

DEFINING COMMON GROUND FOR THE MESOAMERICAN BIOLOGICAL CORRIDOR

Kenton Miller

Elsa Chang

Nels Johnson



WORLD RESOURCES INSTITUTE

July 2001

Carol Rosen
Publications Director

Hyacinth Billings
Production Manager

Alfredo Garzón
Cover Design

The cover illustration portrays a landscape in which terrestrial and marine protected areas are connected through corridors of natural or restored habitat and surrounded by buffer and multiple-use zones to ensure the long-term conservation of biodiversity. In this vision, landscapes are managed for ecosystem services such as clean water, soil stability, crop pollination, and carbon storage that directly benefit people. Many residents continue to rely on forestry, agriculture, and fisheries for their livelihoods but the expansion of biodiversity-friendly activities such as agroforestry, shade coffee, certified timber production, and ecotourism helps to improve both environmental and socioeconomic conditions.

Each World Resources Institute Report represents a timely, scholarly treatment of a subject of public concern. WRI takes responsibility for choosing the study topics and guaranteeing its authors and researchers freedom of inquiry. It also solicits and responds to the guidance of advisory panels and expert reviewers. Unless otherwise stated, however, all the interpretation and findings set forth in WRI publications are those of the authors.

Copyright © 2001 World Resources Institute. All rights reserved.

ISBN 1-56973-473-9

Library of Congress Control Number: 2001093058

Contents

Foreword	iv	Annex 1. Highlights of a Decade of Central American Environmental Achievements and the Evolution of the MBC Initiative	34
Acknowledgments	v	Notes	35
Acronyms	vi	References	39
Executive Summary	vii	Boxes	
I. Introduction	1	<i>Box 1. Mesoamerica's Unique Biological Heritage</i>	<i>1</i>
Regional Background	1	<i>Box 2. Biodiversity-Friendly Agriculture</i>	<i>9</i>
Genesis of the Mesoamerican Biological Corridor Initiative	3	<i>Box 3. Weaving Small Farmers into the Mesoamerican Corridor</i>	<i>10</i>
II. Understanding the Mesoamerican Biological Corridor	7	<i>Box 4. The Campesino a Campesino Movement</i>	<i>15</i>
Rationale	7	<i>Box 5. Local Autonomy for Environmental Planning and Management in Cantón San Ramón, Costa Rica</i>	<i>18</i>
The Mechanism: Differentiated Land-Use Zones	8	<i>Box 6. Collaborative Management of Sarstoon-Temash National Park in Belize</i>	<i>19</i>
Core Zones		<i>Box 7. Land-Use Map Empowers Indigenous Group to Assert Land Rights in Honduras</i>	<i>21</i>
Buffer Zones		<i>Box 8. Land Rights and Ownership Issues in the Rio Platano Biosphere Reserve, Honduras</i>	<i>23</i>
Corridor (Connectivity) Zones		<i>Box 9. Land-Tenure Regimes and Deforestation in Petén, Guatemala</i>	<i>24</i>
Multiple-Use Zones		<i>Box 10. Ecotourism and Community-Based Conservation in Belize: The Community Baboon Sanctuary</i>	<i>26</i>
Determining Zone Extent		<i>Box 11. Potential for Carbon Sequestration in the MBC</i>	<i>27</i>
III. Strategic Challenges and Opportunities	13	<i>Box 12. A Tri-national Effort to Conserve Coastal Resources in the Gulf of Honduras</i>	<i>29</i>
Reconciling Stakeholder Interests	13	<i>Box 13. Environmental Services and Cattle Subsidies in Costa Rica</i>	<i>30</i>
Fostering Democratic Governance and Enabling Civil Society Participation	17	Figures	
Catalyzing Information for Participatory Decision-Making	20	<i>Figure 1. Institutional Structure of the MBC Initiative</i>	<i>4</i>
Clarifying the Function of MBC Land-Use Categories	21	Maps	
Addressing Property Rights and Land-Tenure Issues	23	<i>Map 1. Proposed Elements of the Mesoamerican Biological Corridor</i>	<i>front cover</i>
Capturing Benefits from Ecosystem Goods and Services	25	<i>Map 2. Talamanca-Caribe Biological Corridor</i>	<i>back cover</i>
Harmonizing Institutional and Legal Frameworks and Promoting Intersectoral Cooperation	27	Tables	
Setting Investment and Management Priorities	28	<i>Table 1. Primary Goods and Services Provided by Mesoamerican Ecosystems</i>	<i>2</i>
IV. Conclusions	31	<i>Table 2. Protected Areas in Mesoamerica</i>	<i>8</i>
About the Authors	33	<i>Table 3. Examples of Desirable MBC Outcomes for Main Stakeholder Groups</i>	<i>14</i>

Foreword

In 1999, the World Resources Institute (WRI) entered into a partnership with regional and national conservation and development organizations active in Mesoamerica—the region including the five southern states of Mexico and the seven countries of Central America—to evaluate policy options for accelerating implementation of the Mesoamerican Biological Corridor (MBC). The MBC is a region-wide initiative intended to conserve biological and ecosystem diversity in a manner that fosters sustainable social and economic development. The goals of WRI's partnership in the region are: to broaden the constituency that actively supports and implements the MBC; to highlight the MBC's potential social and economic benefits; to facilitate the use of accurate information in planning and decision-making; and to help decision-makers evaluate policy and investment priorities. This effort seeks to catalyze actions necessary to plan and implement the MBC, by publishing a series of policy notes on key issues raised by the initiative and organizing a series of workshops and briefings for relevant decision-makers using the data and analysis presented in these notes. The publications and workshops will address the following themes:

- **Building a Shared Vision of the MBC Initiative.** This theme introduces the MBC concept, examines how the MBC affects different stakeholder groups, and identifies issues that must be addressed to build wider support in the region.
- **Maintaining Ecosystem Services.** This theme will examine the MBC's potential to maintain ecosystem services such as water flow and quality, carbon sequestration, and pollination. It will also explore options for capturing revenue from beneficiaries of ecosystem services to support MBC development.
- **Broadening Participation and Social Benefits.** This theme will identify strategies for increasing public

participation in the planning and implementation of the MBC and options for increasing social and economic benefits from the MBC.

- **Improving Human and Ecological Security.** This theme will use the best available data to propose ways in which the MBC can anticipate changes in demography, climate, and species distributions (including invasive species) to help improve human and ecological security in Mesoamerica during the 21st century.
- **Providing Timely Information for Decision-Making.** This theme will assess critical data gaps, monitoring needs, and strategies for sharing information to support better decision-making by stakeholder groups and policy-makers.

These notes are intended to help relevant stakeholders in Mesoamerica, including urban and rural residents, civic associations, private business, and government decision-makers and planners—as well as international donors with programs in the region—to better understand the implications of the MBC initiative and the decisions needed to implement it. To this end, we hope these notes will help readers articulate their own expectations of the economic, social, and environmental outcomes they would like the MBC to produce. This first note is based on field interviews and analysis conducted by a team of Central American experts and WRI staff. It examines the basic components of the MBC, the initiative's implications for the interests of the major stakeholder groups, and identifies some of the most pressing challenges that must be addressed if the MBC is to be translated into a widely supported and effectively implemented program of action. The authors' aim is not to prescribe solutions but to raise awareness of the challenges ahead and to clarify options for addressing them.

Acknowledgments

This publication was made possible with the support, insight, advice and information provided by many organizations and individuals. Special thanks are due to our core team of Central American consultants, Galio Gurdíán, Roger Morales, and Raúl Solórzano for their assistance in preparing background papers; and to Juan Carlos Godoy—Guatemala’s National Technical Liaison for the MBC—for his advice and continuous guidance.

We are also much indebted to the University for Peace, CATIE and WWF-Central America, GTZ-Costa Rica, UNDP in Nicaragua, and USAID’s PROARCA/CAPAS. Their contributions of time, office space, insight, and logistical support to the project have been crucial to our research and travel in the region. We are also grateful to the many organizations, colleagues, and friends involved in conservation and development projects in Costa Rica and Guatemala (particularly in the Talamanca-Caribe Corridor, the Arenal Conservation Area, the Maya Biosphere Reserve in the Petén, and in Quetzaltenango, Totonicapan, and Lake Atitlán) for sharing their experiences, hopes, and dreams for the MBC initiative. Their knowledge and enthusiasm has broadened our understanding of the MBC and reaffirmed our commitment to the struggle for conservation and sustainable development in Mesoamerica.

Earlier drafts of this publication were reviewed by a wide range of stakeholders in Central America who attended a consultation workshop in October 2000 at the University for Peace, Costa Rica, which included representatives from nongovernmental organizations, academic institutions, community and farmers’ groups, government agencies, project staff, and the donor community. We appreciate the ideas and suggestions shared at the workshop, which have helped us to improve the usefulness of this publication. Specifically, we would like to thank Lorenzo Cardenal and the core staff of the CCAD’s MBC Regional Office Coordinating Unit in Managua, the eight MBC National Technical Liaisons, staff from the MBC office in Costa Rica, Ana

Báez, Mario Boza, Carlos Brenes, Gerardo Budowski, Silvel Elías, Randall García, Pascal Girod, David Kaimowitz, Alexander Kastl, Jan Laarman, Marta Marín, Felipe Matos, Ronald McCarthy, Huberth Méndez, Jorge Rodríguez, Karla Rojas, and Alvaro Ugalde. Special thanks are due to Lenin Corrales, who has facilitated data and information gathering from the region and offered extensive feedback on the project.

We would also like to express our gratitude to the reviewers of the final draft of this paper, including Mairi Dupar, Jaime Echeverría, Anthony Janetos, Jim Nations, and Dan Tunstall, for their comments and suggestions. We wish to thank Lucy Dorick, Paul Faeth, Tony La Viña, and Frances Seymour for their advice and for helping us obtain project support.

We appreciate the support of the Summit Foundation and the Dutch Ministry for Foreign Affairs, who have generously funded WRI’s project on the Mesoamerican Biological Corridor. We thank the Swiss Development Agency for Cooperation for allowing us to build this project on a previously funded WRI regional project supporting improved governance of natural resources.

We would also like to express gratitude to our research assistant, Amanda Ritchie, who carried out an extensive literature review and helped to draft some of the text boxes, and to Bret Bergst, Cecilia Blasco, and Melissa Boness for valuable research and administrative support. We are grateful to Mathilde Snel for reproducing and adapting the MBC maps in our GIS lab, Alfredo Garzón for designing the cover illustration, and George Faraday and Patricia Ardila for their interest and for their editorial and translation support. Finally, we appreciate the production support provided by Hyacinth Billings and Maggie Powell, and technical support from CATIE (particularly Carlos Manuel Rodríguez, Pedro Ferreira, and Eli Rodríguez) and WWF-Central America (particularly Oscar Brenes, Miguel Cifuentes, and Steve Gretzinger) to print this publication in Costa Rica.

Acronyms

ALIDES	Alianza Centroamericana para el Desarrollo Sostenible <i>Central American Alliance for Sustainable Development</i>	IFAD	International Fund for Agricultural Development <i>Fondo Internacional para el Desarrollo Agrícola</i>
APPTA	Asociación de Pequeños Productores de Talamanca <i>Small Farmers Association of Talamanca</i>	ILRC	Indian Law Resource Center <i>Centro de Recursos Jurídicos para los Pueblos Indígenas</i>
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza <i>Tropical Agricultural Research and Higher Education Center</i>	INBio	Instituto Nacional de Biodiversidad <i>National Institute for Biodiversity, Costa Rica</i>
CCAB-AP	Consejo Centroamericano de Bosques y Areas Protegidas <i>Central American Council on Forests and Protected Areas</i>	IUCN	World Conservation Union <i>Unión Mundial para la Naturaleza</i>
CCAD	Comisión Centroamericana de Ambiente y Desarrollo <i>Central American Commission for Environment and Development</i>	MBC	Mesoamerican Biological Corridor <i>Corredor Biológico Mesoamericano</i>
CCC	Caribbean Conservation Corporation	MOPAWI	Mosquitia Pawisa, Honduras
CEDARENA	Centro de Derecho Ambiental y de los Recursos Naturales <i>Center for Environmental Law and Natural Resources</i>	PNUD	Programa de las Naciones Unidas para el Desarrollo <i>United Nations Development Programme</i>
CI	Conservation International <i>Conservación Internacional</i>	PNUMA	Programa de las Naciones Unidas para el Medio Ambiente <i>United Nations Environment Programme</i>
CICAFOC	Coordinadora Indígena Campesina de Agroforestería Comunitaria <i>Coordinator of Indigenous Farmers for Community Agroforestry</i>	PROARCA/ CAPAS	Programa Ambiental Regional para Centroamérica/Central American Protected Areas System <i>Regional Environmental Program for Central America/Central American Protected Areas System</i>
CIDA	Canadian International Development Agency <i>Agencia Canadiense para el Desarrollo Internacional</i>	PROARCA/ COSTAS	Programa Ambiental Regional para Centroamérica/Coastal Zone Management Component <i>Regional Environmental Program for Central America/Coastal Zone Management Component</i>
CIFOR	Center for International Forestry Research <i>Centro para la Investigación Forestal Internacional</i>	SATIIM	Sarstoon Temash Institute of Indigenous Management <i>Instituto Sarstoon Temash de Manejo Indígena</i>
CONAP	Consejo Nacional de Areas Protegidas, Guatemala <i>Guatemala's National Council for Protected Areas</i>	SICA	Sistema para la Integración Centroamericana <i>Central American Integration System</i>
CRAAN	Comisión Regional Autónoma del Atlántico Norte <i>Northern Atlantic Autonomous Region Commission</i>	SICAP	Sistema Centroamericano de Areas Protegidas <i>Central American Protected Areas System</i>
CRAAS	Comisión Regional Autónoma del Atlántico Sur <i>Southern Atlantic Autonomous Region Commission</i>	TNC	The Nature Conservancy
DESFIL	Development Strategies for Fragile Lands <i>Estrategias de Desarrollo para Tierras Frágiles</i>	UNDP	United Nations Development Programme <i>Programa de las Naciones Unidas para el Desarrollo</i>
DGMA	Dirección General del Medio Ambiente <i>General Directorate for the Environment</i>	UNEP	United Nations Environment Programme <i>Programa de las Naciones Unidas para el Medio Ambiente</i>
FAO	Food and Agriculture Organization of the United Nations <i>Organización de las Naciones Unidas para la Agricultura y la Alimentación</i>	USAID	United States Agency for International Development <i>Agencia de los Estados Unidos para el Desarrollo Internacional</i>
FEMICA	Federación de Municipios del Istmo Centroamericano <i>Federation of Central American Municipalities</i>	WCMC	World Conservation Monitoring Centre <i>Centro Mundial de Monitoreo de la Conservación</i>
FLACSO	Facultad Latinoamericana de Ciencias Sociales <i>Latin American Faculty of Social Sciences</i>	WCS	Wildlife Conservation Society <i>Sociedad para la Conservación de la Vida Silvestre</i>
GEF	Global Environment Facility <i>Fondo Mundial para el Medio Ambiente</i>	WRI	World Resources Institute <i>Instituto de Recursos Mundiales</i>
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit <i>Agencia de Cooperación Técnica Alemana</i>	WWF	World Wildlife Fund <i>Fondo Mundial para la Naturaleza</i>

Executive Summary

The Mesoamerican Biological Corridor is a regional initiative launched in Central America and southern Mexico that aims to conserve biological diversity while fostering sustainable development. Its particular significance lies in the scope and complexity of its goals and the wide range of institutions and social actors it involves. These characteristics give the MBC great promise; however, they also present major challenges that will have to be addressed if the initiative is to have a positive impact on the region. Most centrally, the initiative's success requires the development of a shared vision of its goals and functions—a vision that recognizes the divergent needs at stake and identifies the common interest all regional actors share in achieving ecological and socioeconomic sustainability. The ability to build trust and confidence among various stakeholders of the MBC will, in the end, determine its fate. This paper aims to contribute to the building of such a vision, not by prescribing solutions, but by raising issues and suggesting processes within which these issues can be addressed.

The need for a comprehensive response to Mesoamerica's environmental problems is pressing. The region possesses one of the world's richest concentrations of biological resources, but the viability of these resources is threatened by economic underdevelopment, social inequality, and population pressure. A vicious cycle of environmental degradation and socioeconomic stagnation exists. In the last decade, however, these issues have received increased attention from regional decision-makers, a trend culminating in the launching of the MBC. This initiative has become the focus of significant inflows of donor assistance, and inspired numerous field projects in the region. Nevertheless, stakeholders and policy-makers remain divided and uncertain about the MBC's goals and benefits, and wary of its likely impact on their interests.

The rationale that lies behind the MBC arose from conservation biologists' growing awareness of the need to maintain links between biological habitat areas to ensure species survival. This recognition has stimulated the development of a holistic approach to the relationship between wild and human-impacted land. Such an

approach aims to maximize the conservation functions of protected wildlands by promoting forms of land-use in the wider landscape that offer both conservation benefits and sustainable livelihoods. Guided by this rationale, the MBC's planners have endorsed four land-use zones: Core Zones, Buffer Zones, Corridor Zones, and Multiple-Use Zones. This paper discusses the characteristics of each zone-type as well as the criteria that should be used for assigning land to each.

Core Zones are locations designated as protected areas, designed to provide secure habitats for wild fauna and flora. **Buffer Zones** surround protected areas and function to filter out negative impacts moving into and out from these areas. **Corridor Zones** link core areas with one another, and either remain under wild cover, or are managed to ensure that human land-uses are compatible with the maintenance of a high degree of biological connectivity. Finally, **Multiple-Use Zones** are areas devoted primarily to human use, but managed to facilitate the creation of broader landscapes that are hospitable to wild species. As part of an integrated system for regional land-use, each type of zone provides both ecological and socioeconomic benefits.

Planning and implementing the MBC effectively will require that several strategic challenges be addressed. Eight are considered here:

1. Reconciling Stakeholder Interests;
2. Fostering Democratic Governance and Enabling Civil Society Participation;
3. Catalyzing Information for Participatory Decision-Making;
4. Clarifying the Function of MBC Land-Use Categories;
5. Addressing Property Rights and Land-Tenure Issues;
6. Capturing Benefits from Ecosystem Goods and Services;
7. Harmonizing Institutional and Legal Frameworks and Promoting Intersectoral Cooperation;
8. Setting Investment and Management Priorities.

1. Reconciling Stakeholder Interests: The MBC aims to improve biological conservation in the Mesoamerican region, while delivering benefits to a wide range of rural and urban social groups. It will, therefore, require consensus among public agencies at regional, national, and local levels; the private sector; conservationists; civil society organizations; and rural and indigenous populations. The benefits that each of these major stakeholder groups is likely to seek from the initiative are identified, and strategies for building cooperative relationships among these groups are outlined.

2. Fostering Democratic Governance and Enabling Civil Society Participation: The MBC is being implemented in a regional political context marked by efforts to consolidate democracy, decentralize public decision-making, and increase opportunities for participation by civil society groups. Its planners must take these processes into account; in doing so they also have the opportunity to position the MBC as a key mechanism for deepening democratization within Mesoamerica.

3. Catalyzing Information for Participatory Decision-Making: The MBC's success will depend on the collection and dissemination of accurate, relevant, and appropriate information to the broad array of decision-makers and stakeholders involved. At present, there are severe limitations in the types of information available and the mechanisms for its distribution. These shortcomings must be addressed, at both technical and political levels, if meaningful stakeholder participation is to be achieved.

4. Clarifying the Function of MBC Land-Use Categories: The use of an integrated scheme for the functional zoning of land use lies at the heart of the MBC's proposed strategy. To be effective, therefore, these categories must be well understood and effectively applied. The contribution of each zone should be well defined, taking into account its function within the overall scheme for land use.

5. Addressing Property Rights and Land-Tenure Issues: The MBC raises questions regarding land rights that have long plagued Mesoamerican society. Long-term approaches to land use can only thrive if secure title is recognized, an issue of particular importance to the region's indigenous peoples. Nevertheless, security of land-tenure is no ecological panacea. The problem of unsustainable exploitation strategies must be addressed by also strengthening the broader economic incentives for sustainable land use.

6. Capturing Benefits from Ecosystem Goods and Services: Mesoamerica's ecosystems produce a range of vital goods and services to human populations. At present, however, these benefits are undervalued from an economic standpoint, and often are neither shared with rural populations, nor reinvested in ecosystem maintenance. Potential strategies to address these problems, such as carbon sequestration credits, ecotourism, and sustainable agriculture, are discussed.

7. Harmonizing Institutional and Legal Frameworks and Promoting Intersectoral Cooperation: Implementing the MBC requires actions coordinated across policy sectors and at a variety of geographic levels. Current legal and institutional frameworks are isolated and often provide conflicting approaches to identical issues. The environmental agencies most directly involved in the initiative will have to establish unified responses to the MBC's goals. To this end, there is an urgent need to establish mechanisms for intersectoral cooperation and alliance-building. In addition, many of the regions' environmental issues span national boundaries, requiring the development of crossnational governance arrangements.

