscal crisis in Brazil in the early 1980s or state government decisions to recruit migrants, build roads, and set up colonization projects in ecologically unsuitable areas, had a major influence on the less than full attainment of project environmental and social objectives. Similarly, the other contextual changes briefly described in Chapter 1 have affected both project results and evolving Bank and borrower perceptions, policies, and actions in relation to the social and environmental impacts of

major investments such as those examined in the present study.

Adequacy of Project Preparation and Appraisal

Ex ante Environmental Assessment

As pollution reduction was the major objective of both the sewage collection and treatment and the industrial pollution control projects in São Paulo, no *ex ante* environmental impact assessment *per se* was carried out. These operations, however, were based on information concerning evolving levels of water and air pollution and an evaluation of the investments required to effectively diminish them in terms of municipal sewerage infrastructure and controls on industrial effluents and emissions. In the case of air pollution, however, initial assumptions concerning the relative importance of industrial particulate emissions relative to other sources, especially road dust, in the metropolitan area subsequently proved incorrect. In that of water pollution, initial expectations regarding the timing of municipal sewerage treatment investments in the SPMA later proved too optimistic in light of unanticipated institutional, financial, and political difficulties.

Following standard Bank screening procedures at the time, both Sobradinho and POLONOROESTE benefitted from *ex ante* environmental or regional assessments, but these were either not adequately utilized or as detailed or comprehensive as would have been desirable in order to fully understand the intricacies of local development processes. Even though the environmental "reconnaissance" undertaken prior to the appraisal of Sobradinho identified a number of ecological and social concerns surrounding implementation of the project, various of its recommendations (for example, undertaking a small-scale irrigation-based rural development program and a fisheries project around the new reservoir in support of the population to be resettled) were not acted upon. Furthermore, this assessment in and of itself was insufficient to offset problems later experienced due to inadequate resettlement planning. In the case of POLONOROESTE, even though the Bank's regional survey was a pioneering piece of sector work, in retrospect, it clearly did not consider all of the likely impacts of major road improvements and their potential effects on natural resource use.

As noted in Chapter 3, environmental and Amerindian protection did not become a factor in the Bank's appraisal of the Carajas Project until relatively late in the project preparation process. Partly as a result, the environmental assessment carried out by CVRD was narrowly focused on the immediate impact of project mining, rail, and port investments within the territory directly under the company's control. Subsequent events reveal that this assessment was largely accurate as far as it went. But it almost totally overlooked the potential social and environmental impacts of project infrastructure and related investments (for example, Carajas ore-based industries) in its larger area of influence.

This oversight is surprising for several reasons: (a) the project was partly implemented in a relatively mature, active, and well-populated frontier area (for example, north-central Maranhao and eastern Para); (b) parallel Bank processing of POLONOROESTE, which focused on just such issues, should have provided clear guidance in anticipating Carajas' potential social and environmental impacts; c) the existence of the Amerindian Special Project, which was introduced at the Bank's instigation precisely in order to mitigate the expected adverse consequences of the iron ore operation on tribal communities; (d) parallel processing of a rural development project for much of the Maranhao portion of the corridor, which also stressed the need to consider such impacts;[1] and (e) the fact that project infrastructure was expected to generate significant economic benefits at the regional level by supporting both agricultural and industrial activities, including pig iron production. No attention, however, was given to the potential environmental and social costs of these investments.

Other Aspects of Project Design

At least from a human environmental standpoint, all of the operations examined in the São Francisco valley were characterized by poor planning and, as a result, by less than fully adequate project design. This was particularly the case in the Sobradinho and lower São Francisco cases. At Sobradinho, planning for rural resettlement was clearly flawed, both with respect to displacee preferences as to where they wanted to be relocated (for example, near the new reservoir or in a distant colonization project) and in terms of the services—especially production support services—eventually provided at the new settlement sites adjacent to Lake Sobradinho.

In the lower valley, in turn, much of the rural population affected by the Sobradinho-induced change in the river regime was neither accommodated in the new irrigation schemes nor supported in any other way. In addition, hasty planning of the dikes and polders due to the impending closure of the Sobradinho dam—over which the executing agency had no control—led to insufficient consideration be-

1. The Maranhão Rural Development Project (Loan 2177-BR) was approved two months prior to the Carajas Project, but despite their partial geographic overlap, there was little, if any, coordination between these two operations either in the Bank or in Brazil. This is particularly unfortunate because the rural development operation sought to introduce innovative land use planning and environmental protection measures which, had they been applied systematically throughout the entire Carajas corridor, might have avoided or substantially reduced much of the ensuing environmental degradation in the area.

ing given to hydrological and other technical factors which later adversely affected their operation. In neither the Sobradinho or lower valley operations, moreover, did the resettled populations participate actively in project preparation. Even at Itaparica, finally, which benefitted from many of the lessons of earlier experiences in the valley, such participation only came about after an organized movement of the affected population—which later obtained the Bank's support—forced the implementing agency to take resettlees' preferences more fully into account.

As suggested in the previous section, during preparation and appraisal, the Bank did not sufficiently anticipate many of the broader social and environmental repercussions of the Carajas Project in conjunction with other development tendencies that were already affecting its area of influence. Even though the Bank was clearly instrumental in causing environmental aspects to be taken into consideration by requiring CVRD to prepare an environmental action program which was later included as a project component, it did not appraise the likely indirect impacts of the operation, which later proved to be significant. This shortcoming was also reflected in the ambiguity of the loan covenants concerned with project environmental aspects. While obliging the borrower to "take all action as shall be required to ensure that the execution and operation of the Project are carried out with due regard to ecological and other environmental factors," the Loan Agreement did not clarify either what "due regard to ecological and environmental factors" or project "operation" meant in practice. Such ambiguity made it difficult both for the borrower to know exactly what environmental precautions were required and for the Bank to monitor their implementation.

Like Carajas, POLONOROESTE's initial natural resource management and environmental protection efforts may have suffered as the result of the Bank having limited its analytical and sectoral scope. The focus on small-farmer colonization, while understandable on both social and economic grounds, nevertheless meant that other important actors (for example, land speculators, larger farmers, ranchers, loggers, miners, and prospectors) and their key role in regional development and natural resource use received much too little attention. It also meant that other vulnerable social groups (traditional subsistence farmers, fishermen, rubber tappers, and other forest product gatherers) were not targeted by the program. In a region that was rapidly urbanizing in the 1970s and early 1980s, the investment needs and environmental problems of the burgeoning towns and cities were largely overlooked.

In retrospect, it is evident that POLONOROESTE's design incorporated what were, at the time and in the Amazonian frontier context, progressive environmental and social concerns and that the Bank attempted to build safeguards into the program. However, while it was recognized that paving the BR-364 highway and expanding the regional feeder road network would contribute to the acceleration of migration, its volume and rate—boosted directly or indirectly by the consequences of other government policies—were clearly underestimated, while public sector institutional capacities were clearly overestimated. As indicated in the previous chapter, the resulting environmental degradation was largely a reflection of the public sector's inability and/or unwillingness to control the growth of rural and urban settlement in the region.

These shortcomings were largely foreseeable at the outset—indeed, they were explicitly cited among the principal risks of the program in the Staff Appraisal Report for the Northwest Region Agricultural Development and Environmental Protection Project—and program preparation and appraisal should have included: (a) a review and, eventually, revision of the broader incentives to migration and settlement; (b) a thorough consideration of alternative demographic scenarios and their implications for natural resource use; and (c) much greater attention to borrower institutional capabilities and the extent of its real commitment to program objectives (that is, to the possibility of "government failure"), especially those concerned with environmental and Amerindian protection. Greater attention should also have been given both to the underlying ecological carrying capacity of the new areas to be settled and the economic implications of attempting to promote export crop production in a region located several thousand kilometers from most domestic and external markets. In synthesis, both *ex ante* risk assessment and contingency planning with respect to the volume and rate of migration and their potential consequences with respect to natural resource use were insufficient.

Adequacy of Project Implementation and Supervision

Sequencing of Project Interventions

As indicated in the previous section, the timing of resettlement planning at Sobradinho and Itaparica and of preparation of the "emergency" projects in the lower São Francisco valley was poor. The same observation applies to the sequencing of program investments during implementation in the case of POLONOROESTE. More specifically, timing of the program's initial interventions, particularly those to protect the environment relative to those potentially harmful to it, was inadequate. Pavement of the BR-364 highway and expansion of the regional feeder road network proceeded much more rapidly than the program's agricultural support and environmental and Amerindian protection components.

As a result, physical access to and within the Northwest region improved, facilitating migration, at a time when government institutions were poorly equipped to provide needed production support and community services, protect ecological and tribal reserve areas, or direct the regional occupation process more generally. Institutional strengthening in relation to environmental protection should have preceded, rather than paralleled or followed, infrastructure improvements. Similarly, detailed site-specific soil and other natural resource studies should have preceded decisions to undertake new colonization projects in the region.

That this sequencing did not occur in the case of POLONOROESTE has frequently been attributed to the fact that there was "not enough time" to do so prior to the completion of road and other physical investments. Similar difficulties contributed to poor rural resettlement planning in connection with Sobradinho, as well as to some of the technical and social problems faced by the projects in the lower São Francisco valley. Even at Itaparica, resettlement planning was constrained by the time pressures resulting from the need to close the dam by a predetermined date. As a consequence, in all of these cases, proper preparation—and hence implementation—of often complex "software" components was ultimately overrun by the inflexible scheduling of larger "hardware" investments. This suggests that the Bank needs to give greater attention to the timing of both the planning and the execution of project environmental and social interventions in relation to those of infrastructure investments than was the case in several of the operations reviewed in the study.

Implementation and Supervision

Even though certain rigidities in project design were among the factors that contributed to its initial implementation problems, Bank supervision of the first São Paulo Industrial Pollution Control Project played a key role in its reorientation and subsequent success. More specifically, the Bank was fully supportive of the state government's request to open the PROCOP credit line up to municipalities—especially Cubatão—outside the metropolitan region and to pollution problems other than industrial effluents and particulate emissions. At the same time, it agreed to simplify subloan processing procedures which had kept many potential subborrowers from seeking project resources. The Bank's flexibility, in short, greatly facilitated project execution and led to the preparation and approval of a follow-on operation.

In the case of Carajas, unlike the environmental protection and urban development components, which received too little Bank attention during project execution, supervision of the Amerindian component occurred at regular intervals and provided the support CVRD required in order to induce FUNAI and the federal government to comply with their obligations under the Special Project and Loan Guarantee Agreements. The suspension of Bank disbursements played a similar role with respect to POLONOROESTE's Amerindian and environmental protection components. More generally, however, Bank supervision of POLONOROESTE during its early years was characterized both by inadequate coordination across sectors (that is, between Bank transport, health, and agricultural project divisions) and insufficient attention to the program's emerging implementation imbalances and growing adverse environmental and social impacts, many of which had been clearly identified by an independent monitoring team from the University of São Paulo.

