

Report No. 44062-PA

Republic of Panama Country Environmental Analysis

June 23, 2008

Sustainable Development Department
Latin America and the Caribbean Region



Document of the World Bank

CURRENCY EQUIVALENTS

Currency unit = Balboa
1 US Dollar = 1 Balboa

FISCAL YEAR

January 1 – December 31

Vice President:	Pamela Cox
Country Director:	Laura Frigenti
Sector Director:	Laura Tuck
Sector Manager:	Laura E. Tlaiye
Acting Sector Leader:	Emmanuel A. James
Task Manager:	Juan Carlos Belausteguigoitia

Table of Contents

Acronyms and Abbreviations	i
Acknowledgments	iv
Executive Summary	v
I. Introduction	1
1. Development Objectives, Natural Resources, and the Environment	1
2. Development Plan and Bank Assistance.....	2
3. Main Environmental Problems and New Pressures on Natural Resources	2
4. Rationale, Objectives and Approach, and Value Added.....	5
5. Organization.....	6
II. Institutional and Organizational Analysis.....	10
1. Institutional Analysis	10
2. Organizational Analysis.....	23
III. Environmental Health in Panama	33
1. Background	33
2. Urban Air Pollution: Analysis and Recommendations	34
3. Inadequate Water and Sanitation: Analysis and Recommendations.....	40
4. Rural Energy and Indoor Air Pollution: Analysis and Recommendations	48
IV. Environmental Management in the Panama Canal Watershed	54
1. Background	54
2. Water Quantity and Quality	58
3. Land Use Trends in and Around the PCW	69
4. Institutional Capacity and Current Investments.....	75
5. Conclusions and Recommendations	78
V. Unleashing the Poverty Reduction Potential of the Tourism Sector.....	84
1. Background.....	84
2. The Tourism Sector within the Broader Social and Economic Context.....	84
3. Tourism Potential for Poverty Reduction and Growth in Rural Areas	87
4. Approaches to Measuring Economic and Social Impact at the Local Level	89
5. Tourist Spending at the Province Level in Panama	92
6. Growth Linkages from Tourism Activities in Panama	94
7. Impact of the Tourism Sector on the Environment.....	98
8. Recommendations for Enhancing Sustainability in the Tourism Sector	102
VI. Forestry and Conservation Challenges	105
1. Deforestation: Importance and Causes	105
2. Governance in the Forest Sector	106
3. Transparency, Accountability, and Information	107
4. The Value of Conservation	108
5. Development of Conservation Policies.....	109

6. Challenges for Conservation and Natural Resources Management.....	114
7. Conclusions and Recommendations	114
8. Prioritize Actions	119
VII. Mining and the Environment: Balancing Two Forms of Natural Capital	121
1. Background.....	121
2. Panama’s mining sector	121
3. Environmental and social issues in Panama’s mining sector.....	122
4. Legal and regulatory framework governing mining	125
5. Legal and regulatory framework governing environmental and social protection	126
6. Recommendations for enhancing sustainability in the mining sector	127
7. Conclusions.....	130
VIII. Conclusions and Recommendations	132
1. Conclusions.....	132
2. Recommendations.....	136
Annex I: ANAM Organizational Chart	138
Annex II: Public Environmental Expenditure Review.....	139
Annex III: The “Degazetted” Western Watershed.....	145
Annex IV. Formulating a Carbon Policy: Panama’s Carbon Footprint	149
References	159

Acronyms and Abbreviations

AMRO	World Health Organization region of the Americas
ANAM	National Environmental Authority
ANARAP	National Association of Reforesters and Citizens of Panama (<i>Asociación Nacional de Reforestadores y Afines de Panamá</i>)
ARAP	Aquatic Resources Authority of Panama
ARIs	Acute Respiratory Infections
BOD	Biochemical Oxygen Demand
BPPS	Palo Seco Protection Forest (<i>Bosque Protector Palo Seco</i>)
BRT	Bus Rapid Transit
CABI	Leadership of Upper and Lower Izozog (<i>Capitania del Alto y Bajo Izozog</i>)
CAMIPA	Director of the Mining Chamber
CATHALAC	Water Center for the Humid Tropics of the Caribbean and Latin America
CCAD	Central America Commission on Environment and Development
CCNA	National Consultative Commission on the Environment (<i>Comisión Consultiva Nacional del Ambiente</i>)
CEA	Country Environmental Analysis
CGE	Computable General Equilibrium
CH ₄	Methane
CIAC	Watershed Environmental Information Center (<i>Centro de Información Ambiental de la Cuenca</i>)
CICH	Hydrological Basin of the Panama Canal (<i>Cuenca Hidrografica del Canal de Panamá</i>)
CITES	Convention on International Trade of Endangered Species
CNG	Compressed Natural Gas
CONADES	National Council on Sustainable Development
COPD	Chronic Obstructive Pulmonary Disease
CO ₂	Carbon Dioxide
CPS	Country Partnership Strategy
DALYs	Disability-adjusted Life Years
DO	Dissolved Oxygen
DR-CAFTA	Dominican Republic-Central America Free Trade Agreement
EA	Environmental Assessment
ED	Executive Decree
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ENSO	El Niño-Southern Oscillation
ESIA	Environmental and Social Impact Analysis
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GIS	Geographical Information System
GLE	General Law of the Environment
GNP	Gross National Product
GOP	Government of Panama
GWh	Gigawatt hours
HADCM2	Hadley Centre Coupled Model, Version 2
HCA	Human Capital Approach
ICMM	International Council on Mining and Metals

IDAAN	Institute for National Water Supply and Sewerage Systems (<i>Instituto de Acueductos y Alcantarillados Nacionales</i>)
IDB	Inter-American Development Bank
INRENARH	National Institute of Renewable Natural Resources
I-O	Input-Output
IPAT	Panamanian Tourism Institute
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
JICA	Japan International Cooperation Agency
KINP	Kaa-Iya del Gran Chaco National Park and Integrated Management Area
Ktoe	Kilo ton of oil equivalent
LAC	Latin America and Caribbean
LPG	Liquified Petroleum Gas
LSMS	Living Standards Measurement Survey
MBC	Mesoamerican Biological Corridor
MCM	Million Cubic Meters
MEF	Ministry of Economy and Finance
MGD	Million Gallons per Day
MICI	Ministry of Trade and Industry
MIDA	Ministry of Agricultural Development
MINGOB	Ministry of Government and Justice (<i>Ministerio de Gobierno y Justicia</i>)
MINSA	Ministry of Health
MIVI	Ministry of Housing
Mm	Millimeter
MOP	Ministry of Public Works
MPMZ	Master Plan for the Metropolitan Zone
MW	Megawatt
NEC	National Environmental Council
NGO	Nongovernmental Organization
NO _x	Nitrogen Oxide
N ₂ O	Nitrous Oxide
OAT	Legal Framework for Environmental Zoning (<i>Ordenamiento Ambiental Territorial</i>)
OECD	Organisation for Economic Co-operation and Development
PAs	Protected Areas
PAHO	Pan-American Health Organization
PAI	Immediate Action Plan
PCA	Panama Canal Authority
PCUMS	Panama Canal Universal Measurement System
PCW	Panama Canal Watershed
PCWMP	Panama Canal Watershed Monitoring Project
PDSGIRH	Plan for the Sustainable Development and Integrated Management of the PCW's Water Resources
PEER	Public Environmental Expenditure Review
PES	Payment for Environmental Services
PIGOT	General Zoning Plan (<i>Plan Indicativo General de Ordenamiento Territorial</i>)
PLD	Precise Level Dictum
PM	Particulate Matter
PM _{2.5}	Particulate Matter Smaller than 2.5 Microns in Size
PM ₁₀	Particulate Matter Smaller than 10 Microns in Size
PPM	Parts Per Million
PCW	Panama Canal Watershed

RAMSAR	Convention Regarding Wetlands as Habitats of Aquatic Birds
SAI	Interagency Environmental System
SAM	Social Accounting Matrix model
SEA	Strategic Environmental Assessment
SENACYT	National Secretariat for Science, Technology and Innovation
SIA	Inter-institutional Environmental System (<i>Sistema Interinstitucional Ambiental</i>)
SIAM	Mesoamerican Environmental Information System
SINAP	National System of Protected Areas (<i>Sistema Nacional de Areas Protegidas</i>)
SINIA	National Environmental Information System (<i>Sistema Nacional de Información Ambiental</i>)
SIO	Semi-Input-Output Model
SO ₂	Sulphur Dioxide
TJ	Tetra joule
TSA	Tourism Satellite Account
TSP	Total Suspended Particles
UA	Environmental Units
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
USAID	U.S. Agency for International Development
USGS	U.S. Geological Survey
VSL	Value of Statistical Life
WCS	Wildlife Conservation Society
WDI	World Development Indicators
WHO	World Health Organization
WSSH	Water Supply, Sanitation, and Hygiene
WTO	World Trade Organization
ZLC	Colón Free Zone

Acknowledgments

REPUBLIC OF PANAMA COUNTRY ENVIRONMENTAL ANALYSIS

Executive Summary

Panama is experiencing spectacular economic growth, averaging 7.5 percent during 2004–06; a construction boom; and emerging new opportunities and growing export markets. Despite this impressive growth performance, at the national level poverty remained almost unchanged during 1997–2006 at around 37 percent (masking a decline in rural poverty and an increase in urban and indigenous areas). Key development challenges for Panama include: (a) sustaining its accelerated recent growth performance, and (b) translating growth into poverty reduction. Natural resources and the environment must be key elements of any successful strategy to meet these challenges.

The main objective of the Panama Country Environmental Analysis (CEA) is to provide an analytical foundation to enhance the country's capacity to establish and address environmental policy priorities linked to poverty reduction and sustained economic growth. This report covers three main areas. First, the report analyzes the capabilities of Panama's institutions to perform essential tasks to manage the environment and natural resources; namely identifying problems and designing and implementing policies to solve them. The analysis therefore places great emphasis on the clarity of policies; mechanisms for coordination; use of and access to information, participation, and consultation; and, mechanisms to promote compliance with legislation. The premise of the institutional approach is that only strong institutions are able to offer efficient, equitable, and durable solutions to the increasingly complex problems faced by modern societies. Second, the report identifies environmental and natural resource management issues of key sectors, such as mining and tourism, to provide information on strategic synergies and tradeoffs involving the environment, economic growth, and poverty. Finally, the report offers new quantitative estimates in the fields of environmental health and climate change that will help the Government of Panama establish policy priorities.

The issues analyzed in this report were chosen on the basis of their environmental significance, strong linkages with poverty alleviation and economic growth¹, and were topics of interest to the Government of Panama.

Environmental Management in the Panama Canal Watershed

The PCW covers approximately 5 percent of Panama's national territory. The Panama Canal Watershed (PCW) is the main source of water for domestic consumption for some 1.5 million people, including the two largest cities in the country, Panama City and Colón. The PCW is also the sole source of water for the operation of the Panama Canal. In addition, the PCW harbors globally-endangered species and biodiversity-rich tropical ecosystems. This report explores the potential impacts on water quantity and quality of current land use patterns and trends, population growth and urban development; and the institutional framework for securing the long-term environmental sustainability of the PCW.

The Panama Canal and the Canal Expansion Project. The Canal plays a central role in the Panamanian economy. In 2000, the Panama Canal and its cluster of related activities contributed about US\$2 billion to the national economy or about 21 percent of GDP. In 2004, the Panama

¹ In addition to the topics that appear in the main body of the report, the CEA includes two technical annexes to help the Government of Panama formulate a carbon policy: (i) Estimation of the carbon footprint of the Panamanian economy; and (ii) Analysis of methodologies to estimate deforestation baselines (and an application of a suggested methodology).

Canal generated, in direct and indirect contributions, some 25 percent of total revenues received by the National Treasury. The Government of Panama (GOP) recently embarked on an eight-year, US\$5.25 billion investment program to expand the capacity of the Panama Canal to allow for the passage of larger ships. This expansion enables the Canal to remain competitive. At present, the largest ships (called “Panamax” ships) that can pass through the Canal make up roughly one-quarter of the Canal’s traffic and 60 percent of the Canal’s revenues. By 2011, approximately 37 percent of the capacity of the world’s container ship fleet will consist of vessels that do not fit through the Canal.

Threats to the Sustainability of the PCW. The PCW is being subjected to serious environmental stresses, including: incompatible land use changes, unplanned urban developments, increasing unsustainable agro-pecuarian and agro-industrial activities that threaten the quality of its waters. Even though major advances have been made in certain areas, such as protection of large forest areas within the Protected Areas System, the Regional and Urban Zoning Plans have been only partially implemented, and in some critical areas (e.g., along the Trans-isthmian Corridor), current land use and urban development are in direct conflict with the Zoning Plans’ guidelines.

Water Quantity and Quality. To date the water resources of the PCW have proven generally adequate to meet the needs of the Panamanian society. While the quality of that water is of lesser concern as regards canal operations, it is of great concern to all the other end users. With the Canal expansion, transits are expected to increase overall water demand, though water use per ship transit is expected to decrease by 7 percent (compared to the existing locks) due to the water recirculation basins to be built into the new locks. By increasing water storage capacity through deepening canals and raising dams, it is expected that the needed additional water will be made available. The Panama Canal Authority (PCA) estimates a safety margin of 7 percent of total available water above future total water demands during a planning horizon to 2025.

Potential risks to future water quantity and quality are related to climatological phenomena, namely El Niño Southern Oscillation (ENSO) events and climate change. ENSO events over the Panama Canal Watershed are characterized by a reduction of the total amount of rainfall, with direct negative effects in the amount of water available for ship transits. Current global and regional climate change models are predicting a general warming trend for the Caribbean and Central American Regions over the next 30 years. This warming is expected to increase water losses by direct evaporation from lakes and rivers, and evapo-transpiration. There is also a risk of increased precipitation seasonality with severe floods and droughts.

Land Use in the PCW. Law 21’s regional land use zoning scheme for the management and protection of the rural lands appears to have provided some incremental protection for the PCW, resulting in minimal changes in land use reported in the PCW over the last decade. In contrast, the Master Plan for the Metropolitan Zone, which has not been given force of law, has been less effective in preventing urban sprawl in certain critical areas.

Interventions in the PCW. In order to address the protection of the PCW the GOP has developed a substantial legal framework and ordered the creation of the PCA. The PCA’s main responsibilities are: (i) the management and operation of the Panama Canal, and (ii) the sustainable management of the hydrological resources of the watershed. To coordinate the complex array of institutions with interests in the PCW the PCA created the PCW Interinstitutional Commission (CICH). The CICH is the highest level coordinating entity for all

government agencies and NGOs’ interventions within the PCW. The CICH is working in the development of a *Plan for the Sustainable Development and Integrated Management of the PCW’s Water Resources* (PDSGIRH) to address the watershed’s environmental and social challenges to its long-term environmental sustainability.

Recommendations. The accuracy of the projections on housing and water demand needs, and the demand for other basic services, should be reviewed and updated to account for potential changes on parameters such as the much higher rate of growth of the Panamanian GDP. The protection of the quality of the water resources in the PCW depends on a combination of rural and urban zoning, regulation, incentives, and investments in environmental management of production systems and sanitation. Updating and enforcing these plans is required. In addition, the effects of climate change and ENSO on water supply should be factored into projections and contingency planning.

Once CICH’s *Plan for the Sustainable Development and Integrated Management of the PCW’s Water Resources* is completed, the individual line ministries will be responsible for supporting its implementation within their legal and institutional mandates. Success in safeguarding the integrity of the PCW will require establishing targets and appropriate results indicators for each ministry; accountability and budgetary control from the Ministry of Economy and Finance would be essential tools to assess progress in meeting targets.

Environmental Health in Panama

Environmental health risks, such as those from inadequate water and sanitation, and indoor and urban air pollution, and their associated costs, represent a significant burden on Panama’s economy. Overall, the analysis shows that Panama’s annual economic costs associated with these environmental problems amount to nearly US\$225 million or 1.25 percent of the country’s GDP (Table ES.1). The costs of these problems have been estimated in this report to help policymakers in Panama set policy priorities and to better integrate environmental health considerations into economic development decisionmaking.

Table ES.1. Annual Cost of Environmental Health Effects (Million US\$ per year)

Environmental Categories	“Low” (US\$ m)	Mean Estimate (US\$ m)	“High” (US\$ m)
Outdoor air pollution	30	120	205
Water supply, sanitation, and hygiene	50	70	90
Indoor air pollution	25	35	45
TOTAL ANNUAL COST	105	225	340

The most significant health impact of **outdoor air pollution** has been associated with particulate matter (PM), which penetrate deep into human lungs and cause health impacts such as acute respiratory infection (ARI), chronic obstructive pulmonary disease (COPD) (especially bronchitis), asthma attacks, cardiovascular disease, and lung cancer. In Panama, the accuracy of health data is a concern—with high uncertainty in the quality of data on mortality causes. Given these caveats, there are an estimated 275 premature deaths and 424 new cases of chronic bronchitis in Panama every year. Each year there are an estimated 670 hospitalizations and about 13,000 emergency room visits/outpatient hospitalizations due to air pollution. The total annual costs associated with urban air pollution are estimated to be US\$26 million to US\$206 million. Based on cost-benefit analyses, the report recommends: (i) developing a detailed and integrated emissions inventory for Panama City and San Miguelito, and establishing a health and air quality indicator system; (ii) introducing Bus Rapid Transit (BRT), which will have immediate benefits

in terms of air pollution and consequent health effects; (iii) reducing sulfur content in diesel fuel in Panama from the current 5,000 parts per million (ppm) (0.5 to 1 percent) to 50 ppm (0.005 percent).

Inadequate water and sanitation is another major cause of morbidity and mortality, particularly affecting the poorest households and children. While average water and sanitation coverage in Panama is high by regional standards, there are still gaps in rural and, in particular, in indigenous, areas. Access to improved water supply is estimated to be 78 percent in rural areas and 48 percent in indigenous areas in 2004. Sanitation coverage is estimated at 90 percent in rural areas (27 percent for septic tanks and sewers) and 47 percent in indigenous areas (0 percent for septic tanks and sewers).² Service quality is often poor in areas officially defined as having coverage. Based on the diarrheal prevalence rate reported in the 2003 Living Standards Measurement Survey (LSMS), this analysis estimates that annually almost 130 premature deaths, and about 1 million additional cases of diarrhea in children under age 5 can be attributed to poor water sanitation and hygiene. The estimated annual costs associated with inadequate water supply, sanitation, and hygiene range from US\$50 million to US\$90 million per year—equivalent to about 0.4 percent of the country's GDP in 2006. Key policy recommendations are: (i) improve access to water supply and sanitation in rural indigenous areas; (ii) launching a hygiene promotion program aimed at promoting hand-washing practices for the protection of child health; (iii) promoting water-disinfection practices, such as boiling or chlorination, especially in rural indigenous areas.

Rural energy and indoor air pollution is another important source of morbidity and mortality. Acute respiratory infections (ARIs), and chronic obstructive pulmonary disease (COPD) are the most common diseases associated with indoor air pollution in Panama. This analysis estimates that every year about 160 children under age 5 die from ARI in Panama, of which about 20 percent may be attributed to indoor air pollution. Also, among children under age 5 and women over age 30, there are more than a half-million annual cases of acute respiratory illness in rural areas, while more than 50,000 cases in urban areas may be linked to indoor air pollution. Up to 30 women die annually from COPD, and about 350 new cases of COPD annually can be attributed to indoor air pollution, predominantly in rural areas. The mean estimated annual costs of health impacts from indoor air pollution in Panama associated with the use of traditional fuels (mainly fuelwood) ranges from US\$25 million to US\$45 million, with a mean of US\$35 million, equivalent to about 0.2 percent of the country's GDP in 2006. The key policy recommendation to address this problem is to initiate an improved cook-stove program, especially in rural areas where biomass use is high.

Unleashing the Poverty Reduction Potential of the Tourism Sector

The tourism sector has an enormous significance for the Panamanian economy because of very high and rapidly increasing arrivals of foreign tourists and high levels of spending. In addition to attracting thousands of business travelers, it is a growing center of coastal, cultural, and health tourism, and ecotourism. The number of foreign tourists that visit Panama every year reached 70 percent of the country's population in 2006, and expenditures by foreign tourists total approximately US\$960 million—or 6 percent of the country's GDP. The sector's share in the total value of major exports of goods and services has risen from 13 percent in 1999 to 20

² Panama Water and Sanitation in Low-Income Communities Project, World Bank, 2006.

percent in 2006 and continues to grow.³ Furthermore, the tourism sector has the highest multiplier effects on the economy because of very high backward and forward linkages. The sector also has an enormous potential to benefit the poor and reduce the duality and the gap between the incomes in the high-income urban areas and the rest of the country, and between the indigenous and non-indigenous communities in the areas with high tourism potential.

Tourism revenues have benefits beyond those accruing directly to hotel operators and employees, tour operators, restaurants, and shops that sell goods and services to tourists. Incomes earned from these expenditures by tourists are typically spent at least in part on local goods and services, thereby further raising output and incomes. Thus, the total effects of tourism on income distribution and poverty reduction depend on more than just the level of spending by tourists on various commodities and services, and who receives direct employment and income from these purchases. The overall impact of tourism also depends on the size of the multiplier effects on output of other sectors, and the distribution of the revenues from increased production to various factors (labor and capital) and ultimately to household groups (poor and non-poor). These multiplier effects are particularly important for spreading the benefits of Panama's tourism industry to the poor, since many of the poor do not have direct contact with tourists, themselves (Table ES.1.).

Table ES.1: Panama: Value added multiplier Effects of Various Sectors^a

	National	Bocas del Toro	Chiriquí
Canal	1.64	1.66	1.63
Colón Zone	1.42	1.42	1.42
Maize	1.41	1.46	1.37
Fruits	2.02	2.07	1.98
Shellfish	2.23	2.28	2.19
Other agricultural exports	2.18	2.23	2.15
Mining	1.55	1.56	1.55
Textiles	1.30	1.31	1.29
Tourism (Hotels and restaurants)	2.87	2.90	2.84

a. Total gain in income from a US\$1 exogenous increase in value added from the specified sector.

Source: CEA's estimates from the Social Accounting Matrix multiplier model using LSMS 2003 and tourism survey data.

The new findings from analysis undertaken as part of this CEA also reveal that the poor earn a far greater share of the total increase in income from tourism than from growth in other sectors. Thus, the tourism sector must be seen as the cornerstone of the efforts of Panamanian authorities to reduce poverty in this highly dual economy.

As suggested by global experience, poverty benefits from the tourism sector are not automatic. Whether the poor receive a significant share of the benefits depends on how supply chains are structured and how tourists spend their money. The booming tourism sector is also likely to have a large environmental footprint. Given the importance of the tourism sector and its potential to result in large benefits for the poor and its significant environmental impact, devising a set of indicators and effective monitoring schemes is of paramount importance.

The analysis of the tourism sector in the CEA is aimed at informing the Master Plan for Sustainable Tourism Development (2007–2020), under preparation by the Government of

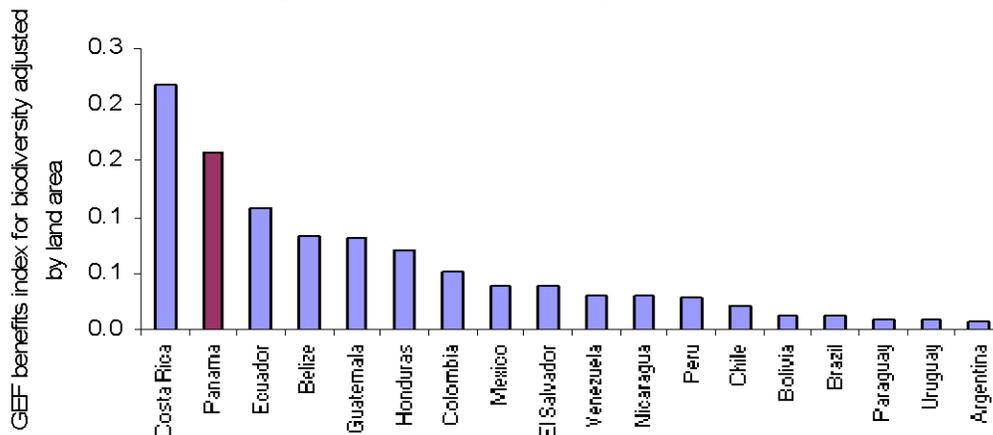
³ In the first quarter of 2006, the number of tourists increased by 14.4 percent and the number of travelers in transit and crew members grew by 16.4 percent, producing an increase of 19.2 percent in expenditures made during those visits (WTO 2007).

Panama since July 2007. Main policy recommendations in this chapter pertain to developing an effective monitoring system, and establishing mechanisms for cross-sectoral coordination and enforcement, and participatory mechanisms through the process of ecological zoning.

Forestry and Conservation Challenges

Panama is a critical link in the Mesoamerican Biological Corridor and it is second only to Costa Rica in terms of animal and plant diversity adjusted by land area (Figure ES.1). The largest concentrations of all of these species reside within designated Protected Areas (PAs), which cover 33 percent of the country’s territory. Growing economic pressures—from the rapidly growing tourism industry, mining operations and hydropower development, pressure for urbanization and second-homes in environmentally sensitive areas, and road construction—and climate change are resulting in the loss of habitat for many species. Conservation and forestry challenges are inextricably linked in Panama, where deforestation—at the rate of about 40,000 hectares per year—and habitat fragmentation are the main threats to the country’s rich biological diversity.

Figure ES.1: Panama is Uniquely Rich in Biodiversity



Note: The Global Environmental Facility (GEF) benefits index for biodiversity was divided by land area (square kilometers) to adjust for country size.

Source: *The Little Green Data Book* (World Bank 2007).

The Government of Panama has placed the protection of the country’s natural heritage high on the political agenda and has made remarkable progress in this area in the past four years. The GOP has developed a National Strategy for the Environment, and through a very extensive process of consultation, a National Biodiversity Policy, which arose through the guiding principles of conserving the natural heritage of Panama. It created the ANAM and the National System of Protected Areas (SINAP), both of which are of great relevance to the conservation of natural ecosystems. Panama has devoted the highest share of land to conservation of any country.

Despite significant progress in terms of consolidating PAs, their management poses significant challenges. First, the existing instruments for environmental management—the Environmental Impact Assessment Process and zoning—are insufficiently agile and not well suited for addressing cumulative impacts from large-scale projects and growing pressures on the environment. Second, the relatively low profile of ANAM—the agency responsible for the management of PAs—in the hierarchy of public administration, hinders its ability to influence

high levels of decision-making. Similarly, the hierarchical level of responsibility for PAs is very low within ANAM's institutional structure. Third, environmental considerations have not been effectively incorporated in sectoral policies, even though interagency coordination mechanisms for conservation of the SINAP are specified in the General Law of the Environment. The main recommendations of this report to address the challenges in the forestry sector and biodiversity conservation fall into five broad areas: (i) strengthening forest governance, (ii) planning capacity for the sector, (iii) improving the regulatory framework, (iv) strengthening institutions, and (v) improving mechanisms for social participation.

Mining and the Environment: Balancing Two Forms of Natural Capital

Historically, mining and mineral processing have not been a major factor in Panama's economy despite the country being richly endowed with mineral resources. In the past, Panama has produced clay limestone and salt, and there are commercially available copper and gold deposits, but these have been exploited on a small scale, as have bauxite, phosphates, and coal. Mining has never accounted for a large proportion of the country's gross domestic product (GDP), and at times has accounted for less than 0.5 percent of GDP. With recent surges in global prices for metals such as gold and copper, Panama's mining sector may be on the verge of an increase in interest from international developers after a period of relative dormancy.

Clearly, the development of the mining sector holds promise for economic and social development, but it also comes with significant environmental and social risks if not managed properly. Global and regional experience clearly shows that the exploitation of mineral resources comes with important social and environmental risks that must be systematically assessed, mitigated, or offset if the development of the sector is to enjoy long-term sustainability. This is especially true in Panama, where large-scale commercial exploitation of gold and copper could pose significant threats to the country's rich biological and social heritage. Many of the country's protected areas are either directly or potentially affected by proposals to develop and exploit mineral resources.

Closely related to biodiversity management is the importance of these resources to indigenous communities, many of which rely on the resources for livelihoods and subsistence. In many respects, it is virtually impossible to distinguish the impacts on the forests and biological diversity and the people that rely on those resources. According to the nongovernmental organization World Rainforest Movement, "The Panamanian Natural Resources Directorate has reported that 70 percent of the approximately 20,000 square kilometers km² of the national territory deemed to have mining potential is on land claimed by indigenous groups." Because mining activities are often located in the most remote areas, it is frequently indigenous communities that face the effects of poorly planned and managed mining activities.

Any successful development of mineral resources in Panama will need to take into account the social context and will need to develop specific strategies to address the concerns of stakeholders and potentially affected people. Many groups and individuals are seriously questioning whether the impacts and risks of mining are warranted, especially when the alternative economic values of biodiversity are considered.

Developing the mining sector in a more sustainable manner will require much greater attention to anticipating, planning, and managing environmental impacts, and greater commitment to using large developments as a way to finance social and economic development in affected communities. While Panama has developed a legal and regulatory framework that addresses some fundamental concerns regarding Environmental Impact Assessment (EIA), it must be

recognized that an EIA, on its own, is a weak environmental management instrument and development of the mining sector will require a much deeper analytical underpinnings. Major stakeholders will need to bring in a much broader range of tools, methodologies, and instruments to assess regional and site-specific impacts. Accomplishing these ambitious goals will also require significant investments in technical capacity building. Capacity building will not only be required in government agencies tasked with assessment and enforcement, but also in the developers, local communities, and civil society. Finally, since the sector is still at a relatively early stage of development, Panama is well positioned to learn from the experiences of the international community. An aggressive program of learning and adopting the emerging lessons and the cutting-edge practices would serve Panama's interests for many years to come.

Institutional Analysis

The GOP has undertaken major efforts to establish institutional and organizational frameworks for environmental management. The following aspects stand out as the most salient strengths:

- Panama has in place an environmental management law that provides a sound basis for regulating environmental pollution and resource conservation.
- The country has established institutions for developing and implementing environmental policies. Key ministries have environmental units and the SIA provides a strategic foundation to mainstream environmental considerations into sectoral policies.
- Several mechanisms encourage public participation, which can provide useful inputs to policy development and foster higher levels of compliance with regulations. In addition, valuable contributions to environmental protection in Panama may also be expected from a series of nongovernmental organizations that are engaged with environmental issues at different levels.
- There is an increasing awareness at many levels within ANAM of the environmental management framework's weaknesses, and the desire to address them. There is a generalized recognition of the need to strengthen environmental management while at the same time eliminating unnecessary hurdles for economic activity.
- Valuable contributions to environmental protection in Panama may also be expected from a number of municipalities that are engaged with environmental issues at different levels (Panama City and Colón stand out).

Specific ongoing efforts will continue to make the system more resilient, adaptable, and active. Among these initiatives, the following merit attention:

- The head of ANAM was granted ministerial rank and now ANAM will have its own seat at the Presidential Cabinet.
- A series of standards on air quality and emissions will be enacted.
- The National Consultative Commission on the Environment will begin operations.
- New staff has been added to both the central and regional offices of ANAM to strengthen its enforcement capacity.
- A budgetary increase has been granted to ANAM to operate and maintain PAs.

Notwithstanding this progress, the overall environmental framework still faces the following significant challenges that could not only hinder the country from achieving sustainable

development in the long term, but also minimize the benefits that Panamanians can draw from their rich natural capital:

- After 10 years in operation, ANAM needs to be reinforced through improved priority setting, planning, convening, and coordination capacities, information processing, and funding.
- A renewed effort to establish effective cross-sectoral coordination mechanisms is needed.
- Panama needs to improve its environmental information systems as a means to better support decision making and monitoring.
- Despite important progress, public participation and consultation processes still face a number of weaknesses, particularly with regard to projects in indigenous communities' lands.
- Compliance and enforcement are perhaps the weakest aspects within the country's institutional framework for environmental and natural resource management. Without effective compliance and credible enforcement, the deterrent, corrective, and guiding effects of an environmental management framework, and its credibility, are jeopardized.

The CEA concludes with specific recommendations summarized in the attached table in the areas of coordination; priority setting and resource allocation; EIA and other instruments; compliance and enforcement; and information and public participation.

The administration's interest in environmental issues creates opportunities for advances in addressing these challenges. Managing the environmental impact of current and future economic activities requires that Panama learns from its experience and strengthens and adapts its institutions and organizations.

Priority Area	Recommendation
<i>Institutional Coordination</i>	<ul style="list-style-type: none"> • Establish or strengthen Environmental Units (UAs) in key agencies and major municipalities. • Encourage ANAM to develop and drive agendas appealing to sectoral ministries or agencies, such as on environmental health with the Ministry of Health (MINSA), tourism and environment with the Panamanian Tourism Institute (IPAT), or on infrastructure and environment with the Ministry of Public Works (MOP). • Ensure that the functions of existing UAs are broadened from promoting environmental permits to actively mainstreaming environmental management within each agency.
<i>Priority Setting and Resource Allocations</i>	<ul style="list-style-type: none"> • Establish national environmental priorities with quantitative goals. • Reflect the stated priorities in the national budget allocation for environmental protection nationally, and develop a “whole of government” accounting system to monitor the use of budgetary resources. Where needed, reassign financial resources and personnel and provide additional sustainable funding. • Reform ANAM’s organization, balancing the preeminence of the Environmental Impact Assessment (EIA) focus inside the agency with reforming of the instrument, and developing specific mandates, capacities, and staff to identify, address, monitor, and achieve the new priorities. • Establish targets and appropriate results indicators for the agencies that form CICH and allocate budgets accordingly.
<i>EIA and Complementary Management Instruments</i>	<ul style="list-style-type: none"> • Adopt detailed guidelines for project proponents in preparing EIAs, and adopt detailed criteria for ANAM in reviewing EIAs and granting environmental permits. • Strengthen environmental zoning by: (a) integrating the various forms of land use planning within a common methodological and technical framework; (b) improving ANAM’s technical and operational capabilities, especially in terms of communication, supervision, and monitoring of sectoral activities. • Launch a pilot Strategic Environmental Assessment (SEA) project to develop this instrument as a complement to the EIA process, and select pilot sectors or regions of the country. • Complement the EIA adjustment and SEA implementation with technical guidelines and norms such as contract specifications, and with guidelines to mainstream design and environmental management best practices.