8. Setting Investment and Management Priorities: Although the financial resources already committed to the MBC are substantial, they are nevertheless finite, while the range of potentially relevant investment targets is vast. Human and financial resources will have to be prioritized so that the most urgent problems are addressed cost-effectively. At present, for instance, coastal issues appear to have been marginalized, while no-cost opportunities for fostering eco-sustainable economic activities should be considered, such as transferring existing subsidies rather than introducing new ones.

The paper concludes by outlining a possible scenario for launching the kind of strategic, yet inclusive review of the MBC's goals and strategies called for here. Pilot participatory action plans could be initiated within each Mesoamerican country. Stakeholders would convene to identify a national site for a pilot project, the major issues involved, and a strategy for addressing them. This option would facilitate a two-way communication process—contributing to an understanding of the MBC, while providing MBC planners with feedback regarding local needs and desires. The MBC now stands at a critical threshold between concept and reality. Its vision will not be realized unless most of the region's people understand the MBC's purpose and commit to its goals and objectives.

I.

Introduction

The Mesoamerican Biological Corridor (MBC) is a region-wide initiative intended to conserve biological and ecosystem diversity in a manner that fosters sustainable social and economic development. Its specific aims are to (a) protect key biodiversity sites; (b) connect these sites with corridors managed in such a way as to enable the movement and dispersal of animals and plants; and (c) promote forms of social and economic development in and around these areas that conserve biodiversity while being socially equitable and culturally sensitive. Putting this vision into practice is a complex and ambitious task that must involve a wide range of actors, including national and local governments, nongovernmental organizations (NGOs), local communities, and international donors.

Regional Background

There are pressing reasons for such an initiative. The Mesoamerican region possesses one of the richest concentrations of species and ecosystem diversity in the world. (See *Box 1*.) From political, social, and economic standpoints, however, the region has been far less fortunate. Although the civil conflicts of recent decades have come to an end, the human and material destruction they wrought has exacerbated long-standing problems of social inequality, economic underdevelopment, and environmental decline. Currently, almost half the population remains below the poverty line and many lack access to basic healthcare, education, and clean water.¹ Moreover, Mesoamerica's population is growing rapidly—at over 2 percent per annum from 1995 to 2000—and despite rapid urbanization, the majority of the region's inhabitants still live in the countryside and depend directly on biological resources for subsistence (State of the Region 1999, INEGI 2000, World Bank 2000).²

This rapid growth, combined with the continued dependence of much of the population on agriculture, and high levels of poverty, has led to unsustainable exploitation of natural resources, widespread water

Box 1. Mesoamerica's Unique Biological Heritage

Comprising the five southern states of Mexico and the Central American countries of Guatemala, Belize, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama, the Mesoamerican region covers 768,990 square kilometers. Its natural ecosystems range from coral reefs and lowland rainforests to pine savannas, semi-arid woodlands, grasslands, and high mountain forests, constituting about 22 distinct "ecoregions" according to biogeographers. Although the region contains only 0.5 percent of the world's land surface, because of the variety of its ecosystems and its location, which links the Americas' northern and southern biotas, Mesoamerica is home to a disproportionate share—about 7 percent—of the planet's biological diversity.

Panama, for example, has 929 species of birds — more than Canada and the United States combined. Belize, a tiny country of 22,965 square kilometers (half the size of Denmark) is home to more than 150 species of mammals, 540 species of birds, and 152 species of amphibians and reptiles. Mexico possesses the world's largest variety of reptiles (717) and 4,000 species of plants used for medicinal purposes. In Guatemala's high central mountains, nearly 70 percent of the vascular plants are endemic. The Mesoamerican Barrier Reef, which runs for 1,600 kilometers along the coasts of Mexico, Belize, Guatemala, and Honduras, is the world's second largest coral reef system, while the region contains 8 percent of the world's mangrove forests. Mesoamerica is also considered to be one of the world's most important centers of origin for agricultural crops: its indigenous peoples bred maize, squash, various beans, and chili peppers from wild species endemic to the region.

Sources: INE/SEMARNAP 1996; CCAD 1998a, 1998b, 2000a; Windevoxhel et al. 1998; UICN 2000.

Table 1. Primary Goods and Services Provided by Mesoamerican Ecosystems

<i>Ecosystem</i>	<i>Goods</i>	<i>Services</i>
Agroecosystems	<ul style="list-style-type: none"> • Food crops • Fiber crops • Crop genetic resources 	<ul style="list-style-type: none"> • Provide habitat for birds, pollinators, soil organisms important to agriculture • Build soil organic matter • Capture and store atmospheric carbon
Coastal Ecosystems	<ul style="list-style-type: none"> • Fish and shellfish • Fishmeal • Seaweed • Genetic resources 	<ul style="list-style-type: none"> • Moderate storm impacts (mangroves, barrier islands) • Dilute and treat wastes • Provide harbors and transportation routes
Forest Ecosystems	<ul style="list-style-type: none"> • Timber • Fuelwood • Drinking and irrigation water • Fodder for livestock • Non-timber products (vines, bamboo, leaves, etc.) • Food (honey, mushrooms, fruit and other edible plants, game) • Genetic resources 	<ul style="list-style-type: none"> • Remove air pollutants • Recycle nutrients • Maintain watershed functions (infiltration, purification, flow control, soil stabilization) • Maintain biodiversity • Capture and store atmospheric carbon • Moderate weather extremes and impacts • Generate soil
Freshwater Ecosystems	<ul style="list-style-type: none"> • Drinking and irrigation water • Fish • Hydroelectricity • Genetic resources 	<ul style="list-style-type: none"> • Buffer water flow (control timing and volume) • Dilute and carry away wastes • Cycle nutrients • Maintain biodiversity • Provide transportation corridors
Grassland Ecosystems	<ul style="list-style-type: none"> • Livestock • Drinking and irrigation water • Genetic resources 	<ul style="list-style-type: none"> • Maintain watershed functions • Cycle nutrients • Remove air pollutants, emit oxygen • Maintain biodiversity • Generate soil • Capture and store atmospheric carbon

Source: WRI 2000.

pollution, soil erosion, sedimentation, and deforestation. By the mid-1990s, the region was losing an estimated 2.1 percent of its forests every year—one of the highest rates in the world (FAO 1999).³ More than half of Mesoamerica's forests have been lost and approximately 90 percent of its primary or "frontier" forests have been logged, converted to agriculture, or replaced with tree plantations (Bryant et al. 1997). Similar habitat losses have occurred in other ecosystems, including the region's coastal mangroves, coral reefs, grasslands, and wetlands (Burke et al. 2000, Matthews et al. 2000, Revenga et al. 2000). The scale and speed of habitat loss

and fragmentation in one of the world's biologically richest areas, has led many conservationists to consider Mesoamerica one of the world's biodiversity "hotspots" (Mittermeier et al. 2000).

Furthermore, the impact of human activities on the region's ecosystems is jeopardizing the limited levels of economic and social welfare already achieved. In addition to goods such as timber, fuelwood, and fish, Mesoamerica's major ecosystems provide the region's people with valuable services, such as water filtration, carbon sequestration, and pollination of crops. (See Table

1.) When these ecosystems are degraded with respect to water quality functions, for example, it may be necessary to invest large amounts in water treatment and filtration plants to replace the “ecosystem services” that have been lost. The present trend of growing ecosystem overexploitation and degradation will impose increasingly large economic costs on the region as clean and reliable water supplies become more scarce, fishery stocks decline, flooding and drought become more severe, and wildlife disappears.⁴

Hurricane Mitch and the forest fires that burned widely across Mesoamerica in 1998 dealt a further blow to the environment and people of the region. These events claimed thousands of lives, destroyed infrastructure, devastated agricultural lands, altered ecosystems and landscapes on an unprecedented scale, and seriously set back economic development, especially in Honduras, Guatemala, and Nicaragua (CCAD-PFA/EU 1998, Barraclough and Moss 1999, World Neighbors 2000). As Hurricane Mitch illustrated, human vulnerability to natural disasters has been exacerbated by the stress that over-use has placed on ecosystem health.

Genesis of the Mesoamerican Biological Corridor Initiative

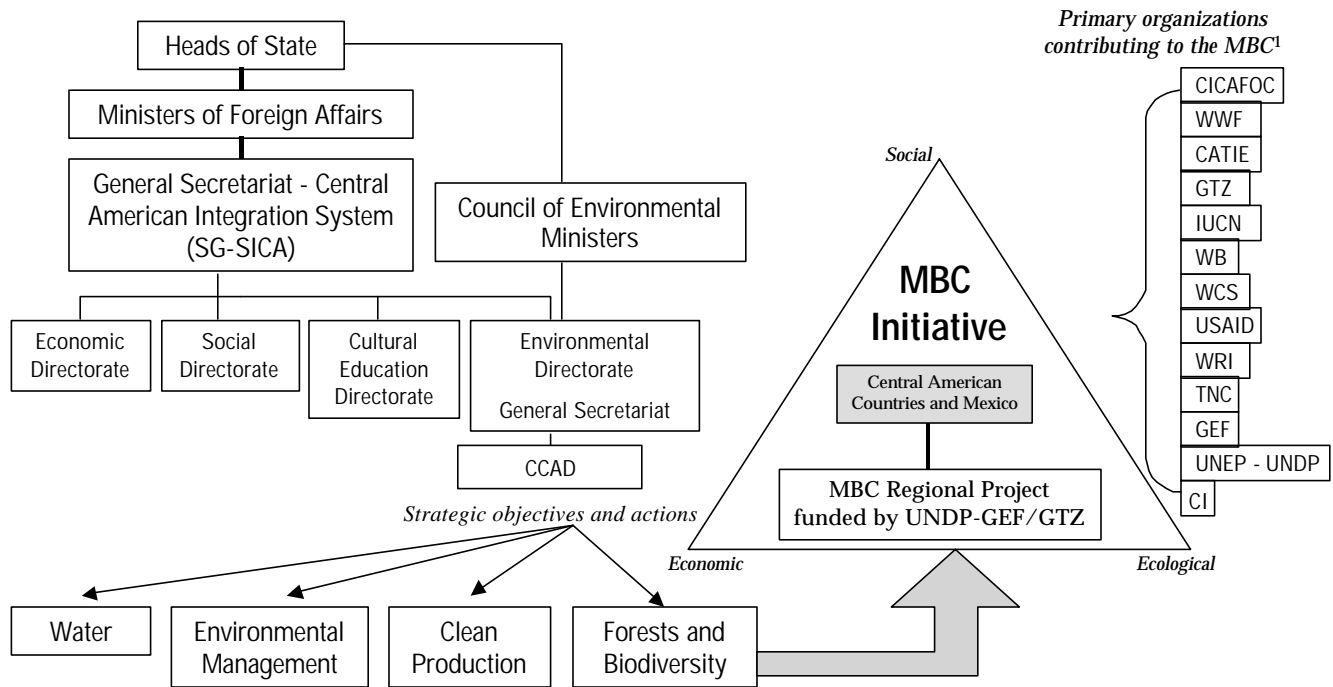
The present MBC initiative is the result of a growing recognition of the need to develop an integrated regional approach to Mesoamerica’s environmental problems. Its development was facilitated by the ending of civil conflicts following the negotiation of cease-fires and the inception of peace processes in the early 1990s. As the peace process moved forward, the reversal of environmental degradation and conservation of biodiversity became an important part of national and regional policy agendas. As public awareness of the importance of environmental protection increased, domestic and international conservation groups stepped up collaborative efforts with the region’s governments to slow deforestation and protect threatened habitats. International attention to Mesoamerica’s environmental issues also grew, resulting in financial support from international development agencies and conservation groups. Environmental and Tropical Forest Action Plans were implemented and hundreds of protected areas—taking in approximately 11.5 million hectares of land—created, as countries designated new national parks, biological and forest reserves, wildlife refuges, and biosphere reserves as part of the Central American Protected Areas System (*Sistema Centroamericano de Areas Protegidas*, SICAP) (CCAD 1998a, UICN 2000).

The legal and institutional frameworks governing environmental issues also changed significantly in this period. At the national level, governments established agencies to oversee environment and natural resources policy formation and administration. At the regional level, Central America’s presidents signed the Charter Agreement for the Protection of the Environment in 1989, resulting in the establishment of the Central American Commission on Environment and Development (*Comisión Centroamericana de Ambiente y Desarrollo*, CCAD) (CCAD 1989). The CCAD embodies a unified vision for regional environmental cooperation within which the quality of life of Central Americans will be improved through rational use of natural resources, pollution control, and the reversal of environmental degradation.⁵

The UN Conference on Environment and Development in 1992, and the adoption of the Convention on Biological Diversity and the Framework Convention on Climate Change, inspired Central American countries to reach a number of regional agreements for biodiversity conservation, protection of priority natural areas, and forest management (CCAD 1993, WRI 1995).⁶ In 1994, the Central American Ecological Summit in Nicaragua culminated with the proclamation of the Central American Alliance for Sustainable Development (*Alianza Centroamericana para el Desarrollo Sostenible*, ALIDES)—a plan to promote peace, consolidate democracy, and protect the environment (CCAD 1994). ALIDES committed the governments of the region to a series of environmental measures, including the consolidation of SICAP and the establishment of a comprehensive system of biological corridors. At the same time, these environmental efforts were also intended to address the region’s socioeconomic needs.⁷

The present Mesoamerican Biological Corridor (MBC) initiative⁸ grew out of a regional wildland conservation effort introduced in 1994 by a consortium of international conservation organizations.⁹ This effort, called the *Paseo Pantera* (Path of the Panther) project, sought to conserve biodiversity by linking protected areas from southern Mexico to Panama using “corridors” of natural and restored habitats (Carr et al. 1994). (See Map 1.) Over the next five years, the concept behind the *Paseo Pantera* project was broadened in scope to form the basis for the MBC, which was now seen as an instrument for integrating sustainable development with ecological protection on a region-wide scale. With the decision that the southern five states of Mexico would participate in the initiative, it was redesignated the Mesoamerican Biological Corridor and publicly endorsed by regional heads-of-state at a summit in

Figure 1. Institutional Structure of the MBC Initiative



Sources: Earth Council et al. 1997; CCAD 2000a.

¹ In addition to the primary institutions listed, there are many national and local organizations contributing to the consolidation of the MBC.

1997, following a series of national consultations promoted by the CCAD.¹⁰ This declaration of support represented a commitment at the highest political level to the development of a land-use planning system that would improve the lives of Central Americans while maintaining biodiversity and ecosystem services. Endorsement of the initiative also represented a significant step by the governments of the region toward honoring their global commitments under the Convention on Biological Diversity and also—given the MBC's implications for increased carbon storage through forest conservation and regeneration—the Framework Convention on Climate Change.

The responsibility for coordinating regional planning and implementation of the MBC was assigned to the CCAD. (See Figure 1.) With financial support from the UNDP's Global Environment Facility (GEF) and the

German Technical Cooperation Agency (GTZ), the CCAD launched a six-year, multi-million-dollar regional project, *Programa Regional para la Consolidación del Corredor Biológico Mesoamericano*.¹¹ When funding for the project was approved in 1999, CCAD established the MBC Regional Office Coordinating Unit (ROCU) in Managua, Nicaragua, which assumed responsibility for working with the designated national technical liaisons in each of the eight Mesoamerican countries to plan, coordinate, monitor, and evaluate strategic policies and actions for MBC implementation (CCAD 1999).¹²

Since its establishment, ROCU has worked with the national technical liaisons to develop operational plans and a comprehensive strategy to coordinate and mobilize action for MBC implementation. CCAD has also encouraged coordination of international and

national technical and financial commitments to MBC activities, including the development of action and management plans for transnational terrestrial and marine/coastal sites and protected areas, institutional strengthening, training, and education. The MBC has received support from a broad spectrum of development and conservation organizations, which are implementing a wide variety of projects relevant to the MBC's goals at a range of geographic levels and addressing diverse issues. For instance, the Nature Conservancy, World Wildlife Fund, and University of Rhode Island (funded by USAID) are focusing on conservation and management of the Mesoamerican Barrier Reef System,¹³ while USAID's Regional Environmental Program for Central America (PROARCA) is supporting a set of activities aimed at strengthening the Central American Protected Areas System, SICAP. National and local-level projects are also underway. In Costa Rica, the national MBC office is coordinating efforts by non-governmental organizations to establish the biological corridors of Paso de la Danta—between protected areas on the Osa Peninsula and the Talamanca Mountain Range, and Corredor Barbilla—connecting indigenous reserves, protected areas, wetlands, and coastal zones (CBM-CR 2000). Additionally, the World Bank is engaged in developing the Atlantic Biological Corridor in Nicaragua and Panama, while the Nature Conservancy, in collaboration with Central American partners, is working to establish local biological corridors between Sierra de Lacandón and Laguna del Tigre National Parks in Petén, Guatemala.

Despite this range of activity, questions remain among regional stakeholders concerning the structure, goals, and impacts of the MBC. The *Paseo Pantera* project proposal, which was defined mostly in terms of biological outcomes, worried many local residents, especially

indigenous groups, who feared expropriation of their ancestral lands and the expansion of protected areas onto their territory. The broadening of the MBC's scope to incorporate socioeconomic goals was in part a response to these fears. However, conservationists have become concerned that the MBC is taking on social and economic problems that it cannot solve, thus creating unrealistic expectations. Meanwhile, the environmental agencies have been accused by other sectors of government and independent groups of using the MBC primarily for political leverage and as a marketing tool to capture donor investments.

If the MBC is to fulfill its promise, these diverse interests and concerns will have to be taken into account. Many of the stakeholder groups critical to its implementation at the local level—indigenous groups, small and large farmers, local governments, and private businesses—will condition their support on the social and economic benefits they expect it to provide (McCarthy and Salas 1998; Gurdián 2000; WRI field visits, with added contributions from Raúl Solórzano, Roger Morales, and Juan Carlos Godoy 1999-2000). Equally, the significant political and financial commitments governments and international donors have made to the MBC stem from their belief that it is capable of addressing a wide array of problems through an “environmentally-driven package of development services” (CCAD 2000b).

The collaboration of these actors is vital if the MBC initiative is to have a positive impact on the human welfare and ecological security of the region. Thus, the major challenge now is to build a widely shared and holistic understanding of how the MBC initiative can benefit both people and nature. The aim of this paper is to facilitate this process.

II.

Understanding the Mesoamerican Biological Corridor

Rationale

If properly planned and implemented, the MBC offers a means to maximize conservation benefits while improving social and economic opportunities for rural populations. In contrast to traditional approaches to conservation, which treated protected wildlands in isolation from the settled or cultivated areas around them, the MBC operationalizes the “bioregional” approach to land-use management. Under this approach, communities and their governments develop strategies for land and water use that encompass entire ecosystems or bioregions,¹⁴ aiming to protect and restore them so they can simultaneously conserve biodiversity and sustain farming, forestry, fisheries, and other human uses (Miller 1996).

This approach to environmental planning accords with the new emphasis within conservation biology on the importance of maintaining connectivity between biological populations. Throughout the world, agricultural expansion, road development, urbanization, and extensive logging, mining, and oil drilling have been cutting up habitat areas into ever-smaller fragments (Bennett 1999). As habitats shrink and become surrounded by human-dominated landscapes, many native species are confined to isolated areas too small to allow them to find adequate food, water, mates, or refuge from predators. As a result, these “islands” of natural habitat lose species over time, with large mammals and birds (especially predators) disappearing first. Even if the habitat patch is large enough to support a small population of a particular species under normal conditions, such populations are vulnerable to local extinction due to hurricanes, drought, disease, and invasive species. Isolated species populations are also less able to adapt to environmental change owing to the limited range of variation present within their gene pool. Population biologists have shown that sites intended to maintain a region’s biota need to be sufficiently large to retain a minimum population of anywhere from 500 to 5,000 individuals of each species (Barbault and Sastrapradja 1995). As habitat fragments become smaller and more isolated from one another,

the local extinction rate accelerates (Bennett 1999). Evidence is already emerging that human-induced climate change is exacerbating these problems.

Recognizing the practical and ethical problems involved in creating sufficiently large contiguous blocks of protected land to counter the ill effects of habitat fragmentation, conservation biologists now view the use of corridors between protected areas as a promising mechanism for reducing localized extinctions (Rosenburg et al. 1997).¹⁵ A growing number of empirical and experimental studies have confirmed the value of this strategy (Bennett 1999).¹⁶ Various means can be used to foster biological connectivity between main habitat areas, including maintaining corridors under contiguous natural cover, the provision of “stepping stones” of small habitats, encouraging diverse cropping patterns in intervening croplands, and retaining large live and dead trees in surrounding forest clearings.¹⁷ The MBC seeks to put this strategy to work.