To the Bank's credit, these and other problems, especially the program's institutional debilities, were recognized at the time of the mid-term review in late 1984 and subsequently redressed when POLONOROESTE was reoriented in mid-1985. Bank supervision also improved significantly after the mid-term review. However, this does not negate the fact that poor initial program design and insufficient Bank attention to environmental problems prior to the suspension of disbursements may have contributed to rising deforestation, associated soil fertility loss, and increasing "invasions" of Amerindian and ecological reserves in Rondonia and parts of northwestern Mato Grosso during the early 1980s.

In the São Francisco valley, finally, the implementation difficulties experienced by the Itaparica Project in recent years should be highlighted. Even though its design consciously incorporated a preoccupation with the socioeconomic reestablishment, as well as physical transfer and rehousing, of rural displacees, installation of project-related irrigation infrastructure has proven to be highly problematic and costly, both in social and financial terms. Delays of several years in implementing many of the physical investments required for the operation of project irrigation schemes have led to social unrest and other disorders among much of the rural population relocated from the area flooded by the Itaparica dam, who still find themselves largely dependent on compensatory payments from CHESF in lieu of income generated from new productive activities. The cost overruns associated with these delays and the continuing need to provide support payments have also greatly increased resettlement costs to the borrower, requiring a $100 million supplementary loan from the Bank in February 1990.

The Itaparica experience, in short, demonstrates both the risks and the potential costs inherent in attempting to handle rural resettlement in a socially sensitive and comprehensive way. As in the case of POLONOROESTE, it also raises the question of the timing of project investments. Beyond taking the needs and preferences of the affected pop-

ulations into account by involving their participation in the definition of resettlement solutions from the outset, future rural resettlement projects that require the construction of physical infrastructure for productive purposes should ensure that these investments are in place by the time the dislocated communities are transferred to their new homes.

Timing of Bank Involvement

The questions discussed in the preceding paragraphs also raise a more general issue. Both the rural resettlement experiences in the São Francisco valley and the two Amazon cases suggest that the timing of the Bank's own involvement in the operations it finances may be of critical significance for the extent to which social and environmental considerations are adequately taken into account in project preparation and subsequent implementation. In the Carajas Project, for example, all major design decisions in relation to ore transport (that is, transport mode, port and rail locations) had been made and were already being implemented, without any consideration of their possible environmental and social costs at the regional level, before the Bank became effectively involved. Similarly, in that of POLONOROESTE, plans to reconstruct the BR-364 highway were well advanced prior to the Bank's involvement and insistence that regional road improvements be packaged together with rural development and environmental and Amerindian protection measures.

These cases suggest that, wherever possible, the Bank should become involved in project preparation early enough to ensure that alternative design solutions adequately consider social and environmental costs and benefits and that indirect, as well as direct, and potential long-term, as well as short-term, environmental effects are identified. Where necessary, corrective or compensatory measures should be defined as part of, or in close parallel to, the operations concerned.

Overall Assessment

The Bank played a positive role in supporting CETESB to prepare, implement, and—after several stumbling blocks were encountered—reorient the first Industrial Pollution Control Project in São Paulo. It also helped CHESF to avoid even greater social costs in connection with resettlement at Sobradinho, and FUNAI, CVRD, and SUDECO to ameliorate the potential adverse impacts of the Carajas Project and POLONOROESTE on Amerindians. Following POLONOROESTE's reformulation in mid-1985, the Bank likewise assisted the governments of Rondonia and Mato Grosso to exert greater control over the settlement process in Northwest Brazil, while increasing support for environmental protection efforts. As noted in Chapter 1, moreover, at the time they were appraised, nearly all of the operations examined in the study constituted pioneering efforts on the Bank's part in attempting to deal with environmental problems.

The Bank's role in connection with the Carajas and POLONOROESTE Amerindian Special Projects, already touched on above, should be highlighted. In the absence of Bank insistence, it is unlikely that either the iron ore operation or the Northwest regional development program would have included tribal protection measures at all. In the case of Carajas, the Bank continues to support resolution of outstanding Amerindian land rights issues through the Second Maranhão Rural Development Project (Loan 2862-BR, 1987), currently under implementation, even though further assistance is likely to be necessary, especially in the state of Para, if adequate tribal protection in the region is to be sustained.

It should also be recalled that several of the projects reviewed, particularly in São Paulo and the Northwest region, underwent significant reformulations and adaptations by the Bank to deal with operational and environmental problems encountered during their early implementation. The Bank has likewise endeavored to incorporate lessons learned and emerging policies and guidelines concerning environmental and social issues in more recent operations. This is reflected, for example, in the design of the Amazon Basin Malaria Control Project, approved in May 1989, the Pantanal and Amazon components of the National Environment Project, approved in February 1990, the Pilot Program to Conserve the Brazilian Rain Forest, and the Rondonia Natural Resource Management Project, both of which were presented to the Board in March 1992.

The Bank's approach to most of the projects assessed in the present study, however, was also characterized by important shortcomings. As indicated above, in various instances, the Bank did not sufficiently anticipate or take into account in project design and early execution the likely direct and indirect impacts of the investments it was supporting. In the Carajas Project, except for those involving Amerindian populations, potentially adverse project impacts in its larger area of influence were largely overlooked. In the POLONOROESTE, Sobradinho, and lower São Francisco operations, project consequences and borrower institutional weaknesses were underestimated, while needed environmental protection (POLONOROESTE) and involuntary resettlement measures (São Francisco valley) were inadequately planned, implemented, or both. In various cases, Bank supervision of project environmental impacts and components was not as strong as it could have been (Carajas, POLONOROESTE before 1985), while environmental covenants were either ambiguous (Carajas) or not fully (Sobradinho) or rapidly (POLONOROESTE until 1985) enforced.

Many of these shortcomings stem largely from an incomplete initial assessment and understanding of the ecological, demographic, socioeconomic, and political-institutional complexities and dynamics of the geographic areas in which the projects were to be carried out. The iron ore operation again provides the best example, since systematic consideration was not given in project preparation to the likely consequences of the Carajas rail and road investments for the regional settlement process and associated renewable resource use.

Beyond this—as in many other countries during the 1970s and early 1980s—intersectoral, interregional, and larger policy issues concerning natural resource management and environmental protection were overlooked in the processing of these operations.[2] Local carrying capacity constraints and the political economy of frontier occupation were given insufficient attention in the Bank's initial decision to help promote rural settlement in Northwest Brazil. In addition, more economically and ecologically sustainable alternatives to extractive-based Amazonian frontier settlement elsewhere in the country—both within and outside the primary sector—to absorb the large number of migrants displaced by agricultural modernization and land concentration in southern Brazil and by persistent poverty and periodic droughts in the Northeast were not considered as such by either the borrower or the Bank.[3]

There were also significant inconsistencies in the Bank's approach. Thus, while the Northwest was the object of a multidisciplinary survey and POLONOROESTE included rural development, rural health, and region-wide environmental protection components, intervention in the equally sensitive Carajas corridor involved none of these concerns, even though the two operations were processed by the Bank at roughly the same time.[4] Similarly, while there was an effort to assist all of the families dislocated by creation of the Sobradinho and Itaparica reservoirs, the same did not occur with all those affected by Sobradinho-induced changes in the lower São Francisco valley. In addition, while indigenous populations were, justifiably, a matter of Bank concern in connection with both Carajas and POLONOROESTE, other vulnerable social groups affected by project investments were not granted similar attention.

Nearly all of the cases examined point to the significant social and environmental risks and uncertainties involved in undertaking investment operations—especially large ones—in territorially extensive, ecologically sensitive, and/or socioeconomically complex and dynamic geographic areas. In such situations, even under the best of circumstances, events are likely to evolve and impacts to occur in ways not anticipated during project preparation and appraisal such that, even with the best of intentions, borrower and Bank command over project execution and outcomes may prove to be highly constrained. The POLONOROESTE experience provides the best illustration of this. As will be further elaborated in the following chapters, this suggests the need both for better *ex ante* assessment of possible project impacts and improved monitoring and on going evaluation of actual project performance and results. It further implies the need to introduce more adequate management and information systems in project design and to enhance supervision of environmentally sensitive operations so that both the borrower and the Bank can respond more quickly and flexibly to evolving project social and environmental consequences.

In conclusion, there were a number of major shortcomings, as well as positive features, in the ways in which the Bank initially approached social and environmental issues in the operations reviewed in the study. Even though the Bank demonstrated sensitivity to the potential impacts of many of the operations considered, in some cases (for example, the basic sanitation projects in São Paulo, rural resettlement at Sobradinho, and POLONOROESTE's agricultural and environmental protection subprojects) its efforts were only partially successful, while in others (for example, the Amerindian Special Projects for Carajas and POLONOROESTE and the Itaparica Project) the longer-run sustainability of the results attained thus far remains uncertain.

The following chapters summarize the principal lessons that can be drawn from the experiences reviewed. In doing so, the focus will be on lessons of direct relevance to future environment-related activities on the part of both borrowers and the Bank and on those which have applicability beyond the specific project areas involved,[5] or Brazil more generally. These lessons address three overlapping topics: environmental protection; environmental assessment and management; and Bank activities and procedures in relation to the human and natural environment.

2. This is one of the main findings of OED's earlier study on renewable resource management in agriculture (see OED, 1990); and is illustrated in further detail in second stage country case studies for Nepal and Bolivia currently in preparation.

3. This is not to say that the Bank and Brazilian government ignored the need to address the problems associated with agricultural modernization in the south and poverty and drought in the Northeast. The Bank and borrower were actively involved in supporting rural and urban development projects in both areas at the time. What was largely overlooked, however, was the comparative appropriateness—particularly in terms of sustainability—of promoting directed rural settlement in humid tropical areas vis-à-vis other alternatives to accommodate the populations that were being induced by a variety of incentives to migrate to Amazonia. The wider range of possible options for these specific groups was not considered by the Bank.

4. In fact, the loan for Carajas was approved by the Bank nine months after the first three loans for POLONOROESTE were presented to the Board.

5. For specific lessons regarding the handling of environmental issues in the São Paulo metropolitan area, the Carajas corridor, the São Francisco valley, and the Northwest region, see the respective case study reports.