Priority Area	Recommendation
<i>Compliance and Enforcement</i>	<ul style="list-style-type: none"> • Establish a Compliance Promotion Program monitored periodically by the National Environmental Council to bring the regulated community—including municipalities and other government entities—into compliance. • Improve staffing, training, and equipment of the enforcement unit of ANAM and strengthen the capacity of the Environmental Prosecutor. • Ensure availability of laboratories to support inspections and evidence gathering by the Environmental Prosecutor. • Step up the creation of independent environmental certification and auditing entities to foster third-party verification in support of government enforcement and voluntary compliance.
<i>Information and Public Participation</i>	<ul style="list-style-type: none"> • Step up implementation of indicators to be used by government officials to steer policy priorities, for instance, concerning water balances, registry of users, and point sources of pollution. • Develop climate models to help better predict the effects of ENSO events on the PCW. • Implement an independent monitoring program of water quality in Gatun Lake. • Consolidate the SINIA by acquiring equipment, adding staff, and providing training, as needed. • Improve current water and air-quality monitoring. • Create an inventory of wastewater discharges and point-source air emissions. • Step up efforts to make operational an environmental accounting system to determine the cost of environmental degradation. • Step up actions to begin the operation of the National Consultative Commission on the Environment (<i>Comisión Consultiva Nacional del Ambiente</i>). • Improve consultation mechanisms on proposed policies, laws, regulations, and norms, by organizing workshops or target groups to discuss proposals.

I. Introduction

1. Development Objectives, Natural Resources, and the Environment

Panama is experiencing spectacular economic growth, averaging 7.5 percent during 2004–06; a construction boom; and emerging new opportunities and growing export markets. Despite this impressive growth performance, at the national level poverty remained almost unchanged during 1997–2006 at around 37 percent (masking a decline in rural poverty and an increase in urban and indigenous areas). Many rural poor have no access to safe water and sanitation, contributing to a high incidence of waterborne diseases, and to high child mortality, despite significantly greater levels of public health spending in Panama than in most countries in the Latin America and Caribbean (LAC) Region. The key development challenges for Panama are: (a) sustaining its accelerated recent growth performance, and (b) translating growth into poverty reduction.

Both natural resources and the environment must be key elements of any successful strategy to meet these challenges. The Panama Canal plays a key role in the Panamanian economy. It directly employs some 9,000 people and its multiplying effect is estimated to account for an additional 231,000 jobs or more than 24 percent of total jobs nationally. In 2000, the Canal and its cluster of related operational and economic activities contributed about US\$2 billion to the Panamanian economy, equivalent to 21.1 percent of GDP for that year. In 2004, the Panama Canal generated, in direct and indirect contributions, some 25 percent of total revenues received by the National Treasury.⁴ In addition, the Canal has an important social role in protecting livelihoods, because the Canal watershed is the sole source of water for the two largest cities in the country, Panama City and Colón.⁵

The functioning of the Canal and the valuable services it provides depend on sound natural resource and ecosystem management of the Panama Canal Watershed (PCW). Maintenance of the hydrological and ecological functions of the watershed is considered a strategic priority for the country, in social, environmental, and economic terms. In addition, the PCW generates global economic benefits (gains to global shipping from access to the Canal route as a least-cost alternative) and environmental benefits (the watershed contains important biodiversity features and provides habitat to numerous endangered and threatened animals and plants, potential reduction in global carbon emissions from reduced cargo-miles, and greater transport efficiency with shipping through the Canal).

Panama is also one of the most biologically diverse countries in the world. It is a critical link in the Mesoamerican Biological Corridor (MBC) and host to more than 12,600 plant species and 2,950 species of vertebrates. Many of these are threatened and some require very large areas of natural habitat (for example, jaguars and harpy eagles). Nearly 50 species of threatened amphibians are endemic to Panama and Costa Rica.

In addition, air and water pollution in Panama is resulting in premature deaths and illnesses, especially among children under 5 years of age. These health impacts have associated economic costs—estimated at around 1.5 percent of the country's GDP—relating to lost work productivity

⁴ Plan Maestro del Canal de Panamá, Autoridad del Canal de Panama, 2006.

⁵ 2007 Informe del Estado Ambiental de la Cuenca Hidrográfica del Canal de Panamá, CICH.

and treatment expenses, apart from the pain and suffering they impose. Moreover, for young children, repeated infections from poor air quality and contaminated water also contribute to malnutrition and subsequent cognition and learning impacts later in life. All these facts indicate that sound natural resource management and environmental quality must be key pillars of development strategies in Panama.

2. Development Plan and Bank Assistance

The main development challenge in Panama is to maintain high rates of economic growth, while narrowing the urban-rural divide and the gap between the part of the urban population that benefits from the booming services sector and the part that does not. Another policy challenge is to improve the efficiency of public spending and public debt sustainability. Panama is one of the most heavily indebted countries in the LAC region, with a recent history of large fiscal imbalances. The introduction of fiscal and pension reforms in 2005 has begun to reverse this trend.

Panama stands out among upper-middle-income countries in terms of having a very large public sector, high levels of public spending on social sectors, and a very unequal income distribution. Improving the efficiency and distributional impact of public spending is another key policy objective of the Government, since many of Panama's social indicators and health outcomes are not commensurate with the high levels of public expenditures in the social sector. The Strategic Vision of the Torrijos administration (2004–09) lays out the government response to these challenges, resting on four pillars: (a) reducing poverty, especially among rural poor and indigenous groups; (b) promoting broad-based growth; (c) establishing modern public financial management systems and institutions and modernizing the State; and (d) improving the health, nutritional, and educational attainment of the poor.

The World Bank's Country Partnership Strategy (FY08–FY10) builds on the program proposed in the Interim Strategy Note for the Republic of Panama (FY06–07) and aims to support the reform program of the current government (2004–09) and stands ready to assist the new administration (2009–14). The cornerstones of the Country Partnership Strategy (CPS) are aligned with the four pillars of Panama's Strategic Vision.

3. Main Environmental Problems and New Pressures on Natural Resources

Panama has achieved significant progress in the governance of natural resources and environmental protection. The first major development is the creation of a legal and regulatory framework and a long-term strategy for sustainable development and more effective environmental management (General Environmental Law of Panama [1998]; National Environmental Strategy [2005]; Law No. 5 on Environmental Crime⁶ [2006]). Creation of a specialized ministry, the National Environmental Authority (ANAM), in 2000, was a landmark in the process of strengthening environmental regulation. Other recent policy measures include enhanced pollution control and natural resource management policies, and measures to enhance policy coordination and information systems, and to make information on public policy

⁶ Ley 5 de Delitos Contra el Ambiente.

accessible to civil society (Inter-agency Environmental System (SIA); Transparency Law (2005)].⁷

Despite these regulatory and institutional reforms, Panama still faces considerable environmental problems, such as the deterioration of water quality in the Panama Canal Watershed and Panama Bay; a high incidence of diarrhea and other waterborne diseases, particularly among the poor; and the loss of biodiversity. These problems can be considerably aggravated by the growing economy and plans to implement major infrastructure projects, such as the expansion of the Panama Canal and expanding tourism and mining activities.

3.1 Key Environmental Problems

Environmental health

Despite a high level of expenditures on public health in Panama, several key health indicators are worse than in other middle-income countries in the region. The under-5 mortality rate in Panama is 21 per 1,000 live births, compared to 9 in Chile and 10 in Costa Rica. In indigenous areas, more than half of the children under age 5 suffer from chronic malnutrition. The incidence of diarrhea and respiratory illness among the extreme poor (42 percent of which live in the indigenous areas) is rising; between 1997 and 2003, it increased by 15 percent.

Biodiversity conservation

Panama is a critical link in the MBC and is host to a vast array of plant and animal species, many of them endemic to Panama and endangered. Despite the designation of one-third of the country's territory as national Protected Areas, institutional capacity for enforcement and monitoring of Protected Areas remains weak. The construction boom, new roads, the rapidly growing tourism sector, mining operations, and, to a lesser extent, expansion of the agricultural frontier, could accelerate the loss of Panama's rich biodiversity.

Climate change

The Intergovernmental Panel on Climate Change (IPCC 2007) expects that climate change will increase the risk of significant species extinctions in Panama, especially in the neotropical seasonally dry forests and in cloud forests. A rise in sea level is very likely to cause significant damage to Panama's coral reefs, and to cause coastal inundation and soil erosion. Altered hydrological patterns can reduce water availability and cause water stress in the Panama Canal watershed. The spreading incidence of malaria and other vector-borne tropical diseases can have high health costs and undermine tourism development. The frequency of extreme events (droughts, floods, and hurricanes) is expected to increase. Finally, higher average temperatures are expected to lower crop yields, reducing agricultural productivity. In the absence of adaptation measures, these effects will have a very high cost to the economy, the operations of the Panama Canal, agricultural production, health, and the ecosystems.

⁷ Sistema Interinstitucional Ambiental (SIA).

3.2 Future Pressures on Sustainable Use of Natural Resources

Environmental impact of mega-projects

To ensure economic competitiveness and sustain rapid economic growth, the national development framework foresees a broad range of investments in large-scale infrastructure projects. They include the expansion of the Panama Canal, construction of new ports, development of infrastructure to support growth of the tourism sector, major road construction, new large-scale mining projects, oil refineries, and hydroelectric power plants.

Tourism development

Tourism is a major source of export revenues and an important source of employment in Panama. The sector's share in the total value of major exports of goods and services has risen from 13 percent in 1999 to 20 percent in 2006 and continues to grow.⁸ Within the framework of trade liberalization following Panama's accession to the World Trade Organization (WTO), Panama has committed to significant liberalization of tourism services. It will eliminate barriers to small-scale tourism investment and grant unrestricted market access to prospective investors (WTO 2007). Tourism is a major source of foreign exchange for the economy, and a potentially powerful means of reducing poverty. It can also help improve the economic profitability of some measures aimed at preserving biodiversity and natural habitats, such as through well-managed ecotourism services. But uncontrolled tourism development poses significant environmental risks.

Mining

Until recently, mining had not developed on a large scale in Panama, despite significant potential. Rising gold prices and recent changes in the mining code have increased investor interest in the sector. The largest gold-mining project in Central America, and a large new copper mine, are currently being developed in the buffer zone of the MBC. Mining operations in these environmentally fragile areas can pose significant environmental risks and may adversely affect the indigenous communities, the subject of heated debate in the nongovernmental organization (NGO) and academic communities in Panama. However, if mining activities in this Protected Area are well regulated, they may also have a positive environmental impact. A new model of sustainable mining and environmental financing, if well implemented, might help reduce the pressure on biodiversity from alternative development.

Effective environmental management and strong institutional capacity are paramount to resolving these priority environmental problems and addressing future pressures on Panama's natural resources. This approach calls for effective mechanisms for setting environmental priorities, adequate environmental information systems, entry points, and a legal framework to facilitate community participation in the consultative processes, effective enforcement mechanisms, and policy coordination across agencies.

⁸ In the first quarter of 2006, the number of tourists increased by 14.4 percent and the number of travelers in transit and crew members grew by 16.4 percent, producing an increase of 19.2 percent in expenditures made during those visits (WTO 2007).

4. Rationale, Objectives and Approach, and Value Added

4.1 Rationale

The Country Environmental Analysis (CEA) analyzes the environmental and natural resources management dimensions of the four pillars of the Strategic Vision of the Government: (a) reducing poverty, especially among rural poor and indigenous groups (focusing on how tourism development, mining, and other emerging opportunities can benefit the poor while preserving Panama's natural capital); (b) promoting broad-based growth (focusing on environmental policies and enforcement mechanisms to improve environmental sustainability); (c) establishing modern public financial management systems and institutions and modernizing the State (focusing on improving the effectiveness and efficiency of environmental management instruments to stimulate economic competitiveness); and (d) improving health, nutritional, and educational attainment of the poor (focusing on the health impacts of improving water quality, sanitation, and adverse impacts of climate change).

4.2 Objectives and Approach

The main objective of the Panama CEA is to provide an analytical foundation to enhance the country's capacity to establish and address environmental policy priorities linked to poverty reduction and sustained economic growth. This is done in three ways. First, the report analyzes the capabilities of Panama's institutions to perform three essential tasks to manage the environment and natural resources; namely identifying problems as well as designing and implementing policies to solve them. The report therefore places great emphasis on the clarity of the policies, mechanisms for coordination, the use of and access to information, participation and consultation, and mechanisms to promote compliance with obligations and responsibilities. The premise of the institutional approach is that only strong institutions are able to offer efficient, equitable, and durable solutions to the increasingly complex problems faced by modern societies. Second, the report identifies environmental and natural resource management issues of key sectors, such as mining and tourism, to provide information on strategic synergies and tradeoffs involving the environment, economic growth and poverty. Finally, the report also offers new quantitative estimates in the fields of environmental health and climate change that will help the Government of Panama establish policy priorities.

4.3 Value Added

The CEA identifies gaps in environmental information, research, regulations, and policy. It may help the government identify environmental policy priorities and address difficult tradeoffs related to: (a) protecting and restoring key environmental services essential for long-term sustainability, (b) using Panama's natural capital in a sustainable way to promote growth and alleviate poverty, (c) mitigating the environmental impacts caused by the rapid growth of infrastructure, (d) reducing logistical and regulatory costs to improve competitiveness, and (e) reducing the health costs of environmental degradation.

The report also provides policy options and practical guidance for achieving more efficient and effective coordination of environmental policy both within the national government and between the national and local governments.

5. Organization

The issues analyzed in this report were chosen not only because of their environmental importance but also for their strong links with poverty alleviation and economic growth⁹. This choice was the result of a process of consultation both within the Bank and with the Government of Panama. The report contains the following chapters:

Chapter II: Institutional Framework: Increasing Policy Effectiveness

Significant progress has been achieved in Panama in the area of environmental regulation. A National Sustainable Development Strategy and a National Environmental Plan have been under implementation for over six years. Other important developments are the creation of ANAM (in 2000), formulation of the National Environmental Strategy (in 2005), and recent legal reforms to establish liability for environmental crimes and increase the transparency of environmental policymaking. The bill to create an integrated Land Management Authority is another important institutional development that can enhance the capacity of the authorities to implement zoning regulations. Although the quality of environmental regulation in Panama is comparable to other upper-middle-income countries in the region, implementation capacity and cross-agency coordination need to be strengthened in view of the rising pressures on the environmental management system.

This chapter describes and analyzes the institutional and organizational frameworks (that is, the rules of the game and the players), and underlines the most important strengths and weaknesses of each. As part of the Bank's approach to preparing a CEA, this report explores not only the basic institutional framework in place (policies, laws, regulations, instruments, and so forth), but also the organizational and human capacities to apply them in an effective, efficient, transparent, and accountable way.¹⁰ It is the synthesis of these two dimensions that provides the key strengths and weaknesses in the country's institutional and organizational frameworks. This chapter includes a discussion of the Environmental Impact Assessment process, and offers strategic recommendations to improve environmentally sound management of economic activities. In addition, this chapter includes a Public Environmental Expenditure Review (PEER). A PEER offers a way to systematically assess the equity, efficiency, and effectiveness of public environmental spending. A comparison of targeted and actual outputs provides information on cost-effectiveness and promotes emphasis on program delivery and on the effective use of public resources and government capacity for budget execution.

Chapter III: Environmental Health: Avoiding Premature Deaths

Globally, an estimated 24 percent of the disease burden (healthy life years lost) and an estimated 23 percent of all deaths (premature mortality) are attributable to environmental risks (WHO 2006). The burden of disease is unequally shared, with the children and the poor being particularly affected. Among children age 0 to 14, the proportion of deaths attributable to environmental risks—such as poor water and sanitation, indoor air pollution and vector-borne diseases—is estimated to be as high as 36 percent (WHO 2006). In children, malnutrition and

⁹ Apart from the issues that appear in the main body of the report, the CEA also produced technical self-contained reports on the following two topics that will help the Government of Panama formulate a carbon policy: (i) Estimation of the carbon footprint of the Panamanian economy; and (ii) Analysis of methodologies to estimate deforestation baselines (and an application of a suggested methodology).

¹⁰ The process was based on an extensive review questionnaire approved by the Government and a series of bilateral discussions with key stakeholders.

environmental infections are inextricably linked—with malnutrition not only the result of a lack of adequate food intake, but more often a consequence of bad sanitation and repeated infections (World Bank 2006). Very recent estimates that include the total health effects of environmental risks (including those effects mediated through malnutrition) highlight the even greater importance of environmental health interventions in child survival and development (WHO 2007; World Bank 2008).

This chapter answers two fundamental sets of questions on environment-related health problems in Panama. The first set helps to demonstrate the significance of environment-related health problems:

- (a) How much disease and how many deaths are attributable to environmental risks?
- (b) Which groups bear the highest burden of disease?
- (c) What are the economic costs of the health impact of these environmental risks?

The second set of questions refers to the appropriate choice of interventions that the Government of Panama can undertake to reduce these environmental risks to human health: Which interventions are the most cost-effective?

Chapter IV: Environmental Management of the Panama Canal Watershed

The Panama Canal Watershed (PCW) covers approximately 5 percent of Panama's national territory (339,650 hectares) but plays a key role in the Panamanian economy. The functioning of the Canal and the valuable services it provides depend on sound natural resource and ecosystem management of the PCW. Maintenance of the hydrologic and ecological functions of the watershed is considered a strategic priority for the country in social, environmental, and economic terms. This chapter analyzes:

- Current land use and trends in land use change.
- Ecosystem services—importance, status, pressure—from a watershed (water quality/quantity/timing; watershed stability) and habitat/biodiversity services perspective.
- Water resources—current and future projections—as regards overall water balance, water consumption/use, and protection and management of water sources.
- Institutional capacity—given current plans, strategies, and challenges—to respond to and manage environmental threats and issues associated with the maintenance of ecosystem services.

The analysis answers a series of questions, including:

- What is the current conservation status of the PCW?
- What are the trends and projections in Land Use and Urban Development, within and around the PCW? Are these trends consistent with guidelines established in the respective Rural Land Use Zoning and Urban Development Plans?
- To what extent are water and biodiversity resources being properly protected within the PCW?
- How might changes in the PCW landscape impact water resources?
- What other factors, such as climate change, might affect or challenge the availability of water resources for human use?

Chapter V: Unleashing the Potential of Tourism to Benefit the Poor and the Environment

Tourism is a major source of foreign exchange for the Panamanian economy, and a potentially powerful means of reducing poverty. Growth of the tourism sector can be a major new source of off-farm income in rural and in some indigenous areas, resulting in a significant decline in rural and indigenous poverty. This reduction can occur through several channels: employment creation, higher wages, and access to newly provided infrastructure and community services developed as part of the tourism area. Tourism development can also benefit the local population through indirect effects, such as changing prices for land and agricultural products. It can also help improve the economic profitability of some measures aimed at preserving biodiversity and natural habitats, such as through well-managed ecotourism services. But uncontrolled tourism development poses significant social and environmental risks, particularly acute in Panama because of the already high inequality and environmental sensitivity of the growing tourist destinations in the proximity of the Mesoamerican Biological Corridor (MBC).

This chapter reviews the impact of the booming tourism sector on poverty and the environment in Panama and offers a set of recommendations to enhance sustainability in the sector. The Master Plan for Sustainable Tourism Development (2007–2020), under preparation by the Government of Panama since July 2007, seeks to address these challenges by developing an integrated framework and enforcement mechanisms for the sector. The primary purpose of this chapter is to provide the analytical basis for including environmental and social considerations in the Sustainable Tourism Development Master Plan and to propose a set of measurable indicators to enhance social and environmental sustainability in the sector.

This chapter includes a review of the literature and global experience, analysis of tourist spending flows and destination and their direct and indirect effects on the local economy and poverty in Panama, and a model ecological zoning plan for a selected area with high tourism potential in Panama. Main policy recommendations in this chapter pertain to developing an effective monitoring system, establishing mechanisms for cross-sectoral coordination and enforcement, and participatory mechanisms through the process of ecological zoning.

Chapter VI: Forestry and Conservation Challenges

Panama is heavily forested. Arable land available for cultivation is limited. Together with a high concentration of landownership and rapid population growth, this has led to increasing cultivation on marginal lands, as well as deforestation and soil erosion. Further, deforestation and degradation affect a large share of the remaining forests. The reasons include changes in land use, unmanaged exploitation for fuelwood and illegal logging, and land tenure insecurity.

Chapter VI analyzes the forestry sector, focusing on governance mechanisms to promote the sustainable management of forest resources. In addition, the chapter describes the main challenges of the forestry sector and analyzes the ability of conservation policies and institutions to address present and future conservation challenges in a context of rapid economic and population growth, and provides practical recommendations.

Chapter VII: Mining and the Environment: Balancing Two Forms of Natural Capital

The purpose of this chapter is to describe the current state of Panama's institutional capacity to assess and manage environmental and social risks associated with large-scale mining, mineral processing, and associated infrastructure. The chapter reviews Panama's current legal framework with respect to the Environmental Impact Assessment (EIA) and related social impact assessment, its current human resource and financial resource capacity to implement existing

laws, and the current experience with respect to commercial-scale mining developments. The chapter makes recommendations for future improvements to the national system and ways to improve performance as it relates to Environmental and Social Impact Analysis (ESIA).

Chapter VIII: Analytical Elements for a Carbon Policy in Panama

The analysis of carbon dioxide (CO₂) emission trends for Panama suggests that both net emissions and emissions per capita have been increasing since the 1990s and that CO₂ intensity (emissions per unit of GDP) is relatively high compared to top emitters in Latin America. The most recent available data for fuel mix break-up suggest that much of energy production comes from liquid fuels (Figure I.3). In terms of the sectoral composition, while transport and electricity sectors are large contributors, the existing data do not identify a large percentage of the contributing sectors (43 percent). The carbon footprinting exercise therefore is particularly important and useful in this context. The analysis in this chapter will feed into the new energy policy currently under preparation in Panama and into country participation in future climate negotiations.

Chapter IX: Conclusions and Recommendations

This section summarizes the main conclusions, and identifies and ranks specific short- and medium-term policy recommendations to assist the Government of Panama to strengthen its institutional capacity. The goal is to help develop policies and cost-effective interventions that protect the environment and improve natural resource management, while avoiding unrealistic and ineffective regulations that hinder competitiveness, impede economic growth, and do not improve environmental quality.

II. Institutional and Organizational Analysis

1. Institutional Analysis

To address its environmental and natural resource challenges, Panama requires effective and efficient environmental policies, laws, and organizations.¹¹ This section focuses on the existing institutional structure (legal framework; policy instruments, including licensing, zoning, information systems, and public participation; and compliance and enforcement mechanisms) followed by an analysis of the stakeholders that play a key role within this institutional setting. It concludes with an examination of the country’s most important policy challenges and a set of recommendations the purpose of which is to outline the key avenues for action.

1.1 Environmental Policies

Governments must be clear about the reasons for their interventions, the objectives of these actions, and the responsibilities of the groups involved in the design, implementation, and enforcement of these interventions. The first issue that the General Law of the Environment addresses is environmental policy, showing its relative importance. Article 3 defines environmental policy as the set of measures, strategies, and actions established by the State to guide economic agents and public and private behavior with regard to conservation, as well as natural resource, and environmental use. In addition, this article states that the Executive branch will design, promote, and implement environmental policy as one of the policies for Panama’s economic and social development. As shown in Table II.1, Panama has issued a number of environment-related policies.

Table II.1: Environmental Policies Issued by ANAM

National Policy	Objective
<ul style="list-style-type: none"> ▪ Environmental National Strategy (1999–2005) 	<ul style="list-style-type: none"> ▪ Strengthen ANAM (which was recently created), identify main environmental problems, and design policy instruments (e.g., standards)
<ul style="list-style-type: none"> ▪ Environmental National Strategy (2008–12) 	<ul style="list-style-type: none"> ▪ Strengthen ANAM’s capacity to: (a) lead environmental policy; (b) coordinate its actions with other national government agencies, local governments, the private sector, nongovernmental organizations and academia; (c) set priorities; and (d) promote a culture of sustainability.
<ul style="list-style-type: none"> ▪ Participative Strategic Plan (2002–06) 	<ul style="list-style-type: none"> ▪ Harmonize management instruments to improve environmental quality and natural resource use.
<ul style="list-style-type: none"> ▪ Biodiversity National Strategy (2000) 	<ul style="list-style-type: none"> ▪ Establish biodiversity as a strategic resource

¹¹ The report differentiates between the concepts of institution and organization. Institutions include all the formal and informal “rules of the game” existing in the country, including laws, regulations, and practices. In the case of practices, the report focuses on the key actors influencing environmental institutions, which includes the key entities, bodies, and “bureaucracies” in charge of developing, applying, and enforcing the institutional framework.

	and define general guidelines for its preservation and sustainable use.
<ul style="list-style-type: none"> ▪ Forestry Sustainable Development Strategy (2001) 	<ul style="list-style-type: none"> ▪ Presents general guidelines and mechanisms for forestry resources use.
<ul style="list-style-type: none"> ▪ General Zoning Plan (<i>Plan Indicativo General de Ordenamiento Territorial</i>, PIGOT) (2001–03) 	<ul style="list-style-type: none"> ▪ Harmonize land use planning instruments to improve land use in accordance to its ecological aptitude and carrying capacity.
<ul style="list-style-type: none"> ▪ Environmental Education Strategy (2003) and Formal Education Strategy (2003) 	<ul style="list-style-type: none"> ▪ Promote a new environmental culture and generate knowledge and skills that contribute to sustainable development, respectively.
<ul style="list-style-type: none"> ▪ Integrated Water Resource Management (2007) 	<ul style="list-style-type: none"> ▪ Contribute to coordinating government's efforts to facilitate integrated water resource management.
<ul style="list-style-type: none"> ▪ Clean Production (2007) 	<ul style="list-style-type: none"> ▪ Promote a preventive approach to industrial pollution.
<ul style="list-style-type: none"> ▪ Solid and Hazardous Waste Management (2007) 	<ul style="list-style-type: none"> ▪ Establish principles, guidelines, and activities to promote rational and sustainable management of solid and hazardous waste.
<ul style="list-style-type: none"> ▪ Environmental management decentralization (2007) 	<ul style="list-style-type: none"> ▪ Establish principles, guidelines, and activities to strengthen environmental institutions in both the public and private sectors, boost the regional and local dimensions of environmental management.
<ul style="list-style-type: none"> ▪ Environmental Information (2007) 	<ul style="list-style-type: none"> ▪ Create and have access to timely environmental information that facilitates environmental management decision making and allows society to know the state of the environment and the way in which natural resources are used.
<ul style="list-style-type: none"> ▪ Climate Change (2007) 	<ul style="list-style-type: none"> ▪ Manage climate change issues and the impact that climate change may have in Panama.
<ul style="list-style-type: none"> ▪ Environmental compliance supervision, control, and enforcement (2007) 	<ul style="list-style-type: none"> ▪ Strengthen the authorities' competences to supervise, control, and enforce compliance with environmental regulations and facilitate community collaboration.

The development of this policy framework demonstrates that environmental issues have begun to take a prominent place in the national debate and public administration. Despite this achievement, however, public policies are often so general and all-encompassing that in practice they do not provide sufficient direction and focus to guide government efforts.

Furthermore, Panama has considerably expanded its public policy agenda. New priorities continually arise without adequate priority setting and compete with each other for scarce

resources and attention. This lack of priority setting is compounded by a lack of inter-institutional coordination in the policymaking process. Consequently, in the case of environmental policy, there is a risk that a growing number of “good intentions” may obscure priorities. In this sense, a clearer definition of national priorities for environmental protection (including their justification) would provide greater direction. Specific quantitative goals and an understanding of the connection between stated environmental policy and the specific tasks carried out at the National Environmental Authority (*Autoridad Nacional del Ambiente*, ANAM) and other environment-related agencies would also improve the effectiveness of environmental protection activities.

1.2 Legal and Regulatory Frameworks

Today, Panama has an increasingly sophisticated system of laws and regulations. The 1994 constitutional reforms establish each citizen’s right to “enjoy a healthy and pollution free environment.” Chapter 7 of the Constitution calls for (a) socioeconomic development that prevents pollution, maintains ecological balance, and avoids the destruction of ecosystems; (b) the State to adopt all necessary measures to guarantee rational natural resource use; and (c) the Law to regulate the use of non-renewable resources in order to avoid negative social, economic, and environmental impacts. The Constitution provides a basis for developing legislation and reforms around these principles.

The 1998 General Law of the Environment (GLE) is the cornerstone of the country’s environmental management framework. It was enacted after thorough consultation with both the private sector and nongovernmental organizations (NGOs), among other key stakeholders. The law provides general policy guidelines for both public and private institutions and sets out the role of the ANAM, the Inter-institutional Environmental System (*Sistema Interinstitucional del Ambiente*, SIA), and other government entities and coordinating bodies.

The GLE provides a good general framework for regulating and managing environmental issues, including those related to pollution control and conservation. It articulates a set of ambitious principles of environmental policy, including the obligation of the State to provide a healthy environment and the principle of incorporating environmental considerations in government decision making. The law touches on practically all of the ideal elements of good environmental management, such as mainstreaming environmental policies, public participation in environmental management, gathering and disseminating information, environmental education, and economic instruments.

The country’s environmental legal framework includes laws (like the GLE, the Forestry Law [1994], the Wildlife Law [1995], the Law of Environmental Crimes [2005], the Law to avoid Atmospheric Pollution Caused by Fuels and Lead [1996], and the Water Use Law [1966], presidential decrees and resolutions [like Decree 58] to regulate the process to create environmental quality and emission standards, Decree 59 to regulate the process of environmental impact assessment [2002], Resolution AG 026 to regulate residual water discharges, and Resolution JD 009 to create the National System of Protected Areas [1994]). In addition, Panama has an ambitious program to create environmental standards (both quality and emission standards) and the country is party to a long list of both global and regional environmental agreements (see Table II.2). Apart from these laws, Panama has several other laws governing environmental and natural resource issues.

Table II.2: Main Environmental Agreements Ratified by Panama

Global Agreements		Date of Ratification
1	Covenant to prevent seawater pollution by hydrocarbons	Sept. 9, 1963
2	Covenant regarding civil liability for damages caused due to seawater pollution by hydrocarbons	Jan. 7, 1976
3	Covenant regarding the intervention offshore due to accidents causing contamination by hydrocarbons	Jan. 7, 1976
4	Convention Regarding Wetlands as Habitats of Aquatic Birds (Ramsar)	Nov. 26, 1990
5	Covenant regarding prevention of sea pollution due to waste discharges	July 31, 1975
6	Convention on International Trade of Threatened Wild Fauna and Flora Species (CITES)	Aug. 17, 1978
7	Covenant to prevent marine contamination by ships	Feb. 20, 1985
8	Covenant on tropical woods	March 3, 1989
9	Vienna Convention for the protection of the ozone layer	Feb 13, 1989
10	Montreal Protocol regarding substances that deplete the ozone layer	March 3, 1989
11	Basilea Convention regarding the control of hazardous waste transfers and its disposal	Feb. 22, 1991
12	UN Framework Convention on Climate Change (UNFCCC)	May 5, 1995
13	Convention on Biodiversity	Jan. 17, 1995
14	UN Convention against desertification on the affected countries by drought and desertification, particularly in Africa	April 4, 1996
15	Kyoto protocol regarding the UNFCCC	March 5, 1999
16	Cartagena Protocol on Biotechnology Safety of the Biodiversity Convention	May 1, 2002
17	Stockholm Convention Regarding Persistent Organic Pollutants	March 5, 2003
Regional Agreements		Date of Ratification
18	Covenant for the protection and development of the marine environment in the Grand Caribbean region	Oct. 7, 1987
19	Covenant for the protection of the marine environment and the pacific sudoriental coastal zone	July 23, 1976
20	Covenant for biodiversity conservation and protection of priority wild areas in Central America	May 26, 1995
21	Covenant on Climate Change	May 6, 1995
22	Covenant regarding management and conservation of natural ecosystems, forestry, and the development of forest plantations	June 28, 1995
23	Covenant for the Constitution of the Central American Commission on Environment and Development (CCAD) and its protocol	Sept. 10, 1996
24	Agreement regarding transfers of hazardous waste across regional boundaries	June 22, 1995

Notwithstanding the considerable benefits that this framework offers, overlaps and contradictions do exist among these laws. One of the main reasons for the lack of coherence in the framework is that almost all of these laws were enacted before the GLE. In addition, an analysis was not carried out to identify conflicting provisions that needed to be derogated. Instead, the lawmakers relied on implicit derogation principles (a recent provision takes precedence over an older one, but a special law takes precedence over general laws, and so on) and on simply stating a blanket derogation of any provisions that contradict the law or its regulations, without identifying them individually. This aspect has tended to structurally weaken the overall coherence of laws and reduce legal security (that is, transparency).

Water resources management offers a clear example of conflicting jurisdictions. No single agency has the authority or responsibility for ensuring the sustainable management of water resources or determining how resources are distributed among competing users. When water is used for irrigation, the Ministry of Agriculture is involved; municipalities are involved in the

provision of potable water; and ANAM is responsible for ensuring that water quality complies with the technical standards, that wastewater is properly treated before discharged, and that water reuse activities are not carried out without an environmental permit.

1.3 Environmental Policy Instruments

1.3.1. Environmental Licensing

The primary instrument for managing the environmental implications of economic activities and investment projects in Panama is the Environmental Impact Assessment (EIA). Panama's basic environmental legislation for EIA is the GLE (Article 23) and Decree 59 of March 16, 2000. This law is further supplemented by supporting regulations, specifically Executive Decree 209 (December 5, 2006). This law lays out the basic organizational and institutional requirements for an EIA and specifies the types of analytical work that apply to different levels of investments.