The MBC concept also promises significant socioeconomic benefits to the people of the region. For example, the regional network of corridors envisioned under the initiative would protect large areas of forest capable of sequestering atmospheric carbon that could be sold in emerging international markets for carbon offsets. The MBC network would also help protect the water supplies on which Mesoamerica’s residents depend. The protection of forests and watersheds under the MBC could also reduce the impact of future natural disasters. It would facilitate the preservation of vital cultural and archeological sites and help spread nature-based tourism beyond Costa Rica and Belize, where it is currently concentrated. Finally, it offers new opportunities for indigenous peoples and rural residents to share the economic benefits from, and assume management responsibilities for, the region’s biological resources.

While, in principle, these benefits could flow from any successful large-scale conservation initiative, the concept behind the MBC has the particular advantage

Table 2. Protected Areas in Mesoamerica

	Total Number (IUCN Categories I-VI ¹)	Small (<10,000 ha)	Large (>100,000 ha)	Total Area (ha)	% National Territory	No. Personnel ² Working in PAs
Mexico ³	41	30	5	1,914,000	8.3	NA
Belize	32	20	2	479,000	20.9	67
Guatemala	38	10	4	1,827,000	16.8	218
Honduras	70	54	1	693,000	6.0	166
El Salvador	2	2	0	5,000	0.2	126
Nicaragua	70	48	1	908,000	7.0	144
Costa Rica	85	26	1	723,000	14.2	864
Panama	30	17	4	1,422,000	18.8	272
Total	368	207	18	7,951,000	10.7	1857

¹ The IUCN recognizes six categories of protected area: Category I (Strict Nature Reserves), Category II (National Park), Category III (National Monument/Landmark), Category IV (Habitat or Species Management Area), Category V (Protected Landscape or Seascape), and Category VI (Managed Resource Protected Area).
² Number of personnel working in protected areas, all IUCN Categories. CCAD 1998a: 134.
³ Protected areas in Mexico included in the MBC are located in the states of Campeche, Chiapas, Quintana Roo, Tabasco, and Yucatan.

Sources: WRI 2000, WCMC 2000.

that it recognizes and utilizes the contribution that a variety of land uses can make to biodiversity conservation. It requires less land to be set aside from human use than would an approach that relied on the creation of large, isolated protected areas, thus implying fewer socioeconomic opportunity costs for the region's inhabitants.

The Mechanism: Differentiated Land-Use Zones

At the heart of the MBC initiative lies a proposed land-use scheme consisting of four categories: Core Zones, Buffer Zones, Corridor Zones, and Multiple-Use Zones.¹⁸

Core Zones

Core Zones are locations designated as "protected areas."¹⁹ Their purpose is to ensure that the forests, wetlands, coastal estuaries, coral reefs, and other wild habitats continue to maintain biodiversity and generate environmental services for people living in and around these areas and beyond. Typically, these zones will include the headwaters of rivers that provide water for towns, irrigation and hydroelectric projects, farms, and industry. They may contain wetlands critical for providing nutrients for surrounding soils, and downstream estuaries important for fisheries. They may harbor insects crucial for biological control of pests and dis-

eases in the areas surrounding them. Their wild species will provide a vital resource for bio-prospecting for new foods, medicines, and industrial materials. And equally important, they may contain scenery, wilderness, and historic places vital to people's cultural and spiritual identity.

Mesoamerica has a large number of protected areas already in place that will function as the MBC's Core Zones, but most of these areas are small. Currently, they average only 18,400 hectares in size, and only 18 exceed 100,000 hectares. (See Table 2.) Overall, they contain nearly 11 percent of the region's land area but the percentage varies for each of Mesoamerica's 22 distinct ecoregions. Research suggests that Core Zones should cover at least 10 percent of a given ecological region, and ideally they should cover substantially more (Soule and Sanjayan 1998).

Buffer Zones

The second type of land designation within the MBC initiative is made up of the geographic areas surrounding protected areas, which are termed Buffer Zones. The purpose of these zones is to create a physical space between protected areas that contain primarily wildland, on the one hand, and adjacent areas that feature farms, harvested forests, and other human uses, on the other. These rings of land and water around the Core

Zones are managed to filter or absorb negative impacts operating in either direction. For example, aerial spraying of pesticides on adjacent agricultural crops can drift hundreds of meters and have serious impacts on wild biodiversity; conversely, wild animals may range out from the Core Zone to damage adjacent farms and crops. Thus, in effect, Buffer Zones serve as transitional areas within which land uses are managed to reduce and control interzone impacts.

Some countries in the region, such as El Salvador, have legislation providing for Buffer Zones within protected areas. Others have established such Zones to define a specific management category, for example at the Maya Biosphere Reserve in Guatemala (CONAP 1999a). Nonetheless, existing Buffer Zones are often not clearly demarcated and few are designed specifically to filter out negative influences flowing between protected areas and surrounding lands. International experience points to the importance of designing Buffer Zones so that they are tailored to the specific conditions of each location (UNEP 1996). If Buffer Zones are to protect the core areas, their residents must be offered a set of equitable incentives and regulations that promote changes in land use, while compensating for such costs as crop damage.

Corridor (Connectivity) Zones²⁰

The third type of zone proposed by the MBC initiative is the Corridor Zone. The purpose of these zones is to provide land or water pathways that link Core Zones with one another, allowing plants and animals to disperse and migrate, and adapt to the pressures of changing climate and habitat conditions. Ideally, land use within Corridor Zones will be natural, or “re-wilded” through restoration work. In practice, however, the lands between Core Zones may already be subject to human use or settlement. In such cases, residents and land users will be encouraged to adopt management practices, such as layered and mixed cropping or shade coffee growing, that create relatively biodiversity-friendly environments while also providing for people’s livelihoods. The central goal is to ensure that land-use patterns within corridors mimic wild nature as closely as possible by featuring a variety of crops, forest patches, and wild habitats. From a social and economic point of view, corridors seek to maintain and enhance the livelihoods of local residents while protecting stream flow and other environmental services of value to residents throughout the region. To avoid confusion it should be clarified that the term corridor is also used in a development context to refer to areas in which territorial strips have been assigned to particular

Box 2. Biodiversity-Friendly Agriculture

The following practices can help to maintain or enhance biodiversity on agricultural lands:

- Agroforestry systems that feature perennial tree crops, sometimes mixed with annual crops or forage;
- Mixed cropping systems that feature several complementary crops (for instance, beans, squash, and maize) in the same field;
- Organic and integrated pest management (IPM) technologies that eliminate or minimize use of chemical pesticides and herbicides;
- Streamside buffer zones of protected or restored native vegetation to filter agricultural runoff before it enters the water and to facilitate movement of animals along river corridors;
- On-farm protection of natural forest patches to provide habitat for pollinators and predators of insect pests;
- On-farm protection of wetland areas to maintain water tables during the dry season, minimize flooding during the wet season, and provide habitat for wetland species;
- Restricting disruptive practices in sensitive areas during key nesting or migratory periods;
- Maintaining traditional crop and animal varieties.

economic functions. However, contrary to the biological corridors discussed above, the corridors developed under this rubric, such as urban, transportation, and energy corridors, are typically characterized by totally domesticated landscapes that create barriers to the movement of wild plant and animal species.²¹

Multiple-Use Zones

The fourth type of zone envisioned by the MBC initiative is used to distinguish areas featuring wildland from those devoted to agriculture, managed forestry, and human settlement. These Multiple-Use Zones can be established within Buffer, and Corridor Zones, in some cases, to denote geographic areas that will be dedicated to direct human occupation and use. The Multiple-Use category can also be applied to wider areas beyond these three zones, to encourage diversity

Box 3. Weaving Small Farmers into the Mesoamerican Corridor

Fewer than ten years ago, Luis Rodriguez bought a 20-hectare farm next to the recently established Talamanca-Caribe Biological Corridor in southeastern Costa Rica. With its degraded pastures and severely eroded soils, local people doubted his farm would ever return to productivity. But Luis had a vision that the land could be restored by allowing regrowth of native trees while farming a diverse range of crop species and domestic animals. Using plenty of sweat equity, Luis has created a farm that helps secure his family's long-term and short-term needs.

Naturally regenerating and planted trees are stabilizing and enriching the soil and will provide future income for retirement and education. Organic cacao, palms, and other fruit trees are beginning to produce crops for the family's "annual savings account." And with the soil stabilized and increasingly fertile, the family is able to grow pineapple, tomatoes, yucca, other vegetables, and medicinal plants, and to raise chickens, turkeys, fish, and goats for their immediate cash and food needs. Luis has not only improved his family's economic situation, his farm now offers habitat for wild flora and fauna. Thanks to his success, Luis has become Coordinator of the Small

Farmers Association of Talamanca (APPTA), which comprises 1,500—largely indigenous—farmers who use innovative agricultural practices and integrated pest management to produce organic banana, ginger, and 20 percent of the world's organic cacao.

If the MBC is to succeed, many more small farmers throughout the region will need to follow Luis Rodriguez's path. Most won't have the same extraordinary vision and commitment as this man. But, by working with leaders such as Luis Rodriguez, MBC planners can identify the policies and market incentives that can motivate farmers to follow his lead. By promoting greater opportunities for local residents to participate in MBC planning and management, supporters of the MBC can help weave thousands of small farmers into the fabric of the corridor network across Mesoamerica.

Source: WRI staff field visit to the Talamanca region, Costa Rica and personal interview with Luis Rodriguez and APPTA representatives, February 2000; UICN 2000: pp. 92-93.

in general land-use practices. The designation recognizes that the forms of human land-use and settlement most conducive to biodiversity maintenance feature a mosaic of distinct patches such as croplands, forests, and wetlands. (See Box 2.) In coastal areas the mosaic may include fishing areas, coral reefs, tourism facilities, and shrimp farms.

Within these zones, it will be necessary to give residents incentives to adopt biodiversity-friendly land-use practices using mechanisms such as environmental service payments. An example of such a policy is offered by the use of community concessions for the harvest of nontimber forest products—xate,²² wildberries, allspice—in the Maya Forest²³ (Primack et al. 1998; Prins 1998; Somos UNO 1998; CONAP 1999a, 1999b; UICN 2000). Similarly, the cultivation of organic cacao in Costa Rica's Talamanca-Caribe Biological Corridor provides an effective habitat area for many species, while supplying livelihoods and income for local producers. (See Box 3.) Another effective strategy is the encouragement of layered-cropping farming techniques, with timber trees growing over fruit trees, shade coffee, and vegetables, as practiced in San Lucas Toliman, a town located in the Multiple-Use protected

area around Lake Atitlan, Guatemala (WRI field visits, January-February, 2000).

Determining Zone Extent

The relative extent of each of these zones will vary depending on the social, economic, biological, and institutional context within which they are situated. A particularly crucial variable is the intensity of existing human use and settlement. Where extensive wildlands still remain and human population is low, relatively large Core Zones can be established and corridors can also feature wildland. Ecosystem goods and services may be exported to adjacent bioregions to support increased populations or large infrastructure projects, such as irrigation or power generation. Income from these goods and services can be recycled back to the Core Zones to help cover their operating costs.

In densely settled areas, the extent of wildland will be small. Farming, grazing, forestry, or, in coastal areas, fishing, will occupy most of the landscape. In this case, the Core Zones and corridors will be limited in extent. Initially they may feature small farms, livestock pasture, and cutover forest. In the short-term, neighboring

residents may need to continue their traditional use of Core Zone resources until alternative livelihoods become available. Governments can support a transition away from this use by ensuring that local populations are able to capture a share of the income generated by Core Zones, for instance from water supplies or

ecotourism, in return for steps by residents to phase out farming and forestry activities within the Core Zones. In areas of particular importance for conservation, it may be necessary to use land purchases and economic incentives to draw people away to other sites.

III.

Strategic Challenges

Despite the existing high level of political commitment and financial support for the MBC, there are a number of strategic challenges that must be addressed if it is to be implemented successfully. The MBC, as articulated and endorsed by regional leaders, may represent a vision shared by environmental ministers and conservation biologists, but it has yet to win widespread allegiance from government officials, the private sector, and civil society. Owing to its scope and goals, the future of the MBC depends more strongly on the mobilization of complex institutional, social, and informational networks than has typically been the case for conservation initiatives. Given the internal diversity of Mesoamerican societies, the MBC's design requires an understanding of the full spectrum of interests at work at both national and local levels. Its effective implementation will require not just the acquiescence of key stakeholder groups, but their willingness to mobilize actively behind the initiative. For these reasons, the process of planning and implementation must incorporate opportunities for dialogue and participatory decision-making.

Some of the key challenges facing the MBC include:

- Reconciling stakeholder interests
- Fostering democratic governance and enabling civil society participation
- Catalyzing information for participatory decision-making
- Clarifying the function of MBC land-use categories
- Addressing property rights and land-tenure issues
- Capturing benefits from ecosystem goods and services
- Harmonizing institutional and legal frameworks and promoting intersectoral coordination
- Setting investment and management priorities

Below we will discuss the importance of each challenge in establishing common ground for MBC implementation. A set of questions is presented within each section to help stakeholders identify effective responses to the challenge in question.

Reconciling Stakeholder Interests

The interests and aspirations of MBC stakeholders differ widely, depending upon their current access to natural resources, their socioeconomic conditions, and their cultural values and beliefs. Thus, for conservationists, the MBC represents one of the few options available for promoting the survival of thousands of species that face certain extinction if habitat-loss trends continue. For landless migrants and indigenous groups, the expansion of protected areas and corridors would appear to diminish their prospect of claiming land and controlling their own destiny. For urban residents, the MBC could mean more secure clean water supplies and reduced immigration to the major cities as socioeconomic conditions in rural areas improve. Meanwhile, the fishing and timber industries may find that the MBC could limit future harvests. Whether and how these groups bridge their differences will determine the approaches, policies, and management practices that build the MBC, and ultimately the initiative's overall success or failure. The prospects for this reconciliation to occur will be strongest if the initiative proceeds through three major stages: (1) identification of conflicts and commonalities of interest; (2) creation of a communication process among stakeholders that allows differences to be negotiated, and shared understandings created; and (3) implementation of policies and products designed to build stakeholder commitment in the light of the previous scoping and communication processes.

The first step toward reconciling the different views of stakeholder groups is for planners to identify what these interests are, and how they conflict or overlap. Table 3 summarizes the types of outcomes that three of

Table 3. Examples of Desirable MBC Outcomes for Main Stakeholder Groups

Conservationists	<ul style="list-style-type: none"> • Better representation of endangered ecosystems in protected areas • Restoration of natural habitat corridors • Creation of biodiversity-friendly landscapes surrounding core natural areas and corridors • Stabilization and recovery of endangered species populations • Expansion of ecosystem services, reduction of human threats to biodiversity
Rural Populations	<ul style="list-style-type: none"> • Greater access to resource planning and policy • Greater participation in decision-making • Recognition and legitimization of indigenous land rights • Recognition of traditional environmental knowledge and a variety of alternative, sustainable resource management practices • Protection of cultural traditions and sacred sites • Improved water supplies and public health • Reduced vulnerability to floods and other disasters • Increased employment and income for residents • Improved access to credit • Increased access to international markets for sustainably produced goods and services
Governments/ Private Sector	<ul style="list-style-type: none"> • Emergence of domestic and international markets for environmental goods and services • New tax and policy incentives for sustainable land-use practices • Development of transportation infrastructure and tourism facilities • Increased regional economic integration • Improved education levels and reduced migration to urban centers • Fair payment or recognition for environmental goods and services provided

the main stakeholder groups—conservationists, rural populations, and governments/large-scale private business—are likely to seek from the MBC. These outcomes are based on extensive interviews with stakeholder groups in the region.

There are significant potential contradictions between these interests. For example, the expansion of protected areas in endangered ecosystems could occur in areas that are often centers of indigenous cultures as well as biodiversity. Unless government policies enable indigenous communities to co-manage protected areas, this expansion is likely to conflict with the desire of indigenous communities to receive official recognition for their land claims. The desire of economic development advocates for increased investment in transportation and tourism facilities may run counter to conservationists' goal of preserving endangered species. Additionally, increased local authority over natural resources management and policy could complicate efforts toward regional economic integration.

Nevertheless, complementarities are not hard to find. Conservationists want to see important ecosystems, such as wetlands and forested headwaters, protected and restored while rural and urban citizens throughout the region want to obtain more reliable supplies of clean water. By focusing on such ecosystems, the MBC can simultaneously conserve important biodiversity habitats, improve water quality, and reduce the potential for destructive flooding. Similarly, the decentralization of authority and capacity to manage natural resources should increase local employment opportunities while fostering the development of skills essential to conserving biodiversity and sustainably managing natural resources—assuming local governments have enough revenue to carry out their new roles. Increased access to international markets for “green” products, such as organically produced coffee or biodiversity-friendly cacao, could boost income for small farmers (PROARCA/CAPAS 1999, IUCN 2000). As farmers turn to such crops, a range of bird and small mammal

Box 4. The *Campesino a Campesino*¹ Movement

The *Campesino a Campesino* (CAC) movement is a decentralized, farmer-led movement promoting sustainable agriculture in Mesoamerica. It appears to have originated among the Kaqchikel Mayas of Guatemala who, facing steadily declining ecological and socioeconomic conditions, organized themselves to experiment with simple agricultural techniques on their own lands. When these techniques began to produce visible benefits on their own plots—yields of corn and beans reportedly increased 100-200 percent within a few years, and the profitability of garlic, onions, coffee, and potatoes rose substantially—interest among neighbors increased and with NGO support, the Kaqchikel farmers founded a 900-member cooperative to disseminate sustainable agriculture techniques. Political turmoil in Guatemala in the early 1980s led to the disbanding of the cooperative, and the flight of many Kaqchikel farmers to Honduras and Mexico where they established dozens of sustainable agricultural projects. In the process, a transnational movement was born, as farmers throughout Central America began learning and teaching the practices and merits of sustainable farming.

The CAC movement has produced a combination of social, economic, and environmental benefits in the areas where it has taken root. Social benefits of the CAC

include recognition and legitimization of farmers' sustainable agricultural practices, increased pride and enthusiasm among farmers as they share their knowledge with others, the broadening of support for farmer-led agricultural projects, and increased involvement and communication among farmers. From an economic standpoint, the CAC has allowed farmers to raise production (in northern Honduras, these practices are 30 percent more profitable than high-input systems) and increase crop diversification, processing, and sales. Benefits to the environment include the regeneration of tens of thousands of hectares of exhausted soils, the reversal of degenerative agroecological processes, and a move away from high-input, agrochemically dependent farming practices.

Farmer innovation and involvement, combined with socioeconomic and ecological imperatives, are key factors in the replication and continuation of the CAC movement. Its proven ability to deliver social, economic, and ecological benefits simultaneously, makes the CAC a relevant model for future sustainable development and conservation initiatives in Mesoamerica.

Source: Bunch and Lopez 1994; Holt-Giménez 1996; Holt-Giménez, personal communication, February 2001.

¹ Farmer to Farmer

species would benefit from the expansion of their effective habitat area.

The second step toward building a shared vision of the MBC is to build trust and confidence among the various groups involved by inviting wide participation in MBC planning and policy discussions at regional, national, and local levels. As the MBC planning process moves out of the capital cities and into the field, it may be helpful to create a process that enables stakeholders to identify their desired outcomes. This should clarify what actions are needed most for building the MBC in a given locality.

The third step toward reconciling different perspectives on the MBC is the implementation of policies and projects that offer a balanced mix of biological and socioeconomic benefits, taking into account the needs expressed during the planning process. (*A model for such activities is described in Box 4.*) As implementation proceeds, it is important for planners and stakeholders to recognize that the types of activity most effectively promoted by the MBC will vary over time; indeed,

given the scale of the problems, it will take decades to fully achieve the MBC's goals. The most effective strategy for sequencing will prioritize projects that build support for the initiative in its early stages, before moving on to address longer-term conservation and socioeconomic needs.

The following summarizes an effective sequencing strategy for MBC activities.

Immediate Term: 1-3 years: The release of start-up funds for the MBC's component projects can provide opportunities for employment, social programs, and the strengthening of protected areas that can benefit people relatively quickly. Jobs can be created within plant nurseries and reforestation projects, protected areas, bio-prospecting projects, and ecotourism enterprises. Social programs can include demarcation of indigenous territories, credit for rural housing, and road maintenance. Key protected areas can be strengthened immediately by demarcating boundaries, placing signs, and undertaking outreach meetings with local residents.

Planning at this stage should prioritize projects that offer clear biological and socioeconomic benefits to all stakeholders. Early MBC policies and projects could be designed to produce a balanced combination of biological, social, and economic outcomes, rather than focusing on only one type of benefit. For example, an early project might focus on the restoration of a municipal watershed lying between two protected areas. Such an effort would produce desired biological outcomes (restored natural habitat linking two previously isolated protected areas), social outcomes (increased access to clean water), and economic outcomes (tax incentives to land-owners for sustainable land-use practices). In this way, confidence can be built among various stakeholders that the MBC is worthy of their support and participation.