5. *Lessons for Environmental Protection*

Project completion and performance audit reports for the operations reviewed above have already identified many of the lessons to be learned from their implementation. Based on the findings of the present study, this chapter discusses the elements that need to be contemplated both in project design and more generally if efforts to enhance environmental protection—whether in terms of urban-industrial pollution control or the preservation of tropical forests and other renewable natural resources—are to be effective. Based on the experiences in São Paulo, the São Francisco valley, and Amazonia, effective environmental protection requires: (a) an adequate policy, legal, and regulatory framework; (b) sufficient institutional and technical capacity; and (c) sustained political commitment. Political commitment to environmental goals, in turn, is likely to require strong community awareness and active participation to ensure accountability in public sector decisionmaking with respect to environmental concerns. Finally, environmental protection is likely to be best served through the use of a mix of policy instruments, including both regulatory (or "command and control") measures and various types of economic incentives. These conclusions can be illustrated from the case studies.

Policy, Legal, and Regulatory Framework

In dealing with environmental problems, public intervention may often be required in order to correct market failures. The rationale behind this can be set out briefly as follows: Most environmental consequences of producing and consuming goods are external costs rather than benefits. From a social standpoint, these should be added to their economic resource costs. Market prices, additionally, are sometimes below resource costs and almost always fail to include externalities. Public intervention is, thus, frequently justified in order to induce changes in the behavior of individuals and firms to decrease environmental costs to a socially acceptable level.[1] In any case, prices of the goods and services involved should at a minimum reflect their economic costs. An often used concept is "the polluter pays principle" by which the individual or firm responsible for environmental degradation is made to bear the cost of its reduction to a predetermined level. See page 27 of OECD 1989, and OECD, 1986, page 24. The existence of environmental externalities that cross national boundaries, such as flood-provoking deforestation, biological diversity loss, acid rain, greenhouse gas emissions, and stratospheric ozone depletion, justifies international public attention, including global environmental protocols and cross-country resource transfers. All of these problems require a clear public policy response.

Beyond this, the public sector itself is often a direct or indirect source of environmental degradation: state-owned polluting industries such as the large steel and petrochemical firms in Cubatão; major infrastructure investments, especially hydropower plants, roads, railways, and ports in Amazonia and elsewhere which adversely affect the environment; and macroeconomic, fiscal, sectoral, or other policies that induce private actors to do so. A second important role for public policy, therefore, is to identify and assess the potential environmental consequences of public investments and policies and to take steps to avoid or mitigate these impacts. This applies equally to the natural environment and to vulnerable social groups such as forced displacees, indigenous peoples, and other traditional communities that may be adversely affected by development projects and policies.[2] In the Brazilian case, for example, while explicit policies concerning environmental and Amerindian protec-

1. As OECD 1989 states: "the existence of environmental social costs is a very strong argument for installing social institutions responsible for environmental quality and equipping such institutions with instruments that will enable them to reach socially desirable environmental objectives" (p. 12).

2. In addition to the inherent vulnerability of these populations, especially tribal peoples, *per se*, the argument for subsuming their protection under the heading of environmental protection is reinforced by the frequently close dependence of these groups on localized habitats and unique physical and cultural environments.

tion presently exist in the federal constitution, national policies on involuntary resettlement, fiscal incentives, taxation, credit, and land regularization and titling in frontier areas, as well as on land disputes and rural violence more generally, have yet to be consistently formulated.

In addition to the definition of environmental policies *per se*, there is a need to establish and maintain an adequate legal and regulatory framework in order to translate these policies into effective government action. Such a framework should include, *inter alia*, definition of: protected areas; ambient air and water quality standards; emissions and effluent thresholds by type of pollutant; restrictions on water, land, and forest resource use; procedures and controls to set up and operate productive activities; and sanctions to be applied when such restrictions are violated. In countries having tribal populations, procedures for creating and protecting reserve areas should also be developed. Legislation and regulations relating to solid and, especially, hazardous waste collection and disposal would likewise come under the heading of environmental protection. In all cases, there is a need for a clear assignment of institutional responsibilities within the public sector for administration of environmental controls at both the national and subnational levels.

In federal systems such as Brazil, general norms and procedures applicable throughout the national territory are defined by the central government. These are complemented by more specific standards and sanctions on the part of regional, state, and/or local authorities. As indicated in Chapter 1, environmental quality and protection in Brazil is governed by a wide range of legislation and institutions. This multi-tiered system, however, opens the way for considerable differences among states and municipalities in the ways in which environmental norms and sanctions are specified and applied, as well as in local institutional capacities for dealing with environmental problems.

The significant differences in subnational environmental protection performance in Brazil are clearly brought out in the case studies. Within the general federal legal and regulatory context, São Paulo is the most advanced state in terms of its normative and institutional framework, as would be expected given its economic and financial capacity. Much of the pollution control legislation currently in effect at the federal level, in fact, had its origins in measures previously enacted in São Paulo or, as in the case of the national vehicle pollution control program, was prepared with CETESB's direct assistance.[3] The lower-income states, including those cut by the São Francisco valley, the Carajas railway, and the Cuiaba-Porto Velho highway, are at the other end of the spectrum where legal and regulatory frameworks for environmental protection are generally much weaker. There is a need to strengthen these frameworks in many parts of Brazil.

Institutional and Technical Capacity

The second major requirement for effective environmental protection is the existence of adequate institutional and technical capabilities at both the national and subnational levels. Such capabilities include both a clearly defined legal mandate and proper licensing, inspection, and enforcement procedures and the equipment and laboratory facilities, logistical support, and trained human resources necessary to monitor and control air and water pollution, excessive deforestation, and other forms of environmental degradation. CETESB is a good example of an agency that possesses the administrative and professional capacity required to effectively monitor and control productive activity that is potentially harmful to the environment. In most other states in Brazil, however, such capabilities have been developed to a far lesser extent.

In the case of São Paulo, even though much of CETESB's technical and institutional capacity existed prior to the two Bank-financed industrial pollution control projects, these operations clearly reinforced the agency's ability to carry out its legal responsibilities. Both the technical assistance component of these projects and the PROCOP credit line have played essential roles in this respect. In addition, the Bank-supported projects have helped to promote better inter-institutional cooperation between CETESB and other state agencies, as well as with local governments and the private industrial sector, in the area of environmental protection. Finally, they have supported CETESB's recent efforts to extend its activities to such areas as hazardous waste disposal and integrated pollution control at the river basin level, both in the metropolitan region and other parts of the state.

Developing similar technical and administrative capacity and coordination among other state environmental agencies and at the federal level remains one of the principal challenges facing those concerned with environmental management in Brazil, including the Bank. Such institutional strengthening is likely to require both time and a steady flow of financial resources. It will probably also require substantial technical cooperation from agencies like CETESB which have already developed much of the necessary skill mix and experience.[4] Beyond this, given the incipient nature of most environmental agencies in Brazil, in order for

3. Knowledgeable specialists generally consider CETESB to be the premier environmental protection agency in Latin America.

4. Under the second Bank-assisted Industrial Pollution Control Project (Loan 2831-BR), CETESB has been helping other Brazilian states to prepare diagnostic studies of pollution sources and levels and to identify the legal, regulatory, institutional and technical measures necessary to improve their capacity to combat environmental degradation. It has likewise provided technical assistance to IBAMA in some of the same areas.

IBAMA and state government entities to be effective, strong political commitment must be present at both the federal and state levels. Federal support will be particularly important in states that still have limited technical, institutional, and financial resources of their own.

Political Commitment and Accountability

Unequivocal political commitment is also critical for effective environmental protection. Similarly, political accountability must be built into the system to ensure that the institutional and technical apparatus properly responds to its legal and regulatory mandate. Since environmental degradation is a social cost, such accountability is likely to be easiest to achieve in a transparent and participatory governance framework.

As the situation on the Amazonian frontier in the 1970s and early 1980s illustrates, key elements associated with more mature local economies are likely to be necessary for truly effective protection of vulnerable social groups and the physical environment. These conditions include clearly defined property rights, strong representative institutions, a competent and fair judicial system, and guaranteed freedom of political expression. Under present circumstances, however, the recent decentralization of authority to and increasing autonomy of Brazilian states and municipalities under the 1988 Constitution may, in fact, make environmental protection more difficult in the short run in frontier states, for reasons discussed more fully below.

The importance of political commitment for the attainment of environmental objectives can be illustrated by the study. In São Paulo, the unambiguous support of a popularly elected governor to "cleaning up" Cubatão played a major role in the reorientation and subsequent successful outcome of the first Industrial Pollution Control Project.[5] In Rondonia, in turn, Bank operational staff report that political commitment has grown steadily since the mid-1980s, such that, despite limited resources, the state has borne nearly the full cost and physical burden of protecting local Amerindian reserves over the last few years. The first phase of POLONOROESTE's implementation, nonetheless, provides the clearest counter example. Few of the program's initial environmental protection goals were attained due in part to a lack of political support at the state and local levels and the inability or unwillingness of the federal government to confront strong local economic and political interests.

Carajas represents a hybrid case. CVRD has had to contend with FUNAI's weakness over the years and has continued to be active on behalf of tribal groups in the vicinity of the Carajas railway. Similarly, environmental protection activities were largely effective inside CVRD's mining and port concessions, as well as along the immediate rail right-of-way, but outside these areas, until recently, environmental controls by state and federal agencies were largely lacking. Part of the explanation for this appears to be that the most important environmental impacts controlled by CVRD, such as soil erosion along the railway and dust pollution at the mine site, were, in fact, private costs that, if left unmitigated, might seriously disrupt project operation.

Local politics on the frontier, as elsewhere, tends to be closely linked to the nature of the local economy. Thus, the lack of political enthusiasm for environmental protection—which in frontier regions inevitably means restricting access to some potentially exploitable land and natural resources in areas where most economic actors are mainly concerned with maximizing short-term private gains—is not difficult to understand. As a result, in the absence of outside intervention, counterbalancing local public sector actions to minimize long-term social and environmental costs may be absent or largely ineffective. Furthermore, not only do most politicians' time horizons tend to be short, but, on the frontier, local authorities are often themselves involved in extractive or nutrient mining[6] activities or dependent on economically powerful interests that are. In either case, environmental preservation is unlikely to be a high priority. At a time of increasing decentralization in Brazil, accordingly, the need remains for some continuing measure of central government attention to renewable resource use in Amazonia since local authorities are likely to be comparatively "short-sighted" with respect to sustainable resource management and environmental protection concerns.

Public Awareness and Community Participation

Generating political commitment and accountability with respect to environmental protection is likely to require both a high degree of public awareness as to the nature, extent, and long-run social cost of the environmental externalities involved and considerable popular and community involvement in support of their mitigation. Again the case studies provide examples.