The legal requirements, procedures, applicability, and standards for an EIA are administered by the National Environmental Authority (ANAM). Under current regulations, ANAM is responsible for administering the EIA process for applicable projects; providing policy and procedural guidance; defining more detailed and sector-specific guidelines and standards; coordinating the review process with other relevant organizations; evaluation of the effectiveness of the EIA system; and reviewing, evaluating, and approving EIAs, among other tasks.¹²

The basic legislation and supporting regulations in Panama are fundamentally sound and include many specific requirements that would be expected in environmental legislation of this type. Executive Decree (ED) 209 provides detailed descriptions of the scope of an EIA, which projects require such studies, institutional responsibility, functions of ANAM, and so on. Project proponents are required to prepare an EIA using independent, qualified specialists.

The ED 209 provides detailed descriptions of which project types trigger an EIA. The list provided includes specific investment types in a range of economic sectors including: agriculture, fishing, industrial manufacturing, industrial construction, tourism, energy generation and distribution, and importantly, mining and minerals extraction.¹³ Panama's regulations further elaborate a system of risk categorization based on specific criteria for identifying risks and impacts.

The system defines five risk criteria against which all project proposals must be evaluated: human health and effects on the biological assets of a project area; effects on the quality and quantity of natural resources; impacts on sensitive habitats, especially PAs; projects involving resettlement or displacement of human settlements or significant alterations to ways of life; and impacts on historical and cultural property. The process of risk categorization identifies three levels of risk, with Risk Level I being the lowest and Risk Level 3 being for projects with the most significant impacts. Panamanian law further describes the typical outlines and frameworks for EIA reports. Standard tables of contents are provided, including the basic expected minimum requirements for Environmental Management Plans (EMPs).

ED 209 does not require the systematic analysis of alternatives to a proposed project. This constitutes a significant gap with the World Bank policies and perhaps other multilateral

¹² For a full description of ANAM responsibilities, see Article 9 of the Executive Decree 209.

¹³ For a complete list of investment projects requiring EIA, see Artículo 16 in the ED 209.

development banks as well. There does not appear to be an explicit requirement for such analysis, which would severely limit the effectiveness of the report's structure.

The Panamanian environmental licensing system, like most systems in the region, is overly ambitious in its aim to evaluate all works and projects. But contrary to other countries in the region, Panama does not have a considerable backlog of EIAs. According to statistics from ANAM, Panama is in general compliance with the deadlines established in the regulations for review and approval of EIAs (Box II.1).¹²

However, there are three problems with this environmental management instrument in Panama. First, with the growing pressures of economic growth within the country,¹³ there is concern that existing systems and procedures, which are largely centralized, cannot respond with sufficient agility. Second, EIAs, which operate at the lower end of the decision-making process, are not well suited to address cumulative impacts. And third, supervision and enforcement of agreed mitigation plans is very poor.

ANAM is in a difficult position to address the environmental implications of large-scale projects (for example, large-scale mining) and ambitious sectoral development plans (for example, tourism and the expansion of the primary road network). Consequently, ANAM needs to strengthen the licensing process and other management instruments. The solution to this problem entails not only efficiency gains via improved processes, equipment, and training; it must also include a new approach to environmental management. Only by designing and implementing additional environmental policy instruments (for example, zoning and strategic environmental assessments) will Panama be able to attain efficient, effective, and affordable environmental management that matches its environmental management challenges.

Enforcement of environmental management plans is also a challenge. Article 24 of the GLE calls on ANAM to conduct environmental audits to verify compliance with the environmental management plans prepared as part of environmental assessments. However, this monitoring and enforcement mechanism has an important limitation: ANAM allocates limited resources to monitoring and enforcement.

Regulation of the public consultation process seems equally essential to highlight serious and demonstrable arguments, achieve a discussion that is reported in the media, and minimize the chance that the EIA process can be "captured" by interest groups.

Finally, it is feasible for the environmental licensing and EIA processes to be self-financing, through the recovery of rights to developers of projects. The amount of such rights would be in proportion to the investment involved, it would represent a flow of labeled resources in the state budget, and would be sufficient to finance personnel and equipment needs.

¹² The terms laid down in legislation are: Category I (10 days), Category II (45 days), and Category III (65 days). The times on average required by ANAM in 2006 were: Category I (11 days), Category II (37 days), Category III (60 days), and time limits were: Category I (15 days), Category II (51 days), Category III (121 days).

¹³ The number of EIAs processed by ANAM has increased from 570 in 2004 to 825 in 2006 (Category I: 630, Category II: 176, and Category III: 19).

Box II.1: Environmental Impact Assessment

The Environmental Impact Assessment (EIA) is an instrument of environmental management. It is complex, costly, and specific to each development project. On the one hand, it combines elements of regulatory analysis with technical and administrative processes, where there is always a margin for broad discretion; it can be very expensive both for the Government to implement and for the regulated community. On the other hand, the EIA is an invaluable tool for environmental policy, able to identify and meet regulatory requirements tailored to each project. However, if its application is not efficient, it can be a major bottleneck that unnecessarily hinders investment.

Efficiency and balance must be sought in two key areas. The first is the legal-institutional context, in which the EIA inserts itself as a component of an organic management system. This highlights balances compared to other policy instruments (zoning, environmental standards, protected natural areas, and so forth) and toward regional and sectoral priorities. The second area relates to the environmental licensing procedure itself, within its administrative, legal, and technical components.

In Panama, the environmental effectiveness of the instrument cannot be assured, since it is impossible to appropriately monitor and track a large and growing volume of projects and activities, all of which require environmental licensing. Under these conditions, strengthening other management instruments (like zoning) and the development of new ones (like the Strategic Environmental Assessment) seems essential to give certainty to both the authority as the project developer, and ensuring environmental effectiveness and transparency. This would allow the implementation of the EIA with more judicious selectivity, using a regulatory framework, standard regional information requirements, and appropriate treatment of cumulative impacts.

To adequately follow up on approvals, licenses, and management plans, ANAM should strengthen its surveillance capacity. This also requires the design and operation of systems for performance evaluation and quality in implementing the EIA and the entire process of licensing, and guides and applicable regulatory terms of reference or each mode of the EIA, guidelines for evaluation and to issue appropriate decisions.

1.3.2. Zoning

Zoning can be an extremely useful management instrument to address the environmental impact of large-scale projects and sectoral and regional development programs, like the expected explosive growth of tourism-related investment. Article 2 of the GLE defines environmental zoning as a planning, evaluation, and control process aimed at identifying and programming human activities that are compatible with natural resource management and taking nature's carrying capacity into account. In addition, Article 22 calls on ANAM to promote environmental zoning in coordination with other government agencies with zoning responsibilities. A study commissioned for this report evaluated the technical capacity of the agencies with zoning responsibilities for the case of tourism. The results are shown in Table II.3.

Table II.3: Technical Capacity of Government Agencies with Zoning Responsibilities

Government Units	Technical Capacity			
	Number of Staff	Trained Personnel	Office Equipment	Field Team
ACP	Adequate	Adequate	Adequate	Adequate
ANAM (Central Offices)	Inadequate	Adequate	Adequate	Inadequate
ANAM (Regional Offices)	Inadequate	Inadequate	Inadequate	Inadequate
CONADES	Adequate	Adequate	Adequate	Adequate
Colón Municipal Government	Inadequate	Inadequate	Adequate	Inadequate
Tourism Institute (IPAT)	Adequate	Adequate	Adequate	Inadequate
Ministry of Agricultural Development (MIDA) (Central Offices)	Inadequate	Adequate	Adequate	Inadequate

MIDA (Regional Offices)	Inadequate	Inadequate	Inadequate	Inadequate
Ministry of Housing (MIVI) (Central Offices)	Inadequate	Inadequate	Inadequate	Inadequate

Apart from evaluating the technical capacity of government agencies, the report reached the following conclusions:

With regard to the legal framework of land use planning:

- Under existing legislation, environmental zoning is a concept that encompasses a whole range of legal instruments of territorial planning. Such a profusion of instruments creates confusion about the mode of environmental management that is best for shaping a sustainable land use policy.
- There is a worrisome disconnect between land use planning, environmental impact assessments, and the master plan for tourism development (which was still under development at the time of writing this report).
- There is confusion about the competences and duties of different government entities. This has caused a lack of coordination in planning and environmental management.
- Citizen participation has been rather marginal because it is not considered by environmental zoning as a mechanism for resolving conflicts among the sectors with conflicting interests regarding the pattern of territorial occupation.
- There are no clear mechanisms for evaluating and monitoring the provisions of environmental zoning. This weakens the role of the Interagency Environmental System as a coordinating entity for land use policy in Panama.

With regard to inter-institutional relations:

- Although ANAM is the main agency for environmental zoning, the relatively minor position of ANAM in government severely restricts its ability to call for the inter-institutional and intersectoral integration that a full implementation of legislation in this area demands.
- The analysis of the network of institutional relations reveals gaps in interagency coordination. The main flaw is that while the environmental zoning is carried out by ANAM, the other spheres of government have played the role of passive recipients of information.

1.3.3. Environment and Natural Resource Information

The GLE states that one of ANAM’s primary obligations is to collect environmental information as an instrument for planning, education, and oversight (Article 7, item 15). This information should be maintained in a National Environmental Information System (*Sistema Nacional de Informacion Ambiental*, SINIA) that records, analyzes, synthesizes, and publicly disseminates environmental information. The SINIA is in turn a national node of the Mesoamerican Environmental Information System (SIAM), an instrument of the regional integration. The SIAM regional node is known as SERVIR. The country currently relies on multiple information systems (Box II.2).

Box II.2: Environmental Information Systems

SINIA: The main objective of this entity is to coordinate those institutions that may generate, store, distribute, and publish data and environmental information. The institutions that form the SINIA are:

- ANAM
- Contraloría General de la República
- Ministry of Health (MINSA)
- Ministry of Public Works (MOP), through the Tommy Guardia Institute
- Ministry of Agricultural Development (MIDA)
- Civil Protection National System.

Contraloría General de la República: Its goal, according to Law 32 of 1984, is to control and regulate the flow of funds and public goods, and to examine, intervene, close, and judge their accounts. It is also responsible for keeping the national accounts, prescribing accounting methods and systems of the public offices, and maintaining national statistics. Information kept by the *Contraloría* includes geo-referenced data.

National Geographic Institute “Tommy Guardia”: Created within the MOP in 1946, the Institute is responsible for developing, executing, and supervising geographic, topographic, cadastral, and hydrographic studies that constitute the basic source of information for the national plans on the use of resources.

SERVIR: In 1995 the Central American region established SERVIR in Panama by decision of the Council of Ministers of the Central America Commission on Environment and Development (CCAD) to monitor and visualize critical environmental information. The SERVIR website is hosted by the Water Center for the Humid Tropics of the Caribbean and Latin America (CATHALAC). Its URL is: <http://www.servir.net/>.

In order to support the national policy of environmental information, ANAM has taken a variety of actions such as: (a) building technical capacity of the SINIA, (b) exchanging information between the SIA and universities, (c) expanding community access to available environmental information, (d) training staff on information technologies and communication for sound environmental management, and (e) publishing the first-ever set of environmental indicators (used for environmental policy and management decision making and for producing the State of the Environment Report).

The environmental indicators are the basis of the SINIA and the main input for the Panama State of the Environment report. A set of environmental indicators grouped into nine key themes was issued for the first time by the Government of Panama (GOP) in June 2006 under the leadership of ANAM. The themes are forest and biodiversity, land use, marine and coastal resources, energy and transport, natural disasters, water, air quality, sanitation, and environmental management. These indicators will have to be further validated and tested for their relevance and content. Similarly, Article 55 of the GLE calls for the creation of a Green Accounting System to provide adequate estimates of the value of environmental goods and services to complement the National Accounts. Unfortunately, this information (which could be an important tool in establishing the country’s policy priorities) has not yet been produced.¹⁴

ANAM has a well-organized website (<http://www.anam.gob.pa/>) that offers links to information on public consultations (including participation, proposed new laws, the national environmental strategy renewal process, environmental quality regulations, fines, awards, and so forth), institutional divisions activities, and contacts. Although some valuable environmental information is available through ANAM and its website, there are still significant information gaps, such as on aquifer levels, number and quality of existing wells, pesticide runoff, solid and hazardous wastes, deforestation rates, and the health impacts of pollution. Furthermore, most of

¹⁴ ANAM has produced some unpublished estimates of the economic value of forests, water, and biodiversity.

the information on the ANAM website is not regularly updated and not yet linked to other available information. Information should be collected on a periodic basis and used to support planning, decision making, and compliance monitoring. Further improvements required to modernize environmental information resources include:

- Ensuring the compatibility of databases.
- Validating, testing, and implementing the set of environmental indicators.
- Gathering information concerning compliance with environmental laws and regulations, the cost of compliance, and the effectiveness of enforcement measures in terms of achieving applicable environmental objectives.

1.3.4 Stakeholder Participation¹⁵

The GLE does not have a specific section for public participation; however, several aspects related to public participation are included in this law. Promoting dispute resolution mechanisms like mediation and public hearings is one of the principles of environmental policy listed in Article 4 of the GLE.

Legal and Regulatory Consultations

Panama has set up a publish and comment process that requires ministries and other agencies to post their draft laws and policies publicly for a reasonable review period, as have most Organization for Economic Co-operation and Development (OECD) countries and an increasing number of middle-income countries (Article 25 of Law 6). In accordance with this law, a public comment process was carried out in adopting the Environmental National Strategy, where ANAM carried out a participatory process to review it through 17 workshops with the participation of over 1,000 representatives from the academic, scientific, and private sectors as well as consultative commissions, and civil society and indigenous groups (*comarcas*). In addition, the elaboration process of environmental quality and emission standards, regulated by Executive Decree No. 58, follows World Trade Organization (WTO) practices in terms of transparency and accountability. For instance, these committees have balanced representation and use “notice and comment” procedures in the development of standards.

Consultations Prior to the Approval of EIAs

Executive Decree 209 (May 2006) lays out the regulatory framework for the EIA. Title 4 of this Executive Decree describes the role of public participation in the EIA process. Project proponents are required to involve the public at the planning stage of the project. In addition, this decree describes the mechanisms for effective public participation, including: (a) a communication plan that describes how the affected community will be notified about the project details (Category I) or a participation plan that describes how the affected community will be involved during the preparation of the EIA (Category II and Category III projects); (b) a formal consultation process (15 working days for Category II projects and 20 working days for Category III projects); and (c) a public forum (mandatory for Category III projects and if at least 2 percent of the affected community signs a petition or if ANAM deems it necessary for Category II

¹⁵ Participation is defined as “a process through which stake-holders influence and share control over development initiatives and the decisions and resources that affect them” (World Bank 1996).

projects). Furthermore, the project promoter must also disseminate a summary of the EIA using public media, like national or regional newspapers, radio, or television.

This public consultation is also followed by the submission of a report detailing stakeholder observations, agreements reached, alternative courses of action in the cases in which no agreements were reached, and recommended courses of action backed by legal, economic, and social analyses. The project proponent will incorporate all agreed actions in the Environmental Management Plan. In cases where no agreements are reached, the project proponent will instead develop a recommended course of action backed by legal, social, and economic analyses. The competent authority will then determine whether the proponent's suggested actions adequately respond to the public's views.

Citizen Complaints

During the current Administration, ANAM established an Office of Environmental Complaints (*Oficina de Atención de Denuncias Ciudadanas*) that seems to be trusted by the public. Complaints may be filed in person or in writing or by calling a toll-free number. This office has received a variety of environmental complaints (illegal logging; pollution of water, air, and soil; poaching; extraction of non-metal materials; obstruction of water resources; sound contamination; wood trafficking; and invasion of Protected Areas [PAs]) and has been able to close 30 percent of the cases (of which a third received sanctions), while in 70 percent of the cases the investigations were in progress.

Active Consultation

Article 18 of the GLE calls for the creation of the National Consultative Commission on the Environment (*Comisión Consultiva Nacional del Ambiente, CCNA*), which shall include representatives from the government, civil society, and the *comarcas*, as an advisory body to ANAM. Unfortunately, the CCNA has not operated, due in part to lack of regulations that would provide guidelines on its functions (although they are being formulated). However, the provincial, district, and *comarcas* consultative commissions, called for by Article 21 of the GLE, do operate very effectively in most cases.

Indigenous Peoples

Panama is one of the few Central American countries to take a proactive public stance in relation to its indigenous populations, particularly when it comes to the recognition of indigenous rights and institutional arrangements for indigenous peoples' development.

It is widely regarded to have one of the strongest legal frameworks for indigenous land rights, as seen in the *comarcas*-related provisions in its 1972 Constitution (Article 123).

The institutional arrangements for indigenous peoples policy are under the responsibility of the National Directorate Office for Indigenous Policy, which is the main institution for coordinating activities with the seven indigenous groups and their authorities. It is also responsible for coordinating with all relevant governmental sectors for ensuring indigenous peoples development. More recently, the government also established by presidential decree the National Council for Indigenous Peoples Development. This Council is a multisectoral consultative body responsible for channeling resources for indigenous development, which are transferred from different sectors including health, education, and environment. However, its activities have been hampered by inadequate budget allocations and a shortage of dedicated, well-trained staff.

Despite containing one of the strongest legal frameworks for indigenous land rights, as seen by the indigenous *comarcas* and establishment of the National Council for Indigenous Peoples Development, full and meaningful participation remains a challenge in Panama. Efforts to strengthen consultation, participation, and grievance mechanisms need to be improved if appropriate land-use planning, concessions for infrastructure development, and opportunities for sustainable productive development to indigenous peoples and other rural populations are to be achieved. Affected populations must have meaningful ways to influence decision making (see Box II.3).

Box II.3: Hydroelectric Power Development and Indigenous Peoples Consultation

Two new, large hydroelectric dams (Bonyic and Chan I) are under construction in the Rio Changuinola watershed of Bocas del Toro Province, and a third (Chan II) is in the advanced stages of planning and government approval. These hydroprojects are being financed mostly by the private sector. They are expected to bring significant benefits to the overall Panamanian economy by boosting electricity supply in the national grid. At the same time, the projects will have important environmental and social implications for the forests and indigenous peoples in *Bocas del Toro*. The Bonyic and Chan I (and II) projects have become the focus of considerable public controversy, within Panama and even among the international community. Some Panamanian environmental nongovernmental organizations actively oppose these dams, while others have adopted a more neutral stance; one is collaborating with project sponsors on the scientific baseline studies. These hydroprojects are particularly controversial from a social standpoint. The Bonyic project does not require any resettlement, nor would its rather small reservoir significantly harm the livelihoods of any local residents. However, the project has exacerbated political divisions within the local Naso indigenous community, because of disagreements over (a) the adequacy of stakeholder consultations by the project sponsor and the environmental regulatory agency (ANAM); (b) the types and amounts of economic benefit-sharing with local residents; and (c) how to improve land tenure security for the Naso community, which presently has neither a *comarca* (indigenous province) nor a legally recognized collective territory. The social tensions are even more acute in the case of the Chan I project, because its reservoir will require the resettlement of four Ngobe indigenous communities with a combined population of about 800. These communities lack secure land tenure, since they are not part of the Comarca Ngobe-Bugle.

1.4 Compliance and Enforcement Mechanisms

Enforcement

The legal framework of environmental compliance and enforcement is set by the GLE (Article 7, which spells out ANAM's responsibilities; Articles 40, 41, 42, 43, and 44 that describe the compliance and enforcement process; and Articles 120, 121, 122, 123, and 124 that empower the Public Prosecutor [*Ministerio Público*] to investigate environmental crimes and creates Environmental Prosecutor Offices) and by Law 5 of 2005, which lists the infractions that are treated as crimes in accordance with the Penal Code. Administrative sanctions for environmental violations are based on fines. During 2005–06, a total of 55 projects received fines from ANAM ranging from US\$500 for not meeting the EIA conditions (50 percent of the cases) to US\$13,500 due to ecological damage (one case). In addition, project proponents that fail to file an EIA may be barred from operating until they comply with this requirement. Environmental crimes may be sanctioned with prison terms. However, and despite recent progress, the environmental prosecutors do not have adequate staff to investigate environment-related offenses, and only a few cases have been brought to court.

Despite commendable recent efforts (60 new staff added to the regional offices' enforcement capacity), the current enforcement system still needs to be strengthened. The importance of adequate enforcement cannot be overstated. The deterrent, corrective, and guiding effect of an environmental management framework, and its credibility, depend on the enforcement of its rules. While efforts are currently underway to strengthen enforcement, the enforcement

framework is still fragile. Lack of resources may be part of the explanation, but better structures and working methods might also promote better enforcement. The GOP should consider the creation of an autonomous institution specialized in enforcement of environmental regulations, with clear, legally defined responsibilities and appropriate powers and resources to achieve its objectives.

Box II.4. Emphasizing Compliance Promotion: The Canadian Example

Under the Compliance and Enforcement Policy for the Canadian Environmental Protection Act (1999), Canada secures compliance through two types of activity: promotion and enforcement.

General Principles

- Compliance—the state of conformity with the law—with the Act and its regulations is mandatory.
- Enforcement officers throughout Canada will apply the Act in a manner that is fair, predictable, and consistent. They will use rules, sanctions, and processes securely founded in law.
- Enforcement officers will administer the Act with an emphasis on prevention of damage to the environment.
- Enforcement officers will examine every suspected violation of which they have knowledge, and will take action consistent with this Compliance and Enforcement Policy.
- Enforcement officers will encourage the reporting of suspected violations of the Act.

Compliance Promotion Measures

- Education and information about the law.
- Technical Information on pollution prevention and pollution control, on measures to prevent releases of substances into the environment, and on methods for analysis and monitoring.
- Consultation on regulation development and review with both the parties to be regulated and the beneficiaries of regulation; and publication of proposed regulations providing affected parties and members of the public a minimum of 60 days to comment on the text.
- Environmental Codes of Practice and Guidelines that do not have the force of law, but that can assist in adopting management practices that will result in better protection for the environment.
- Promotion of environmental audits that are internal evaluations conducted by companies, government agencies, and others on a voluntary basis to verify their compliance with legal requirements and their own internal policies and standards. They are carried out by either outside consultants or employees of the company or facility from outside the work unit being audited. Enforcement officers do not request environmental audit reports during routine inspections.

Enforcement Activities

- Inspection to verify compliance (Inspection Program).
- Investigations of violations.
- Measures to compel compliance without resorting to formal court action.
- Warnings.
- Directions in the Event of Releases.
- Tickets.
- Ministerial Orders.
- Detention Orders for Ships.
- Environmental Protection Compliance Orders.
- Measures to Compel Compliance through Court Action
- Injunctions.
- Prosecution.
- Environmental Protection Alternative Measures.
- Penalties and Court Orders Upon Conviction.
- Use of Court Orders upon Conviction.
- Civil Suit by the Crown to Recover Costs.

Source: Canadian Environmental Protection Act (CEPA) 1999; <http://www.ec.gc.ca/CEPARRegistry>.

Compliance Promotion

Although one of the understood principles of environmental policy is a preference for inducing environmentally sound behavior over sanctioning, there are almost no mechanisms in the current

framework to encourage better compliance. Intermediate actions to achieve improved compliance could include notices of violations, warnings, and compliance agreements (see Box II.4).

However, it still emphasizes administrative sanctions, criminal penalties, and compensation. The use of compliance promotion mechanisms prior to the sanctioning process would improve effectiveness. Eventually, when an alleged violation is discovered, enforcement officers will put into force different actions taking into consideration: a) the nature of the alleged violation; b) the seriousness of the harm or potential harm; c) the intent of the alleged violator; d) whether this is a repeated occurrence; and e) whether there are attempts to conceal information. Then, it will measure the effectiveness in achieving the desired result with the violator, within the shortest possible time and with no further occurrence of violation. Factors to be considered include the violator's history of compliance, willingness to cooperate with enforcement officers, evidence of corrective action already taken, and the existence of enforcement actions under other statutes by other authorities as a result of the same activity. Enforcement officers will also consider how similar situations were handled when deciding what enforcement action to take.

2. Organizational Analysis

In 1998, the GLE was enacted as a general regulatory framework for environmental management within the country. The driving force of this law lies in the mandate to create the Inter-institutional System of Environmental Management (*Sistema Interinstitucional del Ambiente*, SIA), and the qualitative transformation of the former National Institute of Renewable Natural Resources (INRENARH) into a new entity with added responsibilities, the National Environmental Authority (ANAM).

Article 7 of the GLE gives ANAM, among other things, the responsibilities to:

- Formulate environmental and natural resource policies
- Lead, supervise, and execute government environmental policies, strategies, and programs in coordination with the SIA
- Create environmental standards
- Formulate draft proposals of laws
- Emit technical and administrative resolutions for the implementation of environmental policy
- Enforce environmental regulations
- Impose penalties and fines
- Dictate the scope, guidelines, and terms of reference for EIAs
- Evaluate EIAs and emit resolutions
- Promote public participation
- Promote the transfer of responsibilities to local authorities
- Create, maintain, and update environment- and natural-resource-related databases and provide information.

In 2008, ANAM did not have enough staff to carry out these numerous responsibilities. Annex I provides a diagram of ANAM's organization.

Recurrent resource shortages and increasing responsibilities have translated into unrealistic workloads that hinder ANAM's planning, coordination, and enforcement efforts.

2.1 Public Environmental Expenditure Analysis

Public Environmental Expenditure Reviews (PEERs) offer a way of systematically assessing the equity, efficiency, and effectiveness of public environmental spending. The starting point for a PEER is an understanding of a government's appropriate role in managing natural resources and regulating environmental quality. A low level of public environmental spending is not in itself an argument for more expenditure; the question is whether government expenditures are effective in meeting environmental priorities. A comparison of targeted and actual outputs provides information on cost-effectiveness and promotes emphasis on program delivery and on the effective use of public resources and the government capacity for budget execution.

Based on the available information on budget allocation and disbursements of various environmental entities in Panama, the CEA assessed the efficiency of budget execution in Panama and analyze its consistency with various challenges identified elsewhere in the Country Environmental Analysis (CEA). The full PEER is presented in Annex II.

ANAM's allocation has steadily increased in recent years with a large share going towards administrative costs. Environmental expenditure has been quite constant both as a percent of government expenditure and of GDP, although both have been rising steadily during this period. Panamanian expenditures on environmental protection compare somewhat less favorably with other middle-income countries in the region like Colombia and, as expected, are lower than the levels seen in higher-income countries such as Chile and Mexico. The share of operational expenses has been steadily increasing during the last seven years indicative of increasing amounts going toward payment of wages and salaries and other non-salary recurrent expenditures (for example, overtime and transport expenditures). With 80 percent of the operational budget going toward administration expenses there has been a marked increase in the budget allocation to general administration expenses and a decline in share of the regional administration units.

Institutional strengthening constitutes an important aspect of ANAM's investments. A large share of the investment allocation goes toward institutional strengthening, with the balance shared between research and management of natural resources and conservation and sustainable development. The institutional strengthening is necessitated to complement and manage a growing portfolio of donor investments in the sector.

ANAM's execution performance related to investment expenditures, however, is very weak. While the spending patterns for operational expenses have been within reasonable limits of the allocation, the execution of investments have been consistently underperforming over the years. This is especially true for "institutional strengthening" and "conservation and sustainable development" components. This is similar to symptoms experienced in other countries on implementation delays of investment projects due to cumbersome procurement procedures and other administrative bottlenecks. The severe underspending in some years especially highlights some weaknesses in ANAM's budget implementation capacity.

2.2 Cross-sectoral Coordination

Although ANAM is the principal actor within the country's environmental management framework, a number of powerful line ministries and agencies (with considerably larger budgets and political influence) have environmental mandates.

The GLE identifies mainstreaming environmental considerations into sectoral policies as one of its objectives. Article 1 states that the GLE integrates environmental management into the country's socioeconomic objectives in order to reach sustainable development. Given the numerous government agencies that hold environment responsibilities, Article 16 of the GLE established the Inter-institutional System of Environmental Management (SIA) as a mechanism to coordinate different sectors and government levels. Table II.4 lists the SIA member organizations. ANAM, with the support of the National Environmental Council (NEC, formed by three cabinet ministers appointed by the President), coordinates the SIA. In addition, Article 17 calls on ANAM to create and coordinate a network of environmental units that will act as a consultation, coordination, and analytical body for the evaluation of EIAs.

Table II.4: SIA Member Organizations

1	MOP	<i>Ministerio de Obras Públicas</i>	Ministry of Public Works
2	MIVI	<i>Ministerio de Vivienda</i>	Ministry of Housing
3	MEF	<i>Ministerio de Economía y Finanzas</i>	Ministry of Economy and Finance
4	MEDUCA	<i>Ministerio de Educación</i>	Ministry of Education
5	MINGOB	<i>Ministerio de Gobierno y Justicia</i>	Ministry of Government and Justice
6	MINSA	<i>Ministerio de Salud</i>	Ministry of Health
7	MIN PRESIDENCIA	<i>Ministerio de la Presidencia</i>	Ministry of the Presidency
8	MIDA	<i>Ministerio de Desarrollo Agropecuario</i>	Ministry of Agricultural Development
9	MICI	<i>Ministerio de Comercio e Industrias</i>	Ministry of Commerce and Industries
10	INADEH	<i>Instituto Nacional de Formación Profesional y Capacitación para el Desarrollo Humano</i>	National Vocational Training Institute for Human Development
11	FIS	<i>Fondo de Inversión Social</i>	Social Investment Fund
12	ANSEP	<i>Autoridad Nacional de los Servicios Públicos</i>	National Authority of Public Utilities
13	ETESA	<i>Empresa de Transmisión Eléctrica</i>	Electricity Transmission Company
14	IPACOOOP	<i>Instituto Panameño Autónomo de Cooperativas</i>	Panamanian Autonomous Cooperative Institute
15	INAC	<i>Instituto Nacional de Cultura</i>	National Cultural Institute
16	IPAT	<i>Instituto Panameño de Turismo</i>	Panama Tourism Institute
17	AMP	<i>Autoridad Marítima de Panama</i>	Panama Maritime Authority
18	AMPYME	<i>Autoridad para la Micro, Pequeña y Mediana Empresa</i>	Authority for Micro, Small, and Medium Enterprises
19	IDAAN	<i>Instituto Acueductos y Alcantarrillados Nacionales</i>	National Water and Sewage Agency
20	ANAM	<i>Autoridad Nacional del Ambiente</i>	National Environmental Authority

Despite its important role, the SIA has not been effective in promoting coordination given: (a) ANAM lacks staff dedicated to developing and overseeing meaningful sectoral agendas¹⁶; and (b) despite the NEC's support, ANAM lacks political weight to effectively convene and coordinate the actions of powerful ministries and agencies. In addition, ANAM's lack of political weight prevents it from playing a more active role in cabinet meetings (where ANAM does not have a seat and is represented by the Ministry of Economy and Finance) in which key policies and projects are discussed.

In addition, to incorporate environmental considerations into the plans, programs, and projects of key ministries and agencies, their environmental units will have to be strengthened. This should include a review of competences, technical capabilities, standardized administrative procedures, and the provision of a comprehensive training program.

2.3 Balancing Centralized and Decentralized Management

One of the principles of environmental management is that it should be delegated to, and carried out at, the most decentralized level where issues can effectively be managed and national bodies can provide required support and coordination. The GLE calls on ANAM to promote the transfer of natural resource and environmental functions to local authorities (Article 7, item 12). In addition, the law also calls on ANAM to provide technical support to municipalities with regard to local environmental management. In order to strengthen the decentralization drive the GOP laid out the principles, objectives, and lines of action of a National Policy of Environmental Management Decentralization through Executive Decree No. 82 (April 2007). With regard to institutional issues, this decree calls for the strengthening of ANAM's regional offices; promoting a Local Agenda XXI¹⁷ program; adopting zoning as the main environmental management instrument, and preparing zoning regional and local plans; and strengthening local governments' environmental units.

ANAM has signed agreements with five municipalities to advance the promotion of a pilot model of decentralized environmental management. This process is still in its infancy and needs to be consolidated. However, most municipalities in Panama face technical and economic restrictions that prevent them from meeting the responsibilities of natural resource and environmental management. Under these conditions, aggressive decentralization programs are likely to fail. A strategy to create a well-functioning intergovernmental system should first establish minimum technical capacity levels and transparency and accountability mechanisms in an incremental fashion. This can be done by first focusing on capacity building of local authorities and on coordination rather than on transfer of management responsibilities.

2.4 Assessing the Strengths and Weaknesses

The GOP has undertaken major efforts to establish institutional and organizational frameworks for environmental management. The following aspects stand out as the most salient strengths:

Panama has in place an environmental management law that provides a sound basis for regulating environmental pollution and resource conservation. The existing legal framework is

¹⁶ To engage powerful ministries in a meaningful collaboration process, ANAM needs to produce figures and analyses that show the economic and social importance of incorporating environmental considerations into sectoral policies.

¹⁷ Agenda XXI is a comprehensive plan of action to be taken globally, nationally, and locally by organizations of the United Nations System, governments, and major groups in every area in which humans impact the environment.

comprehensive and ambitious in its principles. The GLE also opens opportunities for developing an effective set of environmental policy instruments to tackle other environmental concerns:

- The country has established institutions for developing and implementing environmental policies. Key ministries have environmental units and the SIA provides a strategic foundation to mainstream environmental considerations into sectoral policies.
- Valuable contributions to environmental protection in Panama may also be expected from a series of nongovernmental organizations that are engaged with environmental issues at different levels.
- Several mechanisms encourage public participation, which can provide useful inputs to policy development and foster higher levels of compliance with regulations.
- There is an increasing awareness at many levels within ANAM of the environmental management framework's weaknesses, and the desire to address them. There is a generalized recognition of the need to strengthen environmental management while at the same time eliminating unnecessary hurdles for economic activity.
- Valuable contributions to environmental protection in Panama may also be expected from a number of municipalities that are engaged with environmental issues at different levels (Panama City and Colón stand out).