Medium Term: 4-10 years: Once confidence is established among these interests and constituents, the next phase of investment can focus on more challenging programs. With time for added consultation and project planning, further options open in the conservation, social, and economic spheres. For example, educational programs can be developed to bring people to protected areas, enabling them to appreciate how the area benefits their livelihoods and how they can help co-manage the area. New co-management arrangements can be established and people trained to staff them. At the same time, improvements in farming and forest management practices can be promoted in the Buffer and Multiple-Use Zones that are biodiversity-friendly, sequester carbon, and conserve water. This implies partnerships with universities, and agricultural and forestry centers to help test and apply appropriate technology and cropping patterns. Corridors can be defined in the field, featuring adequate consultation with residents and neighbors. Agreements can be negotiated with residents of corridor areas to establish appropriate cropping patterns and land/water use. Also in this phase, residents of core and corridor areas can be offered the option of relocating to other sites in return for immediate and adequate compensation. Analysis of existing laws, policies, and regulations can suggest how government regulations can be reformed to foster environmentally friendly business activity in the Buffer, Corridor, and Multiple-Use Zones. For example, tax incentives, credit, health and safety standards, and green-practice codes can be used to promote investment and employment while securing the environment, and promoting carbon, health, and water quality standards. At this stage, other sources of development assistance could be encouraged to pick up the needed social investments. Economic programs could generate their own support through the capture of rents from ecosystem services

(for instance, from water, carbon, and ecotourism), while biodiversity conservation funding, such as that from GEF, could be concentrated on biological programs.

Long term: 10-30 years, and beyond: In most parts of the region, the basic elements of the MBC could be in place by the end of the medium-term period, that is:

- the key Core Zones will have been demarcated, signed, and staffed and cooperative relationships will have been established with neighboring populations;
- the communities living in and around the Core Zones and their linkage corridors will have experienced improved opportunities for employment and subsistence, as well as improved access to adequate housing, education, and health facilities;
- opportunities for business enterprise will have expanded through the establishment of a conducive legal, policy, and regulatory environment.

Given the background of inequities among cultural groups, the impacts of warfare, and the resulting degradation of socioeconomic and environmental conditions, it may well take the first ten years of the program to establish a climate of trust and confidence among the region's stakeholders. This groundwork will allow additional long-term investments to generate higher returns. For example, new ecotourism enterprises can be established that will be co-owned and co-managed by rural communities and indigenous groups, with part of the profits going to support local conservation and development needs. The gradual restoration of forests can support the creation of new locally owned timber and wood-product enterprises. Fishing communities can diversify into ecotourism and run diving enterprises on the region's coral reefs. Small-scale hydropower units can provide electricity to rural hinterland communities. Key Core Zones will have secure boundaries, and illegal hunting, plant and tree removal, and settlement will diminish. Erosion will have decreased, and streams will have cleaner and more stable year-round flows of water. Coastal villages and mountain communities will have increased security against storm damage, including floods and mudslides. And, socially equitable economic investment programs will draw residents from sensitive biodiversity sites to nearby towns or other areas that can offer more productive livelihoods.

The following questions can help participants in the planning process within a particular locality to identify the outcomes most important to them and build a collective sense of what they would like to see come from the MBC:

- *What degraded ecosystems in the area should be restored and why?*
- *Which ecosystem services should be the focus of MBC efforts in the area? (See Table 1.)*
- *Which endangered species populations should conservation efforts prioritize?*
- *How can rural and urban residents contribute to the MBC?*
- *Which basic social needs in the area (for instance, employment, food security, access to clean and reliable water supplies) should be provided by the MBC?*
- *How can the MBC protect area residents against floods and other natural disasters?*
- *What social traditions and cultural heritage in the area should be protected by the MBC?*
- *How can the MBC improve public participation in natural resource policy, management, and governance?*
- *What economic benefits and other opportunities should the MBC generate in the area and who should receive them?*
- *How should the MBC program compensate for economic costs or losses caused by program activities?*
- *What types of area businesses should benefit most from the MBC?*

Fostering Democratic Governance and Enabling Civil Society Participation

The manner in which state authorities exercise their responsibilities and are held accountable for their decisions has a major influence on a country's social, political, and economic development. Participation of civil society in public debate and action is a cornerstone for democratic governance and the establishment of an environment conducive to broad-based economic investment and growth. As governments decentralize responsibilities and authority over natural resources, it is important that local constituents enjoy access to

accountability and transparent decision-making processes.

The end of regional conflicts has enabled Central America to launch a series of important institutional, political, socioeconomic, and environmental reforms. Regional integration, together with democracy, economic revitalization, privatization, and decentralization, has become the framework for the modernization of the Central American nations. These policies are the result of government recognition of past failures, international pressure, and national calls for reform from the private sector and civil society. The Central American Integration System (SICA) and the Central American Alliance for Sustainable Development (ALIDES) are two of the most significant landmarks in the construction of a new order in the region. Under these frameworks, the restoration of degraded habitats and conservation of ecosystems as envisioned under the MBC, have become important arenas for implementing broader reforms of the region's economic, political, and legal institutions.

As countries in the region democratize at the local level, new opportunities are being created for social organizations, the business sector, and traditionally marginalized groups—indigenous communities, women, and small farmers—to voice their needs and concerns. Efforts to shift public authority to the municipal level have stimulated investment in the strengthening of local government capacity,²⁴ but these efforts have often been insufficient to fill the gaps left by the withdrawal of central government from many sectors of decision-making. This seems to be especially true for the development and enforcement of environmental regulations and policies.²⁵ As a result, with few exceptions (see Box 5), local authorities have not been able to capitalize on their new responsibilities.

The ability of local governments to play a constructive role in environmental management is reduced by a myriad of institutional weaknesses, including corruption, lack of administrative, financial, and technical capabilities,²⁶ and inability to resolve conflicts among local stakeholders over natural resource use. These weaknesses do not, however, diminish local authorities' potential importance within MBC governance and planning. On the contrary, local governments are central to efforts to facilitate citizen awareness and participation, and to enforce compliance with land-use regulations.

In most parts of Mesoamerica, central government agencies have tended to retain practical control over

Box 5. Local Autonomy in Environmental Planning and Management in Cantón San Ramón, Costa Rica.

The 60,000 inhabitants of the municipality of San Ramón, Costa Rica depend on the local natural resource base for agriculture (primarily coffee, as well as sugar cane, vegetable gardens, and ornamental plants) and cattle ranching. The major environmental problems facing San Ramón include soil degradation, erosion, deforestation of steep hillsides, and pollution by agrochemicals.

In the early 1990s, the municipality became involved with the Ramonense Association for Environmental Conservation (ARCA), a group of students and staff from the University of Costa Rica at San Ramón. Together, they launched a successful effort to protect the nearby Alberto Manuel Brenes Biological Reserve from mining, which encouraged the municipality to mobilize further efforts in environmental management.

In 1996, the municipality formed an Environmental Advisory Commission, and later a Municipal Office of Natural Resources, to monitor forestry issues and work to ensure sustainable use of natural resources. The Municipal Office of Natural Resources gained formal authorization under the National Forestry Law and was given environ-

mental management and regulation responsibilities. These included organizing workshops to increase public participation in local environmental issues.

However, the decentralization of environmental management in San Ramón prompted competition between the efforts of the municipality and those of central government agencies, primarily the Ministry of Environment and Energy (MINAE). To resolve this problem, in 1996 the Ministry and the municipal government signed an agreement that recognized the latter's responsibilities in environmental decision-making and provided for increased participation by civil society.

The greatest strength of this initiative is that it came from the local level, underscoring the vital contribution local government can make to environmental management. It also served to reinforce confidence in local government and create more opportunities for stakeholder participation and cooperation.

Source: Chaves and Loria 1998.

local natural resources management; effective devolution of decision-making is the exception rather than the rule. In Honduras and Nicaragua, for instance, logging and mining concessions have been negotiated in secret between central government agencies and private companies. Plans to allow oil drilling in the Maya Biosphere Reserve in Guatemala, and to complete the Darien Gap section of the Pan-American Highway in Panama were made in the same manner (Native Forest Network 1997, HEED 2000, IGC 2000). Local populations have had little opportunity to voice their needs and concerns.

The same pattern holds true in relations between central government and indigenous communities. Some countries in the region have officially recognized the existence of indigenous governance systems and granted territorial autonomy to indigenous groups (González 1996, Currie et al. 1999, ILRC 1999,²⁷ Kaimowitz et al. 1999). Nevertheless, current policies for agricultural development, land reform, and the award of forestry and mining concessions frequently run counter to these commitments. Even with legal autonomy, therefore, ethnic groups continue to find themselves in conflict with outsiders and other local groups.

A top-down approach has also characterized many conservation efforts impacting indigenous peoples. In Nicaragua, the Atlantic Coast Regional Autonomy Law of 1987 established two separate autonomous regions along the Atlantic coast, covering 43 percent of the country, governed by bodies with substantial legal authority over indigenous affairs and the land, forests, and waters of the region. Although this law formally recognized the communal property rights of the indigenous communities, their territories have never been formally titled or demarcated. When the government established the 8,000-square-kilometer Bosawas National Natural Resource Reserve in 1991, the indigenous people and their community leaders were not consulted (Kaimowitz et al. 1999). This kind of action has created conflict and tension over ownership of the resources and the conduct of conservation efforts in many parts of the region.

However, the region's changing political and social conditions are creating opportunities for greater participation by non-state actors in bringing about MBC goals. Partnership arrangements can create a sense of shared resource ownership that may help to protect public lands. Governments can involve local people in drawing up protective regulations and ensure that they are

provided with adequate legal mechanisms for enforcement. State agencies can strengthen rural communities' customary rights of access and forest use by granting land title, assisting in the demarcation of borders, and facilitating access to information and financing. Collaborative management arrangements between state agencies and local organizations, along with conservation easements with private landowners, can be an important strategy for effective resource management and sustainable use (CONAP 1999b, Borrini-Feyerabend et al. 2000, Mejías 2000). (See Box 6.)

Natural resources are embedded in a political context characterized by competition for control. The MBC can also provide opportunities for training in conflict management as stakeholders test new management regimes and experiment with different decision-making mechanisms.

In order to participate meaningfully in MBC planning and management, local people and organizations—including municipal governments, NGOs, civil associations, businesses, and urban residents—need a political climate where respect for human rights and the rule of law prevails. Social mobilization behind the MBC will depend upon building a democratic system for governing Mesoamerica's natural capital.

The following questions may be useful in generating meaningful local participation in planning and managing the MBC:

- *What are the most important environmental governance problems and opportunities in MBC design, implementation, and monitoring?*
- *Who should be involved in making local planning and management decisions?*

Box 6. Collaborative Management of Sarstoon-Temash National Park in Belize

The Sarstoon-Temash National Park of Belize contains wet forest and wetland of global significance, as well as numerous bird, amphibian, fish, and reptile species. It is located in the isolated and underdeveloped Toledo District, an area with the highest proportion of indigenous peoples in the country. The government's creation of the park in 1994, involved taking land from five indigenous settlements—four of them Q'eqchi' Maya and one Garifuna—yet this step was taken without prior consultation with the affected communities.

The first reaction of these communities was to call for the park's dismantling on the grounds that it deprived them of the land and resources they depended on for survival. In 1997, however, representatives from the five villages decided to seek an agreement with the government to co-manage the park. This decision was a bold move given that the communities had neither previous experience in resource management, nor any previous example of such an arrangement to draw upon.

With assistance from government agencies and environmental groups, the five communities have since made significant progress toward their goal of improving their material welfare through participation in conservation activities. They now have the support of all relevant

ministries to move ahead with their plan and have secured financial backing from several international donors. The International Fund for Agriculture Development (IFAD) and the EcoLogic Development Fund awarded them a joint grant to register their committee with the government as the Sarstoon-Temash Institute of Indigenous Management (SATIIM). SATIIM is currently awaiting a three-year grant from the World Bank/GEF to create a management plan for the park, document its biological resources, record traditional ecological knowledge, and enhance its own management capacity.

Under SATIIM's proposal, indigenous peoples will play a central role in running the park, working as tour guides, resource managers, park wardens, and ecological researchers. Its activities are already having a practical impact. Without waiting for formal arrangements to be put in place, the people of the area have begun to regulate agriculture and resource-use themselves. SATIIM's ultimate goal is to show that giving indigenous communities responsibility for the formal management of their traditional resources can serve ecological, economic, and cultural goals simultaneously. SATIIM hopes its achievements will encourage the establishment of similar arrangements elsewhere in the region.

Source: Caddy et al. 2000.

- *What powers do stakeholders have and how are they accountable for their decisions?*
- *Which implicit or explicit policies hinder meaningful participation by MBC stakeholders?*
- *How can decentralization of resource management in MBC areas be made effective?*
- *How can customary rights within traditional forms of governance structures—such as ejidos, autonomous territories, comarcas, and communal lands—contribute to better management or control of corridors' natural resources?*
- *What is the role of indigenous cultural knowledge and values in biodiversity conservation?*
- *How do population and migration patterns affect rural MBC stakeholders' views on the building of corridors?*

Catalyzing Information for Participatory Decision-Making

Planners and managers of the MBC need a range of social, environmental, and economic information at regional, national, and sub-national levels. Information about the importance of ecosystem goods and services, in particular, is needed to mobilize public support for the MBC and to empower community members to participate meaningfully in the decisions that will affect their lives. (See Box 7.)

Integrating socioeconomic information with environmental information will provide new perspectives on sustainable use and conservation of water, soil, and biodiversity in the MBC. Changes in policy can increase demand for data and make information more available and useful to all stakeholders involved. Specific agencies can be assigned authority and responsibility for providing data. Citizens and civil society organizations can be provided with information to monitor progress and suggest avenues of recourse when obligations are not met.

Numerous conservation and development projects have been collecting data and analyzing information, but the lack of integrated assessments using combined environmental, social, and economic data continues to challenge MBC decision-makers. MBC stakeholders at regional and national levels require more information about the value of ecological services and emerging consumer preferences, and markets for non-traditional or certified natural products. Stakeholders at the

province or department levels are interested in having better information on the technological options available to minimize negative impacts on their environment, and the fiscal incentives available for organic farming. The integration of information still remains a serious problem despite regional commitments on the issue²⁸ and the investments made by donors and government agencies to improve stakeholder information access.

Lack of common standards for collection and documentation makes it difficult to integrate data from different sources across the region and to interpret data from different countries. For example, deforestation rates and poverty indices in each country are estimated using different methodologies, which are not used consistently over time. The lack of a shared terminology for measurement and interpretation prevents the cross-national comparison of trends (Lenin Corrales, personal communication, August 2000).

Public and private institutions in the region have a rich array of information on biodiversity, protected areas, forest resources, soil and agriculture, and other natural resources (CATIE/IUCN 1997). Most information, however, remains sector-specific and lacks the analytical and holistic perspective that planning the MBC requires. For example, statistical data and graphic information for road construction in a remote forest may provide decision-makers with details of the road's economic costs and benefits, but not its social and biological impacts. In other instances, information on land-tenure and ownership in countries that have been ravaged by war and social conflict, such as Guatemala and Nicaragua, remains unavailable because of its political sensitivity.

The success of the MBC depends upon stakeholders being informed on how a project will affect them, how to participate in its design, and how to monitor its implementation. MBC proponents can strengthen the public demand for information by promoting awareness of the region's ecosystems and the environmental, cultural, and economic benefits they offer. They can also support efforts to make public consultation and information disclosure part of impact assessments of development projects. As MBC planning decentralizes, natural resource managers will require more complex information about how the MBC will protect ecological services and biological resources that affect human and economic well-being. Without this information, it will be difficult or impossible to build the support necessary to implement the MBC.

Box 7. Land-Use Map Empowers Indigenous Group to Assert Land Rights in Honduras

The Mosquitia, a region of northeastern Honduras covered by rainforest and savanna, is populated by over 35,000 inhabitants from the Miskito, Garifuna, Tawahka, and Pech peoples. Large numbers of settlers are arriving in the region, at a pace that is jeopardizing both its traditional cultures and ecological security. Conservationists see strengthening indigenous land-tenure rights as vital if this process is to be checked. At present, however, indigenous communities' titles are poorly defined and their lands are not accorded protected status by the government.

One creative response to this problem has been to strengthen recognition of indigenous land-use by encouraging indigenous communities to create a map through a participatory survey process. In 1993, the people of the region elected representatives to gather information about how the inhabitants of the Mosquitia utilize the land. The surveyors administered questionnaires to approximately 200 villages about the lands they use for farming, hunting, fishing, construction material, gold prospecting, and collection of medicinal plants. Often, they were greeted with hostility and suspicion from villagers who feared that the government or private business would exploit the information for its own ends. One of the surveyors remembers: "In one village, they told me they would give

me information only because they knew me, and so if I cheated them, they'd know where to find me."

A cultural geographer and professor from Southern Louisiana University, who once lived in the Mosquitia, used the initial surveys to draft a land-use map for each of the 22 regions, which the surveyors then took back to the communities for review. The surveyors found their informants warmed to the project considerably once they were able to see its tangible results in the form of the draft maps. At the First Congress on Indigenous Lands of the Mosquitia, indigenous representatives and the Honduran land-rights advocacy group, MOPAWI, presented the resulting map of the region to the Honduran Vice President, government ministers, and military officials.

Soon after the congress, the Ministry of Defense came out against a U.S.-based logging company's plans to expand its logging operations in the Mosquitia, marking a significant departure from the Honduran military's usual practice. Thus far, the map and the congress have not resulted in any change to the land rights of the indigenous people of the Mosquitia, but they have helped them to formulate an independent vision of their present needs and future aspirations.

Source: Swenarski 1993.

The following are questions that may help clarify the role of information in MBC planning, implementation, monitoring, and evaluation:

- *What socioeconomic information do MBC stakeholders need most?*
- *What environmental information (including biological, physical, and chemical data) do MBC stakeholders need most?*
- *What regional, national, and local institutions currently collect and manage these data?*
- *How do local stakeholders access information?*
- *Which are the main laws and policies impacting access to government information and public participation in decision-making?*

- *For whose benefit is environmental and development information being used?*
- *What are the costs of implementing new information policies, including increased data collection, improved analysis, and greater outreach to stakeholders? What options exist for meeting these costs?*

Clarifying the Functions of Core, Buffer, Multiple-Use, and Corridor Zones

At present, there is confusion and disagreement about the function of different land-use zones in the MBC. This makes it more difficult to discuss, plan, and implement priority actions. It is important to develop more clarity and agreement about the essential roles and functions of each of the zones.

Core Zones. There are currently nearly 400 legally established protected areas in Mesoamerica, covering

about 11 percent of the region's land surface. An additional 300 protected areas are proposed, which would more than double the area of land in protected status (García 1996b, CCAD 1998a, UICN 2000, WCMC 2000). The high number of existing and proposed protected areas may create the impression that there is sufficient protected habitat to maintain the region's biodiversity. However, it is not the number of sites that determine the potential to conserve biodiversity but rather their size, their habitat coverage, and the effectiveness with which those habitats are managed. As illustrated in Table 2, most sites are less than 100,000 hectares. Moreover, the financial and human resources presently assigned to them are insufficient to manage the existing, let alone proposed, protected areas. The region's governments have neither the budget, the human capacity, nor the skills to effectively manage all Core Zones on their own, resulting in continuing degradation by agricultural incursions, illegal logging, mining, hunting and gathering, and little or no local capture of the ecotourism and other potential benefits that they could provide (Primack et al. 1998).

Two steps can enhance the functioning of the Core Zones in the MBC. First, countries in the region can prioritize their protected areas and work over the long-term to consolidate a smaller number of more extensive Core Zones capable of anchoring the MBC. Ideally, there should be several large Core Zones, that together cover at least 10 percent of each ecoregion (including coastal and marine habitats). This consolidation will require a long-term strategy shared by governments, NGOs, and the private sector. Second, governments should offer a broader role to non-governmental organizations, local communities, universities, and the private sector in the management of Core Zones. By entering into creative co-management arrangements with local organizations, governments can effectively expand the nation's management capacity. This shift will require governments to concentrate on facilitating planning and negotiation, providing education and training opportunities, developing environmental and investment funds, and providing oversight of management quality. Meanwhile, they should reduce their role in direct field management. Naturally, the options and opportunities for co-management arrangements with local government, *campesino*, and indigenous communities will vary from country to country in the region (CONAP 1999b, Borrini-Feyerabend et al. 2000, Caddy et al. 2000, UICN 2000).