In metropolitan São Paulo, many of the initial efforts to reduce air pollution were a direct response to public pressures on the state government and CETESB in particular to do something about the growing problems of industrial

5. As the case study report points out, however, despite the quality and stability of its staff and its impressive track record to date, CETESB's continued success should not be taken for granted. The politicization or dismemberment of the agency could destroy the results of several decades of hard-won institutional development and environmental improvement, as has reportedly occurred in other Latin American countries. Consistent political support is necessary to sustain, as well as achieve, environmental protection gains.

6. This refers to the unsustainable use of renewable soil and forest resources, through which such resources are effectively treated by farmers, loggers, and others, as if they were non-renewable.

emissions.[7] These pressures increased with the direct popular election of the state government in late 1982. They likewise grew as a result of expanded media attention to environmental problems, especially after a major industrial accident in Cubatão destroyed a large squatter settlement and killed as many as 500 people in February 1984. Finally, they increased as a result of CETESB's environmental education campaigns as part of its evolving pollution abatement programs.

The second example refers to the role of POLOSINDICAL in negotiating the Itaparica resettlement program with CHESF in the São Francisco valley. Here, local public awareness of the non-participatory way in which resettlement had been handled at Sobradinho and in the lower valley, together with substantial grassroots organization by local church groups and trade unions, was the key to an agreement for a resettlement program. While instrumental in this respect, the politicization of the negotiation process, however, eventually resulted in a very costly resettlement agreement. A third and better known example, although outside the immediate POLONOROESTE region,[8] was the reaction of rubber tappers in the neighboring state of Acre to attempts by cattle ranchers to clear lands traditionally used to harvest latex and other forest products in order to install pasture. In addition to directing domestic and international attention to the problems associated with occupation of western Amazonia, the violent ending to this confrontation helped induce the Brazilian government to create several "extractive reserves" for local rubber tappers. See Revkin, 1990; Shoumatoff, 1990; and Cowell, 1990, Chapter 6.

As is presently occurring in Brazil, these examples from the case studies suggest that the Bank should be supportive of environmental education programs for the public in general, as well as for government officials and the private productive sector. The mass media should be stimulated to disseminate such initiatives.[9] Wherever possible, the Bank should also encourage the involvement of responsible community associations and other NGOs in environmental monitoring activities. The ultimate key to effective environmental protection is likely to be an informed and active citizenry that can make public sector authorities accountable for the enforcement of environmental regulations where they exist and the enactment of new legislation and creation or strengthening of institutional capabilities where these are lacking or insufficient. Since the obstacles to establishing effective environmental monitoring and enforcement mechanisms are likely to be greatest in lower income, especially active frontier, regions, these, together with more populated and industrialized areas, should receive priority attention.

Command and Control and Economic Incentives

Successful environmental protection, finally, will require the use of an adequate mix of regulations and economic instruments, including taxes, fees, and other incentives. The traditional approach in Brazil, as in many other countries, has been to rely heavily on the regulations, including location, activity and/or pollutant-specific standards, restrictions, and sanctions, especially fines, for non-compliance. This approach, which is often referred to as "command and control," however, is viewed by many as a relatively inefficient way of achieving pollution control. A frequently proposed alternative is to rely to a greater extent on economic incentives.[10] These include such devices as effluent charges and marketable emission permits. The latter allow polluting firms located in a specific geographic area, but using different production technologies, to exchange pollution rights among themselves in such a way that overall emissions are minimized at a lower total cost. Such economic incentives and market-based approaches are presently being tested in the United States and elsewhere in the developed world.[11] The feasibility of their adoption in Brazil and other developing countries[12] should likewise be carefully assessed.

The case studies for Carajas and POLONOROESTE in particular suggest that the financial resources required to effectively enforce environmental regulations in large tropical regions such as Amazonia are likely to be enormous. At the same time, technical solutions alone, such as agroecological zoning, are unlikely to be sufficient to control the location or expansion of productive activity in frontier areas.[13] What is currently being attempted, according to Bank operational staff, is a combination of zoning and economic incentives/disincentives such as land, mineral, and timber taxes, improved public service pricing, and support-

7. The increasing concern with air pollution in the SPMA was a direct response to its tangible impacts including eye, respiratory, and skin irritations, together with more serious health problems. Where the connection between environmental degradation and public health is less evident, as in the case of inadequate sewage treatment and solid waste disposal, a greater effort will be required to inform the public of the benefits to be derived from environmental protection measures.

8. The area involved, however, is in the immediate area of influence of the extension of the BR-364 highway from Porto Velho to Rio Branco, the capital of Acre, which was to be paved under a loan by the Inter-American Development Bank.

9. Recent research has identified the mass media, particularly television, which is seen by the vast majority of Brazilians independently of their income levels, as one of the principal sources of increased public awareness with respect to environmental problems. See Kottak, 1991.

10. For additional details, see OECD, 1989; Pearce and Turner, 1990, Chapter 11; Oates, 1988; and Bernstein, 1991.

11. See, for example, Tietenberg, 1989; and Hahn, 1990.

12. For one recent Bank survey of the experience thus far, see Kosmo, 1989.

13. On the limitations of land use zoning more generally, see Schneider, op. cit., Volume II, Annex VIII, where, on the basis of a review of existing experience, it is concluded (p. 11) that "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 regulation is enforced."

ive public investment programs, among others. These efforts should be closely monitored and evaluated to determine their effectiveness and applicability to similar situations in other countries.

6. *Lessons for Environmental Assessment and Management*

Most of the projects reviewed in the study involved natural resource management, as well as environmental protection, issues. In the Northeast, Bank-supported projects have utilized water from the São Francisco River for both hydropower generation and irrigation. In Amazonia, the Carajas operation focused on the extraction and transport of mineral resources, but also had significant repercussions on land and forest use in its area of influence, while POLONOROESTE was intended in part to guide regional resource use, particularly in relation to small-farmer agricultural development. The cases reviewed contain relevant lessons for the environmental assessment and management of future infrastructure and productive sector investments, especially projects in areas similar to those considered in the study (that is, major urban or metropolitan centers, large river basins in semi-arid regions, and extensive humid tropical frontier zones).

In presenting these lessons, "environmental management" is understood to include both natural resource use and environmental protection concerns, whether at the local, regional, national, or global levels. In this connection, the study takes as its reference point the position advocated in a recent Bank-sponsored book (see pp. 8–9, Warford, 1989) in which it is affirmed that:

> The traditional approach to environmental management is to invest in projects that have primarily environmental objectives ... or to ensure that components of other projects contain elements to mitigate adverse environmental impacts. This project-by-project approach is important and must be continued. Alone it is clearly inadequate, however, and needs to be supplemented by more comprehensive, wide-ranging policies. By concentrating on curative, piecemeal solutions rather than on the underlying causes, the traditional approach ... fails to confront the real issues, which have more to do with the way society works than with the technical aspects of natural resource degradation. Environment-related behavior and policy are in fact at the very heart of social, macroeconomic, and sector policies.
>
> The project-by-project approach should be supplemented by one that integrates environmental and natural resource management directly into economic and social policy. This can be done in two ways: through investment programs that support environmental and natural resource objectives and through economic, social, and institutional policies that influence the environmental-related behavior of government agencies, major resource users and countless small-scale resource-using activities ... The foregoing ... implies a need for a greater understanding of: (1) the nature, dynamics, and severity of natural resource degradation in light of economic and social criteria, including the welfare of vulnerable groups and future generations; (2) the underlying causes, both human and natural, of natural resource degradation; and (3) the range of feasible economic, social, and institutional policy interventions that are appropriate.

Based on the case study findings, this chapter recasts the lessons learned into six "methodological principles" for improved environmental assessment and management of Bank operations:

- Understanding the context in which projects are to be designed and executed
- Maintaining a spatial focus over a carefully determined geographic unit of account
- Adopting a cross-sectoral and multidisciplinary approach
- Considering "induced development" impacts
- Taking interregional considerations into account
- Assessing unintended environmental consequences of public policies and programs.

The chapter closes with several suggestions for future work in two areas: monitoring and managing long-term im-

pacts in the case study regions; and open issues in Amazon frontier development.

Lessons of Experience

Understanding the Context

The ecological and socioeconomic contexts of Bank-supported operations need to be well understood and such comprehension reflected in their design and implementation. Had the Northwest region's limitations with respect to sustainable small-farm production been better understood prior to POLONOROESTE, Bank appraisal might have been less optimistic about the possibilities of consolidating directed agricultural colonization in a tropical area located several thousand kilometers from major markets. Similarly, in the case of Carajas, had the potential impacts of project transport infrastructure been more clearly assessed *ex ante*, appropriate environmental protection measures might have been applied to areas not under CVRD's immediate control.

As the two Amazonian case studies suggest, carrying out an adequate *ex ante* environmental assessment is likely to be particularly important in areas that are territorially extensive, ecologically sensitive and/or heterogeneous, demographically dynamic, and/or socioeconomically complex, as well as in areas where environmental protection capabilities are incipient or weak. Furthermore, in order to give proper weight to the potential impacts in such situations, a coherent analytical framework should be developed which relates these interventions to likely local population growth (including consideration of alternative demographic scenarios), rural and urban settlement, and natural resource use tendencies. The main types of economic actors involved, the principal incentives and constraints which they face, and the linkages between productive activities in different sectors should also be considered, together with likely project impacts on these actors, incentives, constraints, and linkages.

Especially in environments that are very dynamic, the initial assessment should be complemented by consistent monitoring and evaluation of evolving development trends and natural resource use patterns, as well as the impact of project investments and related activities. Understanding the project context and assessing its environmental impacts must be a continuous process. Finally, adequate comprehension of the setting should include an historical perspective on the evolution of resource use and its underlying factors in the area in question. Where, as in the case of many frontier regions, future tendencies are likely to be different from those observed in the past, an effort should be made to assess the environmental and social impacts of comparable investments in ecologically similar areas which have previously experienced such interventions.

Maintaining a Spatial Focus

A spatial focus is justified on various grounds. Ecosystems are necessarily defined in terms of spatial variations and interdependencies in ecological conditions (climate, hydrology, soils, vegetation, habitats, and so on), while human activities and settlements involve factors and interconnections (for example, the fixed location of most natural resources, rural-urban linkages) that are spatially bound. Environmental externalities are spatial spillovers. Productive activity in one location often affects environmental quality elsewhere, with air and water pollution being the most obvious examples. Large infrastructure improvements such as the Sobradinho dam, the Carajas railroad, and the BR-364 highway have major effects on migration, human settlement, and productive activities and, hence, on natural resource use over potentially very large areas. The possible regional and even global climate impacts of large-scale deforestation in specific localities within the Brazilian Amazon, such as the Carajas corridor and Rondonia, or elsewhere provide another example.