Specific ongoing efforts will continue to make the system more resilient, adaptable, and active. Among these initiatives, the following merit attention:

- The head of ANAM was granted ministerial rank and now ANAM will have its own seat at the Presidential Cabinet.
- A series of standards on air quality and emissions will be enacted.
- The National Consultative Commission on the Environment will begin operations.
- New staff has been added to both the central and regional offices of ANAM to strengthen its enforcement capacity.
- A budgetary increase has been granted to ANAM to operate and maintain PAs.

These efforts have carried Panama far in effectively managing the environment. However, the overall environmental framework still faces significant challenges that could not only hinder the country from achieving sustainable development in the long term, but also minimize the benefits that Panamanians can draw from their rich natural capital:

- After 10 years in operation, ANAM needs to be reinforced through improved priority setting, planning, convening, and coordination capacities, information processing, and funding.
- A renewed effort to establish priorities and coordinate their implementation is needed to tackle Panama's environmental degradation problems and to address potentially increasing pressures related to high rates of economic growth.
- Panama needs to improve its environmental information systems as a means to better support decision making and monitoring.
- Despite important progress, public participation and consultation processes still face a number of weaknesses, particularly with regard to projects in indigenous communities' lands.

- Compliance and enforcement are perhaps the weakest aspects within the country's institutional framework for environmental and natural resource management. Without effective compliance and credible enforcement, the deterrent, corrective, and guiding effects of an environmental management framework, and its credibility, are jeopardized.
- Apart from the transfer of responsibilities and resources, a successful decentralization strategy requires institutions to increase transparency and accountability and coordination among the different agencies and government levels.
- Regulations and technical standards are also lacking in several areas, in particular zoning regulations and standards for air, water, and soil quality.¹⁸

In summary, these weaknesses can be tackled effectively in the short term. The administration's interest in environmental issues creates opportunities for advances in addressing these challenges and matters.

2.5 Recommendations

The main recommendation is to improve environmental policy coordination and priority setting through better functioning of the Inter-institutional Environmental System (SIA).

The Need for Better Institutional Coordination

Environmental issues have gained prominence under the Torrijos Administration. However, environmental considerations are still not regularly incorporated into the economic development concerns, priorities, and policies of the Government. The environmental policy coordination established by the SIA has been only partially successful in acting as a framework to mainstream environmental policies and priorities and coordinating environmental tools, budgets, and resources across the government ministries. ANAM's resources have been overstretched and its agendas dominated by short-term expediencies, weakening its planning and coordination capacities. In addition, the sectoral environmental units are weak and understaffed.

Therefore, this report recommends that the government strengthen the operational framework of the SIA by:

- Encouraging ANAM to develop and drive agendas appealing to sectoral ministries or agencies, such as on environmental health for MINSA or on infrastructure and environment with the MOP.¹⁹
- Establishing or strengthening environmental units in the MINSA, MOP, MIDA, MICI, the new Tourism Ministry, and major municipalities.
- Ensuring that, in practice, the functions of existing Environmental Units (UAs) are broadened from promoting environmental permits to actively mainstreaming environmental management within each agency.

The Need to Clarify Priorities, Establish Quantitative Goals for Each Priority, and Assign Resources Accordingly

¹⁸ Draft standards for air, water, and soil quality are being negotiated.

¹⁹ This "sectoral agenda" strategy has been followed by Mexico and Colombia with significant success.

Panama has developed a number of environmental policies at the national level and on specific issues, helping to raise the profile of environmental issues in the national debate and the public administration, and providing a sense of accountability. However, through time, the increasing number of “priorities” and policies has blurred the focus on key concerns and attainable objectives. This “priority” inflation is particularly damaging in light of the low (but increasing) allocation of the national budget to environmental issues. ANAM needs to reaffirm its role as environmental policy leader by establishing a clear sense of direction and priorities for responding to current and potential environmental challenges.

Based on the above recommendations to improve institutional coordination and functioning of the SIA, this report recommends that the Government review the national priorities for environmental protection, sequencing them and providing an appropriate budget to achieve them. The organization and resources allocation of ANAM should reflect these priorities. Specific recommendations include:

- Establishing national environmental priorities with quantitative goals. Priorities and goals should reflect major environmental problems (for example, environmental health) and potential environmental pressures associated with increased economic activity (like those linked to the construction of major infrastructure or the development of large tourism projects and large-scale mining).
- Reflecting the stated priorities in the national budget allocation for environmental protection nationally, and developing a “whole of government” accounting system to monitor the use of budgetary resources. Where needed, reassign financial resources and personnel and provide additional sustainable funding, for instance, to tackle environmental health problems.
- Reforming ANAM’s organization, balancing the preeminence of the EIA focus inside the agency with reforming of the instrument (see recommendation 5.2), and developing specific mandates, capacities, and staff to identify, address, monitor, and achieve the new priorities.

Improve Effectiveness and Efficiency of Environmental Management

Like other countries of the region, Panama has relied almost exclusively on the EIA as the main tool to develop its environmental management capacity. Currently, in Panama, an EIA is required for an extremely long list of activities, and basic standards are absent for facilitating the determination of applicable requirements. Many activities—some of them with standard and predictable impacts that could be managed through technical standards—are required to prepare an EIA that has to be evaluated, consequently taking away precious human resources that could be allocated to other purposes. In addition, monitoring and control of the actual impacts of projects in their operation is limited because of the focus on an ex ante tool like EIA, without a strong inspection system. Moreover, the high economic growth rate and the Government’s very ambitious infrastructure program mean that an urgent effort is required to develop other environmental management instruments that can complement the EIA.

This report recommends that ANAM strengthen the EIA and complement its environmental management toolbox by:

- Adopting detailed guidelines for project proponents in preparing EIAs, and adopting detailed criteria for ANAM in reviewing EIAs and granting environmental permits.

- Strengthening environmental zoning by: (a) integrating the various forms of land use planning within a common methodological and technical framework; and (b) improving ANAM’s technical and operational capabilities, especially in terms of communication, supervision, and monitoring of sectoral activities.
- Launching a pilot Strategic Environmental Assessment (SEA) project to develop this instrument as a complement to the EIA process, and selecting pilot sectors or regions of the country.
- Complementing the EIA adjustment and SEA implementation with technical guidelines and norms such as contract specifications, and with guidelines to mainstream design and environmental management best practices.

Improve Compliance with Environmental Regulations

Although the enforcement capacity of ANAM has improved, compliance is still one of the weakest and most sensitive aspects of Panama’s environmental management framework. Due to the Dominican Republic-Central America Free Trade Agreement (DR-CAFTA), enforcement is one of the most sensitive issues. This is particularly relevant for compliance issues, which are likely to increase since pressure from trading partners might rise rapidly, as has happened in other free trade agreements. In addition, exporters will further demand better sanitation certification technology and capacity to guarantee market access. Many of the components of an effective enforcement system are already in place, but human, material, and technical resources for enforcement activities (particularly inspections) need to be secured.

More substantially, the approach based on threatening with sanctions (that are seldom enforced) needs to be shifted to promoting compliance through achievable requirements that are applied gradually and with flexibility, but with credible sanctions for violators. Improving the legal framework with more precise regulations and standards (as indicated in the previous recommendations) will make compliance and enforcement easier, but those reforms have to take into account compliance from the outset to avoid creating unenforceable requirements. Improving compliance will require time and numerous reforms. An abrupt increase in enforcement without adequate reengineering of the compliance system might seriously affect competitiveness and/or drive businesses toward the informal sector without achieving environmental protection goals.

This report recommends that ANAM refocus the enforcement strategy around a Compliance Promotion Program, and through a combination of initiatives and strong monitoring that combines information, technical assistance, financial incentives, and a credible enforcement threat. Some of the key ingredients of such a program are:

- Establishing a Compliance Promotion Program monitored periodically by the NEC to bring the regulated community—including municipalities and other government entities—into compliance. The program might be based on the provision of information and technical assistance, financial incentives, and a credible enforcement threat, and might include an inspection program for unlicensed facilities and a follow-up and audit program for environmental management and environmental adjustment plans of licensed facilities.

- Staffing, training, and equipping the enforcement unit of ANAM and strengthening the capacity of the Environmental Prosecutor.
- Ensuring availability of laboratories to support inspections and evidence gathering by the Environmental Prosecutor.
- Stepping up the creation of independent environmental certification and auditing entities to foster third-party verification in support of government enforcement and voluntary compliance.

Better Support for Environmental Decision Making and Monitoring through Improving the National Environmental Information System (SINIA) and Public Participation

Environmental information is available at ANAM and through its website. However, a system for periodically gathering data on environmental quality, and in a format consistent with other national, regional, and international database systems, is not yet in place.

This report recommends that ANAM revitalize the SINIA, which could provide relevant environmental information to support decision making, environmental policy implementation, and performance monitoring throughout the SIA and to stakeholders and the general public. Some of the key ingredients of such a program are:

- Step up the implementation of indicators to be used by government officials to steer policy priorities, for instance, concerning water balances, registry of users, and point sources of pollution.
- Consolidating the SINIA by acquiring equipment, adding staff, and providing training, as needed.
- Improving current water- and air-quality monitoring.
- Creating an inventory of wastewater discharges and point-source air emissions.
- Step up efforts to make operational an environmental accounting system to determine the cost of environmental degradation.

In Panama, the environment is one of the most transparent, open, and accountable sectors. The GLE calls for public consultations on EIAs; regional, district, and *comarca* consultative councils operate; and ANAM has a successful citizen complaints mechanism. Nevertheless, transparency and participation still have gaps and weaknesses that need to be addressed. Equity and balance are special issues: while the private sector has considerable lobbying capacity, participation of indigenous communities is less frequent and effective. In addition, lack of follow-up appears to be a generalized problem in consultations with stakeholders, NGOs, and citizens.

This report recommends that the Government strengthen current participation mechanisms by:

- Stepping up actions to begin the operation of the National Consultative Commission on the Environment (Comisión Consultiva Nacional del Ambiente).
- Improving consultation mechanisms on proposed policies, laws, regulations, and norms, by organizing workshops or target groups to discuss proposals.

2.6 Medium- and Long-Term Recommendations

Addressing Legal and Regulatory Gaps

The GLE established a broad basis for building a regulatory framework that might address Panama's priority environmental problems. Coherence of the general legal framework must be ensured. The legal framework relies too heavily on command-and-control instruments, including sanctions, as a response to violations, while economic incentives instruments to promote compliance and achieve the desired conduct are not yet in place. Although some key regulations and technical standards have been adopted, legal thresholds have not been set for key issues such as wastewater discharges and air emissions. Compliance with the law and ANAM's ability to implement and enforce it would improve with a legal framework that takes into account both the regulated community's ability to comply and the Government's ability to oversee compliance and enforce the law.

While substantial progress on environmental management can be made by refining and updating regulations and bylaws in the medium to long term, there is a need for more complicated legal proceedings, which require longer periods of negotiation and consensus building across multiple stakeholders, like completing the legal framework for zoning and land use.

Institutional Reform

After 10 years in existence, ANAM can be proud of its many achievements: (a) consolidating the legal and policy framework; (b) reengineering processes and training activities at both the central and regional levels; (c) provision of equipment and development of administrative and financial systems; (d) strengthening the SIA; (e) developing a national environmental information system; (f) consolidating environmental compliance; and (g) consolidating conservation policies. However, the environmental challenges that Panama will face in the medium and long term due to its fast economic growth and expansion will require an environmental authority with more power to convene and coordinate environmental policy, with increased clout to implement strategic environmental management instruments like zoning and SEA and with more weight to enforce regulations and promote compliance. This administration has given considerable importance to environmental matters and has strengthened ANAM, but in legal terms, Article 6 of the GLE, ANAM does not have a cabinet seat.

Creating a Ministry of Environment will not automatically solve Panama's environmental problems. The environmental performance of many environmental ministries is far below ANAM's performance. However, transforming ANAM into a ministry in the medium term, would go a long way to improve its convening power, its coordination capacity, and its enforcement clout. It is important to stress that what is needed is a powerful ministry, not a large and expensive one, and that Panama will need a strong environmental authority to manage the natural resources on which most of its economy is based and to protect the environment on which the welfare of its people depends.

III. Environmental Health in Panama

1. Background

Environmental health risks, such as those from inadequate water and sanitation, and indoor and urban air pollution, and their associated costs, represent a significant burden on Panama's economy. Urban air pollution is a growing concern in Panama City and other urban centers, and indoor air quality remains a major health problem in the country's rural indigenous areas, where biomass is predominantly used for cooking. While water supply and sanitation coverage is high on average, sharp inequalities in coverage exist, with poor service quality in urban poor areas and scanty coverage in rural indigenous areas. These environmental health risks are especially important for the most vulnerable subgroups of Panama's population, including children under 5 years of age, women, the elderly, and the poor.

As the evidence shows, the environmental health implications of urban air pollution, poor water supply and sanitation, and indoor air pollution impact Panama's ability to achieve targets for reducing child mortality, improving maternal health, combating diseases, and other Millennium Development Goals (MDGs). Overall, the analysis shows that Panama's economic costs associated with these environmental problems amount to nearly US\$225 million or 1.25 percent of the country's gross domestic product (GDP) (Table III.1). This is comparable to results from other such valuation studies on environmental health undertaken in the region (Figure III.1).

Figure III.1. Costs of Environmental Degradation (as percent of GDP)

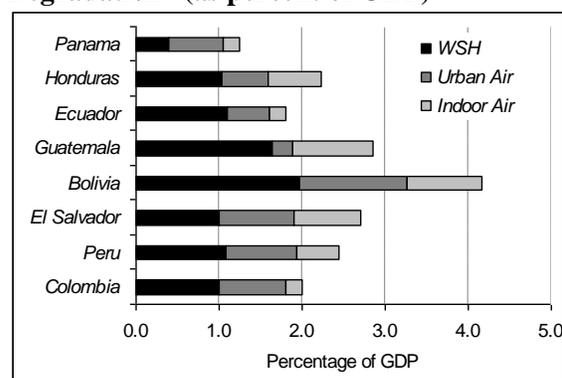


Table III.1. Annual Cost of Environmental Health Effects (Million US\$ per year)

Environmental Categories	"Low"	Mean Estimate	"High"
Outdoor air pollution	30	120	205
Water supply, sanitation, and hygiene	50	70	90
Indoor air pollution	25	35	45
TOTAL ANNUAL COST	105	225	340

The costs of these problems have been estimated in this report to help policymakers in Panama appreciate the magnitude of these issues and to better integrate environmental health considerations into economic development decision making. These costs include not only the medical costs of treatment and lost productivity due to sickness and caregiving, but also provide an estimate of the value of pain and suffering from premature death and disease. This analysis

covers only a limited number of diseases attributed to the three environmental risk factors in question—urban air pollution, inadequate water and sanitation, and indoor air pollution—and therefore underestimates the economic burden these environmental risk factors place on Panama.

2. Urban Air Pollution: Analysis and Recommendations

Air quality: Urban (outdoor) air pollution is a growing concern in Panama’s urban centers, particularly in Panama City and *San Miguelito*. Particulate matter concentrations (measured as total suspended particles [TSPs] and particles smaller than 10 microns in size), exceeding World Health Organization (WHO) air quality guidelines, are the major air quality problem. Urban air pollution costs were estimated for Panama City and *San Miguelito* with a combined population of about 850,000. This urban population exposed to air pollution constitutes about 50 percent of total urban population in Panama.²⁰

Air quality monitoring data are scarce in Panama. In the metropolitan area of Panama City there are only six air quality monitoring stations, five of which measure PM₁₀ (Figure III.2). While PM₁₀ is usually monitored, the proportion of even finer particulate matter (PM_{2.5}) needs to be estimated.

Typically, the ratio of PM_{2.5} in PM₁₀ varies from 0.15 up to 0.96 for different pollution sources. For Panama City and *San Miguelito*, a conservative estimate of 0.5 recommended by WHO is applied in this report, but the ratio may potentially be higher due to a high transportation fleet growth (5 percent annual growth, at about 250,000 units in 2004, responsible for 90 percent of total air pollution (GEO *Ciudad de Panama 2006*).

Results from these monitoring stations show that the annual average PM₁₀ standards were exceeded in this area during all periods observed. The poor availability of air quality monitoring data contributes to the high level of uncertainty in the following analysis.

Vehicle growth

Panama’s transportation fleet is responsible for 90 percent of total air pollution (ibid.). With a high fleet growth rate (5 percent annually) combined with a substantial amount of aging (and heavily polluting) buses and trucks, urban air pollution is a growing concern.

Health impacts

Figure III.2. Monitoring Stations in Panama City



Source: “Año 2006. Informe del Monitoreo de la Calidad del Aire. Ciudad de Panamá.” 2007. Universidad De Panamá. Instituto Especializado De Análisis. Sitio del Instituto especializado de Análisis en Corozal (SIEAC). Laboratorio

²⁰ <http://www.contraloria.gob.pa>.

The most significant health impact of outdoor air pollution has been associated with particulate matter (PM) and, to a lesser extent, with ground-level ozone. Particles smaller than 10 microns in size (PM₁₀), and especially those smaller than 2.5 microns (PM_{2.5}), penetrate deep into human lungs and cause health impacts such as acute respiratory infection (ARI) (both upper and lower respiratory tract infections), chronic obstructive pulmonary disease (COPD) (especially bronchitis), asthma attacks, cardiovascular disease, and lung cancer. Certain population subgroups, such as the elderly, children, and individuals with existing respiratory or cardiovascular diseases, are at increased risk from exposure to particulate matter.

In Panama, the accuracy of health data is a concern—with high uncertainty in the quality of data on mortality causes. Underreporting also contributes to the problem. The combination of poor air quality monitoring, the absence of integrated emissions inventories, and the underreporting of related health problems all contribute to the high level of uncertainty in the analysis of health costs relating to urban air pollution in Panama, and point to the need to strengthen these pollution monitoring and health information systems.

Given these caveats, the estimated annual health effects of ambient particulate outdoor air pollution in Panama are presented in Table III.2. There are an estimated 275 premature deaths and 424 new cases of chronic bronchitis in Panama every year. Annual hospitalizations due to pollution are estimated at 670, and emergency room visits/outpatient hospitalizations at 13,000 per year. Cases of less severe health impacts are also presented in Table III.2.

Table III.2: Estimated Annual Health Effects (and Costs) of Urban Air Pollution

Health End-points	Total Cases	Total DALYs	Total Annual Cost (US\$)
Premature mortality	274	2,458	10–190
Chronic bronchitis	424	933	1.0
Hospital admissions	669	11	0.5
Emergency room visits/outpatient hospital visits	13,116	59	1.4
Restricted activity days	2,274,633	682	11.9
Lower respiratory illness in children	27,307	177	1.6
Respiratory symptoms	7,239,267	543	0.0
TOTAL		4,864	UD\$26–206

DALYS = Disability-adjusted life years.

Economic costs

Increasing air pollution in Panama’s urban areas, especially in Panama City, is imposing a negative economic impact from premature deaths, illness, medical costs, and lost productivity. Costs of health impacts from particulate matter have been assessed, and health conditions such as premature mortality, hospital admissions, restricted activity days, and emergency visits have been considered. In the absence of proper data on treatment costs, informed estimates have been provided by medical experts in Panama City.

The total annual costs associated with urban air pollution are estimated to be US\$26 million to US\$206 million (Table III.2). Mortality range relates to application of two different approaches to estimate the value of mortality risk: a lower estimate is obtained after application of the Human Capital Approach (HCA), and a higher estimate is based on the Value of Statistical Life (VSL) and benefit transfer.

2.1 Summary Assessment of Actions on Urban Air Pollution

Interventions to control primary and secondary particulate emissions from mobile (transport) sources can be broadly classified into (a) market-based instruments, such as fuel pricing and taxation, vehicle taxation, and emission taxes; (b) vehicle technology standards and regulations including in-fleet technology retrofitting and inspection and maintenance programs; (c) fuel quality improvements and fuel use regulations, such as low-sulfur diesel and conversion to compressed natural gas (CNG); and (d) traffic management and urban planning, including public transportation policies (Larsen 2005). Based on an analysis of other Latin American cities with similar pollution problems, several interventions were identified that could drastically reduce PM pollution in Panama City. They include:

Desulphurization of fuel

Reducing the sulfur content causes some direct reduction in particulate emissions from diesel combustion, with no modifications of diesel engines required. Furthermore, low sulfur content is often a prerequisite for advanced particulate control technology on diesel vehicles, or, at a minimum, makes the control technology more efficient. In addition, low sulfur content can also reduce secondary particulate formation (sulfates), providing an added benefit to health.

New Bus Rapid Transport (BRT) system in Panama City

There are comprehensive plans to restructure the whole public transport system in Panama City. The existing bus route system—which consists of a detailed grid of small and medium-sized buses—is intended to be converted to several main lines through special corridors with transfer points. This is expected to reduce the dependence on smaller minibuses; which can then be used as feeders, allowing passengers to transfer onto the larger buses to enter Panama City.

When fully developed, this system could lead to the scrapping of a substantial number of small buses and some cars. These smaller buses are privately owned, so owners will either have to be bought out or may be eliminated naturally as the import of used vehicles is prohibited in the country and the high mileage of the existing ones are more expensive to maintain. New buses may be hybrid or run on natural gas.

Retrofit particle control technology for diesel vehicles

Buses and trucks are responsible for a large part of the PM emissions from mobile sources in Panama City. New vehicles emit less than older buses. Instead of scrapping older vehicles from the fleet, retrofitting older trucks and buses with particulate control technology may also be an option.

Particulate trap (filter) systems and oxidation catalysts are the two main systems that can be used in heavy-duty diesel vehicles. Their efficiency is highly dependent on the sulfur content in the fuel. To operate effectively, they require sulfur content below 50 parts per million (ppm). Their efficiency seems to be around 30 to 50 percent reduction of PM, but for ultra low-sulfur diesel (down to 15 ppm) their efficiency could reach 90 percent reduction (Sierra Research 2000). Thus, this option is viable only after low-sulfur diesel is introduced in Panama.

The cost of these systems seems to be around US\$5,000 to US\$17,000 per vehicle (Sierra Research 2000; Cleaner Vehicles Task Force 2000). The Cleaner Vehicles Task Force (2000) predicts costs will be reduced to around US\$2,500 to US\$3,500 in response to a growing market for these devices as low- or ultra-low sulfur becomes more available. If device cost drops to

US\$3,000, the annual costs are estimated to be around US\$14 million. This intervention is reasonable to implement after the introduction of the BRT, with only remaining vehicles investing in the device.

Emission reduction from stationary sources

In addition to mobile sources, there are several industry and non-industry sources that emit PM. Total emissions from stationary sources are, however, only 10 percent of the total, and are less harmful to human health because they are often located farther away from where people live and stay.

Data for emissions and abatement costs for the industry plants in Panama City are not available, and therefore international data are substituted for this analysis (Table III.3). According to Rabl (2000), PM abatement costs tend to be highly site specific, and are generally not known with precision until an installation is complete. However, international abatement cost data may give some indications as to what extent actions, mostly end-of-pipe measures, may be cost-effective.

All these abatement costs fall within the range of the estimates for the damage costs for outdoor (urban) air pollution in previous studies (World Bank 2007; World Bank 2006; and Ecuador CEA 2006). Thus, abatement action toward stationary industrial sources in Panama City, including power production, might well be cost-effective.

Other interventions that are difficult to quantify may also be considered. They include gradual changes in the tax system that better reflect the relative emissions from the fuels, giving the vehicle owners incentives to buy the most environmentally benign vehicles. However, diesel and gasoline are only substitutes for light-duty vehicles like taxis, implying that this intervention would have only limited effect on emissions in the long term. Thus, other measures are necessary.

An inspection and maintenance program for the whole vehicle fleet in Panama is needed. This could contribute considerably to reduced emissions when targeted to the most polluting vehicles, if it results in better maintenance, and eventually scrapping older, heavy-polluting vehicles. Tax incentives for each car owner to voluntarily scrap the car may be an efficient measure to rapidly remove the most polluting vehicles from the road. However, the incentives required for this voluntary scrapping might need to be rather high—since they would have to be targeted toward vehicles in the whole country to avoid inflow of cars from other areas. Therefore, the potential costs and benefits should be carefully considered. A permanent scrapping program could be designed as a deposit-refund system, where the buyers of new or used imported vehicles pay a deposit, which is returned to the owner when the vehicle is scrapped. Such a scheme may yield long-term benefits.

Biking lanes, green-light waves for traffic, and potentially other city planning measures should be considered further to assess their costs and benefits. Their total effects on PM emissions

Table III.3. Average Abatement Costs for PM in Some Industries

Industry	US\$/Ton PM Reduction
Power production	13,005
Stone/glass	2,747
Petroleum refining	6,745
Paper production	7,725
Chemicals	1,627
Metals	1,202
Mining	2,747

Source: WWS (1999).

would in any case be small, and they should therefore be considered only as supplements to the other actions discussed.

2.2 Recommendations for Actions on Urban Air Pollution

Rapidly increasing urban populations and accompanying vehicle growth, coupled with inadequate regulations and monitoring, will impact the air quality in Panama City and *San Miguelito* unless appropriate actions are taken. The health cost estimate from PM concentrations in Panama City and *San Miguelito* is estimated to be approximately US\$120 million per year. Assessing the various interventions, this analysis tried to develop an “optimal” package of actions to reduce PM, sulphur dioxide (SO₂), and nitrogen oxide (NO_x) emissions. Interventions that are alternatives and that could be complementary are considered taking into account costs, benefits, and practicalities regarding implementation, time frames, and so forth. To avoid double counting, the effects of each action have been adjusted for the effects of others (Table III.4).

Table III.4. Estimated Percent Reductions in Annual Costs of the Actions to Reduce Environmental Health Costs from PM Emissions in Panama City

Actions	Percent Reduction
1. Low-sulfur diesel (<50 ppm)	17
2. Bus Rapid Transit (BRT)	28
3. Retrofit particle control technology	20
4. BRT with clean buses	1
5. Reduction industry sources	4

If the sulfur content in diesel fuel in Panama were reduced from today’s 5,000 ppm (0.5 to 1 percent) to 50 ppm (0.005 percent), the estimated annual average PM₁₀ concentration would be reduced about 19 percent. Annual health benefits of this intervention are estimated at above US\$20 million. Reducing sulfur content to 50 ppm will require substantial investments in the refineries in Panama. Incremental costs per unit of fuel were estimated for Mexico (Blumberg 2007) at 2.2 cents per liter for diesel and 1.1 cent for gasoline. Annual costs are estimated at US\$15 million. This measure corresponds to the introduction of stricter fuel standards that would in turn have the same benefit, but cost would also include administrative costs of standards introduction, enforcement, and verification.

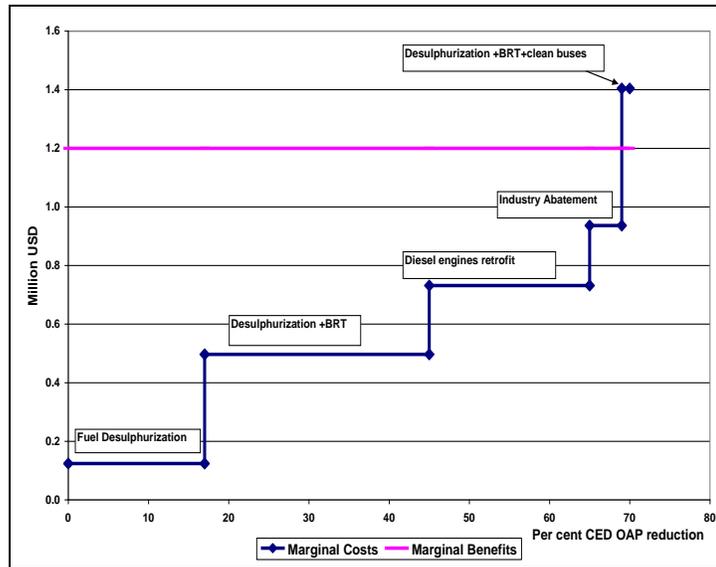
Introduction of Bus Rapid Transit (BRT) also has some immediate benefits in terms of transportation fleet reduction. To achieve best results in terms of pollution reduction, it could be coupled with fuel desulfurization. According to this analysis, the annual average PM₁₀ concentration will be reduced by an additional 31 percent, with corresponding annual health benefits estimated above US\$33 million. Total costs of this plan are estimated to be US\$140 million, including new infrastructure, scrapping of old buses, and so forth. Even if new buses run on diesel, the PM emissions would be substantially reduced, because of high emissions from the existing aging fleet. If the new buses are hybrid or run on natural gas, the PM emissions would be practically eliminated. However, taking into account the new low-sulfur diesel coming to the market, neither of these options appear to be a cost-effective alternative to diesel buses.

The effects of retrofit particle control technology on diesel vehicles (assuming that low-sulfur diesel is available) is considered in this benefit-cost analysis. Benefit calculations are based on average contribution from the vehicle type to the total annual average PM concentration. However, if the most polluting vehicles are scrapped from the fleet through an inspection and

maintenance program, for example, benefits from retrofit technology may be substantially lower. This analysis shows that retrofitting PM control technology may have a positive benefit-cost ratio, with annual benefits around US\$24 million and annual average PM₁₀ concentration reduction of 23 percent.

The potential effects of introducing CNG, assuming that low-sulfur diesel and retrofit particle control are both available, is also indicated. For industry sources, the analysis assumes that 50 percent of total emissions from the industry are reduced. An illustration of the marginal benefits and costs the various actions may yield is provided in Figure III.3.

Figure III.3. Marginal Costs and Benefits of Actions to Reduce PM Emissions



This analysis shows that all actions except converting diesel buses to CNG have marginal costs lower than the marginal benefits (US\$1.2 million). Fuel desulphurization is the cheapest action. BRT systems and retrofitting remaining diesel vehicles are estimated to have both large marginal benefits and low marginal costs, as do actions toward several industry sources.

In summary, the actions where marginal costs are lower than marginal benefits could yield reduced health costs of around 70 percent of total estimated health costs from reduced PM emissions in Panama City, or some US\$80 million per year. In addition, there might also be some other actions that could yield net health benefits, such as how BRT could substantially improve road safety, but they would need a more in-depth analysis. These calculations are only estimates. Many of the cost data are based on international studies, and if data from Panama were available, better estimates would be arrived at.

3. Inadequate Water and Sanitation: Analysis and Recommendations

The *reported* level of access to water and sanitation is high in Panama. According to the Ministry of Health, in 2006 about 97 percent of the population had access to potable water and 97 percent had access to at least basic sanitation. However, estimates from the WHO/UNICEF Joint Monitoring Program (2006) puts access to improved water supply in 2004 at 99 percent in urban areas and 79 percent in rural areas, while access to improved sanitation was 89 percent in urban areas and 54 percent in rural areas, as shown in the Table III.5.

Table III.5: Access to Improved Water Supply and Sanitation in Panama (2004)

		Urban	Rural	Total
Water access	Broad Definition	99%	79%	90%
	House Connections	96%	72%	86%
Sanitation	Broad Definition	89%	51%	73%

Source: [WHO/UNICEF](#) Joint Monitoring Program (2006).

While average water and sanitation coverage in Panama is high by regional standards, there are still gaps in rural and, in particular, in indigenous, areas. Access to improved water supply is estimated to be 78 percent in rural areas and 48 percent in indigenous areas in 2004.

Sanitation coverage is estimated at 90 percent in rural areas (27 percent for septic tanks and sewers) and 47 percent in indigenous areas (0 percent for septic tanks and sewers). Urban coverage with sewers and septic tanks is estimated at 77 percent, but it is only 45 percent in the lowest quintile in urban areas.²¹

Service quality is often poor in areas officially defined as having coverage. While there are no reliable data on service quality, there is anecdotal evidence and frequent press coverage of supply interruptions. Although water quality is perceived as being good, there are only limited data on water quality, in particular in rural areas. Less than one-fifth of wastewater collected receives any form of treatment.²²

Many rural water systems suffer from sustainability issues. These include mismanagement of water sources and insufficient tariff levels to ensure proper operation and maintenance. In addition, inappropriate hygiene practices limit the health impacts from the improvements in water and sanitation systems.²³

Health impacts

Panama has achieved substantial reductions in child mortality and diarrheal child mortality. Estimates from PAHO (2006) and WHO (2006) indicate that 8.3 to 11 percent of child mortality was due to intestinal diseases. It is very difficult to identify diarrheal morbidity because a substantial share of cases are not treated (or do not require treatment at health facilities), and are therefore never recorded. In addition, diarrheal cases treated by private doctors or clinics are often not reported to public health authorities. Household surveys, therefore, provide the most

²¹ Panama Water and Sanitation in Low-Income Communities Project, World Bank, 2006.

²² Ibid.

²³ Ibid.

reliable estimates of total cases of diarrheal illness—but only record diarrheal illness in children. Moreover, these surveys reflect diarrheal prevalence only at the time of the survey. Because there is often high variation in diarrheal prevalence across seasons of the year, extrapolation to an annual average will result in either an over- or underestimate of total annual cases. Correcting this bias is often difficult without knowledge of seasonal variations.

For children under 5 years of age, the 2003 Living Standards Measurement Survey (LSMS) for Panama reports a diarrheal prevalence rate (in the preceding month) of 18 percent in urban and rural non-indigenous areas and 40 percent in rural indigenous areas. This rate is used to estimate annual diarrheal cases per child under age 5, and then total annual diarrheal cases in all children under age 5. The procedure applied is to multiply the two-week prevalence rate by 12 to arrive at an approximation of the annual cases per child. Household survey data in Panama do not provide information on diarrheal illness in the population over age 5. International evidence indicates that diarrheal incidence in children under age 5 is about five times higher than the incidence in the population over age 5 (Larsen 2004a,b).

WHO estimates that 90 percent of diarrheal illness is attributable to inadequate water sanitation and hygiene. Using this figure, there are almost 130 premature deaths, and about 1 million additional cases of diarrhea in children under age 5 attributed to poor water sanitation and hygiene (Table III.6). Although the rural indigenous population share in Panama comprises about 8 percent, the share of children under age 5 and the diarrheal prevalence and mortality in this age group are substantially higher. This explains why health costs associated with inadequate water supply, sanitation, and hygiene (WSSH) for this subgroup are 16 percent of the total.