Buffer and Multiple-Use Zones. In general, the functions of Buffer and Multiple-Use Zones are not well defined or understood. Buffer Zones function to protect Core

Zones from the negative impacts of external activities and to minimize damage to agriculture and other activities from wildlife coming out of the Core Zone. In contrast, the function of Multiple-Use Zones is to promote a diverse, mosaic-like landscape that features mixed crops and land uses that are biodiversity friendly while offering livelihoods to residents. Buffer zones, even when they are under multiple-use management, feature a series of restrictions designed to ensure a gentle transition from wildland to the domesticated landscape beyond the Core Zone. For example, no land-clearing activities along the Core Zone boundary should take place within Buffer Zones, nor should pesticide use be permitted. On the other hand, a Buffer Zone might be an ideal location for visitor facilities, ecotourism lodges, and environmental education camps. By contrast, Multiple-Use Zones beyond Buffer and Corridor Zones, will feature farms, managed forests, villages, and infrastructure. Restrictions there might be limited to the protection of certain species, securing carbon balances, and the protection of water supplies.

Another problem is that the Buffer Zones and Multiple-Use Zones are often poorly demarcated in the field. This leads to conflicts between residents and protected area managers. Without a clear definition of the functions Buffer and Multiple-Use Zones are to fulfil, it will be difficult for planners to negotiate the actual location of these zones in the field with other land-users.

Corridor Zones. To many people the MBC is synonymous with a set of continuous forest pathways from one Core Zone to the next. The real issue, however, is biological connectivity, or the degree to which the region's biota can disperse and respond to environmental change. MBC planners will need to consider a range of tools to increase biological connectivity depending upon biological, social, and economic circumstances. Considerations include: What kinds of plants and animals will be dispersing and migrating? At what distances? Do they need continuous pathways, or do they move step-by-step? (Quetzal birds have been shown to fly among old stag trees in the fields, while large mammals need continuous pathways.) What is the prevailing pattern of land use and tenure? Is the land divided into small-holdings or large plantations? Is the area occupied by many small farmers or by large, indigenous community holdings? Each of these distinctions will call for variations in the design of corridors across the landscape.

The following questions can help MBC planners and stakeholders to clarify the role of Core, Buffer, Multiple-Use, and Corridor Zones:

- *What biological and social criteria are being used to plan the network of Core, Buffer, Multiple-Use, and Corridor Zones?*
- *Will the corridors feature wildland or be “re-wilded” through restoration? Or, will they consist of small farms, indigenous lands, or forestry operations, and thus be internally zoned for Multiple-Use?*
- *Do any large Core Zones cross international borders and are there mechanisms for coordinating management with neighboring countries?*
- *What species are likely to move outward from the Core Zones thus requiring special consideration in planning Buffer Zones?*
- *What will be the role of Buffer Zones in your area? Are they well-demarcated on the ground?*
- *What kinds of land uses exist in the Core, Buffer, and Corridor areas in your region? Are these likely to persist over long periods of time, implying the need for Multiple-Use classification for the foreseeable future? Or, might these zones be “re-wilded” in the longer term? What type of restoration work will be required if this is to happen?*

Addressing Property Rights and Land-Tenure Issues

Clear property rights and secure land tenure are critical requirements for responsible land management practices and conservation of natural resources. The complex task of improving tenure security and strengthening property rights will play an important role in developing the MBC. This is especially true in indigenous communities, from the *ejidos*²⁹ in Quintana Roo, Mexico, the communal lands in Momostenango, Guatemala, and the Miskito lands in Honduras, to the *colonos* in the Darien region of southern Panama. (See Box 8.) Property rights and tenure security have been some of the most contentious issues in Mesoamerica. They have been at the root of ethnic, civil, and political unrest for decades. The issues are complex because land ownership is an expression of socioeconomic and political power, and subject to keen competition by many groups who often have conflicting interests.

Most countries in the region have undertaken land reform and redistribution programs during the past fifty years, but land access remains highly unequal. In Guatemala, Honduras, and Panama, government policies have permitted concentration of large tracts of “idle” land into a few hands. These *latifundios* have converted forest and traditional agricultural lands into

Box 8. Land Rights and Ownership Issues in the Río Plátano Biosphere Reserve, Honduras

The Río Plátano Biosphere Reserve is located in the Mosquitia region of Honduras. It was established as a protected area in 1980 and expanded to its current size of 800,000 hectares in 1992. The reserve covers 7 percent of Honduras’s remaining rain forest, mangrove, flooded forest, and savanna; and is home to a number of endangered wildlife species, including the jaguar (*Panthera onca*), scarlet macaw (*Ara macao*), jabiru stork (*Jabiru mycteria*), and Baird’s tapir (*Tapirus bairdii*).

The traditional inhabitants of the reserve include about 16,000 people from four ethnic groups—the Miskito, Tawahka-Sumu, Pech, and Garifuna—who are being joined by a growing number of land-hungry *campesinos*. Because the boundaries of the reserve are still unmarked and land uses within the proposed indigenous and *ladino*¹ settlement areas have not been legally defined, much less regulated, these populations are in constant territorial conflict. The indigenous inhabitants of the reserve have no rights to the land they have used traditionally, and no legal means to repel squatters. Indigenous claims to be granted clear title remain unresolved.

Source: Youth 1998.

¹ *Ladino* is a popular term used to distinguish either individuals of mixed Spanish and Indian descent, or individuals of any indigenous heritage who have lost their cultural identity.

pastures. This has limited the supply of land available to the rural poor and forced many to settle in marginal lands, which in turn has created widespread environmental degradation. The adverse environmental impacts of migration by people displaced by land expropriations, invasions, resettlement schemes, and political patronage have been widely documented throughout much of Mesoamerica (Williams 1986; Heckadon 1992; Strasma and Celis 1992; Pasos 1994; Kaimowitz 1995, 1996; Sunderlin and Rodriguez 1996; Jaramillo and Kelly 1997; Segura et al. 1997; Youth 1998).

Most small landholders acquired land when they were brought to work for large farms and were given plots to cultivate. Displaced migrants or *colonos* have been formally or informally settled in open, “unclaimed” public lands that are fragile and often unproductive. To establish their rights they cleared the forest. Most have

provisional, partial, or no legal title. In Panama, for example, 46 percent of farmlands are not legally titled—particularly those occupied by small landholders (Segura et al. 1997). Without title, farmers have few incentives to protect and manage their land's resources for the long term. Most are poor and live in remote areas, making it nearly impossible for them to obtain credit. With no legal claim, they cannot qualify for most government subsidies or incentive programs. This locks them out of programs that are available to larger landowners for reforestation, or payments for protection of environmental services.

Nevertheless, there have been significant investments in land-titling programs in Central America. This has been particularly true since the end of regional conflicts, as governments, with donor assistance, have sought to build peace through programs to title public land for the poor and improve their access to private land through market mechanisms (World Bank 1998).

Although clear property rights and secure tenure are necessary conditions for sustainable land use, in themselves they cannot guarantee that natural resources will be well managed—and in some cases they may even provide motive for further exploitation. Additional institutional and policy reforms are required. For example, the institutions that guarantee and enforce property rights—*cadastre* registry, judicial, and policy systems—often fail to operate in a transparent manner. Other factors, such as the economic gains offered by certain unsustainable land-use practices, may provide strong incentives for forest conversion even if land tenure is secure. (See Box 9.) Some studies in Guatemala and Brazil suggest that it is unclear whether providing greater security of land tenure will reduce deforestation or improve natural resource management. For this reason, tenure security must be preceded by removing policy biases that foster land concentration, eliminating legal provisions that threaten farmers with expropriation for the “under-utilization” of productive lands, and abolishing programs that encourage migration of landless farmers onto unproductive lands (Kaimowitz 1995; Jaramillo and Kelly 1997).

Government and civil society should be encouraged to explore alternative property regimes and management arrangements under which customary rights and local power structures enhance wider civil society participation and promote civic responsibilities. Some of the possible options include legalizing land claims of ethnic communities, as well as developing legal and economic instruments for private property conservation through easement agreements.

Box 9. Land Tenure Regimes and Deforestation in Petén, Guatemala

The Petén department of northern Guatemala has experienced rapid deforestation in recent decades, owing to the expansion of ranching, commercial logging, road building by the government and oil companies, and an influx of settlers practicing slash-and-burn cultivation. By the mid-1990s, over 60 percent of forest area in the department had been lost.

A World Bank study (1995) on the influence of land-tenure regimes on forest exploitation in the Petén identified four major types of property regime in the region: public, municipal (or *ejidal*), cooperative, and private. On both public and municipal land, which cover the great majority of the Petén, illegal logging and land clearance is virtually unchecked, owing to lack of effective control over access by the titular authorities.

From an ecological perspective, the situation is no better on cooperative and private land. In the 1960s and 1970s the government supported the creation of cooperatives to encourage settlement in the region. It did not, however, provide adequate roads or agricultural and social services, causing the settlers to rely on exploitation of timber resources. Similarly, private landholders in the Petén, whether large cattle ranchers or small farmers, have cleared forest at unsustainable rates because economic returns from agriculture are higher than those from forest management.

The case of the Petén suggests, therefore, that even security of tenure fails to halt deforestation if the immediate gains from agriculture and natural timber harvesting exceed those from sustainable forestry, and if economic actors have high incentives and lack expertise in sustainable resource-use strategies.

Source: Jaramillo and Kelly 1997.

The growing interest of private landholders in conservation and sustainable management provides an opportunity for public agencies and civic associations to work in partnership with one another. For example, in 1995, a group of private landholders in Costa Rica created a network of private nature reserves to protect remnants of primary and secondary forestlands and wildlife. By developing alternative economic strategies that are friendly to the ecosystem—such as ecotourism, butterfly farms, and medicinal plant crops—these owners have benefited economically from conservation

on their own lands. The network currently has over one hundred members, with the properties set aside as reserves ranging in size from 8 to 23,000 hectares (Martha Marín, Executive Director, Costa Rican Network of Private Natural Reserves, Personal Communication, September 12, 2000).

Another type of policy initiative may be to grant legal title and establish clear territorial demarcation within common or community lands³⁰ where the social and cultural structure allows it. For example, in the department of Totonicapán in Guatemala, most remaining forestlands are under an indigenous communal property regime that dates back to the early colonial period.³¹ These groups (K'icheans), have a strong traditional social structure that effectively controls the rights of community members to exploit their ancestral land's resources—thus preventing further deforestation—while securing the benefits they need, including fuelwood, building material, fiber for craft products, medicinal plants, and water (Eliás 1997b, Reyes 1998).

Some of the following questions may be useful to clarify the issues concerning land-tenure regimes and property rights in corridor areas:

- *What economic and legal incentives can promote responsible stewardship of the land under different tenure regimes?*
- *What are the opportunities for conservation and development created by providing secure land tenure to indigenous peoples?*
- *How can government agencies guarantee user-rights on land that has been legally granted or formally recognized as autonomous or communal?*
- *What policies can foster clear and secure profit opportunities for landowners?*

Capturing Benefits from Ecosystem Goods and Services

Mesoamerica is richly endowed with timber, minerals, fertile volcanic soils, freshwater, and beautifully varied land- and seascapes. The economic benefits derived from these natural resources can provide income and employment for rural people and could be a vital source of funds to build and sustain the MBC. Today, the region's natural resources often do not provide enough benefits to enable poor people to make a sustainable living on the land. Meanwhile, very little of the potential value of timber, minerals, water, and ecotourism is reinvested to maintain national parks,

forest reserves, watersheds, and the proposed corridors that make up the MBC. These chronically under-funded areas provide the region with immense value and so deserve more investment. Promoting wider sharing of benefits from natural resource use and investing a portion of the proceeds in sustainable resource management will help to ensure that the MBC can be implemented and maintained in decades to come.

Trends in agriculture, tourism, and forestry illustrate the potential benefits from sustainable natural resource management as well as the obstacles to capturing those benefits. Rapidly growing international markets for organic shade-grown coffee and cacao, for example, could generate hundreds of millions of dollars in revenues for the region and substantially improve incomes for small farmers and indigenous people. Most importantly for the MBC, shade-grown coffee and organic cacao also provide habitat for a much wider array of species than conventional open-grown crops. Government policies such as pesticide subsidies, however, tend to favor conventionally grown crops and a lack of research and extension efforts slows the adoption of shade-grown crops by farmers.

Ecotourism is also growing rapidly in Mesoamerica. It is already the leading source of foreign exchange in Costa Rica and is swiftly increasing in importance in Belize, Panama, Guatemala, and elsewhere. (See Box 10.) Ecotourism has the potential to provide better livelihoods in rural communities and generate sorely needed revenues for protected areas and conservation activities. Still, it is principally large companies, many of them foreign-owned, that capture these benefits. Furthermore, relatively little of the tourism revenue is being reinvested in conserving the spectacular national parks and wildlands that attract tourists in the first place.

The new markets that are emerging for forest products and services could contribute substantially to building the MBC. For example, over 650,000 hectares of forest in Central America and southern Mexico have been certified as sustainably managed by the Forest Stewardship Council (FSC 2001). While this represents less than one percent of the region's forests, recent commitments by large international retailers such as IKEA, Home Depot, Lowe's, and B&Q to purchase certified wood products indicate a dramatic expansion in international demand for wood produced in ways that generate local social benefits and protect biodiversity.

Mesoamerica has also been a leading region in the management of forests for their environmental services. The potential contribution such approaches can make to

Box 10. Ecotourism and Community-Based Conservation in Belize: The Community Baboon Sanctuary

The Community Baboon Sanctuary (CBS), founded in 1985 by the residents of Bermudian Landing in Belize is an innovative experiment in community-based ecotourism and conservation on private lands.

The CBS began as a community-based conservation program to protect the habitat of black howler monkeys. Over time, it moved into ecotourism activities to provide income to its participants. By 1996, over 4,000 visitors were arriving annually. More than 120 private landowners manage their land to ensure species conservation within the sanctuary, which works with the Belize Audubon Society and is supported by funding from the World Wildlife Fund-US.

The project has not been without difficulties, however. No local management body was formed at the outset, leading to recurring organizational problems, while the unequal distribution of tourist income has generated tension among community members. Nevertheless, CBS's example has encouraged other communities in Belize to become involved in ecotourism. The project has stimulated local pride and provided a mechanism for the community to engage in natural resource management decisions. It shows that rural communities have the capacity to participate in and manage conservation and ecotourism efforts if their needs and views are taken into account from the start.

Source: Horwich and Lyon 1998.

MBC goals was demonstrated in 1995 when a consortium of U.S. electric utilities funded a \$5.6 million carbon sequestration project in Belize's Rio Bravo Conservation and Management Area (Niiler 2000). A recent analysis indicates the MBC could provide the region with important opportunities to capture carbon sequestration investments. (See Box 11.) In Costa Rica, an environmental services fund financed by a gasoline tax pays landowners \$50 per hectare each year to restore forest on degraded lands. Efforts underway in the San José metropolitan water district to invest a portion of water fees in better watershed management practices by farmers and local communities provide further illustration of such an approach.

Steps by a variety of actors, however, are needed to promote biodiversity-friendly agriculture, tourism, and

forestry and to ensure that local populations receive an equitable share of the benefits. National and local governments can establish tax incentives, low-interest credits, and update regulatory processes to create a more level playing field for environmentally sustainable forms of agriculture, tourism, and forestry. National governments can establish user fees, visitor fees, stumpage fees, and mineral royalty payments to capture an equitable amount of the "rent" from the sale or use of publicly owned natural resources. A portion of these proceeds should be reinvested in the management of these resources. Research and training institutions, in partnership with agriculture, tourism, and natural resource agencies, can promote better extension programs for organic farming, ecotourism, and forest management. Such efforts can be targeted to strategic corridor areas. Local farmer, tourism, forestry, business, and campesino associations can network successful pioneering individuals with those who desire entry into growing markets for sustainably produced environmental products and services. International conservation organizations can help build markets in North America, Europe, and elsewhere for sustainably produced Mesoamerican products. They can also help reform trade laws to enable these products to compete fairly in their home countries.

The following questions may be useful in assessing options for capturing benefits from natural resources to help build the MBC:

- *Which natural resources are economically important (or potentially so) in your area?*
- *Who owns and who uses those resources?*
- *If the government owns the resources, how much revenue does it receive for their use?*
- *What portion of user fees, visitor fees, stumpage fees, mineral royalties, and other payments are reinvested in natural resource management?*
- *Are extension services available to help farmers and landowners adopt sustainable agricultural and forest management practices?*
- *How does the area market its potential for organic agriculture, ecotourism, and sustainable forestry?*
- *What government policies hinder sustainable agriculture, tourism, and forest practices?*

- *What market conditions limit investment in sustainable natural resource production?*

Harmonizing Institutional and Legal Frameworks and Promoting Intersectoral Cooperation

As presently conceived, the MBC is one of the most ambitious conservation and sustainable development strategies in the world. As such, building the MBC is clearly a cross-sectoral challenge that will require not only the cooperation of all government agencies whose interests and roles are affected by the MBC, but a fundamental transformation in their institutional structures and legal frameworks.

At present, existing regional and national institutions for conservation and natural resource management are poorly adapted to carry out the new roles the MBC will require as they are not cross-sectoral in their approach, lack clarity in their mandates, and frequently lack the power or authority needed to make decisions. As a result, their efforts are dispersed, duplicated, or conflict with other bodies' legal mandates and provisions, creating constant jurisdictional conflicts (Chang et al. 1996; Earth Council et al. 1997; Segura et al. 1997; CCAD 1998a, 1999). For example, in the Petén, the National Council on Protected Areas (CONAP) and the Ministry of Energy and Mines produced policies that designate the same lands for conservation and petroleum extraction (Ponciano 1998:108). Neither the policy for petroleum concessions nor the conservation policy have successfully reconciled these opposing goals, and no government entity has been granted enough authority to negotiate a solution. In Costa Rica, the Forestry Law and the Law of Multiple Land Titling³² outline procedures for coordination between the Institute for Agrarian Development (IDA) and the Ministry of Natural Resources, Energy and Minerals (MIRENEM)³³ in granting land titles to campesinos and establishing forest reserves (Johnston and Lorraine 1994). Despite the existence of this legal framework, IDA has granted land titles in protected areas without Forestry Department approval. Mistrust and competition for financial resources and power among agencies at local, national, and regional levels threaten to undermine cooperation, compliance, and accountability in MBC implementation.

The more powerful ministries and public agencies, such as those of land reform, agriculture, trade, and transportation, can easily frustrate the attempts of environmental ministries to build the MBC. A transportation ministry, for example, decides where to route a new highway. If it is not engaged in the MBC plan-

Box 11. Potential for Carbon Sequestration in the MBC

Owing to its large potential size and extensive forest area, the Mesoamerican Biological Corridor plays an important role in the sequestration of carbon dioxide and the mitigation of global climate change. According to a study conducted by the *Programa Ambiental Regional para Centroamérica/Central American Protected Areas System (PROARCA/CAPAS)*, it is estimated that the more than 20 million hectares of the MBC has stored 5,721 million tons of carbon dioxide. They go on to note that the MBC has the potential capacity to capture approximately 32 million tons of carbon dioxide per year, if forest cover is restored in areas that have been heavily harvested.

In the Multiple-Use Zone of the Maya Biosphere Reserve, five community forestry concessions were evaluated for their potential to reduce emissions of greenhouse gases. The study determined that the 115,703 hectares of forest in the concessions were responsible for capturing 8.7 million metric tons of carbon, an ecosystem service estimated at more than \$63 million.¹ In addition to the carbon currently captured in the area, proper forest management by the concessions could reduce future carbon emissions by 716,061 metric tons over the next 25 years. Community forestry concessions in the Maya Biosphere Reserve supply a valuable ecosystem service while at the same time providing an income to their residents, and the opportunity for participation and self-management of natural resources.

The CCAD has supported the creation of projects involving renewable energy and carbon sequestration—activities that can help mitigate global climate change. These projects will also offer, in the very near future, economic resources for promoting sustainable development in Central America.

Sources: PROARCA/CAPAS 2000, Tattenbach et al. 2000

¹Based on a market value of \$7.31 per metric ton of carbon.

ning process, and neither its legal mandate nor its policies support MBC goals, it is unlikely that it will integrate the location of proposed corridors or Buffer Zones into its plans.

Regional, national, and local agencies need to establish organizational structures and management styles that

can pursue the full range of social, economic, and conservation objectives envisioned for the MBC. The MBC provides an opportunity for the region to rethink the relationship between government and civil society organizations, and to reform the existing agencies' sectoral responsibilities to align them with MBC goals. From granting legitimacy to emerging governance structures within the non-state sector, to developing investment, financing, and accountability mechanisms for MBC planning and implementation, the challenge for Mesoamerican societies is to redesign and harmonize current institutional and legal frameworks in ways that will enable policies to be consistent and unified.