Many of the most important environmental impacts of a large investment project, furthermore, are likely to be indirect ones and/or become evident only over a fairly long time horizon. Having a "spatial unit of account" will facilitate the identification and monitoring of these effects.[1] Finally, a spatial focus is important because project impacts interact with market forces or public policies at the local or regional level to affect natural resource use and environmental quality. The Carajas operation illustrates all three of these phenomena. Many of the iron ore project's most serious social and environmental consequences were indirect ones, including rural land speculation and concentration and the clearing of large areas along the rail and road corridors which it opened up. Others, such as deforestation associated with increasing charcoal consumption on the part of Carajas ore and transport-dependent pig iron smelters located along the railway corridor, did not occur immediately. These impacts were due to a combination of the greater physical accessibility and raw materials provided by the

1. A similar observation is made by Pearce and Markandya, 1989. These authors affirm (p. 43) that because the "ecological linkages among sectors" mean that a "system shock" such as a major infrastructure improvement can produce impacts "in locations quite distinct from the initial act of natural resource degradation, project evaluation ... needs to consider effects within a spatial unit of account." While the "spatial unit of account" cited by these authors is the watershed, in cases such as Carajas or POLONOROESTE where the "system shock" is a transport investment, the more appropriate unit is the area of influence.

project and other factors including official tax and credit incentives for agro-ranching and industrial activities.[2]

Not all of these impacts, moreover, occur in areas immediately contiguous to the interventions in question. The downstream consequences of the Sobradinho dam in the lower São Francisco valley occurred at a very considerable distance (800 km) from the project site. The starting point for project impact assessment should be identification of its area of influence, recognizing that this area may change over time. The need to take a spatial approach, however, tends to conflict with the traditional sectoral organization of most institutions in the Bank's borrowing member countries, as well as of the Bank itself.[3] Conscious efforts should, thus, be made to increase awareness of the spatial nature of environmental externalities.

One spatial aspect which requires particular attention in frontier areas concerns the relation between local carrying capacity and possibilities of achieving geographically sustainable development.[4] POLONOROESTE's largely frustrated attempt to promote small-farmer colonization through the New Settlements Project in Rondonia illustrates the importance of taking an area's carrying capacity sufficiently into account. The concept of carrying capacity in any particular region refers to "the maximum population of a given species that can be supported indefinitely... without any degradation of the natural resource base that would diminish this maximum population in the future." [5] Although difficult to operationalize,[6] the idea of human carrying capacity is germane to efforts to promote sustainable development in humid tropical regions such as Amazonia, especially when the subarea in question is poorly known in ecological terms as was the case with Rondonia in the late 1970s and early 1980s. Barring major technological breakthroughs, such areas are likely to remain sparsely populated because of the inability of local ecosystems to sustain productive, especially agricultural and ranching, activities over the long run. Given this situation, once such areas are opened up by major transport investments, there is a strong tendency for local economic activity to be largely based on the extraction of non-renewable mineral (or fossil fuel) resources or on the "mining" of renewable soil and timber resources.[7]

Adopting a Cross-Sectoral and Multidisciplinary Approach

In retrospect, as indicated in Chapter 4, the uneven environmental performance of both Carajas and POLONOROESTE prior to its reformulation appears to have suffered from the lack of a broader cross-sectoral approach. The São Paulo and São Francisco case studies likewise provide illustrations of ways in which the approaches initially followed by the Bank should be broadened in the future.

In metropolitan São Paulo, Bank-supported pollution control projects were able to reduce emissions from industrial sources, but pollution from road dust and vehicle emissions was not addressed. On the water side, PROCOP funds and technical assistance were used to install treatment facilities for industrial effluents, but domestic sewage continues largely untreated, resulting in considerable pollution of such important local water courses as the Tiete and Pinheiros Rivers and the Billings Reservoir. While these various sources of pollution do not have to be addressed in a single lending operation, there is a need to take a comprehensive view of urban pollution problems, to develop appropriate abatement strategies, and to define and undertake priority interventions across traditional investment sectors on a city or metropolitan-wide basis.

In the São Francisco valley, in turn, as noted in Chapter 2, a situation of increasing inter-sectoral competition for the use of river water may be developing. However, little effective coordination currently exists among the pertinent federal, state, and local public agencies and no overall water resource use plan or program has been adopted despite considerable external technical cooperation in this respect.[8]

2. While it can be argued that many of these impacts would have eventually occurred, albeit considerably more slowly, in the absence of the project as the result of other public sector interventions (for example, road building and fiscal incentives) and the predatory nature of advancing frontier occupation, the potential role of the Carajas Project in reinforcing or accelerating these tendencies in its area of influence should have been explicitly considered.

3. Myers, 1989a, p. 65, observes that "the environmental interconnections of natural resource systems constitute an 'objective reality' that is... often in conflict with the compartmentalized approach of human institutions... In response, we need to adopt a more integrative approach to natural resource issues."

4. Sustainable development is defined by the World Commission on Environment and Development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs. See *Our Common Future*, 1987, p. 43. Geographically sustainable development requires the management of local renewable resources—particularly water, forest, and soil resources—in such a way that socioeconomic activity can be sustained over time in any given region or subregion.

5. See Kirchner, 1985, p. 45. This concept was devised by natural scientists to indicate the capacity of particular ecosystems to support animal life; by taking into account differences in living standards, income and wealth distribution, technology, and trade, it can be applied to human populations as well. Agroecological zoning represents one attempt to do so.

6. For recent applications of this concept in Latin America, see Fearnside, 1986; Hicks, 1990; and Daly, 1990.

7. In this context, the situations in the Carajas and Cuiaba-Porto Velho corridors must be differentiated in light of the much greater relative access of the former to domestic and external markets and the size of its mineral reserves, which are among the largest and richest in the world. The size of mineral reserves in the Northwest is less well known, but undoubtedly much smaller than at Carajas. In addition, the extraction of commercially valuable timber that supported a logging and lumber processing boom in Rondonia during much of the 1980s may diminish substantially over the present decade, as has already occurred in western Mato Grosso. These differences have important implications for the medium and long-run economic prospects of the two areas.

8. Most recently (1984–87) by the Organization of American States (OAS) through the PLANVASF Project which resulted in a development plan for the region whose summary was published in October 1988.

In addition, a number of factors seem to have led to decreasing water levels of major reservoirs, especially Sobradinho, in recent years. Considering that CHESF and CODEVASF both plan to substantially expand their activities over the coming decades and that private irrigation projects are likely to increase even more rapidly than public schemes, there is a need for improved multi-purpose water resource management at the regional (that is, river basin) level.[9]

A closely related principle is the need to take a multidisciplinary approach to environmental assessment for projects which are likely to have significant social or ecological consequences.[10] Under such circumstances, the timely and effective participation of social science, environmental, and spatial development specialists is likely to reduce the possibility that similar problems will be overlooked or inadequately dealt with in project preparation, appraisal, and supervision. The experiences surveyed provide ample evidence of the importance of assessing large investment operations, especially when they are located in sensitive ecological and/or complex socioeconomic settings, in a multidisciplinary way, thus fully supporting the Bank's current environmental guidelines' recognition of the need to involve environmental specialists and social scientists other than economists in project work.

Considering Induced Development Impacts

The cases examined also reveal instances where projects have had important, but not fully anticipated, "induced development" impacts. Carajas and Sobradinho are particularly illustrative of this. Carajas was primarily concerned with the expansion of iron ore exports. While the appraisal report acknowledged that the infrastructure to be provided would also contribute to the development of other productive activities in its area of influence, the associated social and environmental costs were not assessed or addressed, even though they have been substantial.

Similarly, the Paulo Afonso IV Hydropower (Sobradinho) Project expanded electric energy generation and transmission, particularly to support urban-industrial development in the Salvador and Recife metropolitan areas. It also had an important, but largely unforeseen, impact on local development in the middle São Francisco valley, especially in the area near Sobradinho, where increased energy supply and improved river flow regulation contributed directly to the rapid expansion of irrigated agriculture and associated agroindustrial and urban development.

Induced development impacts of large-scale investments should be anticipated to the extent possible and given their proper weight in overall project assessment. Where these impacts include significant social and/or environmental costs, measures should be defined and implemented to minimize them, either as an integral part of the original large-scale operation or through appropriately designed parallel or follow-on projects. This, in fact, is what occurred both with respect to Sobradinho's downstream impacts, which led to the "emergency" polder and second irrigation projects in the lower São Francisco valley, and in relation to Amerindian protection in the area of influence of the Carajas Project and POLONOROESTE.

Interregional Considerations

A key dimension revealed by the POLONOROESTE experience is the relationship between local development and that occurring elsewhere in the country. This linkage is important both in order to understand the nature and source of recent demographic pressures on the Northwest and to formulate alternatives to the continued less than fully sustainable occupation of the western Amazonian frontier (see below). Many of the problems and adverse environmental impacts associated with POLONOROESTE were due to the region's inability to absorb the large numbers of migrants who arrived during the early and mid-1980s.

Migration to the Northwest responded to a combination of "push" and "pull" factors. The former included rapid rural land use changes, agricultural modernization, and land concentration in earlier frontier areas such as western São Paulo, northwestern Parana, and Mato Grosso. These transformations were primarily due to conversion of areas previously dedicated to small-farm coffee and food crop production into large commercial export-oriented soy bean estates or petroleum-substituting sugar cane plantations for alcohol production. "Push" factors also included increasing unemployment in metropolitan São Paulo and elsewhere during the severe economic recession of the early 1980s. "Pull" factors consisted largely of migrant expectations of obtaining access to cheap, reportedly fertile, land and/or other income and employment opportunities through farming, ranching, land speculation, gold prospecting, cassiterite mining, logging, and associated urban industrial and service activities. The physical and social infrastructure expected to be provided through POLONOROESTE also attracted migrants to the region.

Demographic pressures on the Northwest had their origins in high rates of rural population growth elsewhere in the country, the rapid displacement of part of this popula-

9. This is explicitly recognized in recent Bank sector work. See World Bank, 1990c.

10. This conclusion is also reached by Warford (1989). Warford affirms (pp. 12-14) that "if project and policy measures are to be viable, they should be based on a sound understanding of not only the physical linkages among events, but also the equally complex economic, financial, social and institutional linkages that parallel them" and that "the determination of policies therefore calls for the involvement of the economist, political scientist, sociologist and anthropologist as well as for legal and institutional expertise, in addition to knowledge of the physical sciences."

tion from areas in south-central Brazil, and government policies in response to macroeconomic considerations and constraints. Partly as a result, rural (and later also urban) populations were induced to migrate from areas of temperate climate and comparatively robust soils located close to major markets to the distant Amazonian frontier where such possibilities were considerably more limited.