Table III.6. Estimated Annual Health Effects from Water, Sanitation, and Hygiene

	Cases			Total
	Urban	Rural	Rural Indigenous	
Children (under age 5) – increased mortality	68	40	21	129
Children (under age 5) – increased morbidity ('000s)	440	240	220	900
Population over age 5 – increased morbidity ('000s)	505	260	230	995

Economic costs

Inadequate access to water and sanitation leads to premature deaths and disease, which in turn impose costs on the Panamanian economy. These costs include the expenses incurred to treat illness from diseases attributed to poor water and sanitation, doctor fees, laboratory tests, drugs, and bed charges when hospitalization is needed. Other costs include lost productivity when adults fall sick and stay home from work, or when primary caregivers have to take care of sick children (and potentially lose wages). Furthermore, the pain and suffering from premature death and illness can also be valued by calculating the burden of disease in disability adjusted life years (DALYs), and costing these DALYs at GDP per capita.

The annual costs of diarrheal mortality and morbidity attributed to inadequate water sanitation and hygiene are estimated at US\$38 million in urban areas, US\$15 million in rural areas, and US\$11 million in rural indigenous areas. The cost of diarrheal child mortality—based on the HCA—is estimated at about US\$23 million. The cost of morbidity, which includes the cost of

illness (medical treatment, medicines, and value of lost time), is estimated at US\$42 million. About 50 percent of these costs are associated with the value of time lost to illness (including caregiving), and another 50 percent are from cost of treatment and medicines.

Averting Expenditures

People often take averting measures to avoid perceived health risks. For example, if people perceive a risk of illness from their local water supply sources, some of them are likely to purchase bottled water, while others may boil their water, chlorinate it at home, or install water purification filters. These “averting” costs need to be included in the total costs of health risks. No data were available to estimate averting expenditures in Panama. Applying international experience, it was estimated that in urban areas they constitute 10 to 20 percent of total cost. Table III.7 provides background data for this assessment.

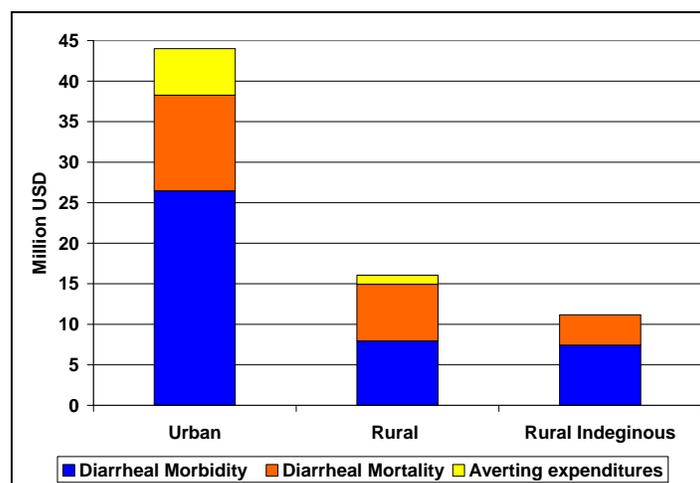
Table III.7: Types of Point of Use Water Treatment in Panama (percent)

	Urban	Rural	Rural Indigenous	Total
No Water Treatment	86	80	80	85
Boil	8	9	12	8
Filter	2	1	0	1
Chlorination	4	10	8	6

Source: LSMS 2003.

In the final analysis, the estimated annual costs associated with inadequate water supply, sanitation, and hygiene range from US\$50 million to US\$90 million per year, with a mean of US\$70 million—equivalent to about 0.4 percent of the country’s GDP in 2006. These costs include those related to mortality in children, morbidity in children and adults, and averting expenditures (mostly water chlorination and water boiling) (Figure III.4). The estimated costs of under-5 child diarrheal mortality are about half of the costs of morbidity in children and adults. Child mortality is valued using the HCA. The lower and upper bounds of estimated costs reflect an under-5 child diarrheal mortality of 8.3 to 11 percent of total under-5 child mortality (PAHO 2006). Costs are distributed unevenly among different populations groups. Urban costs account for 34 percent, while rural costs represent 66 percent of the total costs associated with inadequate water supply, sanitation, and hygiene.

Figure III.4: Annual Costs by Category (million US\$)



3.1 Water, Sanitation, and Hygiene Interventions

Interventions relating to improving the quality and quantity of water supply, improving access to improved sanitation, and programs encouraging better hygiene practices (including hand-washing) have potential health benefits. Based on studies from several countries, estimates of the benefits associated with different interventions to reduce damage arising from unsafe water and sanitation have been developed. These international studies estimate the percentage reductions in the incidence of diarrheal morbidity and mortality following interventions to improve the infrastructure that provides drinking water or basic sanitation, or interventions that improve personal hygiene.

To evaluate the benefits and costs of the interventions, it is important to distinguish between interventions that involve changes in household behavior and interventions that involve infrastructure or hardware improvements. Interventions that involve changes in household behavior are improved hygiene and water treatment at point-of-use. While public authorities can promote these behaviors, the actual changes in behavior are beyond their control. It is therefore important to explicitly account for this behavioral component in a benefit-cost analysis. As regards infrastructure or hardware (water supply and sanitation facilities), improvements are predominantly functions of provision and are likely to be used by households if design and service delivery reflect demand and provide convenience. Uncertainties regarding behavioral change in relation to water supply and sanitation tend therefore to be less important in a benefit-cost analysis than for hygiene improvement and point-of-use treatment of drinking water.

Benefit-cost Analysis of Water and Sanitation Improvements

To estimate the health benefits of water and sanitation interventions it is necessary to provide an estimate of the Panamanian population shares in each of the scenarios (Table III.8).

Table III.8: Water Supply and Sanitation in Panama (Percent of households)

Water Service	Total	Urban	Rural Non-indigenous	Rural Indigenous
Piped, public	63	90	27	1
Piped, community	25	5	55	55
Piped own	2	2	4	1
Protected well	1	0	2	0
Non-protected well	0	0	0	0

River, watershed	4	0	5	31
Other	3	3	3	4
Sanitation Service by				
Sewage, own	29	46	4	0
Sewage, shared	2	4	0	0
Septic tank, own	21	23	23	0
Septic tank, shared	2	3	1	0
Pit latrine, own	32	17	59	33
Pit latrine, shared	6	6	8	5
None	8	2	6	61

Source: LSMS 2003.

The aim of the infrastructure interventions is to improve water supply and sanitation, largely in rural areas. Two programs are investigated: one that provides 0.7 million people with improved sanitation in rural areas, and 0.25 million people in rural indigenous areas; and one that provides 0.08 million people with an improved water supply in rural areas and 0.09 million people in rural indigenous areas. Providing piped water supply to all rural households is likely to be very expensive. A realistic objective might be to at least provide improved water supply (protected well or borehole) and sanitation facilities (improved pit latrine or pour-flush latrines).

The benefits are derived from a range of studies and are calculated separately for different categories of individuals in rural Panama. The morbidity costs, based on the costs of treatment and value of lost time, are US\$16 per case of diarrhea in rural areas. The mortality costs are at US\$174,000 and are calculated based on the HCA. However, there are strong reasons to believe that the HCA approach underestimates the value of a lost life; hence, the figures reported here should be taken as lower bounds. Finally, the programs generate savings in time, which is an important ingredient in the calculations. It is based on data for households more than a 15-minute walk from a water source (approximately 2,000 households are in this category). Time saved is valued at 75 percent of the average rural wage (US\$5.6 /day, or US\$0.7/hour).

The analysis reveals that programs to improve water supply and sanitation in rural indigenous areas where child diarrheal prevalence is very high, have a benefit-to-cost ratio greater than 1.0 (Table III.9). However, for other rural areas, the benefit-cost ratio is greater than 1 only if time benefits are included. For water supply/sanitation programs in urban areas, the costs are higher and the benefits lower due to lower diarrheal mortality among children under age 5 and lower diarrheal prevalence. Marginal cost²⁴ would exceed marginal benefits²⁵ (health damage reduction) only for water supply and sanitation programs in rural areas.

²⁴ Approximated by average cost per 1 percent of WSSH cost reduction.

²⁵ Value of 1 percent of WSSH cost reduction, estimated at about 18 million Ls.

Table III.9: Benefits of Reductions in Diarrheal Morbidity and Mortality in Rural Panama

	Non-Indigenous		Indigenous	
	Improved Sanitation Facilities	Improved Water Supply	Improved Sanitation Facilities	Improved Water Supply
Population (thousand) Receiving Improved Sanitation	730		250	
Population (thousand) Receiving Improved Water Supply		80		88
Percent Reduction in Diarrheal Illness per Person ^a	32%	25%	32%	25%
Diarrheal Cases (thousand) Averted per Year	124	14	86	47
Deaths in Children Averted per Year	11	1	5	3
Annual Health Benefits of Improved Services (US\$ m)	3.9	0.5	2.2	1.2
Annual Value of Time Savings from Improved Services (US\$ m)	7.8	0.5	1.9	0.7
Annualized Cost of Service Provision (US\$ m)	5.8	0.6	2	0.6
Benefit-cost Ratio (Health Benefits Only)	0.7	0.8	1.1	2
Marginal cost (million US\$ per 1% of WSSH health cost reduction)	1.7	0.9	0.65	0.36
Benefit-cost Ratio (Health Benefits and Time Savings)	2	1.6	2	3

a. From Fewtrell and Colford (2004).

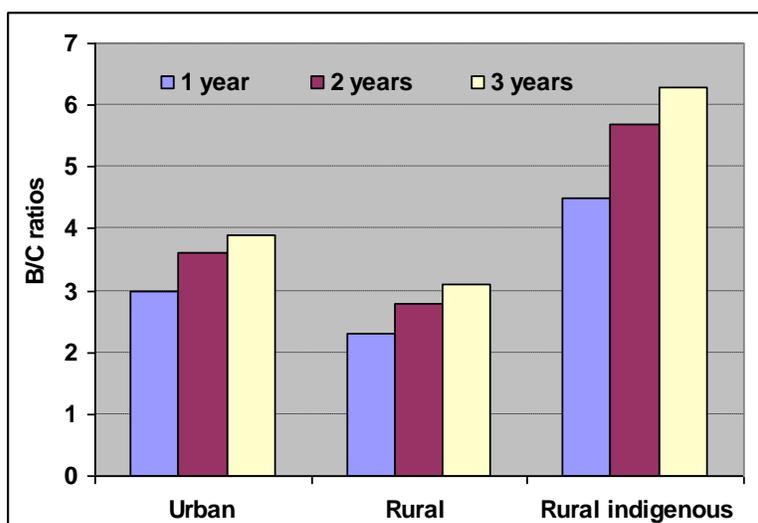
Benefit-cost Analysis of Hygiene Improvements

One of the most effective hygiene interventions has been found to be hand-washing after defecation, before preparing meals, and before eating. Curtis and Cairncross (2003) provide a meta-analysis of close to 20 hand-washing studies and report a mean reduction in diarrheal illness of about 47 percent. Fewtrell and Colford (2004), in their meta-analysis, report a mean reduction in diarrheal illness of about 45 percent from hand-washing interventions.

A benefit-cost analysis of hygiene improvement (hand-washing programs) involves an assessment of several key parameters and outcomes. The costs of improved hand-washing practices include the costs of program preparation and implementation and the private costs associated with increased water and soap consumption. The effectiveness

of the hand-washing program in terms of changing household and individual behavior, and the

Figure III.5. Estimated Benefit-Cost Ratios (15% program effectiveness target)



sustainability of this changed behavior, is country and context-specific. It will also depend on the design, duration, and overall magnitude of the hand-washing program. The expected benefits from such a program can be estimated from the diarrheal illness risk reductions reported in Curtis and Cairncross (2003) and Fewtrell and Colford (2004), and the monetized benefits (or costs avoided per case of diarrheal illness reduction) for Panama.

In the absence of data relating to hand-washing programs in Panama, a review of three other hand-washing programs (including information about the program costs and behavioral change) in Guatemala, Thailand, and Burkina Faso have been used to model three scenarios for Panama.

Correspondingly, the three “low,” “medium,” and “high” scenarios estimated for a hand-washing program in Panama represent: (a) program effectiveness of 10 to 20 percent in terms of the percent of households (or primary caretaker of children) that start regular hand-washing or improve hand-washing practices for the protection of child health; and (b) program costs ranging from US\$0.4 to US\$5.0 per targeted household or primary caretaker (US\$4.0 to US\$25.0 per household or primary caretaker with behavior change). Also, the benefit-cost analyses were carried out for rural indigenous, rural non-indigenous, and urban households, to provide a range of possible estimates.

For the various scenarios, the benefit-cost ratios were found to range from 7 in the “low” scenario to about 1 in the “high” scenario. This analysis implicitly assumed that the benefits of the program are realized for only one year, or that behavioral change (hand-washing) lasts only one year. While it is difficult to assess the sustainability of behavioral change, benefits for only one year is clearly a very conservative assumption. If benefits are sustained for two years, the estimated benefit-cost ratios would increase. Figure III.5 presents benefit-cost ratios for children for this target for a program (assuming a 15 percent effectiveness target) with sustainability of behavioral change lasting from one to three years.

Benefit-cost Analysis of Drinking Water Disinfection

In Panama, the most common method of disinfection is boiling water (LSMS 2003), and that is therefore the method considered in the benefit-cost analysis (Table III.10). Chlorination is by far the cheapest option; however, due to the lack of cost data, this method of disinfection was not included in the analysis. Fewtrell and Colford (2004) report from their meta-analysis that disinfection of drinking water at point-of-use on average reduces diarrheal illness by 47 percent in rural areas and 23 percent in urban areas.

Table III.10: Water Treatment at the Point of Use in Panama (Percent of households)

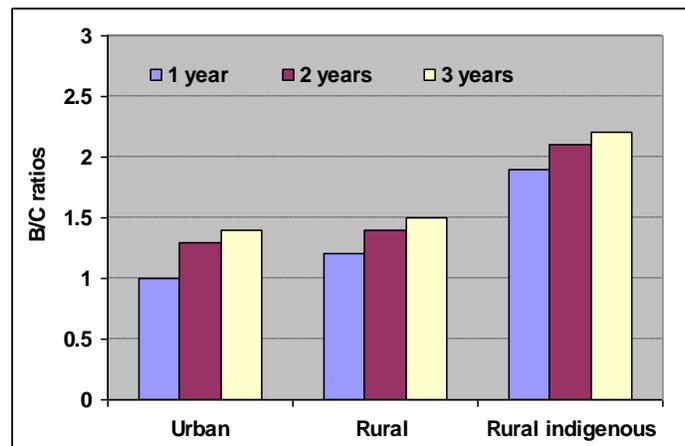
Type of Water Treatment	Total	Urban	Rural Non-indigenous	Rural Indigenous
No treatment	84	86	80	79
Boil	8	8	9	8
Filter	1	2	1	1
Chlorine	6	4	10	6
Other	0	0	0	0

Source: LSMS 2003.

There are no estimates of program costs to promote drinking water disinfection at point-of-use in Panama. Therefore, for this analysis, the same costs as for hand-washing programs (and for the same three scenarios of effectiveness ranging from 10 to 20 percent) have been applied. The program costs, instead of per primary caretaker of children, is now per household, with the assumption that one person in the household is primarily responsible for boiling drinking water. The private cost of boiling drinking water includes the use of commercial fuels and wood for fuel collection time by the household members. Collection time is estimated at 75 percent of the average rural wage (US\$5.6 /day, or US\$0.7 /hour).

Results from this analysis reveal that in rural areas, the disinfection programs are estimated to avert 30,000 to 60,000 cases of diarrhea and up to 10 deaths in children per year. The benefit-cost ratio for the central estimate in water-boiling programs is 1.4 to 2.1, corresponding to a 15 percent program response rate with drinking water disinfection sustained for two years (Figure III.6). For urban areas in Panama, these benefit-cost ratios are lower, but still well above, except for the “high” case. Drinking water chlorination programs in both rural and urban areas would have high benefit-cost ratios since private program costs are low.

Figure III.6: Estimated Benefit-cost Ratios (15% program effectiveness target)



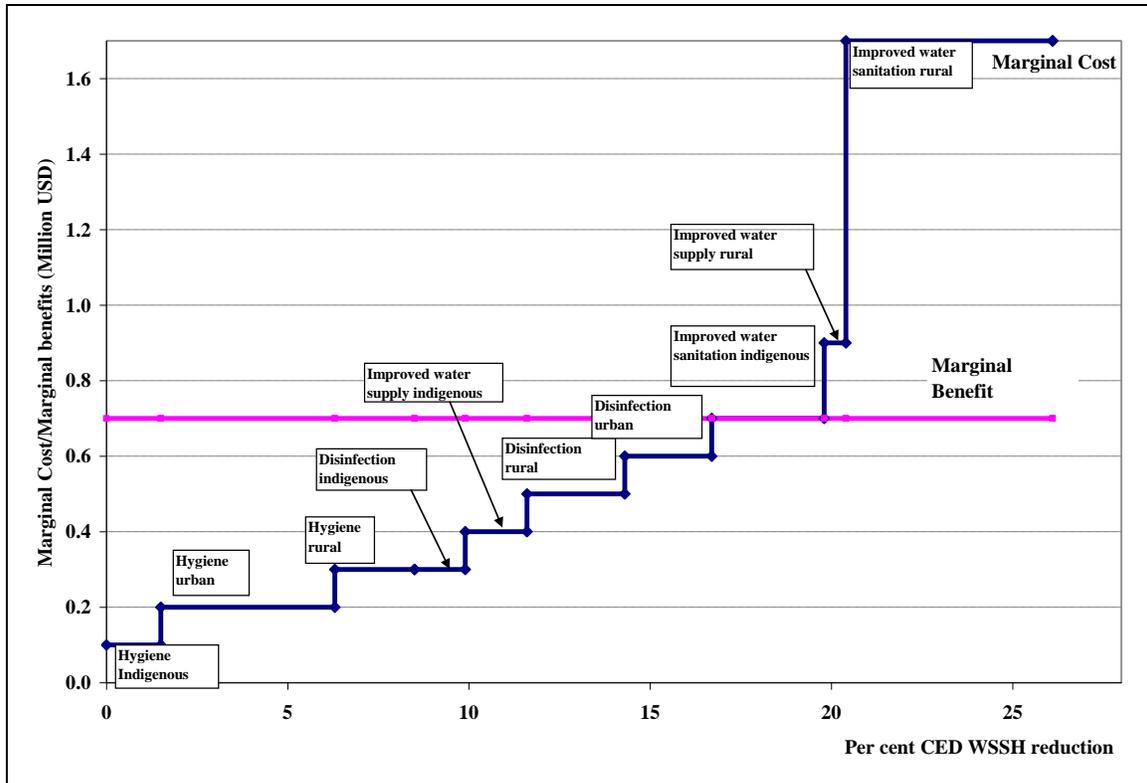
3.2 Summary Assessment of Interventions Relating to Water, Sanitation, and Hygiene

The different interventions discussed above can be summarized in terms of their contribution to reduced environmental damages and the costs per 1 percent of health damages reduction (marginal cost). The hygiene and disinfection programs are estimated to have the largest potential health benefits, but only if at least 20 percent of the population responds favorably to the program and improves hand-washing practices (Figure III.7). Hygiene improvement and disinfection of drinking water at point-of-use have a substantial potential to reduce diarrheal disease. The challenge, however, is to develop and deliver programs that induce sustained behavioral response on a large scale, while containing program costs at an affordable level.

The benefits of improved water supply and sanitation in rural indigenous areas exceed costs due to high diarrheal prevalence (Figure III.7). The benefit-cost ratios for hand-washing and drinking-water disinfection are based on behavioral change being sustained for two years. The ratios would be higher if, as a result of promotion programs, households sustain improved behavior for longer than two years, and would be lower if households sustained improved behavior for shorter than two years. For some interventions, such as programs of improved water supply and sanitation in other rural areas, costs exceed benefits. Furthermore, the benefits of hand-washing among adults, and safe water supply and sanitation programs in urban areas—not shown in the figure—are estimated to have significantly higher costs than benefits and a corresponding benefit-cost ratio less than 1. This analysis does not consider the possible interaction effects among different interventions (that is, how the impacts of a first intervention

affect those of a second intervention), because data constraints preclude a sound analysis of such effects.

Figure III.7: Marginal Costs and Marginal Benefits Relating to Interventions for Water, Sanitation, and Hygiene in Panama



3.3 Recommendations for Actions on Water, Sanitation, and Hygiene

From the analysis presented here, it is clear that most measures to improve the water supply and sanitation facilities in rural areas yield benefits in excess of costs under most assumptions. The programs are also justified because the benefits are concentrated primarily among the poor. These measures include drinking-water disinfection, hand-washing, improved rural water supply, and safe rural sanitation. The highest priority should be given to the drinking-water disinfection and hand-washing programs.

4. Rural Energy and Indoor Air Pollution: Analysis and Recommendations

About 2.4 billion people worldwide burn biomass (wood, crop residues, charcoal, and dung) for cooking and heating. The smoke created from burning these fuels turns the kitchens of the world's poorest countries into death traps. Every year, indoor air pollution from the burning of solid fuels kills over 1.6 million people, predominantly women and children. Smoke in the home is one of the world's leading child killers every year, claiming the lives of nearly 1 million children (ITDG 2004). In Panama, especially in the rural indigenous areas, indoor air pollution remains an important concern.

Rural energy use

The vast majority of Panamanian households in rural indigenous areas use biomass for cooking, especially firewood and agricultural residues. According to household surveys, about 93 percent of rural indigenous, 36 percent of rural, and 3 percent of urban households used fuelwood for cooking in 2003 (LSMS 2003).

Health effects

Acute respiratory infections (ARIs), and chronic obstructive pulmonary disease (COPD) are the most common diseases associated with indoor air pollution in Panama. ARIs affect mainly women and children, especially in rural indigenous areas on Panama, where over 9 out of 10 households burn fuelwood in inefficient stoves in poorly ventilated areas. Mortality in children under age 5 from ARIs is 9 to 11 percent of total estimated child mortality in Panama (PAHO 2006). Data on COPD mortality and especially morbidity incidence are not readily available for Panama; therefore regional estimates from WHO (2001) and Shibuya and others (2001) for the AMRO B region are used instead.²⁶

Every year, 160 children under age 5 die from ARI in Panama (Table III.11). Of these cases about 20 percent may be attributed to indoor air pollution. Also, among children under age 5 and women over age 30, more than a half-million annual cases of acute respiratory illness in rural areas and more than 50,000 cases in urban areas may be linked to indoor air pollution. Indoor air pollution also causes COPD in women over age 30. Up to 30 women die annually from COPD in urban and rural areas, and about 350 new cases of COPD annually can be attributed to indoor air pollution, predominantly in rural areas.

Table III.11: Estimated Annual Health Effects of Indoor Air Pollution

	Estimated Annual Total Cases	
	“Low”	“High”
<i>Acute Respiratory Illness (ARI):</i>		
Children (under age 5) – increased mortality	24	35
Children (under age 5) – increased morbidity	278,800	413,000
Females (age 30 year and older) – increased morbidity	190,300	288,300
<i>Chronic obstructive pulmonary disease (COPD):</i>		
Adult females – increased mortality	25	44
Adult females – increased morbidity	244	442

Economic costs

The mean estimated annual costs of health impacts from indoor air pollution in Panama associated with the use of traditional fuels (mainly fuelwood) ranges from US\$25 million to US\$45 million, with a mean of US\$35 million, equivalent to about 0.2 percent of the country’s GDP in 2006. COPD mortality in adult women accounts for 40 percent of the cost, and respiratory child mortality represents 13 percent (Figure III.8). ARIs in children, and COPD and ARI morbidity in adult women, each represent 23 percent of the cost. The rural population bears 86 percent of the total cost of indoor air pollution.

²⁶ Panama belongs to the AMRO B region of WHO, which is one of three WHO regions in the Americas.

4.1 Indoor Air Pollution Interventions

A wide range of interventions are available to reduce indoor air pollution and associated health effects. These interventions can be classified according to the level at which they are effective: (a) interventions on the source of pollution—including moving from traditional stoves to improved stoves, and switching to cleaner fuels such as LPG; (b) interventions to the living environment—such as chimneys and smoke hoods (with flues); and (c) interventions to user behavior—such as keeping young children away from smoke. For purposes of this economic analysis of indoor air quality in Panama, only those

interventions relating to the source of pollution have been considered, that is, moving from unimproved to improved stoves, and switching to cleaner fuels.

A benefit-cost analysis of interventions to reduce indoor air pollution from solid fuels represents a challenge for many reasons. The relative risks used in this analysis represent averages from many studies, and do not necessarily reflect the pollution exposure situation in households using solid fuels in Panama. Moreover, the pollution load from solid fuels is not homogeneous across households. Some households use unimproved stoves or open fire while others use improved stoves with chimneys, and some households use a combination of solid fuels and clean fuels such as LPG. A benefit-cost analysis framework should therefore be flexible enough to accommodate these differences and allow for a sensitivity analysis of parameters that will influence the benefits and costs of interventions to reduce pollution loads and/or exposure.

Four scenarios considered for Panama represent four stylized situations commonly found in most developing countries (Table III.12). These stylized situations represent reasonably well the pollution loads from solid fuel use. However, actual pollution exposure can vary substantially in each scenario, and depend on additional factors such as household ventilation practices, housing characteristics, and household behavior.

Table III.12 Scenarios for Indoor Air Pollution Interventions

From Unimproved Stove to Improved Stove
From Unimproved Stove to LPG
From Improved Stove to LPG
From Unimproved Stove and LPG mix to LPG only
From Improved Stove and LPG mix to LPG only

Figure III.8: Annual Costs of Indoor Air Pollution (Million US\$)

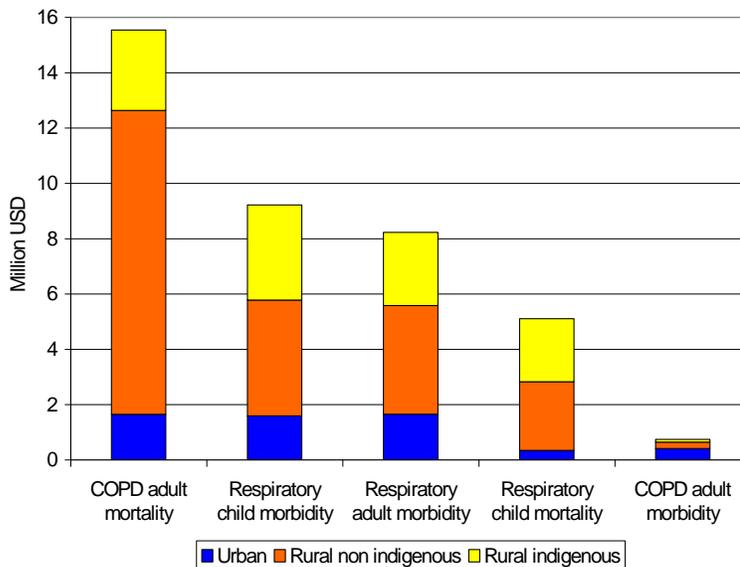


Table III.13: Benefits and Costs of Indoor Air Pollution Control in Rural Panama

	Rural Indigenous				Rural Non-Indigenous			
	Improved Stove from Unimproved Stove	LPG from Improved Stove	LPG from Mix of Unimproved Stove and LPG	LPG from Mix of Improved Stove and LPG	Improved Stove from Unimproved Stove	LPG from Improved Stove	LPG from Mix of Unimproved Stove and LPG	LPG from Mix of Improved Stove and LPG
Population receiving intervention (thousand)	80	80	40	40	130	130	51	51
ARI cases averted per year (thousand)	23	22	11	6	84	84	32	18
ARI deaths in children averted per year	<5	<5	<5	<5	4	4	1	1
COPD cases averted per year	18	19	8	4	50	50	19	10
COPD deaths averted per year	2	2	1	1	6	6	2	1
Annual health benefits (million US\$)	1.5	1.5	0.7	0.4	5	5	2	1
Annual time/ fuel wood saving (million US\$)	0.8	1.5	0.6	0.4	2	5	1	1
Program cost (million US\$)	0.1	0.1	0.04	0.04	0.2	0.2	0.1	0.1
Annualized stove cost, (million US\$)	0.15	0.2			0.4	0.5		
Annual cost of LPG (million US\$)		2.4	0.6	0.6		5.3	1	1
Benefit-cost ratio (health benefits only)	6.0	0.6	1.2	0.7	9	0.8	1.7	0.9
Marginal cost (million US\$ per 1% of IAP health cost reduction)	0.06	0.07	0.3	0.6	0.04	0.43	0.2	0.38
Benefit-cost ratio (total benefits)	9.2	1.1	2.2	1.3	13	1.6	3	1.8

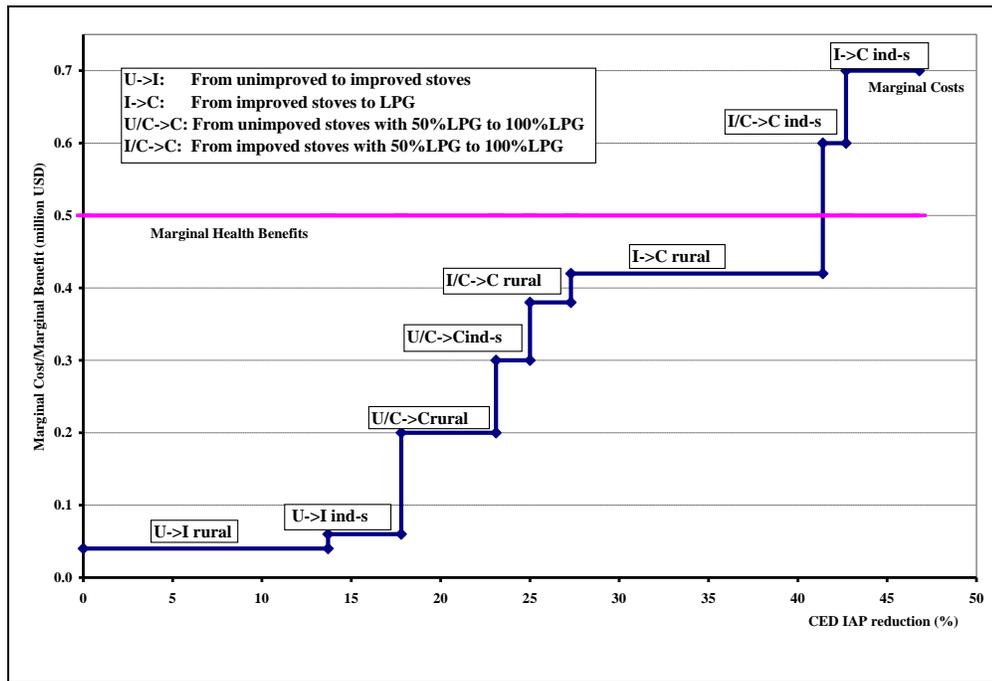
Substitution of unimproved for improved stoves in individual households is found to have substantially higher benefits than costs (Table III.13). The benefit-cost ratio is estimated at 9–13 when time benefits are included, and 6–9 if only health benefits are included. The benefit-cost ratio (health-benefits only) is more than 1 for only those rural indigenous and other rural households that switch from using an unimproved stove with 50 percent LPG, to 100 percent LPG. The reasons for the high benefit-cost ratios are substantial health and time gains accompanied by lower improved stove cost. However, for households with improved stoves, the health benefits alone are not large enough to outweigh the cost of switching to LPG. While promotion of improved stoves is a very attractive intervention, the merits of promoting LPG in individual rural households are uncertain. LPG prices would have to be reduced dramatically for the estimated benefits to exceed costs. Therefore, it seems that LPG will have a chance of success only in better-off households. However, if the benefits include both health improvements and time saving from reduced fuelwood collection, then the benefit-cost ratio exceeds 1 for all interventions.

4.2 Summary Assessment of Interventions to Address Indoor Air Pollution

The various interventions are summarized in terms of their contribution to reduced environmental damages and costs per 1 percent of health damages reduction (marginal cost),²⁷ as was done for the water and sanitation programs (Figure III.9). Marginal costs reflect only program cost; private household costs, including time; and fuelwood saving. Marginal benefit is approximated by the value of 1 percent of indoor air pollution cost reduction, estimated at US\$0.5 million. Household substitution from unimproved to improved stoves has the largest reduction in damages in all rural areas. This is followed by household switching to LPG alone from a mix of unimproved stove and LPG in rural areas. Also, marginal benefits exceed marginal costs for transition of improved stoves to LPG and switching to LPG alone from a mix of improved stove and LPG in rural areas. In total, the former six interventions reduce the cost of health effects by about 45 percent per year. This reflects a substitution to improved stoves in 32 percent of rural indigenous households, and 13 percent of other rural households, switching to LPG alone from a mix of unimproved stoves, and LPG in 15 percent of rural indigenous and 5 percent of other rural households.

²⁷ Approximated by the average cost to implement intervention per 1 percent of indoor air pollution cost reduction.

Figure III.9: Marginal Costs and Marginal Benefits Relating to Interventions for Indoor Air Pollution in Panama



4.3 Recommendations for Actions on Indoor Air Pollution

The analysis presented here supports the unqualified recommendation to shift households that have unimproved stoves to improved ones. The results of other interventions, such as from unimproved stoves to LPG or from improved stoves to LPG, depend on the costs and benefits used. Hence, a more detailed analysis needs to be carried out for such changes, looking at specific cases and taking into account other benefits.