The MBC needs to bring together the authorities responsible for natural resources, environment, agriculture, transportation and public works, tourism, forestry, and economic planning because each of these agencies has knowledge, skills, and authority essential for building the initiative. An intersectoral approach toward horizontal cooperation and collaborative problem solving is vital. For example, the transportation ministry can design bridges, culverts, and tunnel passages to facilitate the movement of fish and wildlife across roadways that otherwise isolate populations. Likewise, the agriculture ministry and extension programs can target their resources to promote shade-grown organic coffee in areas that are priority landscape linkages between protected areas. Water and energy agencies may be able to supply MBC planners with vital expertise in hydrology to help design corridors that not only maintain biodiversity but also protect water supplies. No sector acting in isolation can successfully build the MBC. Ultimately, its success will depend on the strength of commitments made by non-environmental agencies.

Partnerships and alliances among public authorities are also important to facilitate the protection, management, and regulation of transnational ecosystems. (See Box 12.) The MBC consists of species, land, and water resources that traverse political boundaries, which means that governments must work collaboratively to protect their common natural heritage.

Strategies for harmonizing the legal and institutional frameworks for intersectoral cooperation will vary significantly from one location to another. One strategy is to look for opportunities to exchange information, identify common interests and potential conflicts, and plan collaborative efforts at a sub-national level. The regional conservation areas designated in Costa Rica, Guatemala, and Nicaragua are perhaps the ideal scale at which to promote intersectoral collaboration. At this

scale, the issues, opportunities, and problems are more specific than they are at national level. Also, decentralization trends have already transferred many of the relevant authorities to the sub-national level. A public, annual, interagency workshop to review MBC progress and plans could help to build intersectoral cooperation.

The following questions may be useful in assessing options for harmonizing legal and institutional frameworks to implement the MBC:

- *What non-environmental agencies and policies (for instance, agriculture, mining, energy, transportation, and public works) are most relevant to building the MBC?*
- *How can each agency's legal mandate, responsibilities, and functions be harmonized with the requirements of MBC implementation, compliance, and monitoring?*
- *Are there overlapping sub-national administrative regions that could be useful for organizing interagency collaboration to build the MBC?*
- *What incentives might bring other government and nongovernmental actors to the planning table?*
- *What private sector organizations could contribute to the MBC? What are their potential interests in the MBC?*
- *How active are non-environmental agencies in MBC planning? How active are private sector organizations?*

Setting Investment and Management Priorities

Governments, donor agencies, and non-governmental organizations have begun to make major financial commitments to develop the Mesoamerican Biological Corridor. Already, governments in the United States and Europe, private foundations, and international development agencies have made commitments estimated at anywhere from \$85 million to \$600 million, while governments in the region have assigned additional human, technical, and financial resources (Burnett 1998; WRI field interviews, 2000, 2001). By any measure, this is an impressive commitment to conservation and sustainable development. Still, the challenge remains: how to invest these resources wisely. Many of the commitments have been made at regional and national scales. The challenge now is to translate those commitments into site-specific actions that move the MBC forward on the ground. Which ecosystems are most threatened? What private sector incentives are most needed? What investments would create the most social benefits? These are just a few of the questions that

Box 12. A Trinational Effort to Conserve Coastal Resources in the Gulf of Honduras

The Gulf of Honduras, off the Caribbean coasts of Honduras, Guatemala, and Belize, contains a great variety of coastal and marine habitats and supports high levels of biodiversity and marine productivity. The gulf is home to the Caribbean's largest manatee population, totaling 300 to 700 individuals, sustains the largest stand of mangroves in all of Belize and coastal Guatemala, and includes the Belize Barrier Reef, which was classified as a World Heritage Site in 1996. The high productivity level of the gulf and its surrounding coastal habitat enables a variety of economic activities, including commercial and sport fishing, banana cultivation, industrial shipping, and ecotourism. The coast's inhabitants are largely of the Garifuna ethnic group, whose occupation of the area predates the establishment of national boundaries.

The Gulf of Honduras is experiencing a general decline in the health of its natural resources, including declining water quality, diminishing commercial fish stocks, and waning manatee populations. Effective international coordination is needed to ensure sustainable management of coastal and marine resources, promote environmentally sound economic development, deal with transnational migration of commercially exploited species, address cross-national contributions to degrading water quality, and handle overlapping responsibilities of various

government actors within each country. In spite of existing legislation and enforcement authorities, the ability of all three countries to enforce regulations effectively is limited by scarce resources, lack of institutional coordination, and conflicts over use-rights in the gulf due to overlapping Exclusive Economic Zones (EEZ) in the territorial waters of the three countries.

Despite these limitations, the governments of Belize, Guatemala and Honduras do share strong commitments to developing and managing multiple-use coastal and marine protected areas, which will promote ecotourism development, environmental protection and monitoring, fisheries management, and marine environmental education. With technical and institutional support from PROARCA/Costas¹ and various local NGOs, the goal of these governments is to establish a trinational system of coastal and marine protected areas to serve both environmental protection and sustainable development objectives.

Source: PROARCA/Costas 1996.

¹PROARCA/Costas is addressing transboundary coastal and marine issues at a variety of additional sites throughout Central America, including the Gulf of Fonseca, the Miskito Coast, and the Gandoca/Bocas del Toro region.

must be resolved in light of local needs and circumstances.

A number of general considerations could help orient the use of resources in the most effective manner. For example, MBC commitments thus far appear to be heavily biased toward terrestrial areas. Yet, coastal and marine habitats are vital to biodiversity and human livelihoods in Mesoamerica. The Costas project funded by USAID and the Mesoamerican Barrier Reef project are helping to integrate coastal ecosystems into the MBC. Other needs and opportunities to integrate coastal and marine areas into the MBC should be considered.

Another important issue is the balance and timing of investments in protected areas as against those directed at new corridor regions. Today, there are over 700 declared and proposed protected areas in Mesoamerica (WCMC 2000). This raises the question of whether enough resources are being targeted up front to safe-

guard the protected areas and wildlands that are the keystones for the MBC.

One issue that will also be vital to orienting resources for the MBC is determining the appropriate mix of direct financial investments, policy development and reforms, and targeted incentive and subsidy programs. For example, creating new incentives for biodiversity-friendly crops like organic shade-grown coffee and cacao is sometimes characterized as necessary for corridor development. However, it may be more effective to eliminate existing subsidies for crops incompatible with biodiversity maintenance, like sugar and cattle, or to shift these subsidies toward biodiversity-friendly crops and land uses. (*See Box 13.*) Another important issue is the role of investments in the public versus the private sector. Should direct investments be targeted primarily at improving public sector resources, such as staff and basic facilities, while policy reforms, tax incentives, and targeted investments in demonstration projects become the principal tools for

Box 13. Environmental Services and Cattle Subsidies in Costa Rica

In 1996, an environmental service payments program was initiated by the Costa Rican government to provide forest owners with monetary incentives not to fell trees. Initially, the program was considered to be a model for successful forest management and conservation and is being replicated in other Latin American countries, such as Guatemala, Nicaragua, and Paraguay. Low earnings from ranching, combined with government subsidies to landowners who allowed their fields to revert to forestland, convinced many ranchers to agree to reforestation quotas and participate in the program.

However, the environmental service payments program is now in danger of collapse. Forestry groups are blaming the threatened future of the program on the Costa Rican government's failure to invest revenues from a fuel tax into the program, as required by law. They claim that the government has been investing only 40 percent of the total funds earmarked for the program, which has severely limited its effectiveness. The president of the Costa Rican Forestry Chamber noted that while almost 235,000 hectares of private forests have been incorporated into conservation and management programs since 1996, forest owners, representing an additional 500,000 hectares of forest, have expressed interest in participating in the program. If the Costa Rican government had been investing the stipulated funds all along, these demands could have been met, allowing a greater proportion of the country's forests to benefit from improved management and conservation practices.

Sources: Dulude 2000, Kaimowitz 2000.

encouraging greater private sector participation in the MBC?

A substantial proportion of the resources committed to the MBC will be used to build human and institutional capacity to develop this initiative. There is no doubt that these investments are much needed, but what capacities are needed most? Developing the MBC will

require skills and capacities in fields ranging from the basic biological, social, and economic sciences through to practical fieldwork, policy analysis, business management, conflict management, community organization, and rural extension.

All of these skills are relevant, but the exact mix necessary will vary by location and will depend on the stage of the MBC's development. An important step is to develop a capacity assessment. Such an assessment could take place once a basic MBC plan or strategy has been developed. It would identify skills needed to implement key elements of the strategy, assess where those skills already exist and how they can be harnessed, and propose how new ones could be developed. However, building capacity is neither cheap nor quick. For example, to bolster Costa Rica's limited capacity in taxonomy, local people were provided with basic training and employed by the National Biodiversity Institute (INBio) to help inventory the country's biotic wealth. The program found that it cost more than \$50,000 to train, employ, and support each parataxonomist over ten years (Janzen et al. 1993). Clearly, investments in capacity building must be chosen carefully in response to the most pressing needs.

Ultimately, prioritizing resource use to build the MBC will take into account local needs and opportunities. The following questions may be useful in assessing options for targeting resources to where they are needed most:

- *Have ecological, social, and project priorities for the MBC been identified in your area? Are they being used to direct financial, human, and other resources?*
- *Are there obvious gaps in current investments in the MBC (for instance, coastal areas, protected areas, or community extension)? Are there plans to address these gaps? If not, how can they be addressed?*
- *Are policy reforms, such as shifting subsidies from biodiversity-unfriendly to biodiversity-friendly crops in corridor areas, being considered in addition to direct financial investments?*
- *What additional human and institutional capacities are most needed in your area to implement the MBC?*

IV. Conclusions

The MBC is a visionary effort to safeguard one of the world's biodiversity hotspots while meeting the social and economic needs of the region's people. Although governments and donors have made important financial and political commitments to the initiative, public awareness, local support, and broad public and private agency involvement remain quite limited. Among people and institutions that are aware of the MBC, there are often different and sometimes conflicting expectations about its goals and objectives and how to proceed with implementation. This reflects very real differences in values and opinions as well as a lack of understanding about the conservation, social, and economic roles of the MBC. The MBC now stands at a critical threshold between concept and reality. Its vision will not be realized unless most of the region's people understand the MBC's purpose and commit to its goals and objectives.

The ability to build trust and confidence among various stakeholders of the MBC will, in the end, determine its fate. Identifying and employing strategies that build such conviction should be a major goal of early implementation efforts. These efforts should assure people that the MBC will improve their livelihoods while preserving the region's biological richness. Initial actions taken to address local and national social and economic priorities should provide incentives for residents to participate actively in the design and management of the MBC. In addition, early measures to address important conservation priorities should reassure conservationists that the MBC will yield long-term benefits for biodiversity. Giving broadly equivalent attention to social, economic, and conservation priorities in the early stages of implementation will build public support for addressing more complicated issues later on. Even so, frequent negotiation and conflict management between stakeholders and project proponents will be essential. Out of this dynamic process, a more broadly shared vision of the initiative may emerge, which can both inform general strategy and prioritize particular activities.

A deliberate, place-based effort to engage stakeholders may be a key step toward establishing confidence and trust in the MBC. One approach would be for each of the Mesoamerican countries to develop a pilot participatory action plan. Goals of such a plan would include establishing a widely supported MBC action plan for each area, and developing skills in MBC planning and implementation. Expertise gained through this action plan can be shared among countries and used to promote planning and implementation of corridor projects in other parts of each country. Adoption of this strategy could include three major steps:

First, a draft framework could be designed that would help guide the countries as they establish their pilot participatory action plans. This framework might be developed by the CCAD's MBC Regional Office Coordinating Unit and its team of national liaisons, in collaboration with regional institutions such as CATIE, IUCN-Mesoamerica, the University for Peace, the Pan-American School El Zamorano, and international organizations such as WWF, the Nature Conservancy, and the World Bank. The framework would include options or questions that each country might consider for dealing with planning and implementation issues in the pilot area. It would also contain information and tools to help the countries address those issues. For example, it might include methodologies for promoting dialogue and discussion among stakeholder groups; participatory strategies for identifying social needs; data sets on ecological, social, and economic features of the pilot areas; candidate criteria for identifying Corridor, Buffer, and Multiple-Use Zones; maps showing biodiversity, carbon, and other environmental service values; and summaries of the biodiversity impacts of different crops and cropping patterns. The framework would be a checklist of issues and options, accompanied by a set of tools and data to help each country orient its pilot implementation plan. Each country could adapt the framework to its local circumstances. Countries would be encouraged to track and explain

their changes to the framework and identify which parts were of greatest and least use.

Second, each country would select a proposed corridor pilot site where the government and stakeholder groups could develop a participatory action plan for the MBC. This process would enable proponents of the MBC to test and evaluate options for moving forward with implementation. Issues addressed in developing the participatory action plan would be similar to those identified in the previous section. These include public participation; accessing and sharing information and stewardship for the resources; refining criteria for corridors, Buffer and Multiple-Use Zones; addressing tenure issues; generating and distributing economic benefits; promoting intersectoral cooperation; and establishing investment and management priorities. The order in which issues would be addressed and the effort devoted to each would vary between pilot areas according to local circumstances.

Third, after each country has implemented its pilot participatory action plan, the countries would meet to compare experiences. This comparison will help planners and decision-makers to understand the complex interactions and tradeoffs that will occur in different settings as the MBC moves toward implemen-

tation. Based on the pilot experiences, the draft framework would be revised by CCAD and the regional institutions. Each country would then be able to adopt and adapt the planning framework to develop corridor action plans in other parts of the country.

While pilot projects are one option to begin the process of long-term development and implementation of the MBC, there are surely others. Participants and stakeholders should be encouraged to continue undertaking further analysis of the challenges facing implementation. It is vital that MBC planners and decision-makers take into account the different strategies required for each setting.

Regardless of how they choose to build trust and confidence, no challenge is more urgent for governments and other proponents of the MBC. Lack of trust and understanding can slow implementation of the MBC just as surely as can a shortage of money or personnel. The best way to forestall this danger is to use a participatory approach to planning and implementation of the MBC, and to modify the approach as appropriate for each particular setting. In this manner, the MBC can become a central mechanism for achieving Mesoamerica's long-term development and conservation goals.

About the Authors

Dr. Kenton Miller is WRI's Vice President for International Development and Conservation. His work at WRI has included extensive analysis of biodiversity and bioregional management around the world and he led the international team that formulated the Global Biodiversity Strategy. He holds degrees in Forest Management from the University of Washington and a Ph.D. in Forest Economics from State University of New York, Syracuse.

Ms. Elsa Chang is Senior Associate and Director of the Mesoamerican Biological Corridor project in WRI's Biological Resources Program. Formerly a

Mesoamerican archaeologist, she holds an MA in International Development Policy from the Sanford Institute of Public Policy at Duke University.

Mr. Nels Johnson is Deputy Director of WRI's Biological Resources Program. His research over the last decade has concentrated on sustainable forest management and biodiversity conservation in Asia, the Caribbean, and the United States. Mr. Johnson received a BA in Biology from Reed College and a Master of Forest Science from Yale's School of Forestry and Environmental Studies.

Annex 1. Highlights of a Decade of Central American Environmental Achievements and the Evolution of the MBC Initiative

- 1989** – The Central American Commission on Environment and Development (*Comisión Centroamericana de Ambiente y Desarrollo*, CCAD) is established as a regional inter-governmental mechanism to promote cooperation and coordination of environmental policies and actions, protect the environment, manage and conserve natural resources, and control pollution by member countries
- 1990-91** – The Tropical Forestry Action Plan for Central America (TFAP-CA) is developed to address deforestation and provide guidelines for forestry concessions and policies
- 1992** – The Central American Agenda for Environment and Development is prepared and presented at the UNCED—this represented the first consensus-based regional position statement that encourages sustainability
 – Governments sign the Central American Convention on Biodiversity and Protected Areas, thus creating under the CCAD, the Central American Council for the Protected Areas (CCAP)
 – Governments sign the Central American Convention for the Management and Conservation of Natural Forest Ecosystems and the Development of Forest Plantations
- 1993** – The ratification of the Forest convention creates the Central American Council on Forests (CCAB) to bring together the region's national forest service directors and TFAP national coordinators
 – The Central American Integration System (SICA) begins operation as the new regional institutional structure and framework for decision-making and implementation of regional commitments for peace, democracy, socioeconomic development, and the environment
- 1994** – The regional wildlands conservation project, Path of the Panther (*Paseo Pantera*), is launched to establish natural biological corridors along the Caribbean coast
 – The Central American Alliance for Sustainable Development (ALIDES) is established as the regional agenda for global economic cooperation and development, social equity, environmental protection, and conservation of natural resources—to strengthen the Central American Protected Areas System (SICAP), through the establishment of the Central American Biological Corridor. Therefore, the CCAD is assigned to oversee and take the lead in implementing the Corridor Initiative
- 1995-96** – The Mexican government joins the CCAD in a pledge to establish the Mesoamerican Biological Corridor
 – CCAD with support of GTZ and GEF conducts a planning phase for a regional project to implement the MBC
 – Technical assessments are conducted at the National level
- 1997** – The heads-of-state of Central America endorse the establishment of the MBC through the strengthening of SICAP, as a regional priority for conservation and sustainable development
 – The governments of Mexico, Belize, Guatemala, and Honduras sign the Tulum Declaration, which establishes a commitment to conserve and manage the Mesoamerican Caribbean Reef System in a sustainable manner
- 1998** – CCAD finalizes a proposal for a regional project entitled, "Program for the Consolidation of the Mesoamerican Biological Corridor," which is submitted to UNDP/GEF-GTZ
 – CICAFOC (*Coordinadora Indígena y Campesina de Agroforestería Comunitaria Centroamericana*), a regional coordinating body for indigenous and farmers' associations formulates a unified position asserting their role and envisioning the MBC as an option for local sustainable development for indigenous peoples, blacks, and farmers
- 1999** – The CCAD's regional Project for the MBC is approved and funded by the UNDP/GEF-GTZ; National Technical Liaisons are hired and offices are created
- 2000** – A CCAD-UNDP/GEF-GTZ Regional Coordinating Office for the MBC Project is established in Nicaragua

Sources: WRI 1995; Page and Schwarz 1996; Earth Council et al. 1997; CCAD 1998a, 1998b, 1998c, 2000a, 2000b; CICAFOC 1998, 1999.

Notes

1. The mean GNP per capita of the region is US\$1,900, which has grown very little during the past decade (INEGI 1997, 2000; World Bank 2000). A large proportion of the region's population (40 percent) lack access to basic health care services (CCAD 1998a). Most of the reported disease cases (80 percent) are water-borne, many of which are easily preventable given access to clean water (CCAD 1998a). Illiteracy in the region is relatively high by world standards—21 percent for women and 17 percent for men (WRI 2000). The rate is higher still for older age cohorts.
2. Income from agriculture represents 16 percent of GDP in the region, and an average of 27 percent of Central America's workforce was employed in the formal agricultural sector between 1990 and 1996 (Inter-American Development Bank 2000, World Bank 2000). More than one fifth of Mesoamericans live in coastal areas where fishing is an important or sole source of income and livelihood, worth at least US\$750 million annually (CCAD 1998a). Fuelwood remains an important source of energy in Mesoamerica—an estimated 92 percent of wood production in the region is for fuelwood (CCAD 1998a).
3. This figure represents the deforestation rate in Central America. It does not include data from Mexico.
4. A study in Costa Rica has estimated the economic value of environmental services provided by its forest ecosystems (including conservation of water quality and biodiversity, and carbon sequestration) to be between US\$29 and \$87 per hectare per year for primary forest, and between US\$20.88 and \$62.64 for secondary forests. This translates to an annual economic value for Costa Rican forests of between US\$17.8 and \$87.6 million (Carranza et al. 1996).
5. The CCAD is the regional intergovernmental forum of the seven Central American ministers of environment and natural resources. Mexico participates in this forum as an observer. CCAD's Executive Secretariat is housed in the General Directorate for the Environment (DGMA) within the General Secretariat of the Central American Integration System (SICA) in El Salvador. CCAD promotes cooperation and coordination of policies and actions by member countries to protect the environment, manage and conserve natural resources, and control pollution.
6. These included the Convention on Biodiversity and the Convention for the Management and Conservation of Natural Forest Ecosystems and the Development of Forest Plantations. Along with the establishment of these regional treaties, a set of new institutions were created under the CCAD framework, including the Central American Council on Forests (CCAB) and the Central American Council for Protected Areas (CCAP).
7. The signing of ALIDES provided a framework for international cooperation for Central America. Countries in the region sought financial and technical assistance from multilateral and bilateral agencies (USAID, World Bank, CIDA, and others) to implement conservation and environmental protection projects.
8. The term "initiative" is used in this document to refer to the Mesoamerican Biological Corridor as a range of activities carried out at regional, national, and local levels to establish corridors for the conservation of biodiversity and improvement of socioeconomic conditions.
9. The Wildlife Conservation Society (WCS) and Caribbean Conservation Corporation (CCC) with financial support from the USAID.
10. Originally, ALIDES endorsed the Central American Biological Corridor. However, after the region's heads-of-state met with the Mexican government at the Tuxtla II negotiations, they agreed to incorporate the five states of southern Mexico within the initiative, now known as the Mesoamerican Biological Corridor (McCarthy et al. 1997).
11. We refer to the activities of the GEF and GTZ funded regional CCAD MBC project office and the technical liaisons as "the Program."
12. The primary roles of the ROCU are: program coordination and strategic planning, resource mobilization, information and monitoring on biodiversity, education and citizen participation, training and capacity building efforts, communication and outreach, and legal framework and policy harmonization.