Assessing Unintended Policy Consequences

The case studies, particularly those in Amazonia, likewise reveal the often important impacts of government policies that are not explicitly concerned with natural resource utilization or the environment on the ways in which such resources are used and environmental quality more generally. Examples include the primary export promotion and import substitution policies mentioned in the preceding section in connection with POLONOROESTE and the fiscal and credit incentives touched on earlier in relation to the recent occupation of the Carajas corridor.[11]

Any public policy that affects population distribution, settlement patterns, productive activities and, natural resource use will have some effect on the human and physical environments. Policies that are relatively benign in some areas may be very harmful elsewhere. This is the case, for example, with obligatory land clearing to promote "productive" occupation of rural land holdings which, while appropriate in southern Brazil, is ecologically perverse in Amazonia. In any event, the potential environmental consequences of macroeconomic (including trade and fiscal) and sectoral policies should not be ignored and corrective or compensatory measures should be taken where needed. The environmental implications of policies for the agriculture, industry, power, and transport sectors should receive particular attention in this connection.

Suggestions for Further Work

Monitoring and Managing Longer-term Impacts

São Paulo. Despite the comparative success of industrial pollution control efforts in São Paulo, the urban pollution problem in the state has by no means been solved. The Bank's assistance, while having evolved and broadened considerably over time, has not confronted several of the main sources of environmental contamination in the São Paulo metropolitan area, including road dust and vehicle emissions. In short, the Bank's experience in São Paulo, while generally quite positive, also testifies to the need to pursue urban environmental management in a more comprehensive way. Dealing in a cost effective manner with the broader set of urban/metropolitan pollution and resource management issues requires both an increased emphasis on policy and economic—together with legal, institutional, technical, and financial—measures and application of a cross-sectoral, cross-media approach to environmental problems at the city or metropolitan level. These must also be combined with actions at the national level, particularly the definition and enforcement of adequate vehicle emission standards.

São Francisco Valley. Due to the projected expansion of both public and private irrigation schemes, aside from increasing inter-sectoral water resource competition, the principal long-run environmental risk facing the middle and lower valley is the growing use of chemical fertilizers, herbicides, and pesticides often associated with such undertakings. Potential contamination of domestic water supplies, crops, and fish stocks could present a danger to public health in the future and should be carefully monitored by state environmental authorities. As the area of irrigated agriculture expands, soil salinity and waterlogging—which are potential problems with any irrigation project and have already occurred elsewhere in the Northeast—may become more widespread unless local water management techniques are improved. Finally, there is a need to strengthen cross-sectoral coordination of water resource use.

Carajas. Hydroseeding, landscaping, and drainage, which together accounted for roughly 90 percent of CVRD's environmental protection expenditures, are essential for the maintenance of project infrastructure, especially the railway, and thus are highly likely to be sustainable. In contrast, those environmental measures not directly linked to ongoing project operations, particularly basic scientific and ecological research, appear less likely to be continued in connection with the project. In addition, other environmental control actions such as air and water quality monitoring, while generally satisfactory thus far, will need to be strengthened in order to counter environmental threats associated with expected future developments in the region. These include both the expansion and diversification of mining activities within CVRD's concession and mineral-based industrialization along the corridor. The study of alternative (to wood-based charcoal) energy sources for pig iron and other metallurgical production in the Carajas region, currently being carried out by the Brazilian government and the Bank, is of particular relevance in this regard.

Possible Climate Change. Even though available evidence does not permit a clear picture as to the extent of localized climate change in either the Carajas corridor or Northwest

11. The papers by Mahar (1989) and Binswanger (1989) cited in Chapter 1 above provide more detailed discussions.

Brazil,[12] the deforestation that has occurred in these areas over the past two decades nonetheless corresponds to a substantial share of that which has taken place in Brazilian Amazonia more generally. Furthermore, while estimates range widely, recent surveys suggest that the contribution of Amazonian deforestation to global carbon dioxide emissions may be as high as 9 percent of the international total and that this level probably doubled during the 1980s.[13] It is also known that extensive deforestation in tropical areas can be accompanied by rising temperatures, lower rates of evapotranspiration, and increased surface water run-off.[14] Deforested areas tend both to contribute less to atmospheric humidity and to be generally warmer than those under primary vegetative cover. The aggregation of microclimatic changes, when these take place over large areas such as eastern or western Amazonia, additionally, can result in alterations in the dynamic equilibria that determine climate conditions at the regional level and may eventually contribute to global climate change. Such changes, accordingly, should be carefully monitored.

Amerindian and Environmental Protection Needs. The study raises as a significant issue the continuing need to ensure the protection of indigenous peoples and other vulnerable groups once Bank projects have been completed. Among the case studies, this is particularly germane with respect to the Amerindian Special Projects implemented in parallel to the Carajas iron ore operation and POLONOROESTE and may also prove to be a problem for the Itaparica Project.[15] Furthermore, it is relevant to environmental protection components of large public investment programs such as POLONOROESTE whose sustainability in the absence of continued external support may be highly tenuous. In the case of indigenous peoples protection, pressures on Amerindian lands both in the Carajas corridor and the Northwest region may well increase in the future as rural settlement continues to expand, while the Sobradinho experience reveals that rural resettlees' needs for production and other forms of assistance may extend well beyond the original project period. In view of this situation, the Bank should help define and agree with Brazilian authorities the measures required to ensure the sustainability of such protection efforts.

Follow-on or Parallel Projects. In some cases, this could be done by extending the project implementation period or through one or more follow-on operations,[16] although ideally ways to guarantee sustainability of project Amerindian and environmental protection components should be sought through means other than continued reliance on Bank lending. Even though such operations may complicate overall scheduling and coordination, there are advantages to having environmental and tribal peoples protection or involuntary resettlement projects in parallel to the original infrastructure or productive operations that made them necessary in the first place. Such parallel operations could be prepared at the same time as the original infrastructure/productive projects and be contractually linked to them in the same way as the various loans for POLONOROESTE were legally interdependent. They could also have a longer time horizon and are likely to draw greater Bank and borrower attention to issues which might be given lower priority during the preparation, appraisal, and supervision of large infrastructure and productive projects.

Ex post Environmental Impact Evaluations. Although the borrower is ultimately responsible for managing the environmental and social consequences of its development projects, it is in the Bank's, as well as the borrower's, interest to become more fully aware of their longer-term impacts. This is especially true for large projects such as those examined in the present study. Beyond surveying observable project environmental performance and results soon after completion through PCRs and audits and the eventual undertaking of ex post environmental assessments by OED, the Bank should encourage systematic, detailed, and independent investigation of the long-term consequences of large investments by local and outside experts in order to better understand the interactions between large-scale physical and socioeconomic systems over time.

"Nutrient Mining" and Sustainable Development. The Carajas and POLONOROESTE case studies suggest that perhaps the main reason for increasing environmental problems in substantial parts of Amazonia over the past two decades is the predominantly extractive nature of the economies in these areas combined, until very recently,

12. To determine this would require detailed observation and analysis of daily variations in temperature, rainfall, and other parameters at representative locations over a period of at least several years, and ultimately, decades.

13. See Reis and Margulis, 1991, pp. 335-80. Brazil was estimated to be the third largest producer of greenhouse gases in 1987, accounting for 10.5 percent of the world total in that year. See World Resources Institute, 1990. For a more general discussion, see Arrhenius and Waltz, 1990.

14. On the potential climate impacts of tropical deforestation, see Myers, 1985, especially Chapter 15; and Myers, 1989b, pp. 32-34.

15. Recent socioeconomic research reveals that recovery from the effects of resettlement in West Africa took around seven years. These findings, moreover, pertained just to the time required to reach equilibrium in household economies and not the normally even longer period needed to reap full benefit from productive investments carried out in conjunction with resettlement.

16. In the Maranhão part of the Carajas corridor, for example, Amerindian protection activities initiated in connection with the iron ore project are being maintained under an on going rural development project, while in the Northwest region, continued support to indigenous communities is one of the components of the recently approved Rondonia Natural Resource Management Project.

with the almost total absence of effective environmental protection. This was particularly evident in eastern Para and Rondonia during the 1970s and early 1980s, where the principal elements in the regional economies were mining, prospecting, logging, ranching, and annual crop production, together with closely linked urban industries and services (for example, lumber and mineral processing, construction, commerce).

Mining and prospecting involve the extraction of non-renewable resources, while logging, ranching, and annual crop production have traditionally entailed nutrient "mining"[17] from potentially renewable resources—the tropical forest and its underlying soils—whose initial fertility derives largely from ash formed through the burning of the forest. Since such uses normally require the elimination of forest cover, in the absence of relatively expensive chemical fertilizers, the nutrient base tends inevitably to decline over time and agricultural and grazing activities are forced to move elsewhere. As a result, these activities are frequently not sustainable at any given location, leading the frontier to shift, often in an equally unsustainable manner, to areas still in virgin forest. The extent to which this process continues to occur in the Carajas corridor and the Northwest region should be the subject of further investigation with an eye toward developing more sustainable alternatives for productive occupation of the Amazon frontier.

Alternatives to Amazon Settlement. In light of this situation, furthermore, an important question in connection with the Bank's decision to promote small-farmer settlement in the Northwest was whether many of the objectives associated with this initiative, particularly the absorption of rural migrants, could not have been better achieved elsewhere in the country, including the migrants' regions of origin and/or outside the agricultural sector altogether. As an alternative to agricultural colonization on the Amazon frontier, for example, among the (non mutually-exclusive) options that could have been considered were the intensification of rural settlement and agricultural production in previously occupied or unoccupied non-tropical areas in south-central Brazil (the *cerrados*) and the expansion of non-agricultural activities.[18] Unlike POLONOROESTE, in short, proposed future land settlement initiatives in the humid tropics should first be assessed in a broader interregional framework.

17. Nutrient mining on the Amazonian frontier is further discussed in Schneider (1992). A recent book by Pearce and Turner (1990, p. 39) describes this process in the following terms: "If we harvest a renewable resource at a rate faster than the rate at which it grows, the stock will be reduced. In this way, a renewable resource can be 'mined,' treated like an exhaustible resource. If we wish to sustain renewable resources, we must be careful to harvest them at a rate no greater than their natural regenerative capacity."

18. See Hicks,1990, for a more detailed discussion of such alternatives in the Ecuadorian Amazon case. Similar proposals are also contained in FAO, 1990, a working paper prepared by an Interdepartmental Task Force on the Amazon.

7. Recommendations for Bank Operations

The two previous chapters have described the principal lessons emerging from the study with respect to environmental protection, assessment, and management. Most have clear implications for Bank activities and procedures as well. These recommendations are summarized below for several major Bank activities: economic and sector work (ESW), technical assistance, and project preparation, appraisal, supervision, monitoring, and evaluation. Suggestions are made for internal Bank resource deployment. Mention is also made of some of the ways in which these lessons have been incorporated into recent Bank work. The findings of the case studies provide strong support for many of the steps the Bank has taken in recent years to integrate environmental concerns into its policies, guidelines,[1] and operations, even though the overlap between the lessons of the study and the new initiatives is not perfect.