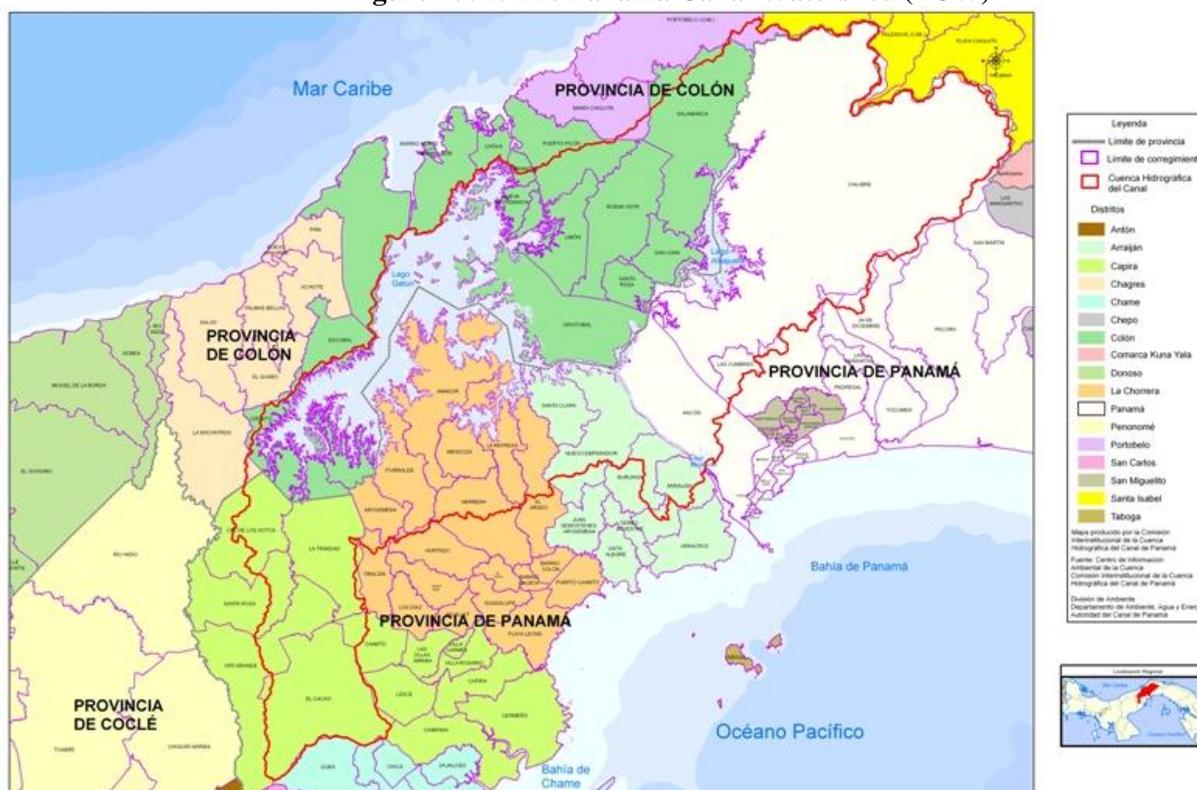
IV. Environmental Management in the Panama Canal Watershed

1. Background

The Panama Canal Watershed

The Panama Canal Watershed (PCW) covers approximately 5 percent of Panama's national territory²⁸ and is politically divided by the Provinces of Colón and Panama. Portions of the PCW are found in six districts, and 33 corregimientos (district subdivisions). The PCW also plays extremely important social and environmental roles. Among others, the PCW is the sole source of water for domestic consumption for some 1.5 million people, including the two largest cities in the country, Panama City and Colón²⁹ and offers “unparalleled biodiversity.” The PCW is home to a number of endangered and endemic species. It is particularly important to neotropical migratory birds.

Figure IV. 1. The Panama Canal Watershed (PCW)



Source: CICH (200&)

²⁸ An area of 339,650 hectares, which corresponds to the area defined by “...the highest elevations of the hills and mountains that flow into Gatun Lake. These natural boundaries are those of the watershed of the Chagres River, which were dammed in 1914 by Gatun Dam during the construction of the Canal. For the purposes of allowing the Panama Canal Authority to manage and administer, the Miraflores Lake sub-basin has been included in the Panama Canal Watershed. geographic area that supplies water by surface flow to the Canal or the reservoirs, rivers and streams which supply it” (<http://www.pan canal.com/eng/general/canal-faqs/watershed.html>). This definition provides for surface water resources, not necessarily for subsurface water resources. Given the lack of information on the geohydrology of the PCW, the geographic area that supplies water by subsurface flow could be larger and have limits outside of the currently defined watershed.

²⁹ 2007 Informe del Estado Ambiental de la Cuenca Hidrográfica del Canal de Panamá, CICH.

The Panama Canal represents a significant asset to the international community in that it represents the least-cost alternative for shipping of goods between major global markets; 4 percent of global trade passes through the Canal. The Canal also plays a central role in the Panamanian economy. It directly employs some 9,000 people and its multiplying effect is estimated to account for an additional 231,000 jobs or more than 24 percent of total jobs nationally. In 2000, the Panama Canal and its cluster of related operational and economic activities contributed about US\$2 billion to the Panamanian economy or about 21 percent of GDP. In 2004 the Panama Canal generated, in direct and indirect contributions, some 25 percent of total revenues received by the National Treasury (PCA 2006A).

The functioning of the Panama Canal and the valuable services it provides depend on sound natural resource and ecosystem management of the Panama Canal Watershed. Maintenance of the hydrologic and ecological functions of the watershed is considered a strategic priority—in social, environmental, and economic terms—for the country. In addition, the PCW generates global economic³⁰ and environmental³¹ benefits.

In this chapter we analyze the environmental condition of the PCW and its ability to sustainably provide its most critical service: water for human consumption and Canal operations. The chapter explores the potential impacts on water quantity and quality of current land use patterns and trends, population growth and urban development; and the institutional framework for securing the long-term environmental sustainability of the PCW. Management of this watershed already presents challenges even before considering the role of the Panama Canal expansion program. The responsible institutions face the need to ensure water supply, both for the operation of the Canal under its future, expanded capacity scenario, and to provide adequate water quantity and quality for domestic, commercial, and industrial supply to Panama's growing urban populations and booming economy.

The Canal Expansion Project

The Government of Panama (GOP) recently embarked on an eight-year, US\$5.25 billion investment program to build a third set of locks and expand the capacity of the Panama Canal to allow for the passage of larger ships. This expansion enables the Canal to remain competitive and relevant in global commerce and transport. At present, the largest ships (called “Panamax” ships) that can pass through the Canal make up roughly one-quarter of the Canal's traffic and 60 percent of the Canal's revenues. However, ships that do not fit through the Canal (called “post-Panamax” ships) represent 27 percent of the world's capacity of containerized maritime shipping and 50 percent of the current capacity under ship-building contracts (262 new vessels) to be delivered by the end of 2011. At that time, approximately 37 percent of the capacity of the world's container ship fleet will consist of vessels that do not fit through the Canal. A great part of this future fleet will then be placed in routes that compete with Panama's route, such as the transpacific-intermodal route and the Suez Canal route.

³⁰ Gains to global shipping from access to the Canal route as a least-cost alternative.

³¹ In addition to the important biodiversity features and habitat services for numerous endangered and threatened animals and plants, there is also the potential reduction in global carbon emissions from reduced cargo-miles and greater transport efficiency with shipping through the Canal.

Figure IV. 2. The Panama Canal Area. Route 3 is the Trans-isthmian Highway.



Source: Panama1.com <http://www.panama1.com/imagenes/mapa/canalzone.jpg> (2008)

Relevant to the discussion of water balance is the scope of the Panama Canal expansion. The investment program sets out to:

- Building of water reutilization basins in each of the new locks—expected to reduce by 7 percent overall the amount of “new” freshwater water used per transit;
- Deepening Gatun Lake’s navigational channels by 1.3 meters (m)—increasing the water storage capacity of the system by 1.54 million cubic meters per day (m³/day), or enough water for seven additional lockages - the passage of a boat or boats through a lock; the raising or lowering of a boat from one water level to another-; and,
- Raising Gatun Lake’s maximum operational level by approximately 0.45 m—increasing its water storage capacity by 0.66 million m³/day, enough to carry out three extra lockages.

The Impact of Panama's Economic Growth and Urban Development on the PCW.

Today, the Panamanian economy is among the fastest growing in Latin America. In the last five years, Panama's economy has experienced a boom, with growth in real gross domestic product (GDP) forecast to be 8.5 percent for 2006/07, and 7.5 percent for 2007/08.³² Between 1980 and 1990, the watershed's population grew at a rate of 3.8 percent per year, almost 50 percent higher than the country's growth rate for that period (Heckadon 1999). In 2000, the watershed's population was estimated to be 153,000 (compared to 21,000 in 1950); by 2020, it is expected to reach 400,000.

Population is not only growing, but is also increasingly concentrated (CELADE 1999). In 2002, about 80 percent of the watershed's population lived in the eastern half of the PCW; 60 percent of those live in periurban settlements within 2.5 kilometers of the Transisthmian Highway.

The rapid urban growth underway is not taking place in either an orderly or a systematic fashion. The explosive population growth in the city of Panama is already exerting pressure on lands that had been zoned as unsuitable for urban development. While the cities of Panama and Colón both have developed Master Urban Development Plans—which define areas suitable for urban growth and provide guidelines for density of development—these do not have force of law and the current trends are increasingly in conflict with the Plans' guidelines. Within the PCW, settlements and increasing agroindustrial activities along the Transisthmian Corridor and other areas within the PCW are also placing development pressures on lands identified as critical for the protection of the watershed. The growing population is resulting in fast-expanding satellite communities of people that work in the Metropolitan areas of Panama City and Colón but live on the urban fringe. With increasing population comes increased water consumption and stresses on water quality from such activities as domestic and industrial wastewater discharges, lack of appropriate solid waste management systems, localized conversion of remaining forest patches, loss of groundwater recharge capacity from soil compaction and paving over of green spaces, and increased production of mineral and organic sediments from construction.

Also, almost two-thirds of the country's population lives immediately adjacent to the watershed in the Metropolitan areas of Panama³³ and Colón and are dependant on it for water supply.

IDAAN's drinking water production, and transport capabilities have been adequate to cover the current demand of the Metropolitan population. However, serious water losses are reported. The actual water consumption per capita in the Metropolitan Areas is unknown, but it is estimated that about 30 to 40 percent of total drinking water production is lost as a result of leaks and other problems during the distribution phase.

According to Harza's (2001) estimate, population in this area was expected to increase to 2.11 million by 2020, or by 36 percent over 2000 levels. In the face of these challenges and pressures brought upon by population growth and prosperity—challenges not generally handled well by most rapidly developing countries—Panama's best interest is to invest in improved management of the PCW.

In order to address the protection of the hydrological resources of the PCW the GOP has developed a substantial legal framework, and ordered the alignment of the institutional interventions in the watershed. The Panama Canal Authority, (PCA), was created with two main

³² Source: United Nations Economic Commission for Latin America and the Caribbean (ECLAC).

³³ The Panama Metropolitan service area extends east from the Canal to the International Airport in Tocumen and north along the Trans-Isthmian Highway to Alhajuela Lake.

responsibilities (see box IV.2): the management and operation of the Panama Canal, and the sustainable management of the hydrological resources of the watershed to meet the current and future demands of the Canal and of the Metropolitan populations of Panama City and Colon. To coordinate the complex array of institutions, governmental and private, with interests in the PCW (see box IV.2), the PCA created, and presides, the PCW's Interinstitutional Commission, (CICH³⁴). The CICH is the highest level coordinating entity for all other government agencies and NGOs' interventions within the PCW. CICH's role in the sustainable management of the watershed's hydrological resources is further explored in the Institutional Analysis section, later in this chapter.

2. Water Quantity and Quality

Critical for the operation of the Panama Canal is the condition of the PCW, as this is the sole source of water supply for canal operations. The PCW's waters are also the primary source for municipal and industrial water systems. The GOP and the PCA have pledged to keep the supply of water for human consumption needs as the first priority use of the PCW's waters above other uses, including Canal operations. To date the water resources of the PCW have proven generally adequate to meet the needs of Panamanian society. However, both experience and future projections indicate that the capacity of the PCW to support Canal operations, meet municipal and industrial water requirements, and generate hydropower has its limits.

The Rio Chagres, dammed during the creation of Gatun Lake, is currently the primary source of drinking and industrial water for the rapidly growing urban developments along the Transisthmian Corridor, and the Metropolitan areas of Panama City and Colón. Chagres River and its tributaries are major sources of water for Alhajuela and Gatun Lakes. Water intakes for the current water treatment plants are located in the watershed's artificial (Gatun, Alhajuela and Miraflores) lakes. About 38 percent of the water for human consumption comes from Alhajuela Lake. The remaining water for human consumption comes for Gatun and Miraflores Lakes.

Table IV. 1 PCW's Three Artificial Lakes.

Name	Created in	Area (Km2)	Drainage Area (Km2)	Percent of PCW area	Maximum Capacity (MCM)	Useful Capacity (MCM)	Elevation (m.a.s.l.)
Gatun Lake	1912	436	2,314.10	68.14	5431.9	766	26
Alhajuela Lake	1935	44	983.94	28.97	799.5	651	73
Miraflores Lake	1913	4	98.35	2.89	2.5	2.2	16.5

Source: CICH (2007)

Recent studies indicate that the quality of the PCW's rivers and lakes is deteriorating, as a result of an increase in the concentration of biological and agrochemical pollutants, resulting from the discharge of wastewaters from human settlements and agropecuarian runoff (CICH, 2007). Additionally, there is a concern on the possibility of salinization of Gatun Lake's waters, as a result of the operation of the new Post-Panamax Locks. Salinization of Miraflores Lake has already required the PCA to move the water intake to a new location where the levels of salinization are still adequate for potabilization. The PCA has commissioned additional studies to assess this risk and implement prevention and mitigation measures, as needed.

Potential risks to water quality include contamination of Gatun Lake from ship transits through the canal. The GOP is a signatory of the MARPOL convention on the prevention of marine

³⁴ Comisión Interinstitucional de la Cuenca Hidrográfica del Canal de Panamá (CICH).

pollution from ships (see box IV.1). The PCA has an Emergency Action Plan and training program in place to address spills and other potential accidents in the Canal area.

Box IV.1 Minimizing Water Pollution Throughout the Canal Passage

The International Convention for the Prevention of Pollution from Ships (MARPOL), designed to minimize pollution of the seas, entered into force in October 1983 and its regulations have an impact in the daily life of the Canal, including its tourism industry. As a signatory of this international Treaty, Panama is subject to its requirements to control accidental or deliberate discharge of substances such as oil, chemicals and garbage as well as to limit air pollution from ships

An overall Canal Emergency Action Plan provides: (i) periodic training for employees, including drills; (ii) spill record-keeping; (iii) procedures for conducting annual “area threat analyses”; (iv) emergency response organization; (v) documentation and reporting of vessels in transit; (vi) internal and external emergency communication plans, etc. See: <http://www.pancanal.com/eng/projects/ctan.html>. Moreover, the ACP links very closely to the National Police and Panama Maritime Authority and other organizations to form the National Response Team so that emergency events outside the Canal Area that affect transit vessels and adjacent population centers can be contained.

To offset potential incident costs, a fee is assessed to transiting vessels with carrying capacity of 400 metric tons or more of oil cargo and/or fuel to cover the cost of keeping the personnel and equipment available to respond to oil spills from ships in transit or awaiting transit of the Panama Canal. Additionally, other charges and/or penalties could result from non-compliance with ACP regulations.

Other potential risks to water quantity and quality are related to climatological phenomena, namely ENSO events and Global Climate Change (GCC). ENSO events are better understood now, and their effect over the Panama Canal Watershed is characterized by a reduction of the total amount of rainfall during dry ENSO events, with direct negative effects in the amount of water available for ship transits. The future effects of GCC over the PCW are still unknown. However, current global and regional climate change models are predicting a general warming trend for the Caribbean and Central American Regions³⁵. This warming is expected to increase direct evaporation from lakes and rivers, along with increasing evapotranspiration – water loss through vegetation cover -. A potential increase on the frequency of ENSO events is also being hypothesized.

Water demand projections for Canal Operations

The current expectation is that traffic through the Canal will increase due to, among other factors, the successful completion of the third set of locks to allow the passage of post-Panamax ships. The additional shipping will increase overall water demand, though water use per ship transit is expected to decrease by 7 percent due to the water recirculation basins to be built into the new locks. By increasing water storage capacity through deepening canals and raising dams, it is expected that the needed additional water will be made available.

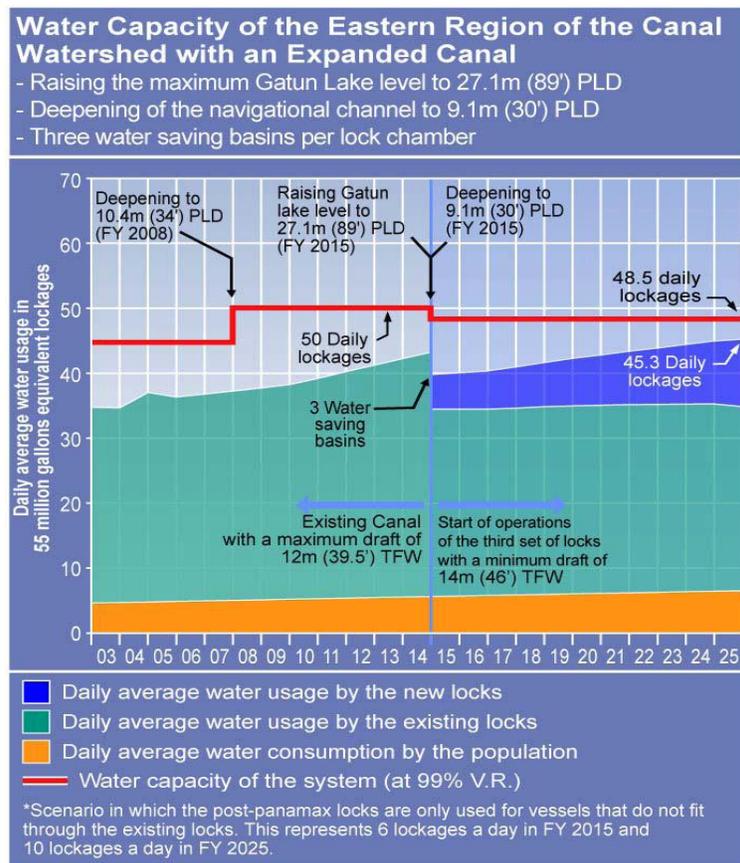
This additional water supply is calculated to meet expected demand for increased total water consumption in the canal operations and the increasing demand for human consumption. One common measure of water supply used for the canal is the equivalent lockage.³⁶ As of 2006 the

³⁵ In regard to the risks associated with GCC the Central American presidents recently (May 2008) signed a regional agreement to develop mechanisms for prevention, adaptation and mitigation of GCC and Global Warming potential negative effects, including major natural disasters.

³⁶ This is the total amount of water used during a complete canal transit, which represents a water volume of about 55 million gallons of water. A complete transit consists of a first lockage to raise a ship from sea level to Gatun Lake’s level and a second lockage to lower it back to sea level plus additional water requirements for related canal

average daily water consumption—for canal operation and human consumption—was equivalent to 37 lockages per day or about 82 percent of average maximum capacity of 45 lockages per day. Following the expansion, average maximum is expected to increase by 3.5 lockages per day to 48.5 lockages.

Figure IV.3. The expansion program for the third set of locks is expected to increase water supply to the equivalent of 48.5 lockages per day and meet water requirements for the expanded Canal and the general population to beyond 2025.



Source: PCA (2006a).

While Figure IV.3 shows the demand for water for human consumption will increase significantly as the urban areas and their economies and populations continue to expand in and around the PCW (Harza 2001), as a result of completion of the proposed Canal Expansion program, the total demand for canal operations are expected to increase only slightly as a function of the water reuse system to be built.

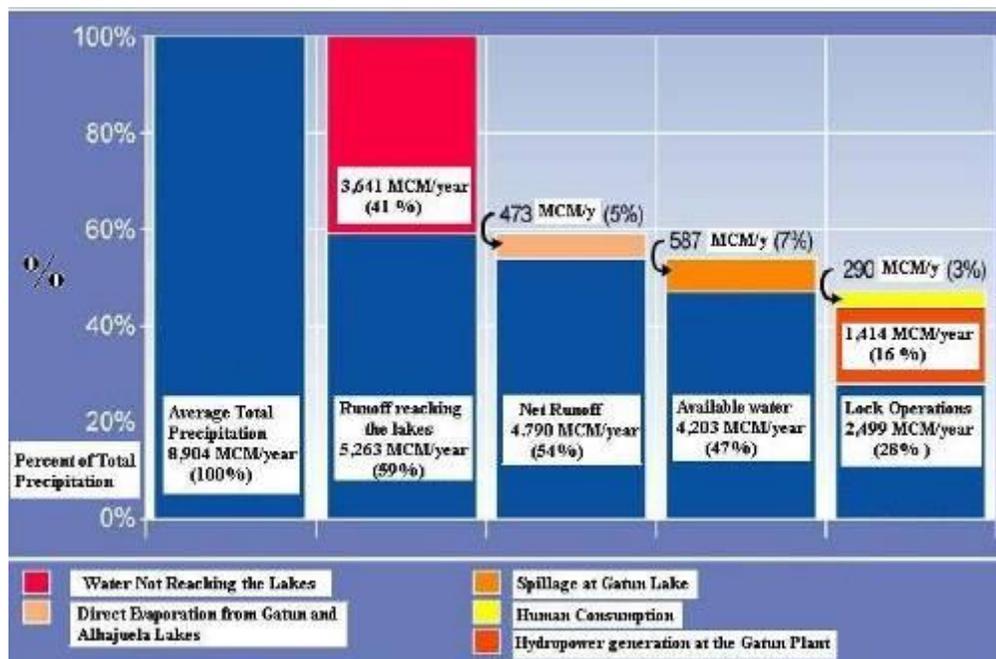
The PCA in its Canal Master Plan (PCA 2006a) reported that during the last 10 years the average volume of usable precipitation falling within the PCW was 8,904 million cubic meters per year (MCM/year)³⁷. About 47 percent of this total estimated volume (after variables such as the

operations, such as hydraulic support, movement of PCA floating equipment, elevation control at the Miraflores Lake, and similar operations.

³⁷ The data used for this analysis is taken from the PCA's official documentation, specifically the "Plan Maestro del Canal: (Master Plan for the Canal)", available online at the PCA's website: www.pancanal.com. The 10-year average seems too short for analyzing precipitation patterns. Ideally, precipitation data from a longer time frame should be used and presented disaggregated – year by year- , to allow for further analysis of wet and dry years.

reservoirs' maximum storage capacity, evaporation, and controlled spillages were factored out) is available for canal operations, hydropower generation, and water supply for human consumption (see Figure IV.4). This 47 percent or 4,203 million cubic meters (MCM) (available water) is partitioned as 58.5 percent to Canal operations, 33.6 percent to hydropower generation, and 6.9 percent for human consumption (PCA 2006a). The 290 MCM/yr for human consumption in Figure IV.4 represents the average use from 1994–2003, whereas current use (PCA 2006a, Chap. 4: p. 17) is 370 MCM/yr (33 percent greater) or 8.8 percent of available water.

Figure IV.4. Panama Canal Watershed's Water Budget. Only water produced in the Eastern Region (the actual watershed, as currently defined by law and surficial hydrology) is used for Canal operations and as a source of municipal and industrial water for the urban Metropolitan areas of Panama City, Colón, and urban development along the Transisthmian Corridor. Percent values shown are relative to total precipitation within the traditional PCW.



Source: PCA (2006a).

Harza (2001) predicted that future drinking water requirements will be significantly greater than existing and/or planned water supply and production capacity in the PCW.³⁸ It also predicts that significant increases in municipal and industrial water demands will occur in the area during the next 60 years. Demand is projected to increase by an estimated 39 percent by 2020 and 105 percent by 2060, compared to year-2000 demand. The study projected population growth over these same periods to be 36 percent and 71 percent, respectively,³⁹ indicating that factors other

³⁸ This study was carried out prior to the development of the canal expansion proposal, thus the conclusions must be interpreted in the current context of “with expansion project” as having indicated a significant need for increasing (planned) water supply.

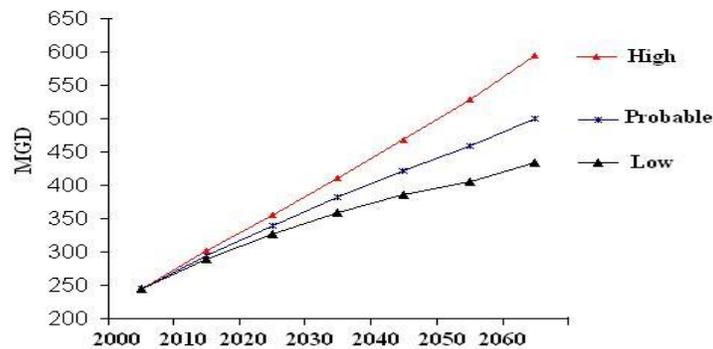
³⁹ The Harza (2001) study based its recommendations on an assumed annual rate of population growth that would taper off to well below 1 percent in the years after 2020, arriving at about 0.28 percent by 2050, while per capita water consumption rates would increase only modestly over the already quite high 158 gals/day per capita reported in the study for 2000. The water consumption projections appear to be conservative, while the population growth rates appear to be very modest.

than population growth (that is, commercial and industrial use) will contribute to the increase in water demand.

The Harza (2001) study additionally predicted the greatest increases in municipal and industrial water requirements to occur in and around existing urban centers, with the largest increase in demand—more than 150 million gallons per day [MGD] (or about 207 MCM/yr), projected for the Panama Metropolitan service area. In addition, the study concluded that to meet year 2060 water requirements for human consumption, an additional 255 MGD or 353 MCM/yr will be required. The Harza study indicated that their water requirement forecasts were sensitive to several factors, the most critical being the per capita consumption rates, assumptions regarding water use by unmetered customers, and physical leakage in the distribution systems.⁴⁰ The author varied these factors to produce high, medium, and low water use scenarios. It also recommended that future efforts related to monitoring and updating of forecasts should include mechanisms to improve the tracking of actual rates of water usage and the actual effects of water loss management efforts. It is widely reported that drinking water losses in the Metropolitan areas are very high (at about 30 to 40 percent of total drinking water production), as a result of administrative and network distribution problem. Figure IV.5 shows three possible future water consumption scenarios.

Figure IV. 5. Projected Water Consumption, under different scenarios.

Source: Harza (2001)
Harza(2001)



Source: Harza (2001)

⁴⁰ On the other hand, demand management interventions, such as increased water rates could also have an important impact.

The PCA’s Panama Canal Master Plan (PCA 2006A),⁴¹ presents total water demand projections for Canal operations and human consumption that show needs increasing from the 2005 average of 38 lockages/day (2,888 MCM/year) to 44 lockages/day (3,316 MCM/year) in 2013, the year prior to the start of operations of the new Post-Panamax Locks. The current maximum water supply, with no additional investment in water storage, is equivalent to 45 lockages/day and with the investment in the deepening of the Gatun Lake channel—a program initiated by the PCA in 2002 and expected to be completed in the short term—the maximum firm supply will increase to 50 lockages/day equivalent. After the completion of the expansion program and third set of locks (in 2014/2015), the average daily water needs are expected to drop to about 40 equivalent lockages/day (3,040 MCM/year), as a result of the water reutilization basins and an expected reduction in the number of transits. By 2025, water demand for population needs and Canal operations are foreseen to reach the equivalent of 45.3 lockages/day or 3,442 MCM/year compared to the projected available firm supply of 48.5 lockage equivalents or 3,686 MCM. This leaves a margin of safety of 3.5 lockage equivalents or 266 MCM/yr in 2025 and uses about 72 percent of the estimated, average annual availability of 4,790 MCM.

The GOP’s policy and PCA’s pledge is to keep water use for the population as first priority, above other uses, including Canal operations. According to the Harza study’s (2001) long-term projection, an additional 193 MCM/yr of water supply will be required by 2060 for human consumption. Based on the PCA’s assumptions and estimates, this quantity would be available within the 266 MCM/yr margin of safety (approximately 7 percent of average annual water availability), requiring the commitment of almost 75 percent of the unallocated firm water supply in the PCA’s scenario.

Table IV.2 summarizes PCA’s estimated water demands for the population and Canal operations, with the Panama Canal Expansion completed (that is, water reutilization basins, deepening of the Lake Gatun and Culebra Cut channels, and raising the maximum operational level of Lake Gatun).

Table IV.2. With Canal Expansion Investments: PCA’s Estimate of Total Water Demand for Supplying Human Consumption and Canal Operations

Year	Population		Canal Operation		Total	
	MCM/y	Lockage Eq.	MCM/Y	Lockage Eq.	MCM/y	Lockage/Eq
2005	371	4.9	2398	31.6	2769	36.5
2010	403	5.3	2584	34.0	2987	39.3
2015	434	5.7	2597	34.2	3031	39.9
2020	466	6.1	2796	36.8	3262	42.9
2025	498	6.6	2948	38.8	3446	45.4

Source: PCA (2006a).

⁴¹ The figures from the Harza study (2001) are used by the PCA in their Master Plan to estimate water demand for human consumption.

Stress on Water Quality

Recent water quality assessments at major PCW's rivers and their tributaries, draining into Gatun Lake show an increase in the presence of biochemical contaminants, correlated with an increase of human activities. At the confluence of the rivers Boquerón and Pequení (draining into Alhajuela Lake), a major indicator of biological pollution was found to exceed the recommended standard values.

In September 1997 the Panama Canal Watershed Monitoring Project (PCWMP), with U.S. Agency for International Development (USAID) financing, began monitoring the environmental status of soils, water, and other natural resources within the PCW.⁴² In 2000, the PCA created a Water Quality Control Unit that began a systematic water quality monitoring program (CICH 2007). Prior to these, some limited water quality assessments had been carried out at the water intakes of the Miraflores⁴³ and Monte Esperanza water treatment plants by the former Panama Canal Commission. Additional contributions had been made by other sources, such as ANAM through a monitoring agreement with the PCA (ANAM-ACP 2006b). Overall, the findings indicate a reduction in the quality of water in sampling sites located within the area of influence of the Transisthmian Corridor; where about 50 percent of the total population of the watershed resides.

The 2000–01 PCWMP water quality testing results also confirmed that degraded water quality tends to be associated with development along the Transisthmian Corridor. High concentrations of nitrogen and phosphorus, two elements characteristic of eutrophicated⁴⁴ water bodies, were found in rivers that drain into Gatun and Alhajuela lakes. Sampling sites next to the Transisthmian Corridor's bridge and the Canal waterway, near the town of Paraíso, showed the highest concentrations of phosphates. Biochemical Oxygen Demand (BOD⁴⁵) measurements from the Chilibre, Chilibrillo River, and Cabima Creek sub-watersheds registered high, indicating water pollution problems.

Results near moderately-to-densely populated areas show strong correlations between pollution levels and the size of the local populations, and with the presence of cattle/swine raising and poultry-farming activities. With the exception of the headwaters of the Boqueron and Chagres rives –located within Chagres National Park–, all sampled rivers showed levels of bacteriological contamination above the acceptable range for recreational uses of water. Total and fecal coliforms⁴⁶ counts were found to be up to five times above the maximum acceptable values at the

⁴² Monitoring took place during 1996 to 1997 through an ANAM/STRI consortium and in 2000–01 by the Louis Berger Group.

⁴³ Miraflores Lake is currently considered to be a brackish-water lake (CICH, 2007)

⁴⁴ Eutrophication of water bodies is caused by the influx of excessive nutrients, which stimulates the growth of floating plants, especially algae. These use up dissolved oxygen (DO) in the water and block sunlight from reaching deeper parts of the water column, causing the death of underwater plants. The decay of these plants and animal matter stimulates the growth of oxygen-consuming bacteria and the levels of DO become too low to sustain animal life. The water body becomes anaerobic, stimulating in turn, the growth of anaerobic bacteria, accelerating the vicious cycle, and in extreme cases leading to the release of foul-smelling gases such as hydrogen sulphide and methane.

⁴⁵ BOD testing determines how fast biological organisms use up oxygen (through degradation of organic material) in a body of water. It is used in water quality management and assessment, ecology, and environmental science as a broad indicator of water quality.

⁴⁶ Coliforms are bacteria present in the digestive tracts of animals, including humans, and are found in their wastes. Total coliform counts give a general indication of the sanitary condition of a water supply, whereas fecal coliforms indicate the presence of animal or human waste. This is a much more serious problem due to the potential for spreading disease.

Chilibre, Chilibrillo, and Gatún River sites. These rivers have the highest concentrations of people and swine-raising and poultry farms.

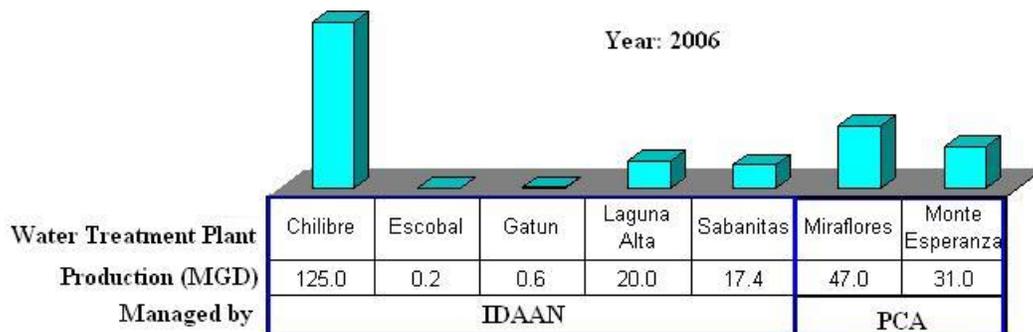
The data show that the best water quality values were found in association with Protected Areas (Soberanía National Park and Chagres National Park). Water quality problems are more frequent in dry periods and along the Panama City-Colón corridor. In Lake Gatún and at the mouth of the Chagres into the Lake (at Gamboa) growth of aquatic plants (a product of eutrophication due to elevated nutrient levels) that interfere with transport are recorded. Dissolved oxygen concentrations are for the most part satisfactory but with the same tendency in geographic and seasonal terms—some monitoring stations fell below acceptable levels during dry periods, particularly along the Panama City-Colón corridor. However, none of the sub-watersheds met the requirements for pre-potable water in Panama (that is, the quality required prior to treatment for primary sediments and chlorine disinfection (CICH, 2007)). Although the data are limited, untreated water in the inhabited area of the PCW is increasingly unfit for human use, particularly in the dry season. The more immediate and growing problem with respect to water quality is related to human habitation and the development of agroindustry along the Panama City-Colón corridor. While there is the impression that the water quality situation is worsening, the lack of standard methodologies and the small numbers of studies inhibit firm conclusions on trends and their magnitudes. Further work is also required to better understand cause, and the effect on public health and economic activities (Aylward 2002).