13. This is a separate initiative endorsed by the heads-of-state of Mexico, Belize, Guatemala, and Honduras in Quintana Roo, Mexico on June 5, 1997 under the Tulum Declaration. The endorsement pledges the inclusion of wetlands and coastal and marine management and conservation in the MBC (CCAD 1998d, PROARCA/COSTAS 1999).
14. A bioregion is “a geographic space that contains one whole or several nested ecosystems. It is characterized by its landforms, vegetative cover, human culture, and history, as identified by local communities, governments, and scientists” (Miller 1996).
15. There has, however, been active debate about the conservation benefits of corridors. Some critics have raised concerns about their potential role as a vector of disease, invasive species, and other disturbances, and their cost relative to other conservation options such as creating new protected areas (Simberloff et al. 1992, Bonner 1994).
16. For example, in the early 1980s, cattle pastures cleared from the forest threatened to surround the La Selva Biological Station in Costa Rica’s Atlantic lowlands, a biologically rich but relatively small area, world famous as a research and educational reserve. Some species, such as the Jaguar (*Panthera onca*), Emerald Toucanet (*Aulacorhynchus prasinus*), Bare-throated Umbrella Bird (*Cephalopterus glabricollis*), Green Hermit (*Phaethrinis guy*), and Silver-throated Tanager (*Tangara icterocephala*) regularly move between the reserve and Braulio Carrillo National Park nearly 30 km. away. Researchers estimated that more than 90 species of birds would eventually disappear from La Selva if the reserve were totally isolated (Pringle et al. 1984). To safeguard the biodiversity at the research station, a corridor of primary forest and restored secondary forest was established joining La Selva and Braulio Carrillo in the late 1980s.
17. For example, the endangered Resplendent Quetzal (*Pharomachrus mocinno*) breeds in the montane forests of Costa Rica’s Monteverde Cloud Forest Preserve. The birds, however, spend half of the year feeding in remnant lower elevation forest habitats on the Pacific and Atlantic slopes below the Monteverde Preserve. Because almost all the surrounding lands are privately owned dairy farms, a contiguous corridor is not possible. Instead, efforts are focusing on developing a patchwork of interconnected forest fragments along streams and steep slopes that together can function as a system of suitable habitat for the Quetzal (Powell and Bjork 1995).
18. The regional heads-of-state recognized these zones when they endorsed the MBC in 1997 (*XIX Reunión Ordinaria de Presidentes Centroamericanos*, Julio 1997).
19. A protected area is “an area of land and/or sea especially dedicated to the protection of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means” (IUCN 1994).
20. The term “corridor” is used throughout this discussion in order to maintain consistency with the terminology adopted by the MBC initiative. However, from a biological perspective, the pertinent issue is the “connectivity” of a landscape—the extent to which it supports or inhibits movement between suitable habitats—rather than the specific form of connecting habitat. A high level of connectivity can be achieved through the use of a variety of formats, including corridors, stepping stones, and habitat mosaics (Bennett 1999).
21. Some transportation corridors, such as the Braulio Carrillo Parkway in Costa Rica, are characterized by the maintenance of their scenic values, and other development corridors may include some natural elements, such as greenways, gardens, urban forestry, and animal underpasses.
22. A palm of the genus *Chamadorea*, native to Central America that is exported and used locally in floral arrangements.
23. The Maya Forest constitutes one of the last large blocks of tropical forest remaining in North and Central America. It stretches from the Mexican state of Chiapas across northern Guatemala into the southern Yucatan Peninsula, and across Belize. The region is rich in biological resources and archaeological sites.
24. Constitutions in Central America generally specify that the municipal government is autonomous, both financially and politically, leading mayors to press strongly for increased revenues and control over resources. National associations of Municipalities in El Salvador, Honduras, and Nicaragua, have played pivotal roles in getting municipal interests onto the legislative agenda in their respective countries (USAID 1999). Together with their regional federation, FEMICA—the Federation of Central American Municipalities—these associations have continued to fight for decentralized power by coordinating actions and policies to strengthen municipal autonomy and gain independence from national party politics. FEMICA was created in 1991 and consists of all six National Municipal Associations (it excludes Belize), which represent a total of 1,185 local municipal governments.
25. Most municipal governments devote the majority of their budget and attention to urban issues—sanitation, garbage collection, improvement of water systems, and building infrastructure—their demands for policy reform and municipal autonomy, therefore, have been limited to decisions over these issues, rather than those regarding forestry concessions, biodiversity conservation, or watershed management.

26. Municipalities are able to set and adjust user fees but may be unable to levy their own taxes and raise their own revenues. In addition, in most countries in the region, the current system for budgeting, accounting, and reporting of municipal revenues and expenditures is deficient and does not comply with international standards for financial management (USAID 1999).
27. Relevant precedents cited in ILRC 1999 include the Constitution of Nicaragua (1987), Articles 49, 89, 180, 181; *Estatuto de Autonomía de las Regiones de la Costa Atlántica de Nicaragua*, Law No. 28 (7 September 1987); and *Panamá: Sobre el Regimen Especial de la Comarca Kuna Yala*, Articles 3, 11, 12, 20.
28. Such as (ALIDES) and the CONCAUSA agreement signed between the United States and the Central American governments in the Summit of the Americas in 1994, and later at a similar regional event in 1996 in Santa Cruz, Bolivia. The countries of the region agreed upon the establishment of a country-level information clearing-house and an environmental information system (CCAD 1994, Corrales 2000).
29. The term *ejido* refers to collective or communal land mostly used for agriculture. In Mexico, an *ejido* property regime was established following the Revolution in 1910. It takes the form of a land grant administered by a group of individuals called *ejidatarios*, who hold usufruct rights to their *ejido* accorded to them by the Mexican federal government (Ericson et al. 1999). At least 80 percent of forestlands in Mexico are community-owned (Santos et al. 1998). In Guatemala, these collective lands—established during colonial times as a way to control the distribution of indigenous populations and collect taxes—are similarly used by a community, but are administered under municipal provisions and bylaws, therefore they are more commonly known as *ejidos municipales* (Eliás 1997a).
30. Research conducted by Ostrom and other scholars suggest that common property regimes can be an appropriate institutional arrangement for the effective management of forest resources. They point out that this type of tenure seems to work best in areas with low migratory pressures, where there is a reduced disparity in wealth and a strong social organization, and when such administrative arrangements reaffirm long-standing customary rights of access and forest use by local communities (Jaramillo and Kelly 1997).
31. Titles over the lands were granted to these groups by the Spaniards during colonial times, but the titles are more significant in their historical value than in their ability to act as legal guarantees of land rights (Eliás 1997a, Reyes 1998).
32. The 1994 Law of Multiple Land Titling (#5064) was declared unconstitutional by the Supreme Court of Costa Rica. Due to this change, all issues relating to multiple land titling now fall under the Law of Land Titling in National Reserves (#7599) (Lenin Corrales, personal communication, May 2001).
33. Currently, the Ministry of Environment and Energy (MINAE).

References

- Amillien, Caroline, Carlos M. Chacón, Rolando Castro, Stephen Mack, y Andrea Meza. 1998. "Mecanismos Legales para la Conservación de Tierras Privadas en América Central," en *Conservación de Tierras Privadas en América Central*. Carlos Chacón y Rolando Castro, eds. Pp. 19-52. San José, Costa Rica: CEDARENA.
- Ascher, William. 1995. *Communities and Sustainable Forestry in Developing Countries*. San Francisco, CA: Institute for Contemporary Studies.
- Barbault, R, and S.D. Sastrapradja. 1995. "Section 4: Generation, maintenance, and loss of biodiversity," in *Global Biodiversity Assessment*. V.H. Heywood, ed. United Nations Environment Programme, Nairobi, and Cambridge University Press, Cambridge.
- Barraclough, Solon and Daniel Moss. 1999. *Toward Greater Food Security in Central America Following Hurricane Mitch: Rethinking Sustainable Rural Development Priorities*. Washington, DC: Oxfam America.
- Bennett, Andrew F. 1990. "Habitat Corridors and the Conservation of Small Mammals in a Fragmented Forest Environment." *Landscape Ecology* 4: 109-122.
- Bennett, Andrew F. 1999. *Linkages in the Landscape: The Role of Corridors and Connectivity in Wildlife Conservation*. Gland, Switzerland: IUCN.
- Bonner, J. 1994. "Wildlife's Road to Nowhere?" *New Scientist* 143 (1939): 30-40.
- Borrini-Feyerabend, Grazia, M. Taghi Farvar, Jean Claude Nguingiri, and Vincent Ndangang. 2000. *Co-management of Natural Resources: Organising, Negotiating and Learning-by-Doing*. GTZ and IUCN, Kasperek Verlag, Heidelberg, Germany.
- Bryant, Dirk, Daniel Nielsen and Laura Tangle. 1997. "The Last Frontier Forests." *Issues in Science and Technology* 14:85-7.
- Bunch, Roland, and Gabino López. 1994. "Soil Recuperation in Central America: Measuring the Impact Three to Forty Years after Intervention." Paper presented at the International Institute for Environment and Development's International Policy Workshop. Bangalore, India, November-December 1994.
- Burke, Laretta, Yumiko Kura, Ken Kassem, Mark Spalding, and Carmen Revenga. 2000. *The Pilot Analysis of Global Ecosystems: Coastal Ecosystems*. Washington, DC: WRI.
- Burnett, J. 1998. "After the Wars: Protecting Central America's Environment." Online at: <http://www2.planeta.com/mader/planeta/0898>.
- Caddy, Emma, Gregorio Ch'oc, and Shaun Paul. 2000. "Case Study of the Sarstoon-Temash National Park." Unpublished paper. Boston: Ecologic Development Fund. Online at: <http://www.ecologic.org/sarstoon.htm>.
- Carr, Margaret H., J. David Lambert, y Paul D. Zwick. 1994. *Mapeo de la Potencialidad de un Corredor Biológico Continuo en América Central/Mapping of Continuous Biological Corridor Potential in Central America*. Final Report, Paseo Pantera. Florida: University of Florida.
- Carranza, Carlos Francisco, Bruce A. Aylward, Jaime Echeverría, Joseph A. Tosi, y Ronald Mejías. 1996. *Valoración de los Servicios Ambientales de los Bosques de Costa Rica*. Centro Científico Tropical, San José, Costa Rica. 1 de Agosto de 1996.
- Castañeda, Anselmo. 1996. *The Belize National Report on the Mesoamerican Biological Corridor Project*. Proyecto Sistema Regional Mesoamericano de Areas Protegidas, Zonas de Amortiguamiento y Corredores Biológicos. RLA/95/G41. Belmopán, Belize: PNUD.
- Centro Agronómico Tropical de Investigación y Enseñanza/ Unión Mundial para la Naturaleza (CATIE/IUCN). 1997. *Directorio de Estudios Ambientales en América Central. Serie Bibliotecología y Documentación*. Directorios No.2. Turrialba, Costa Rica: CATIE/IUCN.

- Centro Latinoamericano para la Competitividad y el Desarrollo Sostenible (INCAE/ CLACDS), Harvard Institute for International Development (HIID), y Secretaría General del Sistema de la Integración Centroamericana (SG-SICA). 1998. *Estrategia para la Reconstrucción y la Transformación de Centroamérica después del Huracán Mitch*. Propuesta para la preparación y seguimiento del Grupo Consultivo Regional. Washington, DC. 10-11 December 1998.
- Chacón, Carlos y Rolando Castro, eds. 1998. *Conservación de Tierras Privadas en America Central*. San José, Costa Rica: CEDARENA.
- Chang, Elsa, Alfonso González y Aarón Zazueta. 1996. *Hacia el Fortalecimiento del Marco Institucional de la Gestión Ambiental en Centroamérica*. Washington, DC: WRI.
- Chaves Q., Silvia E. y Mario Loría. 1998. "La Municipalidad de San Ramón y la Gestión Ambiental Descentralizada," en *Manejo Descentralizado y Colaborativo del Medio Ambiente en Centroamérica, Memoria del Encuentro*. Pp. 67-72. San José, Costa Rica. 20-22 abril 1998.
- Comisión Centroamericana de Ambiente y Desarrollo (CCAD). 1989. *Central American Agreement for the Protection of the Environment*. Signed at the Summit, San Isidro Coronado, Costa Rica. 10-12 December 1989.
- Comisión Centroamericana de Ambiente y Desarrollo (CCAD). 1993. *Plan de Acción Forestal Tropical para Centroamerica*. Convenio Regional para el Manejo y Conservación de los Ecosistemas Naturales Forestales y el Desarrollo de Plantaciones Forestales. Guatemala City, Guatemala: CCAD.
- Comisión Centroamericana de Ambiente y Desarrollo (CCAD). 1994. *Central American Alliance for Sustainable Development*. San José, Costa Rica: CCAD.
- Comisión Centroamericana de Ambiente y Desarrollo (CCAD). 1998a. *State of the Environment and Natural Resources in Central America 1998*. San José, Costa Rica: CCAD.
- Comisión Centroamericana de Ambiente y Desarrollo (CCAD). 1998b. *Programa Estratégico del Corredor Biológico Mesoamericano*. Micronoticias de Integración Ambiental. Guatemala: CCAD.
- Comisión Centroamericana de Ambiente y Desarrollo (CCAD). 1998c. *Incendios: Problemática y Perspectivas. Memoria de la Reunión Técnica*. San Pedro Sula, Honduras. 23-24 June 1998.
- Comisión Centroamericana de Ambiente y Desarrollo (CCAD). 1998d. *Taller de Expertos Legales de los Países Signatarios de la Declaración de Tulum, Respecto al Sistema Arrecifal del Caribe Mesoamericano (SAM)*. Edición Especial. Boletín Semanal No. 30/98. Julio, 1998.
- Comisión Centroamericana de Ambiente y Desarrollo (CCAD). 1999. *Documento de Proyecto, RLA/97/G31, Establecimiento de un Programa para la Consolidación del Corredor Biológico Mesoamericano*. Managua, Nicaragua: CCAD.
- Comisión Centroamericana de Ambiente y Desarrollo (CCAD). 2000a. *Plan Ambiental de la Región Centroamericana*. Dirección General del Medio Ambiente, Sistema para la Integración Centroamericana (DGMA-SICA). San Salvador, El Salvador: Ediciones Sanabria.
- Comisión Centroamericana de Ambiente y Desarrollo (CCAD). 2000b. *Programa para la Consolidación del Corredor Biológico Mesoamericano*. Managua, Nicaragua: CCAD.
- Comisión Centroamericana de Ambiente y Desarrollo (CCAD) – Programa Frontera Agrícola (PFA), European Union. 1998. *Atlas Centroamericano de Incendios: las Quemadas e Incendios de la Temporada 1998 en la Región Centroamericana*. Panamá: CCAD.
- Consejo Nacional de Areas Protegidas, Guatemala (CONAP). 1999a. *A un paso del Siglo XXI en la Reserva de la Biosfera Maya*. Guatemala: Serie Documentos Técnicos No. 04. Julio 1999.
- Consejo Nacional de Areas Protegidas, Guatemala (CONAP). 1999b. *Estado Actual de la Gestión y Avances 1999*. Memoria de Labores, Guatemala.
- Coordinadora Indígena Campesina de Agroforestería Comunitaria (CICAFOC). 1998. "Corredor Biológico Campesino e Indígena en América Central." Paper presented at the Donor Coordinating Meeting. Paris, France. 29-30 October 1998.
- Coordinadora Indígena Campesina de Agroforestería Comunitaria (CICAFOC). 1999. *Componente Social y Productivo del Corredor Biológico Mesoamericano*. San José, Costa Rica: CICAFOC.
- Corrales, Lenin. 2000. "Manejo de Datos e Información sobre Recursos Naturales en Centroamérica: un Análisis Piloto." Unpublished draft manuscript. Costa Rica.
- Corredor Biológico Mesoamericano- Sección Costa Rica (CBM-CR). 2000. *Puentes de Vida*. Organismo Informativo del Corredor Biológico Mesoamericano- Sección Costa Rica. CCAD/GTZ/PNUD/MINAE. Número 2, Abril 2000.

- Costanza, R., R. D'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Maem, R.V. O'Neil, J. Paureulo, R. Raskin, P. Sutton, and M. van den Belt. 1997. "The Value of the World's Ecosystem Services and Natural Capital." *Nature* 387: 253-260.
- Curre, Jochen, Bernadina Nixon, Maik Potthast, Rita Reinhardt, Stefan Schukat, y Anna Steinschen. 1999. *Posibilidades de Protección Sostenible de Areas Protegidas con la Participación de Etnias Indígenas- un Estudio de Caso de la Reserva de Biosfera BOSAWAS, Nicaragua*. Universidad Humboldt, Berlin.
- Dulude, Julie. 2000. "Pioneer Program in Peril." *Tico Times* 6(5). San José, Costa Rica.
- Durán de Jager, Patricia. 1997. "The Roles and Relationships of the Social Investment Funds, Local Governments and Communities in Central America." Central American Federation of Municipalities (FEMICA). Paper presented at the Inter American Development Bank workshop on Decentralization. May 1997. Online at: http://www.iadb.org/regions/re2/consulta.p/groups/decentralization_workshop_2htm.
- Earth Council, Central American Commission for Environment and Development (CCAD), Ministry of Tourism and Environment of Belize, Cooperation Foundation for Sustainable Development (Fundecooperación), Guatemalan Association for Research and Social Studies (ASIES), United Nations Development Programme (UNDP). 1997. *Regional Evaluation Report for Central America: Evaluation of Accomplishments of the Central American Commitments Acquired Within the Framework of Agenda 21 and the Central American Alliance for Sustainable Development Towards the Rio+5 Forum*. Belize City, Belize: 27-30 January 1997.
- Elías, Silvel. 1997a. *Bosques Comunales en Guatemala*. Cuadernos Chac. Guatemala: Facultad de Agronomía, Universidad de San Carlos.
- Elías, Silvel. 1997b. *Autogestión Comunitaria de Recursos Naturales, Estudio de Caso en Totonicapán*. Guatemala: FLACSO.
- Ericson, Jenny, Mark S. Freudenberg, and Eckart Boege. 1999. *Population Dynamics, Migration, and the Future of the Calakmul Biosphere Reserve*. Occasional Paper No.1. Washington, DC: American Association for the Advancement of Science and Program on Population and Sustainable Development.
- Food and Agriculture Organization of the United Nations (FAO). 1999. *State of the World's Forests 1999*. FAO Forestry Programme. Online at: <http://www.fao.org/forestry/FO/SOFO/SOFO99/sofo99-e.stm>.
- Forest Stewardship Council (FSC). 2001. *List of forests certified by FSC-accredited certification bodies*. January 31, 2001. Online at: <http://www.fscoax.org/html/5-3-3.html>.
- García V., Randall. 1996a. *Propuesta Técnica de Ordenamiento Territorial con Fines de Conservación de Biodiversidad en Costa Rica: Proyecto GRUAS*. Working Paper No. 10. New York: WCS.
- García V., Randall. 1996b. *Proyecto Corredor Biológico Mesoamericano*. Informe Técnico Regional. Proyecto Sistema Regional Mesoamericano de Areas Protegidas, Zonas de Amortiguamiento y Corredores Biológicos. Programa de las Naciones Unidas para el Desarrollo, PNUD-GEF, RLA/95/G41. San José, Costa Rica: CCAD.
- Godoy, Juan Carlos y Jorge Cardona. 1996. *Propuesta Técnica para Desarrollar el Sistema Guatemalteco de Areas Protegidas y sus Corredores Ecológicos*. Informe de país. Proyecto Sistema Regional Mesoamericano de Areas Protegidas, Zonas de Amortiguamiento y Corredores Biológicos. RLA/95/G41. Guatemala: PNUD.
- Gonzalez, Leonel. 1997. *Diagnóstico Sobre el Manejo de la Información Ambiental en Centro América: Informe Final*. Manuscrito impreso. Guatemala: PNUMA/CCAD.
- González, Otoniel. 1996. "Kuna-Yala, Panama: Sustainability for Comprehensive Development," in *Strategies for Sustainability: Latin America*. Arturo López Ornat (ed.), IUCN: SSP/CESP, 1996. Online at: <http://www.iucn.org/themes/ssp/panama.html>.
- Gurdián, Galio C. 2000. *Sección Socio-Cultural: Aportes a la Nota #1 del WRI Sobre el CBM*. Informe de investigación de consultoría con WRI. Managua, Nicaragua.
- Heckadon, Stanley. 1992. "Central America: Tropical Land of Mountains and Volcanoes," in *Toward a Green Central America, Integrating Conservation and Development*. Valerie Barzetti and Yanina Rovinski, eds. Pp. 5-20. Connecticut: Panos Institute.
- Holdridge, Leslie R. and Joseph A. Tosi, Jr. 1964. *Life Zone Ecology*. San José, Costa Rica: Tropical Science Center.
- Holdridge, Leslie R. and Joseph A. Tosi, Jr. 1972. *The World Life Zone Classification System and Forestry Research*. San José, Costa Rica: Tropical Science Center.
- Holt-Giménez, Eric. 1996. *The Campesino A Campesino Movement: Farmer-Led Sustainable Agriculture in Central America and Mexico*. Food First Development Report No. 10. Oakland, CA: Institute for Food and Development Policy.