Economic and Sector Work and Technical Assistance

Considerable progress has been made in recent years with respect to environmentally-focused ESW, particularly in relation to: (1) the identification and analysis of priority problem areas (for example, destruction of natural habitats, land degradation, depletion and degradation of fresh water resources, urban, industrial, and agricultural pollution, and degradation of the "global commons"); (2) diagnostic studies; and (3) the definition of country environmental strategies and action plans. This has also helped the Bank to develop an increasingly robust environmental lending program.[2]

The case studies, particularly those for Carajas and POLONOROESTE, reveal the critical importance of integrating environmental concerns into Bank ESW. More generally, in Brazil, as in most other borrowing member countries, natural resource management considerations have been largely absent from the Bank's policy dialogue and economic and sector work until comparatively recently.[3] The study points to several areas that deserve further attention in this regard.

As suggested in the previous chapter, the natural resource use and other environmental implications of the policy measures assessed by the Bank in dealing with macroeconomic and sector issues should be paid explicit attention. When significant human and physical environmental impacts are anticipated, a cross-sectoral and multidisciplinary approach should be taken. Bank ESW should also be increasingly targeted on country or region-specific environmental problems.[4] The task, however, is immense

1. Bank operational directives require environmental assessments (EAs) to address issues associated with agrochemicals, biological diversity, dams and reservoirs, indigenous peoples, induced development and other sociocultural aspects, industrial hazards, involuntary resettlement, land settlement, ports and harbors, tropical forests, watersheds, wetlands, and wildlands. Regional and sectoral, as well as project-specific, EAs are covered, as are sector and financial intermediary lending, emergency recovery projects, global issues, institutional aspects, and EA procedures including environmental screening, interagency coordination, and the involvement of affected groups and NGOs.

2. See World Bank, 1990b or 1991, for details. In addition to Brazil, freestanding natural resource management or environmental protection operations have recently been approved for countries as diverse as Benin, Bolivia, Burkina Faso, the Central African Republic, China, Côte d'Ivoire, India, Madagascar, Mauritius, Mexico, Nigeria, the Philippines, and Poland while numerous others are currently under preparation.

3. OED (1989) for example, reaches the following conclusion in its case study on Brazil: "at the macro level ESW has never really come to grips with the strategy issues in using or conserving renewable natural resources as a vehicle for achieving national socioeconomic development objectives" and "although resource management issues were raised in ESW, they were not addressed in any operational sense at the national level."

4. Recent Bank sector work that should be highlighted includes previously mentioned studies for the Brazilian and Ecuadorian Amazon regions (Schneider, (1992), and Hicks (1990) as well as the Philippines ("Environmental and Natural Resource Management Study," 1989), Indonesia ("Sustainable Development of Forests, Land, and Water," 1990), Nigeria ("Towards the Development of an Environmental Action Plan for Nigeria," 1990), Bangladesh ("Environmental Strategy Review," 1991), Venezuela ("Environmental Issues in Venezuela," 1991), and the Czech and Slovak Federal Republic ("Joint Environmental Study," 1992), among others.

and is likely to require large amounts of resources in free-standing and project-financed technical assistance.

In Brazil specifically, in addition to recently completed or ongoing research on the environmental aspects of Amazonian development and urban-industrial pollution, the study recommends that the Bank should continue to support work—perhaps leading to future lending operations—dealing with urban environmental management,[5] industrial development and environmental protection in the Carajas corridor,[6] and water resource use, competition, and management in major watersheds, particularly the São Francisco valley.[7] More generally, in demographically large and territorially extensive countries such as Brazil, the Bank should encourage and assist borrowers to develop policies for guiding population growth and distribution and rationalizing natural resource use.

Supporting and strengthening national and subnational institutional and technical capabilities for environmental management are of particular importance. Where necessary, further attention should be devoted to developing or consolidating the policy, legal, regulatory, and administrative frameworks and information systems, monitoring tools, and enforcement mechanisms required for more sustainable renewable resource use and effective environmental protection. These objectives should be promoted both through free-standing technical assistance and institutional strengthening projects and components. Finally, the need to increase public awareness of environmental problems, their causes, and potential solutions through public education programs, media campaigns, NGO participation, and other means and to ensure greater accountability in local and national decision making with respect to environmental issues should be specific concerns of both Bank policy dialogue and lending operations.

In the Brazilian case, recent projects with important institutional strengthening objectives are the National Environmental Project, currently under implementation, and the G-7-sponsored Pilot Program to Conserve Brazilian Tropical Rainforests. Such efforts merit the Bank's continuing support.

Project Preparation and Appraisal[8]

Upgrading Ex ante Environmental Assessment

Among the case study operations, the Carajas and lower São Francisco projects are the ones which might have benefitted most from additional social and environmental assessment prior to appraisal. In similar situations in the future, a rigorous and systematic methodology should be followed combining, as outlined in the previous chapter: a spatial, cross-sectoral, and multidisciplinary approach; analysis of any likely "induced development" impacts; consideration of interregional and intersectoral alternatives; and evaluation of the resource use and environmental management implications of sector and macro policies.

Based on the examination of past experience in Brazil, among the "country factors" that should be taken into account in any such analysis are:

- Demographic and economic considerations including the possible impact of alternative demographic scenarios, macroeconomic instability, and policies designed for other purposes (such as fiscal and credit incentives) on natural resource use and the effectiveness of environmental protection measures, the role of interregional linkages, and possible induced development impacts.
- Governance factors including the extent of political commitment to project.
- Environmental objectives, the degree of public awareness and community participation, and the likely effects of political-administrative decentralization.
- Institutional capacity constraints

Rigorous and systematic *ex ante* assessment of project human and physical environmental impacts is especially important. Particular attention should be given to potential impacts which are irreversible (for example, species extinction) and to areas known to be ecologically sensitive and/or having large population concentrations. In this sense, addressing the environmental management needs of large cities and metropolitan areas should clearly be among the Bank's main priorities [9] in Brazil and other highly urban-

5. In this connection, see World Bank/UNDP, 1989; and Bartone, 1989a, 1989b, and 1990.

6. The Brazilian government and the Bank agreed in October 1990 to jointly undertake an energy options study for the Carajas region under the Bank/UNDP Energy Management Assistance Program (ESMAP).

7. This issue has also recently become the subject of Bank research in the Environment Department.

8. Although the discussion in this and the next section refers specifically to individual investment projects, the same general considerations also apply to sector investment operations and the investment components of hybrid projects.

9. This conclusion is also reached both in the World Bank's urban policy document, "Urban Policy and Economic Development: An Agenda for the 1990s," endorsed by the Board in January 1991, and in World Bank, 1992.

ized or rapidly urbanizing countries.[10] The Bank's current requirement that all new operations be classified in accordance with the potential severity of their environmental impacts for the application of appropriate assessment procedures represents an important first step in relation to the above suggestions.[11]

Refining Project Design

The number and scope of environmental protection components and free-standing environment projects has grown quickly over the past several years. The role of the Bank in the administration of the Global Environmental Facility (GEF) is compounding this increase. The case studies, particularly for Carajas and POLONOROESTE, point to four areas where improvements in project design could be made: (1) better integration of "country factors" (that is, the macroeconomic, demographic, policy, governance, and institutional capacity considerations mentioned above); (2) better balance and timing of physical versus policy and institution-related project components; (3) improved design of environmental covenants; and (4) more extensive risk analysis and greater allowance for uncertainty.

As suggested above, ESW and free-standing technical assistance should provide the framework for improving country lending strategies from an environmental perspective and addressing items (1) and (2) of the previous paragraph in a systematic way. This framework will need to be refined during project preparation to ensure the timely implementation and effectiveness of non-physical components, particularly project-financed technical assistance. A good balance in the accumulation of physical and non-physical assets, moreover, is likely to be a key factor in the sustainability of project benefits.

Environmental covenants and other instruments recording areas of agreement for project implementation should clearly spell out the nature and, when needed, the expected timing of the environmental precautions and mitigatory actions to be taken in conjunction with any Bank operation.

10. The Bank-assisted Metropolitan Environmental Improvement Program (MEIP) involving Beijing, Bombay, Colombo, Jakarta, and Manila is an effort that should be replicated among the large cities of Latin America and elsewhere. The Bank-supported environmental program for the Mediterranean, in turn, illustrates a multi-country initiative that focuses on urban and other environmental management issues. See World Bank, 1990d.

11. While potential project environmental impacts should ideally be traced out as far as they may reach in every direction, in practice this is seldom possible. Given the limitations of time and resources, environmental assessments are always partial and incomplete. Nonetheless, general rules of thumb for assessing how broadly potential environmental problems need to be conceptualized and over how large an area potential impacts need to be assessed should be formulated, recognizing that application of such guidelines to concrete situations will necessarily have to be flexible and, as indicated, in Chapter 4, adequate environmental monitoring mechanisms and procedures should also be put into place and sustained.

There are risks associated with most of the "country factors" listed above. Borrower commitment, public awareness, institutional deficiencies, and the environmental impact of non-environmental policies are often difficult to gauge. They are also subject to changes, some occasionally profound, as the case studies illustrate. Uncertainties in assessing project impacts are also due to limitations in gathering and processing information and the random nature of some environmental outcomes. The case studies nevertheless clearly indicate a need for the Bank to improve its performance in this area.

Risk analysis and allowance for uncertainty should be integrated into the design of large-scale projects having long-term and possibly irreversible impacts on the affected populations and the physical environment. Formulating adequate responses to risk can draw on two simple principles:

- Employ project designs which offer greater options and flexibility over those which are excessively rigid.
- Base project design on a forward-looking set of costs, benefits, and probabilities. In light of growing environmental concerns, the second principle would favor projects with less complex design and those which are likely to be more robust in the face of one or several possible adverse conditions in terms of macroeconomic performance, policies, governance, and institutional capacity.

Project Supervision, Monitoring, and Evaluation

The case studies reveal situations where Bank supervision was both insufficient (for example, the environmental protection and urban development components of Carajas, the initial years of POLONOROESTE) and of critical importance (the Amerindian Special Projects of both Carajas and POLONOROESTE) to ensure a positive outcome. Responsive Bank supervision also played a key role in the reorientation of the first Industrial Pollution Control Project in São Paulo. In general, however, the operations reviewed demonstrate a need to strengthen Bank supervision of environmental components and to improve Bank monitoring of social and environmental impacts. Especially in large, complex, or risky projects that may have substantial environmental and/or social impacts, during supervision the Bank should systematically monitor both project performance and any relevant contextual changes—such as migration rates, emerging settlement patterns, and their consequences in Northwest Brazil—so as to "flag" any significant alterations in the basic parameters assumed at appraisal and to permit the introduction of necessary modifications in project design in as timely a fashion as possible. In such operations, furthermore, the Bank should routinely undertake

a comprehensive mid-term review, as was done in connection with POLONOROESTE.