The CICH has identified the need for further water quality monitoring, as a critical input for watershed management. Through its Technical Unit (the Center for Watershed’s Enviromental Information) and with the technical and financial support of its member government agencies, the CICH should lead efforts to develop sound water quality monitoring capacity at priority sub-watersheds. Significant advances and experiences have already been realized, for example, through the PCA-USAID Joint Fund. The basics of this approach were developed with World Bank support to MIDA for the “Program for the Rural Areas of the Panama Canal Watershed” (MASAR-CHCP).

Water Treatment and Distribution Issues

CICH’s assessment of The Environmental Condition of the PCW (CICH 2007) reports the water treatment capacity within the PCW to total 325 MCM/year from the seven water-treatment plants located in the provinces of Panama (three) and Colón (four), representing approximately 7.7 percent of the average annual total PCW water supply.

Figure IV. 6. Drinking -Water Production in Panama and Colon



Source: CICH (2007)

The PCA currently has the capacity to provide enough raw water to the water treatment plants to cover the demand for human consumption. The principal limitations for providing water for human consumption are: (a) water treatment capacity, not water supply; and (b) the poor condition of the pipelines and storage and distribution systems, resulting in loss rates of 35 percent to 50 percent through the system. IDAAN is currently implementing several water production, treatment, and distribution projects that will increase its capacity to attend current and future demands (see Table IV.2). These efforts, however, will still fall short of meeting projected future municipal water demands.

Table IV.3. IDAAN’s Ongoing Water Services Projects to Address Water Treatment, Production, and Distribution Needs in the Metropolitan Areas

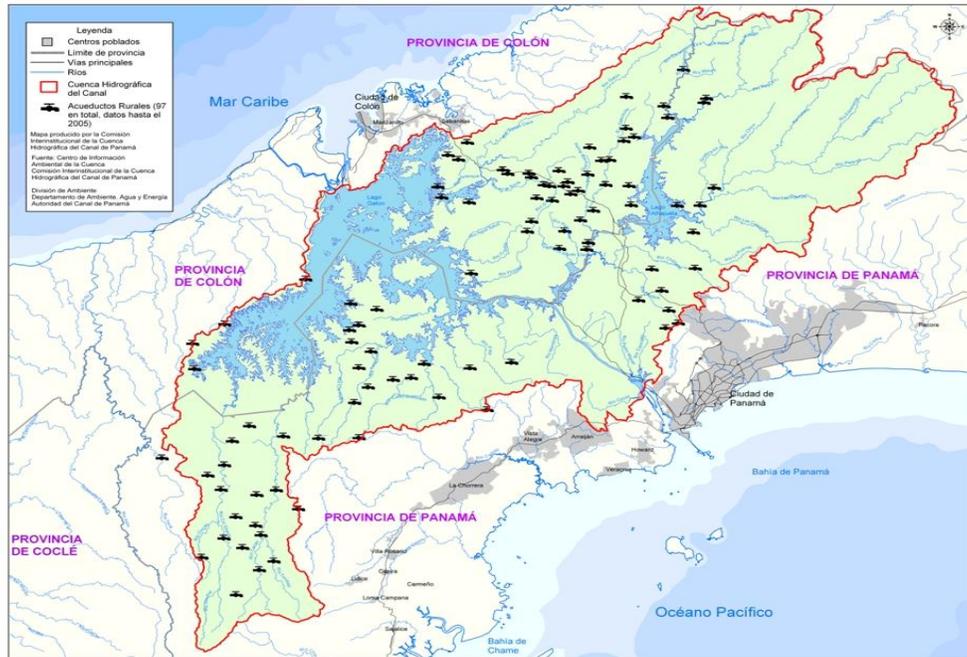
Project	US\$ Million	Number of Users Served
Federico Guardia Conte water-treatment plant (rehabilitation and expansion)	48.8	1,000,000
Improvements to water supply systems of Panamá, Colón, La Chorrera, and Arraiján,	21.0	1,400,000
Backup pipeline to ensure water supply in the event of a catastrophe and maintain existing water storage tanks (Tinajitas, Guadalupe, and Bethania) at capacity	33.4	900,000
Total	103.2	3,300,000

Source: IDAAN (2008).

The PCA and IDAAN are currently working together in the construction of a new water treatment plant (“Las Mendozas”), west of Panama City. This new plant will have a production capacity of 40 MGD. PCA will finance the construction of the water treatment plant and the water intake, along with the 6 km pipeline linking both. IDAAN will finance the 18 Km pipeline linking the new facility to the existing plant at “La Chorrera” (CICH (2007). IDAAN (2008)

IDAAN legal mandate is to provide drinking water and sewerage systems to populations larger than 1500 individuals. Smaller communities have to rely on their own community-based water systems.

Figure IV.7. Rural Water Systems for communities with less than 1,500 individuals.



Source: CICH (2007)

Erosion and sedimentation

Erosion and sedimentation have been monitored in the PCW since 1987. The monitoring showed erosion rates diminishing from the mid-1980s to the mid-1990s as a function of the declaration of Protected Areas in the headwaters of the principal rivers, the increase in areas naturally regenerating, and reduction in rates of forest loss. The monitoring was ended in 1996, ostensibly due to the low levels of sediment being detected leading to the conclusion that further monitoring was not warranted. New monitoring was initiated in 2006 by the PCA Operation Unit, and this one-year sampling found significantly increased sediment loading in all but two rivers (Pequeni and Boquerón), with the Chagres and Trinidad almost tripling their sediment production.

Sediment production rates in 2006 ranged from 322 tons per square kilometer (t/km²) (Trinidad) to 661 t/km² (Chagres). It is estimated that the natural rate of sediment production (that is, what would be expected in the absence of anthropogenic influences) ranges from about 100 t/km² to 600 t/km² in the PCW. Earlier information (PMCC 1999; Ibañez and others 2002) suggests that total erosion (and, subsequently, sedimentation) may be largely driven by heavy rainfall events that cause landslides. Some experts (Stallard and Kinner 2002) have hypothesized that sediment yields are greatly controlled by landsliding that requires rainfall/runoff that exceed a certain threshold. On a localized basis, ill-conducted off-farm activities, poor mining practices, and poor construction and maintenance of rural roads also appear to contribute to erosion and sedimentation (PMCC 1999).

With regard to sedimentation, there is little to no evidence that water quality or operational capacity of Lake Alhajuela⁴⁷ has been compromised—nor that this will occur in the short or long term. At the aggregate level it appears that existing productive land uses are not having a major negative impact on sedimentation of the Canal system. Given the aggregate nature of the empirical analyses, much still remains to be known about erosive processes and sediment transport at the field or plot level. While the PMCC (1999) report indicates the important contribution of penetration roads to erosion and landslides, the relative contribution of poor land and road management to existing sediment loads remains to be well documented in the PCW (Aylward 2002).

Global Warming: Effects in Regional Climate and Weather Patterns and Potential Impacts on Water Availability in the PCW

A wild card in the PCW water resources scenario is the potential impact of climate change. Currently, this is not factored into water supply and demand predictions. Models⁴⁸ have predicted that Panama will undergo a warming (mean +1.16° C) and drying (mean -14.66 millimeters per month [mm/month]) trend and be expected to endure more frequent heat waves and droughts, increased-intensity rainfalls, and sea-level rise as predicted for the rest of Mesoamerica. Should annual mean temperatures increase, one result would be increased loss of water to evapo-transpiration. Currently, some 59 percent of average annual rainfall reaches the lakes (PCA, 2006a). Of the 41 percent that does not, some significant percentage of that represents evapo-transpiration losses. Of the water reaching the lakes, an additional nine percent is lost to direct evaporation from the open water surfaces. What might be the additional losses under the increased temperature scenarios implied by the climate change models? How would this affect overall water supply and canal operations? Also, some 11 percent of average annual rainfall reaching the lakes is currently lost to spillage. Might additional losses occur due to the increased rainfall-intensity scenarios predicted by climate change models? How would this affect overall water supply? What impact would the modest, predicted drying have in combination with the increased temperatures on evapo-transpiration rates? What might be the synergistic effect of this and storm intensities on total water supply?

Further, and potentially much more serious, is the impact of climate change on the El Niño-Southern Oscillation (ENSO). In the 1997–98 El Niño event the Panama Canal watershed experienced the worst recorded drought in Canal history which resulted in the imposition of ship draft restrictions and reduced lockages. It is not known what the impact of climate change might be on the ENSO; however, the risk is real. There are many actions that are currently being implemented (such as improving management of sub-watersheds) or planned (such as the installation of water-saving locks) that will be useful for adaptation purposes. However, and despite the impact that climate change may have on the PCW, there is no comprehensive adaptation plan or strategy. What risk management alternatives and contingencies should be built into water resources planning in the PCW⁴⁹?

⁴⁷ Lake Alhajuela is the first lake on the Chagres River (principal source of potable water for Panama City) and as such captures the sediments generated from the upper Chagres watershed, protecting Lake Gatun.

⁴⁸ Hadley Centre Coupled Model, Version 2 (HADCM2), as reported in M. Mulligan, “Downscaling” Global Climatic Futures for Hydro-impact Studies, King’s College London, 2003. Same modeling data as used by the Intergovernmental Panel on Climate Change (IPCC).

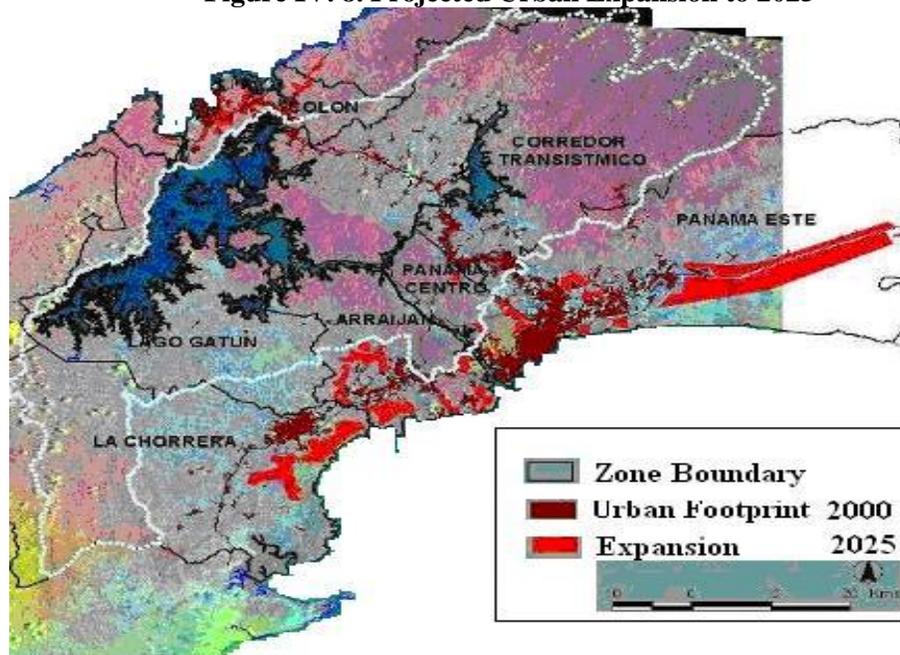
⁴⁹ As previously indicated in footnote 8. The GOP along with the presidents of Central America and representatives of the Caribbean Region have signed an agreement to combat global warming and its potential effects. Among other activities the agreement asks governments to order their meteorological institutions to improve and share data to better understand these phenomena.

3. Land Use Trends in and Around the PCW

During the last several years, the Panamanian economy has experienced a sustained, accelerated annual growth rate. With this economic growth, there has also been a boom in the construction industry. A large number of new residential projects are mushrooming across the main Metropolitan areas of Panama City and Colón. The populations of Panama City and Colón are also growing much faster than originally projected, exerting pressure on the demand for housing solutions and basic services, such as access to drinking water and sewerage systems. Panama's urban is expected to grow faster than the rural populations, reflecting a trend toward greater concentration, while the rural populations tend to become more dispersed (CELADE 1999).

The PCA commissioned Intracorp (2007) to prepare an evaluation of the potential effects of the expansion of the Panama Canal on the migration patterns from rural areas to the Metropolitan region. The report describes current residential land use types and densities for the main urban and periurban areas within and around the PCW, and using the current patterns predicts population growth and urbanization expansion, identifying the areas most affected, within and around the PCW. The great majority of the urban expansion is expected to occur outside of the PCW as per the Plan for Urban Development of the Metropolitan Areas of the Pacific and Atlantic (Executive Decree No. 205, December 28, 2000).⁵⁰ Current trends show that the Transisthmian Corridor is the most vulnerable to urban development and expansion and the plan specifically seeks to limit this outcome.

Figure IV. 8. Projected Urban Expansion to 2025



Source: INTRACORP (2007).

This report incorporates information derived from the most recent, available GIS analysis, carried out by ANAM (ANAM-ACP 2006a) using satellite images⁵¹ from no later than 2003. As

⁵⁰ This plan, which lacks force of law, was developed to contain urban development and expansion within the PCW in order to protect the watershed and its water resources.

⁵¹ Images used included Landsat TM from 2000 and Landsat ETM from 2001, 2002, and 2003.

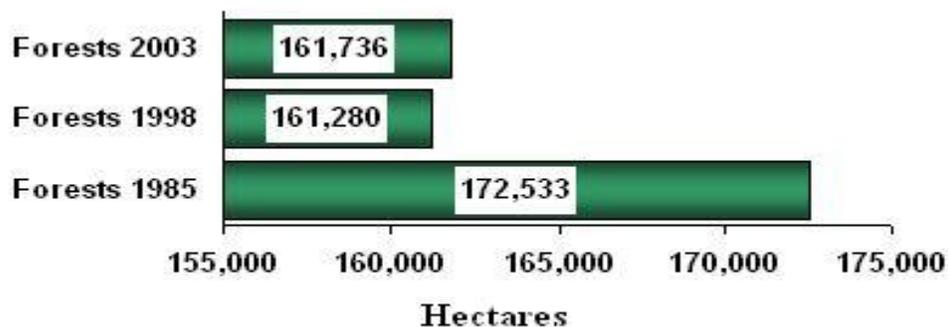
such, changes and trends from the last five years are unknown, particularly as regard the trends of greatest concern: urbanization and development in the Transisthmian Corridor.

A large reduction in forest cover took place during the second part of the 20th century, particularly in the 1970s and 1980s. By the mid-1990s, the condition of the PCW reflected the effects of two separate processes: the long-term process of deforestation associated with the conversion from tropical moist forest to pasture, and the more recent trend toward urbanization and industrialization. Although the rate of deforestation has been significantly reduced and a high proportion of remaining forests are currently under legal protection,⁵² demographic and development trends indicate that pressure on the watershed's resources will increase.

Law 21, which provides a land use zoning scheme for the management and protection of the rural lands (see figure IV.10), appears to have provided some incremental protection for the PCW. This conclusion is supported by the minimal changes in land use that are reported as having occurred in the PCW over the last decade (see figure IV.10). In contrast, the Master Plan for the Metropolitan Zone, which has not been given force of law, has been largely ignored. In the near to medium term, an increase in development and in-migration into the PCW can be foreseen from, among other things, the completion in the next 1.5 to 2 years of the Transisthmian Highway, the pressure building up from the rapid economic growth in Panama City, the generation of employment and other indirect development impacts from the construction activities associated with the Canal expansion, and the future bridging of the Canal on the Atlantic side.

The ANAM-PCA 2006 report on current Land Cover in the PCW indicates that forest cover in the "traditional" watershed appears to be stable. Some previously deforested areas have reverted to forest cover (ANAM-ACP 2006), and as of 2003, the PCW was beginning to show a positive trend in forest area cover. The findings are presented in Figure IV.9 and Table IV.4.

Figure IV. 9. Forest Cover in the PCW



Source: CICH (2007).

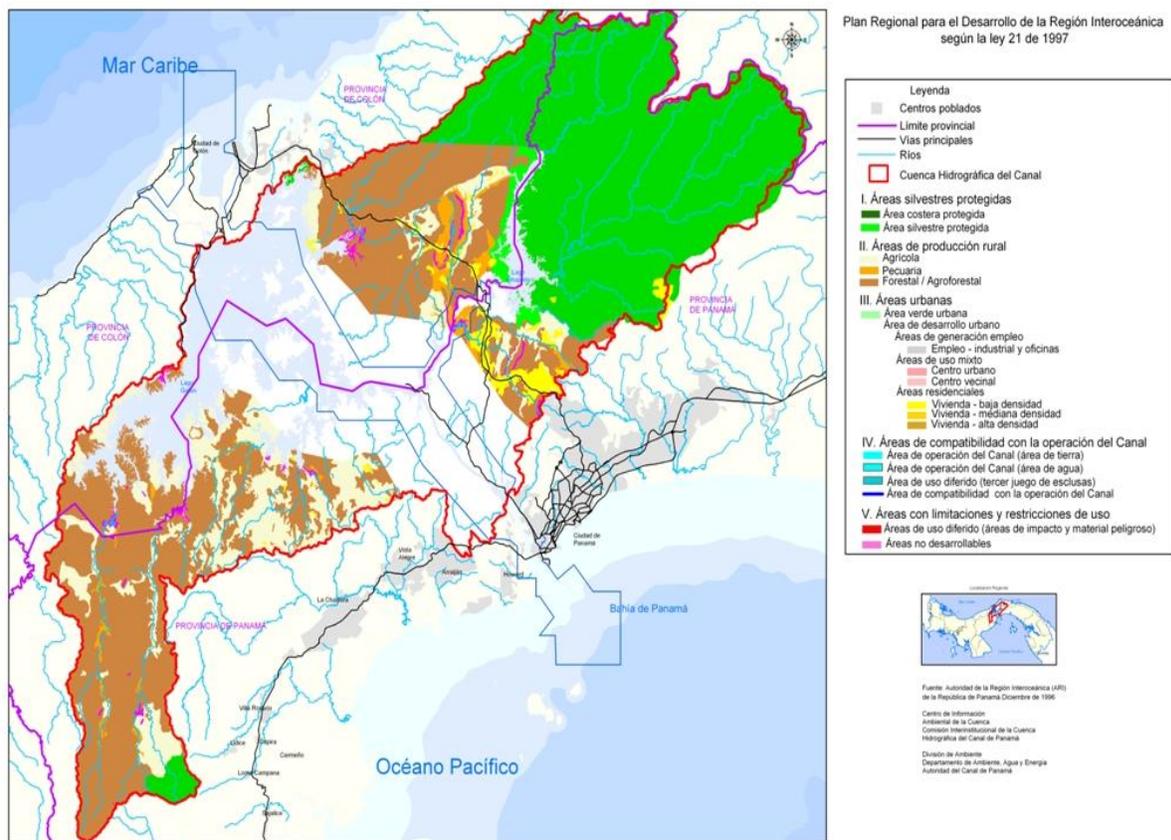
⁵² About 69 percent of remaining forests are within the limits of Protected Areas. These cover approximately 40 percent of the land within the PCW, including four national parks (Chagres, Soberanía, Altos de Campana, and Camino de Cruces) and two other protected areas (Monumento Natural Barro Colorado and Area Recreativa del Lago Gatún).

Table IV. 4. Land Cover Types within the current legal boundaries of PCW, in Km2 and Percent of Total Area

Land Cover Type	Area (km ²)	% Cover
Primary forests	805.108	23.704
Secondary forests	786.163	23.146
Shurblands	514.157	15.138
Pasturelands	660.093	19.435
Invasive herb	89.791	2.644
Crops	2.929	0.086
Forest plantations	26.089	0.768
Human settlements	55.605	1.637
Bare ground	21.052	0.620
Mining activities	3.638	0.107
Waters	430.062	12.662
No data	1.803	0.053
TOTAL	3396.5	100 %

Source: ANAM-ACP (2006a).

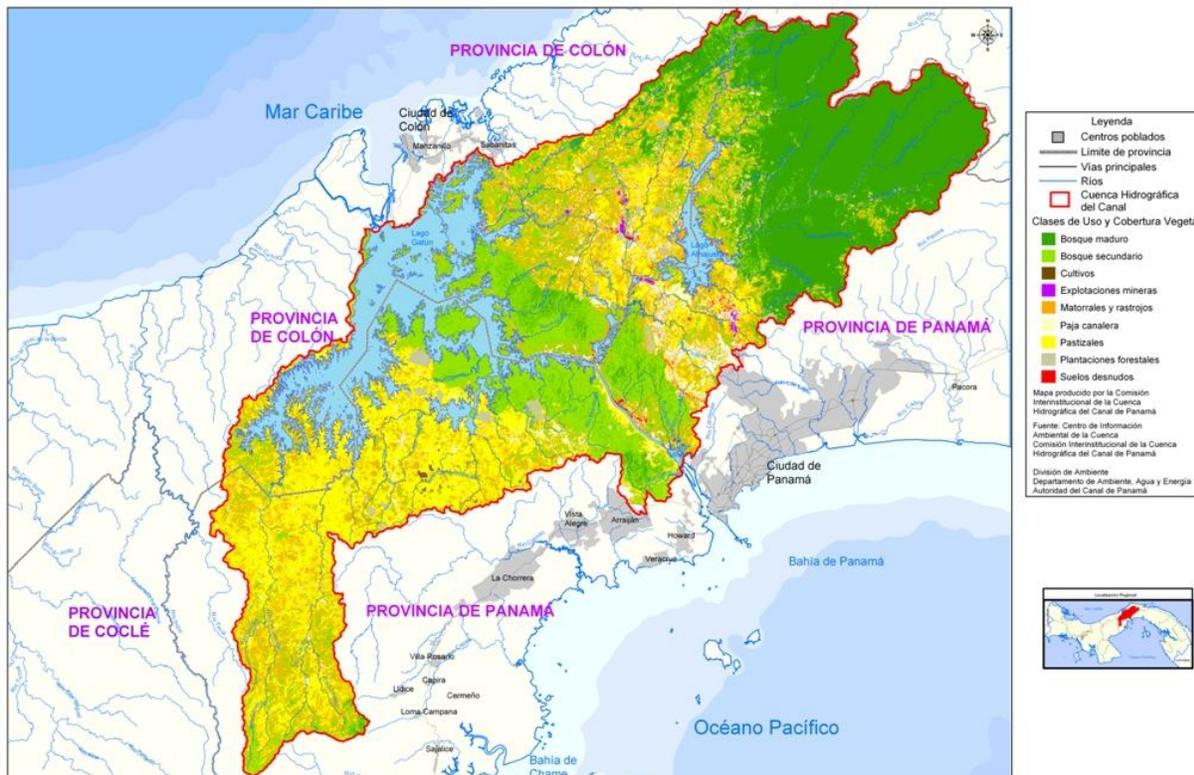
Figure IV.10 General Land Zoning for the PCW as defined by Law 21 of 1997



Source: CICH (2007)

In past years, work supported by the World Bank for the management of the PCW had called into question the assumptions behind Law 21 (regulating land use in the rural areas of the PCW) that by reforesting large areas of the PCW low flows would increase. The Bank-supported analysis came to the opposite conclusion and an assessment of the economic impacts of a full and massive program of reforestation—the extreme scenario for the implementation of Law 21—suggested that there was a significant risk that such activities could have negative impacts on Canal operations in terms of reduced water inputs. Based on this and other studies (status of land use, production methods, potential impacts of different implementation scenarios on the rural economy and operation of the Canal) it was concluded that a conservative approach was warranted over the short to medium term, placing priority on shifting agricultural production toward the sustainable approach proposed under the Law, in particular by promoting improved livestock production methods, supporting reforestation or natural regeneration in riparian and other critical areas, and extending assistance to rural poor. Concurrently, it was also recommended that further analysis of the low flow issue was essential, prior to promoting large-scale land use changes. Since then, the PCA has supported research on reforestation impacts with native species by STRI with the Yale School of Forestry (PRORENA project), which has been a step in this direction. PRORENA financing finished in 2007, and research of this type and that discussed above is critical to the management of the PCW for optimizing the use of its water resources.

Figure IV.11 Current Land Use within the PCW



Source: CICH (2007)

Potential future importance, as a water source, of the degazetted Western Region

As described in Box IV.2, in 1999 the legislature officially expanded the legal limits of the PCW by some 231,100 ha by gazetting territory west of the natural watershed divide to meet future water supply demands for both canal operations and urban/industrial consumers. This land was subsequently degazetted in 2006 following the conclusion that the proposed expansion could take place and water supply needs could be met from the original PCW, that is, interbasin transfers of water would not be required. Nonetheless, it may be prudent to assume that this area is important to meeting Panama's long-term water supply⁵³ and hydropower needs. Indeed, should the somewhat slim 7 percent margin⁵⁴ in projected 2025 water supply compared to demand be "consumed" by unforeseen factors (such as those arising from climate change or increased climatic variability or human consumption, and so forth), this region's water resources might also become important to the long-term operation of the Canal. Due to the potential importance of this region and due to recent studies indicating that this area is under pressure, the situation in the Western Region has been included in Annex III.

⁵³ The author's wish to note the oft-quoted example of New York City and how it has been able to avoid enormous expenses and ensure adequate supply for economic growth due to a series of farsighted decisions between 1830 and 1905 to invest in the protection of water supplies from watersheds far north of the city, ensuring water quality from as-yet unspoiled rural watersheds (see Box IV.3).

⁵⁴ The PCA projects that the average annual, sustainable water volume yield of the PCW is equivalent to 48.5 lockages, whereas the average annual demand will be equivalent to 45.3 lockages. The difference—3.2 lockages or about 7 percent—notionally constitutes the margin of error for covering the errors in the PCA's assumptions and predictions.

BOX IV.2 Legal Framework for the Management and Sustainable Use of the PCW hydrological Resources.

The Constitution of the Republic of Panama (Article 316) provides to the Panama Canal Authority the maximum authority over the PCW and its water resources. It is "...exclusively in charge of the administration, operation, conservation, maintenance, and modernization of the Panama Canal and its related activities...in order that it may operate the Canal in a manner that is safe, continuous, efficient, and profitable...in coordination with other government agencies as established by the Law shall be responsible for the administration, maintenance, use and conservation of the water resources of the Panama Canal watershed, which include the waters of the lakes and their tributary streams...[and] any plans for construction, the use of waters, and the utilization, expansion, and development of the ports, or any other work or construction along the banks of the Panama Canal shall require the prior approval of the Panama Canal Authority."

Law 19 of June 11, 1997 created the Panama Canal Authority (PCA) as a private entity with financial autonomy, to be responsible for the operation, administration, functioning, conservation, maintenance, improvement, and modernization of the canal to ensure that it is permanently open for the uninterrupted and peaceful transit of the ships of all countries of the world. To ensure this, among others it provides to the PCA the responsibility for the administration, maintenance, use, and conservation of the water resources of the canal's watershed. To exercise this authority, the PCA is to coordinate with the competent government authorities and nongovernmental organizations specialized in relevant matters. This law also establishes that the limits of the canal watershed are to be defined by the "geographic area whose waters, surface and subsurface, flow toward or enter the canal and its reservoirs and lakes.

The GLE of July 1, 1998, Article 84, clarifies that the PCA "...in coordination with ANAM, as the entity responsible for the management, usage, maintenance and conservation of the hydrologic resources within the PCW, based upon the strategies, policies and programs related to the sustainable management of the natural resources within that watershed" (ANAM 2006). A formal agreement (Cooperation Agreement between ANAM and PCA of August 10, 2006) establishes the roles and responsibilities of each institution for purposes of environmental protection and management of the watershed.

The PCA does not have jurisdiction over the lands outside of its patrimonial area. To comply with its mandate of protecting the hydrological resources of the PCW the PCA relies on the competent government authorities (Ministries and other government agencies such ANAM) to exercise their legal mandate and responsibilities within the PCW for its sustainable management. To ensure that these other institutional actors carry out their particular roles in the management of the PCW, the Interinstitutional Commission of the Panama Canal Watershed (Comisión Interinstitucional de la Cuenca Hidrológica, CICH) was created by the same law that created the PCA (Law 19, Article 6, June 11, 1997).

Law No 77 of December 28, 2001 restructured IDAAN as an autonomous agency, with funding independent of the central GOP. IDAAN directs, coordinates and supervises production, financing and development of all activities related to drinking-water supply, and the sewerage systems for populations with 1500 or more inhabitants (urban aqueducts). This same law, designates MINSA the oversight of rural aqueducts (at communities with less than 1500 individuals). The PCA and IDAAN depend on each other, and cooperate, to comply with their respective mandates of ensuring the availability of enough, good-quality water for human consumption by the Metropolitan populations of Panama City, Colon and other urban areas in and around the PCW.

4. Institutional Capacity and Current Investments

The comprehensive legal framework that exists for the protection of the Panama Canal Watershed (see Box IV.2) mandated the creation of the CICH. The CICH is presided by the PCA's administrator. The CICH's main responsibility is the coordination of the activities of government agencies⁵⁵ and NGOs with interests within the PCW (see table IV.5, below). CICH supervises, evaluates and sanctions programs, projects, and policies for the sustainable management of the PCW. CICH resolves inconsistencies, conflicts, or duplication of efforts among its member institutions. In order to support the implementation of the programs and strategies for the PCW's management, the Commission also has the responsibility to seek and obtain resources and to promote initiatives, through establishment of an appropriate mechanism of financing from both national and international sources.

The CICH has been successful in overcoming institutional issues that were identified as potential challenges to its coordinating role on a study commissioned by USAID - under the "Protection of Panama Canal Program" (USAID 2008). CICH has made progress in understanding, engaging and reshaping the dynamics of interactions with its member institutions, facilitating better coordination in the implementation of specific watershed management-related activities. CICH has brought together the major PCW's government and non-government stakeholders, during the consultation process for the preparation of the "Plan for the Sustainable Development and Integrated Management of the PCW's Water Resources (PDSGIRH)". This document is expected to provide the organizing framework for all the integrative management interventions within the PCW. The highly participatory process for the preparation of the PDSGIRH has generated new, and integrated current knowledge of the environmental, social, demographic, and economic conditions of the PCW. It is expected that once the PDSGIRH is completed, the line ministries, along with other major players within the PCW will support its policy and investment recommendations, working together under the coordinating role of the CICH to ensure that all interventions are compatible with the long-term goals of environmental and socio-economic sustainability.

The consultation process has already helped identify the five major challenges to the ecological and socio-economic sustainability of the watershed. The following bulleted list shows the challenge areas, and interventions needed to address them:

- Loss of Natural and Cultural Heritage - Conservation, protection, restoration, and monitoring of natural systems and hydrologic resources.
- Unplanned Urban and Industrial Expansion - Consolidation and enforcement of the Land Use and Urban Development Plans.
- Extensive agriculture and livestock production systems with negative environmental impacts - Transformation and strengthening of sustainable production systems.
- Weak institutional coordination and inadequate levels of community organization and empowerment -

⁵⁵ The CICH's steering board is composed of several line ministries and other government agencies and two civil society organizations, known as Commissioners. Supporting the CICH's Executive Secretariat there are two technical committees: The Permanent Technical Committee, whose members are senior technical representatives of the commissioners' agencies. Additionally, the Extended Permanent Technical Committee includes other agencies which are important players within the PCW (among them: MOP, MINSA and IDAAN.)

Modernization of the State, transparency, and accountability and community strengthening.

- Lack of response to the social needs of the population -
Development of infrastructure and public services.

The consultation process has provided the CICH, line ministries, other government agencies and major NGOs working in the PCW, with a portfolio of some 140 projects that address, in an integrative way, the challenges to sustainability identified above. The total estimated investment for implementing these projects is US \$130,000,000 over five years.

Current Investments

Under the CICH's oversight 23 pilot projects were recently implemented in priority subwatersheds⁵⁶. The thematic areas covered by these projects included: sustainable agriculture, water supply and sanitation, livestock management, soil conservation, organization and strengthening of local watershed management committees, and appropriate use of agrochemicals. These projects were financed through the Fund for the Conservation and Restoration of the Panama Canal Watershed (Fundación Natura 2008). This fund was established with contributions from the PCA and USAID, based on an agreement signed in 2003 to provide funding for projects that advance “*sustainable development, protection and restoration of the Canal Watershed*”.

A second phase for this program has been approved⁵⁷. This second phase builds on the lessons learned and incorporates the results of the PCW stakeholders' consultation process—coordinated by the CICH (see CICH 2008a), along with the experiences of ANAM and other government agencies and NGOs involved in the PCW (see table IV.5).

All these pilot projects -sanctioned by the CICH, as the coordinating multisectoral agency - fall under the overarching theme of integrated management and sustainable use of the PCW's water resources. They are expected to provide alternatives that guarantee the maintenance of both water quantity and quality, while providing instruments for economic development and quality-of-life improvements for the local populations.

Other major investments in the Region

The restoration and construction of the Panama-Colón (Trans-isthmian) Highway is underway, with an estimated cost of: US\$121.4 million (MOP 2008). IDAAN has several ongoing water services projects to address water treatment, production, and distribution needs affecting the Metropolitan areas, as previously detailed.

Table IV. 5 Non-exhaustive list of GoP agencies and NGOs with interests/ activities within the PCW.

⁵⁶ At the time before the “Western Region” was degazetted, in response to the critical environmental and social conditions found in that region – reflected in unsustainable land use changes-, in 2005 a US\$35 million program, co-financed by the Inter-American Development Bank, was initiated under the coordination of CICH. Its main components are (a) land titling, (b) expansion of the hydro-meteorological network and development of watershed management methodologies and approaches, and (c) community-based watershed management-related initiatives.