- Horwich, Robert H. and Jonathan Lyon. 1998. "Community-Based Development as a Conservation Tool: The Community Baboon Project and the Gales Point Manatee Project," in *Timber, Tourists, and Temples: Conservation and Development in the Maya Forest of Belize, Guatemala, and Mexico*. Richard B. Primack, et al, eds. Pp. 343-363. Washington, DC: Island Press.
- Human, Economic & Environmental Defense (HEED). 2000. *No Gold Mining in the Rainforest!* The International Law Project; A project of the National Lawyers Guild, Los Angeles. Online at: <http://www.heed.net/bill/cr/gold4.html>.
- Indian Law Resource Center (ILRC). 1997. *Maya Atlas: The Struggle to Preserve Maya Land in Southern Belize*. Berkeley, California: North Atlantic Books.
- Indian Law Resource Center (ILRC). 1999. *Proposed American Declaration on the Rights of Indigenous Peoples- Authorities and Precedents*. Articles XIV, XV. Inter-American Commission on Human Rights. Online at: http://www.indianlaw.org/briefing_book.html.
- Institute for Global Communications (IGC). 2000. *Stop Oil Exploration in Maya Biosphere Reserve, Guatemala*. Global Response Action, March 16, 2000. Online at: <http://www.igc.org/igc/en/aa/100031619265/aa4.html>.
- Instituto Nacional de Ecología (INE) y Secretaría de Medio Ambiente, Recursos Naturales y Pesca (SEMARNAP). 1996. *Propuesta Corredores Biológicos del Sureste Mexicano*. Proyecto Sistema Regional Mesoamericano de Areas Protegidas, Zonas de Amortiguamiento y Corredores Biológicos. RLA/95/G41. México: PNUD.
- Instituto Nacional de Estadística, Geografía, e Informática (INEGI). 1997. *Encuesta Nacional de la Dinámica Demográfica*. México: INEGI.
- Instituto Nacional de Estadística, Geografía, e Informática (INEGI). 2000. *XII Censo General de Población y Vivienda*. México: INEGI.
- Inter-American Development Bank. 2000. *Basic Socio-Economic Data Reports: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama*. Statistics and Quantitative Analysis Unit, Integration and Regional Programs Department, 21 December 2000. Online at: <http://www.iadb.org/int/sta/ENGLISH/staweb/index.htm>.
- Janzen, D.H., W. Hallwachs, J. Jiménez, and R.G., Elmez. 1993. "The Role of Parataxonomists, Inventory Managers, and Taxonomists in Costa Rica's National Biodiversity Inventory," in *Biodiversity Prospecting*. W.V Reid, S.A. Laird, R.G. Elmez, A. Sittenfeld, D.H. Janzen, M.A. Gollin, and G. Juma, eds. Pp. 223-254. Washington, DC: WRI.
- Jaramillo, Carlos and Thomas Kelly. 1997. *Deforestation and Property Rights in Latin America*. Washington, DC: IADB. Online at: http://www.iadb.org/sds/publication/publication_1030_e.htm.
- Johnston, George and Hilary Lorraine. 1994. *The Green Book*. Vols. 1 (Policy Source Book), 2 (Methodologies), 3 (Applications). Regional Environmental and Natural Resources Management Project, USAID/G-CAP, Chemonics, and Development Strategies for Fragile Lands (DEFIL). Washington, DC: USAID.
- Kaimowitz, David. 1995. "Land Tenure, Land Markets, and Natural Resource Management by Large Landowners in the Peten and the Northern Transversal of Guatemala." Unpublished draft paper presented at the Latin American Studies Association (LASA) Conference, Washington, DC.
- Kaimowitz, David. 1996. *Livestock and Deforestation in Central America in the 1980s and 1990s: A Policy Perspective*. Indonesia: CIFOR.
- Kaimowitz, David. 2000. "Costa Rican Ranchers Let Forests Grow Back." Posting to POLEX listserv. 18 January 2000.
- Kaimowitz, David, Angelica Faune, and Rene Mendoza. 1999. "Your Biosphere is My Backyard: The Story of Bosawas in Nicaragua." Unpublished draft paper.
- Kelleher, Graeme. 1999. *Guidelines for Marine Protected Areas*. World Commission on Protected Areas (WCPA) Best Practice Area Guidelines Series No. 3. Gland, Switzerland: IUCN.
- Man and the Biosphere Programme (MAB). 2000. *How are Biosphere Reserves Organized?* United Nations Educational, Scientific and Cultural Organization (UNESCO). Online at: <http://www.unesco.org/mab/brfaq-3.htm>.
- Mathews, Emily, Richard Payne, Mark Rohweder, and Siobhan Murray. 2000. *The Pilot Analysis of Global Ecosystems: Forest Ecosystems*. Washington, DC: WRI.
- McCarthy, Ronald y Alberto Salas. 1998. *Talleres de Intercambio de Información sobre Corredor Biológico Mesoamericano y Grupos Indígenas y Campesinos de Centroamérica*. Resumen de las Reuniones Nacionales. Febrero 1998. CCAD/UICN-ORMA, y DANIDA.
- McCarthy, Ronald, Juan Carlos Godoy, Alberto Salas, y Juan Carlos Cruz, eds. 1997. *Buscando Respuestas: Nuevos Arreglos para la Gestión de Areas Protegidas y del Corredor Biológico en Centroamérica*. San José, Costa Rica: CCAD/CCAB-AP/UICN-ORMA/PFA.

- Mejías Esquivel, Ronald. 2000. *Incentivos para la Conservación de Tierras Privadas en América Central*. Documento de trabajo. San José, Costa Rica: CEDARENA.
- Metrick, Craig. 2000. "Towards an Implementation Framework for Regional Sustainable Development and Conservation Strategies: the Mesoamerican Biological Corridor (MBC)." Manuscript, Masters in Science thesis. Virginia: George Mason University.
- Miller, Kenton. 1996. *Balancing the Scales: Guidelines for Increasing Biodiversity's Chances Through Bioregional Management*. Washington, DC: WRI.
- Mittermeier, R.A., C.G. Mittermeier, N. Myers, G.A.B. da Fonseca, and J. Kent. 2000. "Biodiversity Hotspots for Conservation Priorities." *Nature*, 403(6772): 853.
- Morales G., Roger. 2000. *Mesoamerican Biological Corridor: Building a Shared Vision*. Documento de Trabajo de Consultoría con WRI. San José, Costa Rica.
- Native Forest Network. 1997. *Chainsaw Concessions Threaten Primary Rainforest in Nicaragua*. Native Forest Network Action Alerts and Info, No. 7, October 1997. Online at: <http://www.nativeforest.org/alerts/alert11.html>.
- Niiler, E. 2000. "Kyoto Opponent Authors Carbon Legislation." *EcoAmericas*. August 2000:4.
- Page, Kara D. and Martin J. Schwarz. 1996. *USAID Capacity Building in the Environment: A Case Study of the Central American Commission for Environment and Development*. Washington, DC: USAID.
- Pasos, Ruben. 1994. *El Último Despale, la Frontera Agrícola Centroamericana*. Costa Rica: Fundación para el Desarrollo Económico y Social de Centro América y Panamá.
- Plant, Roger and Soren Hvalkof. 2000. *Land Titling and Indigenous Peoples*. Washington, DC: IADB.
- Plath, Clarence V. 1967a. *La Capacidad Productiva de la Tierra en la América Central*. Turrialba, Costa Rica, IICA, Centro de Enseñanza e Investigación.
- Plath, Clarence V. 1967b. *Uso Potencial de la Tierra: Programa de las Naciones Unidas para el Desarrollo*. Rome: FAO.
- Plath, Clarence V. y Arjen von der Sluis. 1968. *Uso Potencial de la Tierra del Istmo Centroamericano: Evaluación Basada en los Recursos Físicos*. Rome: FAO.
- Ponciano, Ismael. 1998. "Forestry Policy and Protected Areas in the Petén, Guatemala," in *Timber, Tourists, and Temples: Conservation and Development in the Maya Forest of Belize, Guatemala, and Mexico*. R.B. Primack, D. Bray, H. Galletti, and I. Ponciano, eds. Pp. 99-110. Washington, DC: Island Press.
- Population Reference Bureau. 2000. *2000 World Population Data Sheet*. Online at: <http://www.prb.org/pubs/wpds2000/>.
- Powell, G.V.N. and R. Bjork. 1995. "Implications of Intra-tropical Migration in Reserve Design: a Case Study Using *Pharomachrus moccino*." *Conservation Biology*: 354-362.
- Primack, R.B., D. Bray, H. Galletti, and I. Ponciano, eds. 1998. *Timber, Tourists, and Temples: Conservation and Development in the Maya Forest of Belize, Guatemala, and Mexico*. Washington, DC: Island Press.
- Pringle, C, I. Chacón, M. Grayum, H. Greene, G. Hartshorn, G. Schatz, G. Stiles, G. Gómez, and M. Rodríguez. 1984. "Natural history observations and ecological evaluation of the La Selva Protection Zone, Costa Rica." *Brenesia* 22: 189-206.
- Prins, Kees. 1998. "Gestión y manejo de recursos en condominio- el caso de las concesiones forestales comunitarias." *Revista Forestal Centroamericana*, No. 23, Año 7, 1998.
- Programa Ambiental Regional para Centroamérica/Central American Protected Areas System (PROARCA/CAPAS). 1999. *Estudio Centroamericano de Certificaciones de Café, Vol. 1 Situación Actual del Café Certificado*. Guatemala: PROARCA/CAPAS.
- Programa Ambiental Regional para Centroamérica/Central American Protected Areas System (PROARCA/CAPAS). 2000. *La Región Responde al Cambio Climático*. Hoja Informativa. January 2000. Guatemala: PROARCA/CAPAS.
- Programa Ambiental Regional para Centroamérica/Componente de Manejo de la Zona Costera (PROARCA/Costas). 1996. *Gulf of Honduras: Preliminary Site Overview*. Guatemala: PROARCA/Costas.
- Programa Ambiental Regional para Centroamérica/Componente de Manejo de la Zona Costera (PROARCA/Costas). 1999. *Project Summary, Coastal Zone Management Project in Central America*.
- Programa Bosques, Árboles y Comunidades Rurales de la FAO (FAO/FTPP). 2000. "Agroforestería Comunitaria y Gestión Local del Desarrollo." *Boletín Electrónico*, 4(4).

- Revenge, Carmen, Jake Brunner, Norbert Henninger, Ken Kassem, and Richard Payne. 2000. *Pilot Analysis of Global Ecosystems: Freshwater Systems*. Washington, DC: WRI.
- Reyes, Enrique Virgilio. 1998. *Poder Local y Bosques Comunales, Estudio de Caso: Totonicapán*. Debate 43. Guatemala: FLACSO.
- Contreras, Reyna, Ana Violeta, Silvel Elías Gramajo, Carmen Cigarroa, y Pablo Moreno. 1999. *Comunidades Rurales y Areas Protegidas: Análisis de la Gestión Colectiva en Dos Sitios de El Petén*. Guatemala: FLACSO.
- Ribot, Jesse. 1999. "Framework for Environmental Governance." Draft essay presented at the Workshop on Environmental Governance in Central Africa. 26-27 April 1999. Washington, DC: WRI.
- Rosenberg, D.K., B.R. Noon, and E.R. Meslow. 1997. "Biological Corridors: Form, Function, and Efficacy." *BioScience* 47:677-687.
- Santos, Victoria, Rosa Ledesma, and Patricia Negreros. 1998. "Community-based Forest Management: Organización de Ejidos Productores Forestales de la Zona Maya, Yucatán." Unpublished paper. The World Bank/WB's Community-Based Natural Resources Management Initiative. 6 February 1998. Online at: <http://srdis.ciesin.org/cases/mexico-010.html>.
- Secaira, Estuardo. 2000. *La Conservación de la Naturaleza, el Pueblo y Movimiento Maya, y la Espiritualidad en Guatemala: Implicaciones para Conservacionistas*. Guatemala: PROARCA/CAPAS.
- Segura, Olman, David Kaimowitz, y Jorge Rodríguez, eds. 1997. *Políticas Forestales en Centro América: Análisis de las Restricciones para el Desarrollo del Sector Forestal*. IICA-Holanda/Laderas C.A: Impresión Edicsa.
- Simberloff, D., J.A. Farr, J. Cox, and D.W. Mehlman. 1992. "Movement Corridors: Conservation Bargains or Poor Investments?" *Conservation Biology* 6:493-504.
- Solórzano-Soto, Raúl. 2000. *Corredor Biológico Mesoamericano: Contribución a una Visión Compartida*. Informe de investigación de consultoría con WRI. San José, Costa Rica.
- Somos UNO. 1999. "Dos Concesiones Forestales Comunitarias y dos Cooperativas en La Reserva de la Biósfera Maya, reciben Certificación Verde." *Somos UNO, Expresiones vivas para una tierra nueva*, Vol. 1, Edición 7.
- Soule, M.E. and M.A. Sanjayan. 1998. "Conservation Targets: Do They Help?" *Science* 279: 2060.
- State of the Region. 1999. *First Report on Sustainable Human Development in Central America*. Human Development for Democratic Consolidation and Peace in Central America Project (State of the Region), San José, Costa Rica, May 31, 1999. Online at: <http://www.estadonacion.or.cr/InfoRegion/english1/prologue.html>.
- Strasma, John D. and Rafael Celis. 1992. "Land Taxation, the Poor, and Sustainable Development," in *Poverty, Natural Resources, and Public Policy in Central America*. Sheldon Annis et al., eds. Pp. 143-169. Washington, DC: ODC.
- Sunderlin, William D. and Juan A. Rodríguez. 1996. *Cattle, Broadleaf Forests and the Agricultural Modernization Law of Honduras: The Case of Olancho*. Occasional Paper No. 7. Bogor, Indonesia: CIFOR.
- Swenarski de Herrera, Lisa. 1993. "Unusual Map Helps Indians of Honduras Push for Land Rights," in *The Tropical Conservation Newsbureau*. 17 March 1993. Online at: <http://www.generation.net>.
- Tattenbach, Franz, Brenda Kleysen, William Alpízar, Paulo Manso, Lenin Corrales, Juventino Galvez, Mario Leiva, Pablo Imbach, y Gabriela Mora. 2000. *Propuesta de Proyecto de Reducción de Emisiones de GEI para Cinco Concesiones Forestales Comunitarias en la Reserva de la Biosfera Maya, Peten, Guatemala*. Reporte Final, Septiembre 2000. USAID.
- Tremblay, Claude J., Manfred Peters and Daniel Malenfant. 1996. *Case Study on Development of Environmental Capacities: The Arenal Conservation and Development Project in Costa Rica*. Rome: OECD.
- Trolldalen, Jon Martin. 1992. *International Environmental Conflict Resolution: The Role of the United Nations*. Washington, DC: WFED.
- Umaña, Alvaro. 1999. *Options for WRI Involvement in Mesoamerica: Opportunities posed by the Mesoamerican Biological Corridor (MBC) and Reconstruction Efforts After Hurricane Mitch*. Internal Position Paper 1/14/99.
- Unión Mundial para la Naturaleza (UICN). 2000. *Comunidades y Gestión de Bosques en Mesoamérica*. Perfil Regional del Grupo de Trabajo sobre Participación Comunitaria en el Manejo de los Bosques. Gland, Switzerland: UICN.
- United Nations Development Programme (UNDP). 2000. *Human Development Report*. Online at: <http://www.undp.org/hdro/>.
- United Nations Environment Programme (UNEP). 1996. *Global Biodiversity Assessment*. V.H. Heywood, ed. Cambridge University Press, Cambridge, UK.

- United States Agency for International Development (USAID). 1999. *Municipalities in the Reconstruction and Transformation of Central America and the Caribbean*. Stockholm, Sweden. 25 May 1999. Online at: <http://hurricane.info.usaid.gov/stockmun.htm>.
- Williams, Robert G. 1986. *Export Agriculture and the Crisis in Central America*. Chapel Hill, NC: University of North Carolina Press.
- Windevoxhel, N., J. Rodríguez. y E. Lahmann. 1998. "Situación del Manejo Integrado de Zonas Costeras en Centroamérica: Experiencias del Programa de conservación de humedales y zonas costeras de UICN para la región." Unpublished document. San José, Costa Rica: IUCN.
- World Bank. 1998. *Land Issues in Central America*. Land Policy Network. Online at: <http://wbln0018.worldbank.org/Networks/ES>.
- World Bank. 2000. *World Development Indicators 2000*. Online at: <http://www.worldbank.org/poverty/wdrpoverty/report/index.htm>.
- World Conservation Monitoring Centre (WCMC). 2000. *Protected Areas Searchable Database*. Online at: http://www.wcmc.org.uk/protected_areas/data/nat.htm.
- World Conservation Union (IUCN). 1994. *Guidelines for Protected Area Management Categories*. Commission on National Parks and Protected Areas (CNPPA)/WCMC. IUCN, Gland, Switzerland and Cambridge, UK.
- World Neighbors. 2000. *Reasons for Resiliency: Toward a Sustainable Recovery after Hurricane Mitch*. Lessons from the Field Series. Tegucigalpa, Honduras: World Neighbors.
- World Resources Institute. 1995. *Remarkable Events in Central America: International Perspectives on Sustainability*. Washington, DC: WRI.
- World Resources Institute. 2000. *World Resources 2000-2001: People and Ecosystems*. Washington, DC: WRI.
- Youth, Howard. 1998. "Green Awakening." *World Watch*: 28-36.

World Resources Institute

WRI's Board of Directors

William D. Ruckelshaus, *Chairman*

Julia Marton-Lefèvre, *Vice Chair*

Frances G. Beinecke

David T. Buzzelli

Deb Callahan

Michael R. Deland

Sylvia A. Earle

Alice F. Emerson

José María Figueres

David Gergen

John H. Gibbons

Paul Gorman

William M. Haney, III

Denis Hayes

Cynthia R. Helms

Samuel C. Johnson

Calestous Juma

Yolanda Kakabadse

Aditi Kapoor

Jonathan Lash

Mahmood Mamdani

William F. Martin

Jeff Miller

Qian Yi

Peter H. Raven

Florence T. Robinson

Jose Sarukhan

Scott M. Spangler

James Gustave Speth

Ralph Taylor

Pieter Winsemius

Wren Wirth

Jonathan Lash

President

Matthew Arnold

Senior Vice President and Chief Operating Officer

Anthony Janetos

Senior Vice President and Chief Program Officer

Marjorie Beane

Vice President for Administration and Chief Financial Officer

Lucy Byrd Dorick

Vice President for Development

Kenton R. Miller

Vice President for International Development and Conservation

The World Resources Institute is an environmental think tank that goes beyond research to create practical ways to protect the Earth and improve people's lives. WRI's mission is to move human society to live in ways that protect Earth's environment and its capacity to provide for the needs and aspirations of current and future generations.

Because people are inspired by ideas, empowered by knowledge, and moved to change by greater understanding, the Institute provides and helps other institutions provide objective information and practical proposals for policy and institutional change that will foster environmentally sound, socially equitable development. WRI's particular concerns are with globally significant environmental problems and their interaction with economic development and social equity at all levels.

The Institute's current areas of work include economics, forests, biodiversity, climate change, energy, sustainable agriculture, resource and environmental information, trade, technology, national strategies for environmental and resource management, and business liaison.

In all of its policy research and work with institutions, WRI tries to build bridges between ideas and action, meshing the insights of scientific research, economic and institutional analyses, and practical experience with the need for open and participatory decision-making.

WORLD RESOURCES INSTITUTE

10 G Street, N.E.

Washington, D.C. 20002, USA

<http://www.wri.org/wri>