Also important is the need for independent, multidisciplinary monitoring and evaluation of project performance in relation to environmental and social objectives, issues, and impacts. Where feasible, the participation of responsible NGOs in environmental monitoring activities should be encouraged. As was attempted in the case of POLONOROESTE, ongoing assessment should consider evolving development tendencies and their environmental consequences in project areas of influence as well as project implementation performance and results.

Current Bank operational guidelines require that completion reports (PCRs) present an evaluation of project environmental impacts, noting whether they were anticipated in the *ex ante* environmental assessment report, and of the effectiveness of mitigating measures and of any related institutional development and training. These reporting requirements should be further elaborated and included as part of the PCR guidelines more generally. *Ex post* evaluation of project environmental performance and impacts should likewise receive greater priority.

Suggestions for Internal Resource Deployment

Incorporating the lessons summarized in this chapter into Bank procedures and operations implies possibly significant additional time and financial costs in terms of planning horizons, project preparation and appraisal, supervision frequency and intensities, and, ultimately, personnel requirements, staff profiles, overseas presence, internal training, and so on. Because many environmental costs are externalities, especially in relation to global issues, borrowers and executing agencies are frequently less concerned than the international community more generally. When the potential environmental risks and impacts of the investments it supports are likely to be significant, Bank supervision efforts need to be intensified.

The exact nature of such activities and the extent of the additional resources required will vary from country to country and should be the subject of further investigation with the direct involvement of Bank operational staff. Since the incremental expenditures are in the direct interest of its borrowers as well as the Bank, the necessary funding should be drawn from a range of sources including the project preparation facility, engineering and technical assistance loans, environmental trust funds, the GEF, and new lending operations in addition to the Bank's administrative budget. The Bank should not expect, however, that already severely constrained operational personnel, even with increased environmental awareness and training, will be able to orient and evaluate environmental assessments or provide the necessary monitoring and supervision of the environmental impacts and components of ongoing projects without more resources than those presently at their disposal.

The case studies contain examples of several pioneering efforts on the Bank's part to broaden its approach to project preparation and appraisal. These include the preappraisal environmental "reconnaissance" of Sobradinho, the multidisciplinary Northwest region survey mission, and the participation of Bank and consultant anthropologists and ecologists in the appraisal and supervision of the Amerindian and environmental protection components of Carajas and POLONOROESTE and, more recently, in the preparation and ongoing supervision of the Itaparica Project. These experiences confirm the need for a staff/consultant skill mix that covers a range of disciplines in the preparation, appraisal, and supervision of projects that are likely to have significant social and environmental effects.

Finally, in countries like Brazil where the environmental portfolio is large and rapidly growing or where ongoing operations are expected to have significant physical or human environmental impacts, the Bank should study the cost-effectiveness of placing one or more specialists in the field to intensify project environmental monitoring and supervision and expedite communication with borrowers on environmental matters.[12] The in-country presence of specialized Bank staff or long-term consultants would both facilitate the preparation of new environmental projects and send a clear signal to borrowing member countries as to the importance attributed by the Bank to ecological and social issues.

12. In addition to Brazil, Bank country or regional offices in China, India, Indonesia, Mexico, the Philippines, East and West Africa, Central and Eastern Europe, and the former Soviet Union, among others, would probably benefit from the presence of resident environmental specialists.

Annexes

Annex 1: Bank-supported Projects Evaluated or Surveyed in the Study

São Paulo Pollution Control

Projects Evaluated in Depth

São Paulo Industrial Pollution Control Project—Loan 1822 for $58 million, approved on March 27, 1980 and closed on June 30, 1986

Projects Surveyed

São Paulo Water Supply and Pollution Control Project—Loans 0757 and 0758 for $22 million and $15 million, respectively, approved on May 18, 1971 and closed on June 30, 1977

Greater São Paulo Sewage Collection and Treatment Project—Loan 1525 for $110 million, approved on February 28, 1978 and closed on September 30, 1984

Second Industrial Pollution Control Project—Loan 2831 for $50 million, approved on June 9, 1987 and expected to close on June 30, 1994

São Paulo State Water Sector Project—Loan 3102 for $280 million, approved on October 24, 1989 and expected to close on June 30, 1994

Carajas-São Luis Corridor

Projects Evaluated in Depth

Carajas Iron Ore Project—Loan 2196 for $304.5 million, approved on August 10, 1982 and closed on December 31, 1987

Projects Surveyed

Alto Turi Land Settlement Project—Loan 0853 for $6.7 million, approved on July 6, 1972 and closed on December 31, 1980

Maranhão Rural Development Project—Loan 2177 for $42.7 million, approved on June 10, 1982 and closed on December 31, 1988

Second Maranhão Rural Development Project—Loan 2862 for $84 million, approved June 30, 1987 and expected to close on March 31, 1996

Lower and Middle São Francisco Valley

Projects Evaluated in Depth

Paulo Afonso IV Hydroelectric Project—Loan 1008 for $81 million, approved on June 4, 1974 and closed on June 30, 1983

Lower São Francisco Polders Project—Loan 1153 for $23 million, approved on June 9, 1975 and closed on September 30, 1983

Second São Francisco Irrigation Project—Loan 1729 for $28 million, approved on June 19, 1979 and closed on June 30, 1987

Itaparica Resettlement and Irrigation Project—Loan 2883 for $132 million, approved on November 17, 1987, and Loan 2883-1 for $100 million, approved on February 2, 1990, both of which are expected to close on December 31, 1996

Cuiaba-Porto Velho Corridor (POLONOROESTE)

Projects Evaluated in Depth

Northwest Region Agricultural Development and Environmental Protection Project—Loan 2060 for $67 million, approved on December 1, 1981, and Loan 2060-1 for $22.8 million, approved on December 8, 1983, both of which closed on March 31, 1990

Northwest Region Health Project—Loan 2061 for $13 million, approved on December 1, 1981 and closed on June 30, 1988

Northwest Region Highway Project—Loan 2062 for $240 million, approved on December 1, 1981 and closed on September 30, 1988

Mato Grosso Rural Development Project—Loan 2116 for $26.4 million, approved on March 25, 1982 and closed on December 31, 1988

Rondonia New Settlements Project—Loan 2353 for $65.2 million, approved on December 8, 1983 and expected to close on March 31, 1992

Projects Surveyed

Amazon Basin Malaria Control Program—Loan 3072 for $99 million, approved on May 25, 1989 and expected to close on June 30, 1995

National Environmental Project—Loan 3173 for $117 million, approved on February 27, 1990 and expected to close on June 30, 1994

Annex 2: Recent Bank Operations Involving Environmental Issues in Brazil

The design of the Amazon Basin Malaria Control Project (Loan 3072-BR; 1989) benefitted directly from the operational research undertaken under the POLONOROESTE health project which generated significant advances in the understanding and control of the disease in frontier areas. Special mention should also be made of the Power Sector Loan (2720-BR; 1986), under which sectoral authorities agreed to implement measures which represented a fundamental change in procedures to protect the human and natural environments in areas affected by power sector activities. These measures reflected lessons learned from earlier projects[1], including Sobradinho.

The first such measure was the preparation of a plan for resettlement of families displaced by the hydro-electric project at Itaparica. Previous delays notwithstanding, the plan was formulated and corresponding actions were taken. The second measure, which was of more global significance, was the elaboration of an Environmental Master Plan (EMP) for the sector, which included, *inter alia*, (1) guidelines to improve environmental planning, including criteria to assess environmental costs and benefits; (2) project-specific environmental and social action plans to be updated annually; and (3) measures, including funding, to strengthen the institutional capacities of company, state, and federal agencies to coordinate and to enforce (1) and (2).[2] The Bank played a major role in facilitating these improvements.

In addition, in 1987–88, the Bank, the government, and sector authorities sought to agree on a second sector loan, including measures to strengthen the institutional capacity of company, state, and federal environmental agencies. Two rounds of negotiations were held during which environmental components under the loans were agreed. Due to macroeconomic and other factors, however, these efforts did not result in new lending to the sector. In 1989, in an effort to preserve environmental and energy conservation components previously agreed upon, the same parties again attempted to process a loan promoting environmental reforms and energy conservation. Agreement was reached on all sector issues, but just prior to negotiations, in early May 1989, the deteriorating macroeconomic situation of Brazil led the Bank to suspend the processing of this operation.

Awareness and understanding on the part of local authorities concerning the importance of taking appropriate measures to address ecological and social issues continues to grow—with and without Bank prompting. Despite continuing delays with respect to effectiveness of the most recent power loan (3227-BR; 1990), ELETROBRAS revised and re-issued the EMP in 1990 and enforces the standards for project selection, design, implementation, and operation set forth in the EMP. Further, awareness of the need to address ecological/social issues now extends beyond the power sector. For example, in connection with a gas distribution project partially financed by the Bank (Loan 3043-BR; 1989), the Bank and the Borrower agreed that the latter would carry out and operate the project in accordance with federal and state pollution control regulations, while in a recent hydrocarbon transport and processing project (Loan 3376-BR; 1991), disbursement for two petroleum-product pipelines has been conditioned to Bank approval of the corresponding RIMAs prior to that of federal and state authorities.

Recent operational activities in Brazil—notably the National Environmental Project (Loan 3173-BR; 1990), current-

1. This annex is drawn from notes prepared by Bank regional staff involved in current operations in Brazil.

2. The PPAR for the Power Sector Loan (dated December 31, 1990) judged the elaboration and expansion of the EMP to have been a success, particularly in light of the difficult economic and political situation at the time.

ly under implementation; the Natural Resource Management Projects for the States of Rondonia and Mato Grosso, respectively under negotiation and appraisal; and the G-7 Pilot Program to Conserve the Brazilian Tropical Rainforests—have given greater emphasis to environmental protection and natural resource management issues, capacities, and constraints. Supporting and strengthening national and subnational institutional and technical capabilities for environmental management are a significant part of these operations. These operations have also focused on developing or consolidating the legal, regulatory, and administrative frameworks and the information systems, monitoring tools, and enforcement mechanisms required for better natural resource use planning and more effective environmental control. Among other features, these projects explicitly recognize the need to increase public awareness of environmental problems, their causes, and potential solutions through educational programs, media campaigns, NGO participation, and other means and to ensure greater accountability in decisionmaking.

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