⁵⁷ Several projects are currently underway, including: “Sustainable Cattle-raising and Biodiversity Conservation in the Subwatersheds of the Boqueron, Gatun, and Pequeni Rivers” (total funds committed: US\$249, 000); “Participative Management of the Deciduous Forest and Improvement of the Natural Environment at Nuevo Caimitillo to increase Visitation to Chagres National Park” (US\$111,800); “Development and Implementation of Consultative Counsels for the Joint Management of the watersheds of the Boquerón, Chagres, Gatún, and Salamanca Rivers” (US\$153,800); “Community Participation in Biodiversity Monitoring within Soberanía and Chagres National Parks”(US\$85,000); and “ Network of Plant Nurseries, with Community Participation” (US\$103,000).

	Agency / Institution	Main agency's role/ role within the PCW
1,2	Ministry of Agropecuarian Development (Ministerio de Desarrollo Agropecuario)	Technical assistance and financing for Agricultural activities, including: cattle/swine/poultry raising and agroindustrial production. Land Reform
1,2	Ministry of Economy and Finance (Ministerio de Economía y Finanzas)	Manages budgets and allocates' funds to government agencies's activities within the PCW.
3	Ministry of Education (Ministerio de Educación)	Responsible for schools and formal education in the PCW.
1,2	Ministry of Government and Justice (Ministerio de Gob. y Justicia)	Responsible for citizen's security and safety.
3	Ministry of Health (Ministerio de Salud)	Responsible for health services to the population
1,2	Ministry of Housing (Ministerio de Vivienda)	Coordination and implementation of GoP's urban development and housing policies.
3	Ministry of Public Works (Ministerio de Obras Públicas)	Builds/ maintains main roads and related infrastructure.
	Ministry of Social Development (Ministerio de Desarrollo Social)	Protection to children and women. Provides food supplements to the extreme poor.
3	Ministry of the Presidency (Ministerio de la Presidencia)	Participates through the Social Investment Fund (see below)
3	Ministry of Trade and Industry (Ministerio de Comercio e Industrias)	Coordination, regulation, and implementation of GOP's policies for the expansion of enterprises and industries.
	Ministry of Tourism	Promotion of tourism activities within and around the PCW.
3	National Authority of Public Utilities (Autoridad Nacional de Servicios Públicos)	Regulation and control of basic utilities' providers/tariffs, including drinking water, sewage, telecommunications and electric power.
1,2	National Environmental Authority (Autoridad Nacional del Ambiente)	Protection and Management of areas legally-designated as Protected Areas within the PCW.
1,2	Panama Canal Authority (PCA) (Autoridad del Canal de Panamá -ACP)	Responsible for protecting the PCW's hydrological resources. Manages the Panama Canal. Presides the CICH.
1,2	Natura Foundation	NGO. Manages the Panama Ecological Trust Fund -FIDECO - (\$25 million), a grant-making fund for conservation and environmentally sustainable projects.
1,2	Caritas Arquidiocesana	NGO. Faith-based organization. Provides social services for the poor and extreme poor.
	Authority of the InterOceanic Region (Autoridad de la Región Interocéánica)	Manages lands contained within the former Panama Canal Zone.
	National Bank of Panama (Banco Nacional de Panamá)	Cofinance for sustainable, natural resource management activities within the PCW (see Natura Foundation)
3	National Water and Sewerage Institute (Instituto de Acueductos y Alcantarillados Nacionales)	Provides drinking water and sewerage systems to the Metropolitan Areas and communities with more than 1500 individuals.
3	Social Investment Fund of the Ministry of the Presidency (Fondo de Inversión Social de la Presidencia de la República)	Provides relief to basic needs of communities with poor and extreme poor inhabitants. Provides training and community organization support
1= CICH Commissioner ; 2 = CICH's Technical Permanent Committee (TPC)'s member; 3 = CICH's Expanded TPC's member		

5. Conclusions and Recommendations

The environmental health of the Panama Canal Watershed is under pressure from rapid, largely unplanned, and unregulated urban growth. The explosive growth in the city of Panama is already exerting significant pressure on lands that have been designated as unsuitable for urban sprawl. The cities of Panama and Colón both have Master Urban Plans, defining areas for urban growth and areas for other uses. However, these plans have not been fully implemented.

The investment in the Panama Canal Expansion project is underpinned by the assumption that water in the quantity needed for the operations of the expanded canal is available after meeting the current and growing demands for water for domestic consumption and commercial and industrial use of almost 50 percent of the country's population and over 80 percent of its GDP. While the quality of that water is of lesser concern as regards canal operations, it is of great concern to all the other end users.

Relevant to these factors, the PCA's projections show that water quantity is adequate for, and water quality will not be impacted by, the Canal expansion program. To arrive at these conclusions, the PCA has brought in recognized experts in many fields and generated and synthesized a mass of data and information that is impressive by any agency standards. They have produced a detailed set of proposals to develop a viable technical, financial/economic, social, and environmental proposal. Two issues however, possibly remain and would benefit from further evaluation:

Population Growth and Urban Development Projections. Previous population growth rate estimates, used for predicting water demand, are showing to be too conservative. Already the water demand for human consumption is higher than the 10-year average consumption level used by PCA for balancing its water budget. If this trend continues⁵⁸, it may be possible that the current margin of water safety -offered by the canal water saving improvements- to become inadequate to provide for the additional water demand. Such situation may result in a reduction in the level of confidence at which the canal could operate, with negative economic effects unless other water-saving measures are implemented.

Potential Impacts of Global Climate Change on the PCW. The information and analysis presented discuss availability in terms of annual average rainfall and availability. To the extent that climatic variability is discussed, it is done through discussion of the confidence intervals for provision of water, with a heavy reliance on the last 10 years of record. It is known that ENSO events can severely impact water availability and canal operations. It is also known that interannual climate variability of either the Pacific (that is, ENSO), or Atlantic (that is, North Atlantic subtropical highs) explains a significant amount of the total variance in rainfall in the Caribbean and Central America (Giannini, Kushner, and Cane 2002). It is also thought, but not known, that climate change impacts in Central America and Panama over the next decades will result in higher temperatures (with resulting higher evapotranspiration rates); in higher storm intensities (that may affect interannual storage in the PCW's lakes and reservoirs through greater-than-expected spillage) and, possibly, more frequent ENSO events. This risk merits further investigation.

⁵⁸ There are water and environmental management interventions (such as leak reductions and zoning) that could revert this trend; however they would require substantial strengthening of the implementing agencies' capacities.

The recommendations presented here are structured around the hydrologic parameters relevant to the issues of management of the PCW watershed and water resources (that is, water quantity, quality, timing, or temporal distribution), institutional issues for the management of the PCW, and issues around the development of an environmental services marketing or payment scheme for the conservation of the PCW.

Water Quantity and Quality

The water resources of the PCW must supply the operations of the current and expanded canal, the growing population, and economy of the Metropolitan area, and it may be used to generate hydropower. Under present conditions, water supply is seen as adequate to meet current demand. However, while the official projections for meeting increased, future water demand indicate that supply from the PCW will be adequate,⁵⁹ there appears to be room for debate on this issue. Specifically, there is room for debate on:

- *The underlying assumptions used for projection of water supply needs to the Metropolitan area for domestic, commercial, and industrial consumption.* The demand projections for water may be too low. Population growth estimates were made using significantly lower rates of economic growth and did not factor in the increased water demands from, among other things, the ongoing boom in the construction of commercial high-rise buildings, commercial centers, and residential developments. The accuracy of the projections on housing and water demand needs, and the demand for other basic services, should be revised and updated to account for major changes on parameters such as the much higher rate of growth of the Panamanian GDP, and the accelerated rate of construction, and migrations to the Metropolitan Cities and the Transistmian Corridor.
- *If and how the issue of climate change impacts on water supply should be factored into projections and contingency planning.* While the current strategy for ensuring adequate water supply does allow for some climatic variability,⁶⁰ the issue of climate change has not been factored in for the reason that current projections (according to CATHALAC) do not presage significant problems for PCW. However, the El Niño-Southern Oscillation (ENSO), which is the dominant mode of climate variability in Latin America and the natural phenomenon with the largest socioeconomic impacts, has twice affected Canal operation, once in 1982/83 and again in 1997/98. In the 1997/98 El Niño, the Panama Canal watershed experienced the worst recorded drought in Canal history. There was a 25 percent reduction in runoff toward the tributary lakes of the Canal and a 58 percent decrease of water flow toward Gatun Lake. Draft restrictions were imposed on the ships passing through the Canal, and the number of ships passing through decreased by 4 percent during the second trimester of 1998 compared to the previous year. The Canal and water supply are clearly vulnerable to the ENSO phenomena. Whether climate change will affect the occurrence of the ENSO phenomena is not known. The precautionary principle should be applied here and alternative scenarios for changes in ENSO occurrence as a function of climate change explored. Investment by the PCA and GOP in further research, expert consultation, and climate modeling to explore potential vulnerability and appropriate responses would appear to be desirable.

⁵⁹ Given the successful completion of the expansion program for the third set of locks, which is increasing both storage capacity and installing a water reutilization system, expected to reduce by 7 percent total freshwater usage per transit.

⁶⁰ Through increasing overall storage capacity in lakes and canal, reusing about 60 percent of the water with the new locks, and reducing hydropower generation.

- *The valuation of water—that is, efficiency of use and sustainability of the water treatment and distribution systems.* Given the priority attached to the supply of treated water, should a situation of water scarcity be reached, the production of treated water would imply reducing the supply of shipping transits by the Canal Authority. It is widely reported that very high water consumption per capita is actually the result of major problems in the water distribution infrastructure, such as permanent water leaks. However, about half of urban and most all rural users do not have water meters, so their actual consumption is unknown⁶¹ and those that do have meters pay a fixed, basic residential tariff to IDAAN for the first 10,000 gallons each month. This compares to the daily indoor per capita water use in the typical single family home in the United States of 69.3 gallons or about 2,100 gallons per month (AWWA 2001). Neither IDAAN's urban nor rural tariffs are sufficiently high to cover investment and maintenance costs, nor does the tariff structure provide incentives to conserve water⁶². It would appear that the potential for water savings through development of an appropriate pricing structure for water is essential. Public information and education campaigns around the value of water and water conservation programs may over time enable the GOP and IDAAN to increase water charges. Even so, this would require a long-term, permanent effort to eventually enable achieving full cost recovery.

The principal client for water quality in the PCW is the population reliant upon that resource for potable water. The operation of the Canal itself is not significantly impacted by water quality, with the possible exception of eutrophication and the growth of algae that would damage water pumps, turbines, and so forth. Over the last decade various reports have highlighted a number of actual and potential future sources of water quality problems in the PCW, problems that without action can be expected to worsen with continued urbanization and industrialization of the Panama City-Colón corridor. Recent water quality analyses show an increase in the levels of bacteriological and biochemical pollution of the waters draining into the lakes (CICH, 2007).

IDAAN's water treatment plants provide high quality potable water to the Metropolitan cities of Panama and Colon. However, within the PCW there are a large number of small, rural aqueducts - not under IDAAN's jurisdiction-. The water sources may become contaminated as a result of the lack of treatment of wastewaters, from human and agropecuarian activities, in many of these rural communities.

⁶¹ According to PCA (2000), estimates of per capita consumption averages about 53 gallons/day in outlying municipalities.

⁶² Indeed, a 2002 study (Aylward 2002) found that the PCA sold water to IDAAN for US\$0.183/m³ and IDAAN sold it to the end-use consumers for US\$0.173/m³ after incurring an estimated treatment cost of US\$0.061/m³ and without factoring in distribution costs.

Water Treatment and distribution Capacity

IDAAN's water treatment capacity is already severely limited. Additional stress, caused by pollution of the waters sources will have an impact on water treatment costs, but more seriously is the potential risks to the health of the populations, living near polluted water bodies. Specially those without access to municipal water systems, as is the case of many small settlements within the PCW.

A major issue, in regard to water supply and demand, is the systemic technical and administrative problems affecting IDAAN. Although, local experts have described IDAAN's capabilities to be improving in two aspects of their business: water production, with new water-treatment plants being built, and improvements to water transport. The agency still needs additional capability in the final distribution phase (e.g. fixing permanent water leaks and increasing the percentage of metered customers). Water consumption per capita seems very high, but is known to be the result of inefficiency in the distribution phase. Accurate statistical data on water consumption is critical for improving the reliability of projections on future demands.

Land Use Changes in and around the PCW

Settlements and increasing agroindustrial activities along the Transisthmian Corridor and areas within the PCW are reported to be placing pressure on lands considered critical for the protection of the watershed, and are increasing the demand for water for human and industrial use. There are increasing pollution problems caused by dumping of untreated wastewater directly into rivers that drain into the canal waterway or the lakes, there is a lack of trash collection services, and there are terrestrial transportation nightmares for a growing population that resides in the fast-expanding satellite cities, but work in the Metropolitan areas of Panama City and Colón.

Ultimately, the protection of the quality of the water resources in the PCW will have to depend on a combination of zoning, regulation, incentives, and investments in environmental management of production systems and sanitation:

- ***Zoning.*** The Master Plan for the Metropolitan Zone should be reviewed and subjected to dual processes of stakeholder consultation and scientific review and an updated, agreed plan given legal status. Subsequently, a strategy and action plan for its implementation should be developed, using the mechanism of the CICH to the extent possible, but with additional representation from those interests from outside the PCW that are helping to drive development within the PCW (for example, investment banks, real estate interests, developers). In light of this exercise, the "Law of Overlapped Uses" for the lands along the Transisthmian Corridor should be reviewed and, to the extent that it may promote negative effects on the quality of the water in rivers and Gatun Lake, amended (see chapter 2).
- ***Regulation.*** For new developments in the PCW, ANAM functions as the clearinghouse and coordinator of the clearance process with the other competent agencies (for example, the Ministry of Public Works and Transport [MOP] for streets/bridges/culverts/roads, MIVI for housing, PCA for water-related issues including potable water supply, sewage, garbage, and waste management and drainage). ANAM handles the overall EA requirements and natural resources/environmental impacts. For existing developments, businesses, activities, and the operational phase of new developments it is important that the regulating agencies enforce the implementation of the necessary environmental management and mitigation measures. Given the spatial and temporal nature of the issues that affect the management of the watershed, the CICH, through its technical unit, should coordinate the incorporation and

maintenance, in a Geographic Information System (GIS), an inventory of the existing developments, businesses and activities that require environmental monitoring. The data shall be made readily available to other bona-fide users of such information. Developing the internal technical capacity or mechanisms for data-sharing within other government agencies may be required.

- *Incentives/investments in environmental management.* A programmatic approach that is targeted at priority sub-watersheds identified through the water quality monitoring program is required. Replicating and expanding the approaches and activities of the “Program for Sustainable Management of the Rural Areas of the Panama Canal Watershed” (MASAR-CHCP) is strongly recommended.
- Considering the strategic importance of the PCW, it is surprising how little is known about the hydrologic functioning of the watershed (Harmon, 2005). Some efforts have been made to develop information on the spatial distribution of rainfall over the catchment, to better understand streamflow generation processes, and to evaluate the impacts of revegetation/reforestation programs on interception and evapotranspiration losses and the water balance (Harmon, 2005). However, there is little information or research being done on groundwater and its interactions with stream and reservoirs in the PCW. With increasing pressure for land use change—through, for example, urbanization/industrialization along the Panama-Colón corridor and reforestation in the rural areas, among others—having such information becomes increasingly critical for operational decisionmaking.⁶³ In urbanizing areas, limits might need to be established on impervious cover at the micro- or sub-watershed levels to mitigate against increased peak flows that could result in increased spillage during the wet season or other zoning or management measures taken to protect areas of the watershed that perform critical functions in runoff generation and/or groundwater recharge. The warming predicted from climate change, while modest, would increase evapotranspiration. The long-term, sustainable management of the PCW—particularly in the face of economic development pressures—will require good knowledge of the hydrologic function of the watershed and the development of decision-support models based on that knowledge.

The issue of improving and/or maintaining optimal low flows during the dry season to supply water to the reservoirs is seen as a critical issue for PCW management. Further support to PROENA (especially because reforestation impacts on water resources have generally been shown to change over the medium term) would be warranted as part of a priority research program for management of the PCW and the evaluation of tradeoffs for public policymaking on land use and development.

Investment in building Panama’s capacity in watershed hydrology-related research is already ongoing and should be further encouraged within a prioritized framework of required research to systematically build the knowledge base and develop the tools for management of the PCW and the evaluation of tradeoffs for public policymaking on land use and development.

⁶³ For example, the EIA for the canal expansion states that the dumping of dredge spoils from the construction, which will reduce infiltration, decrease soil moisture recharge, and increase runoff from storm events in the areas impacted by the dumping, will not affect the watershed hydrology because the affected areas are small. While this may likely be true, in the absence of any knowledge of the importance of groundwater to the system and presence or absence of critical recharge areas, the conclusion is, at best, a guess.

Institutional Aspects

The CICH's coordinating goals represent a paradigm shift in the way watershed management has been done in Panama, and many other places in developing and developed countries. The CICH and its Technical Secretariat seem to be functioning reasonably well and providing the needed intersectoral mechanism for agreeing upon and coordinating the diverse actions required for the management of the PCW. The PCA's reliance on the CICH and the various line ministries to carry out their institutional mandates within the agreed framework for the PCW's management is also proving to be a good formula. The main challenge facing the CICH at this time is establishing the institutional and implementation strategies and arrangements for implementing the "*Plan for the Sustainable and Integrated Management of the Panama Canal Watershed's Water Resources*".

The current thinking is that once the participatory planning process is completed, the CICH will seek MEF's commitment that all public expenditure (including donor financing) will be strongly guided by and directed to the implementation of the Plan. The local, sub-watershed committees (of which there are currently 25) will provide the local institutional linkage and local coordination and prioritization function. The individual line ministries will be responsible for supporting implementation of the Plan, within their legal and institutional mandates (see table IV.5). A strong and clear message from the GOP to its government agencies would be needed to effectively support the integrated watershed management approach proposed by the CICH53 (see box IV.3), and to develop the internal capacity to align the necessary human and financial resources, as per their respective legal responsibilities within the PCW. A critical factor for measuring success will be to establish targets and appropriate results indicators for each line ministry, for which they would be accountable and their budgetary releases from MEF would be against progress in meeting targets and results. In addition, it would require additional capacity in each line ministry to monitor and evaluate their performance and to mainstream participatory, demand-driven approaches and watershed and environmental best management practices into their programs.

The integrated management of watersheds is complex, as it involves many local and external stakeholders and new working arrangements. Most importantly, it requires changing the way in which agencies are accountable for the use of their own human and financial resources, towards a shared goal. The CICH has been visionary in taking the lead in championing such an approach within the PCW. The PCA and the GOP shall continue to provide and expand their support to the CICH, and guide official agencies to contribute their best efforts towards achieving the sustainable management goals of the watershed's natural resources.

Box IV.3 Integrated Water Resources Management

New York City has long been proud of its excellent municipal drinking water. Approximately 90% of that water comes from the Catskill/Delaware Watershed, which covers about 1,900 square miles (nearly 5,000 square kilometers) of densely forested land north of the city and west of the Hudson River. The city water is outstanding for so large an urban area. Yielding 1.2 billion gal (450,000 cubic meters) per day, and serving more than 9 million people, this is the largest surface water storage and supply complex in the world. The watershed's protection program is funded by water and sewer rates. The Water Finance Authority collected \$1.7 billion in 2004. \$900 million of this was used for water supply operations and debt service. They have a monitoring and protection program, designed to prevent future degradation of water quality. There are also remediation programs, designed to address specific problems and are expected to result in measurable decreases in pollutants.

Sources: BNET. Environment News Service, April, 2007 http://findarticles.com/p/articles/mi_kmens/is_200704 (June, 2008).
www.unece.org/env/water/meetings/payment_ecosystems/Presentations/Principe.ppt (June, 2008).

V. Unleashing the Poverty Reduction Potential of the Tourism Sector

1. Background

This chapter reviews the impact of the booming tourism sector on poverty and the environment in Panama and offers a set of recommendations to enhance sustainability in the sector. The Master Plan for Sustainable Tourism Development (2007–2020), under preparation by the Government of Panama since July 2007, seeks to address these challenges by developing an integrated framework and enforcement mechanisms for the sector. The primary purpose of this chapter is to demonstrate the very high potential of the tourism sector in Panama to become a major source of income for the poor, but also the potentially very high environmental costs, to provide the analytical basis for including environmental and social considerations in the Sustainable Tourism Development Master Plan and in broader policy planning, and to propose a set of criteria to help derive measurable indicators and enhance social and environmental sustainability in the sector.

2. The Tourism Sector within the Broader Social and Economic Context

Panama is experiencing spectacular economic growth, averaging 7.5 percent during 2004–06; a construction boom; and emerging new opportunities and growing export markets. The conclusion of a trade promotion agreement with the United States in June 2007, and plans to expand the Panama Canal over the next six to seven years, will create additional new opportunities. Historically, Panama has had a service-oriented economy, with a major contribution from Canal-based services, tourism, the Colón Free Zone (ZLC), and banking adding to the country's gross domestic product (GDP) and exports.

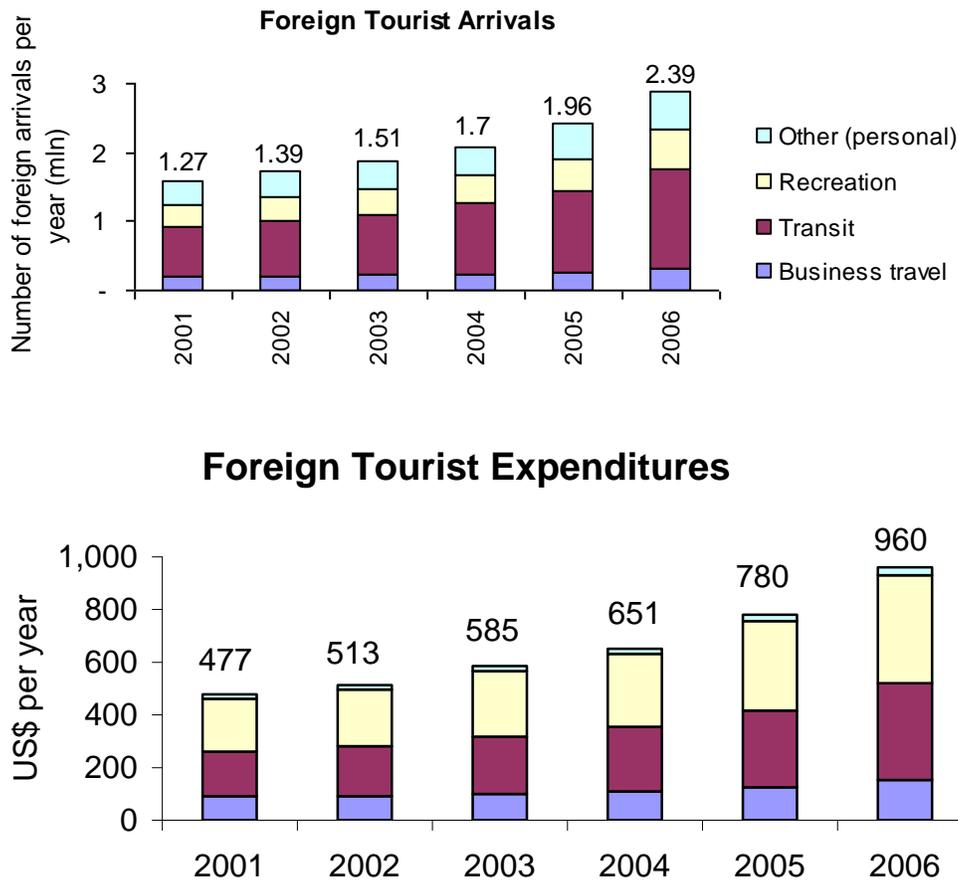
Tourism is a major source of export revenues and an important source of employment in Panama. The sector's share in the total value of major exports of goods and services has risen from 13 percent in 1999 to 20 percent in 2006 and continues to grow.⁶⁴ Within the framework of trade liberalization following Panama's accession to the World Trade Organization (WTO), Panama has committed to significant liberalization of tourism services. It will eliminate barriers to small-scale tourism investment and grant unrestricted market access to prospective investors (WTO 2007).

The number of foreign tourists that visit Panama every year reached 70 percent of the country's population in 2006, and expenditures by foreign tourists total approximately US\$960 million—or 6 percent of the country's GDP (Figure V.1). Of the total of about 2.39 million visitors per year, about half of the visits are direct transit⁶⁵ and a quarter are for recreation; the former account for one-third of total expenditures by foreign tourists and the latter for over 40 percent. Panama is also becoming a popular destination for retirees from North America and Europe, a fact not reflected in these statistics on tourism arrivals but which contributes to the real estate boom in the Metropolitan area of Panama City, Bocas del Toro, and Chiriquí.

⁶⁴ In the first quarter of 2006, the number of tourists increased by 14.4 percent and the number of travelers in transit and crew members grew by 16.4 percent, producing an increase of 19.2 percent in expenditures made during those visits (WTO 2007).

⁶⁵ Passengers in direct transit are visitors that spend less than 10 hours in the airport and proceed to other destinations. Using this definition, in 2005, 48 percent of tourists were in direct transit, and 13 percent were defined as (indirect) transit passengers. An additional 24 percent were recreation tourists, 13 percent were business visitors, and 2 percent were non-business visitors for purposes other than transit or recreation.

Figure V.1. Tourism Arrival and Expenditures Are Rapidly Growing



Source: Contraloría, Department of Statistics and Census, 2008.

Panama is attracting tourism not only because of its scenic vistas and vast biodiversity, but also because of its rich cultural heritage. In addition to attracting thousands of business travelers, it is a growing center of coastal, cultural, and health tourism, and ecotourism. Surveys of foreign tourists reveal that business and shopping are still the main purposes of the trip for about a quarter to a third of all visitors; recreation is the main purpose for over a third of all visitors, and family visits for around 20 percent. Among activities, shopping, entertainment, and business needs are still the main motives for the trips. But adventure and coastal tourism and ecotourism are gaining prominence.⁶⁶ One survey reveals that over 40 percent of foreign visitors have spent time at the beach, and 10 percent have participated in ecotourism, among other activities.⁶⁷ Another survey suggests that ecotourism is one of the main purposes of the trip for about 15 percent of foreign visitors, while cultural tourism is still in a nascent stage (Table V.1).

⁶⁶ Results for October and November 2007 of the ongoing tourism survey conducted by PSM SIGMADOS. Each month's sample size is 500 tourists (with the total sample size of 6,000 once all rounds of the survey are completed).

⁶⁷ Tourism survey conducted in June 2006 by Dichter & Neira Latin Research Network. Sample size: 843 foreign tourists.

Investments in infrastructure and hotel accommodations, which are not yet sufficient for meeting the growing tourism demand in most areas outside of Panama City, are expected to grow. Although most expansion in hotel capacity is expected to occur in the Metropolitan area of Panama City, in relative terms accommodations are likely to more than double in Bocas del Toro and significantly rise in Coclé and other areas of coastal tourism.

Table V.1. Activities Realized during the Trip

<i>Foreign Tourists</i>		<i>Domestic Tourists</i>	
Shopping	82%	Recreation	32%
Entertainment	46%	Vacation	24%
Beach	22%	Family visit	24%
Ecotourism	15%	Rest (<i>descanso</i>)	10%
Ethnotourism	2%	Religion	5%
Other	11%	Health	2%
		Other	3%

Source: Data from tourism surveys for Satellite Tourism Accounts, 2008. For foreign tourists, 1,626 tourists (and more than one response was permissible); for domestic tourists, 1,423 trips (states only the main purpose).

Tourism is a major source of foreign exchange for the economy, and a potentially powerful means of reducing poverty. It can also help improve the economic profitability of some measures aimed at preserving biodiversity and natural habitats, such as through well-managed ecotourism services. But uncontrolled tourism development poses significant social and environmental risks, particularly acute in Panama because of the already high inequality and environmental sensitivity of the growing tourist destinations in the proximity of the Mesoamerican Biological Corridor (MBC).

Panama is one of the most biologically diverse countries in the world. It is a critical link in the MBC and host to more than 12,600 plant species and 2,950 species of vertebrates. Many of these are threatened and some require very large areas of natural habitat (for example, jaguars and harpy eagles). Nearly 50 species of threatened amphibians are endemic to Panama and Costa Rica. Deforestation, at 40,000 hectares per year, and habitat fragmentation, are the main drivers of the loss of biodiversity. Large-scale tourism, mining, and planned road construction in biodiversity-rich areas are likely to increase the pressure on wildlife habitats.

The Master Plan for Sustainable Tourism Development (2007–2020), under preparation by the Government of Panama since July 2007, seeks to address these challenges by developing an integrated framework and enforcement mechanisms for the sector. This Country Environmental Analysis (CEA) provides the analytical basis for including environmental and social considerations in the Sustainable Tourism Development Master Plan. It provides recommendations for enforcement of land-use planning (zoning) policies and incentive mechanisms to mitigate the likely environmental damage and harness improved environmental sustainability of the booming tourism sector.

The analysis of the tourism sector carried out as part of this CEA includes a review of the literature and global experience, analysis of tourist spending flows and destination and their direct and indirect effects on the local economy and poverty in Panama, and a model ecological zoning plan for a selected area with high tourism potential in Panama. Main policy

recommendations in this chapter pertain to developing an effective monitoring system, and establishing mechanisms for cross-sectoral coordination and enforcement, and participatory mechanisms through the process of ecological zoning. Specifically, this chapter identifies the gaps in the data that are needed for more accurate monitoring of the sector's social and environmental impacts at the local level and measures needed to support the capacity of the relevant agencies (Panamanian Tourism Institute [IPAT] and the Statistics Department [*Contraloría*]) to implement this assessment. The model zoning plan proposed for the area of Portobello and the Port of Colón illustrates the potential to use ecological zoning to enhance environmental sustainability of various forms of tourism and to ensure that the benefits of sector's growth reach marginal and indigenous communities.

3. Tourism Potential for Poverty Reduction and Growth in Rural Areas

Panama has traditionally been characterized by a dual economy with high inequality, and includes: (a) the rapidly growing urban sector based on exports and services from the Canal and the ZLC; (b) poor urban areas and rural areas where agriculture is the main source of livelihood and poverty is high, especially in the indigenous areas.⁶⁸ The urgency of the poverty concerns is evident from the deep divide between the urban and rural areas, and—within rural communities—between the indigenous and non-indigenous. Almost 85 percent of the poor in Panama live in indigenous and non-indigenous rural areas, and poverty in rural and especially in indigenous areas of Panama is two to three times as high as poverty rates in urban areas (Table V.2).⁶⁹

Table V.2. Poverty Has Slightly Declined Nationally, but Not in the Indigenous Areas

	Poverty		Extreme Poverty		Inequality	
	(percent of population)		(percent of population)		(Gini coefficient)	
	1997	2003	1997	2003	1997	2003
National	37.3	36.8	18.8	16.6	48.5	46.9
Urban	15.3	20.0	3.1	4.4	41.4	42.1
Rural (non-indigenous)	58.7	54.0	27.4	22.0	41.3	39.0
Indigenous	95.4	98.4	86.3	90	40.2	34.9

Source: 1997 and 2003 ENV data.

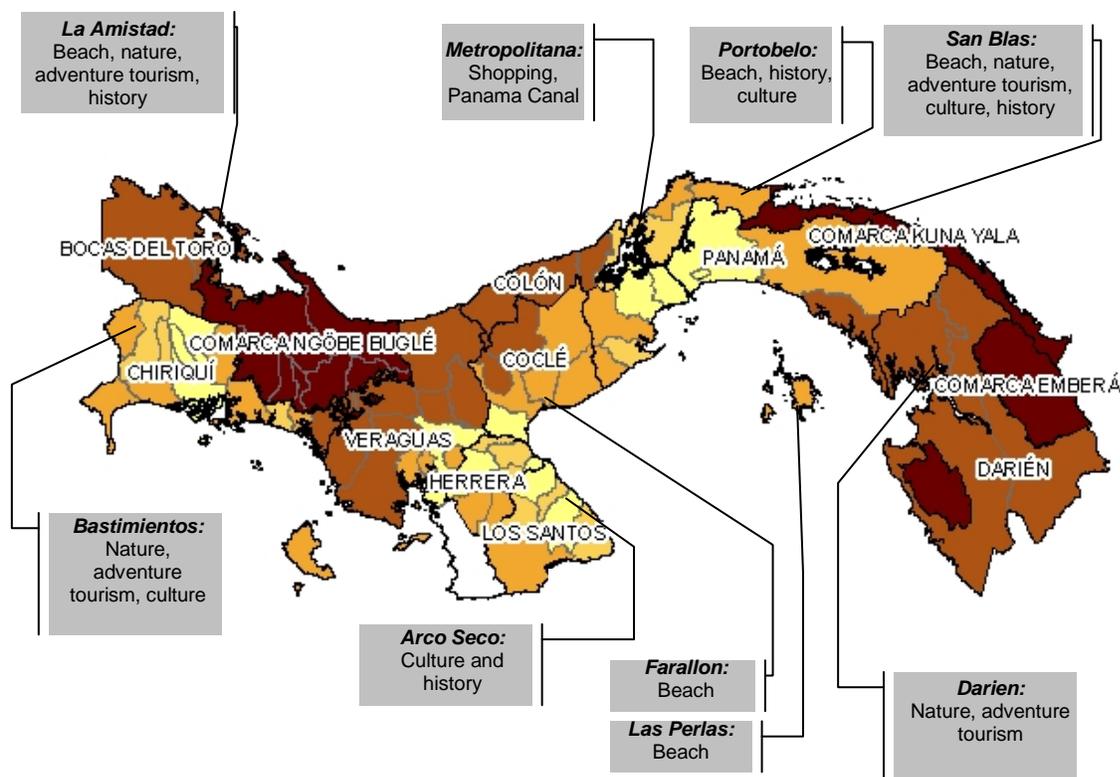
This duality between the welfare levels in urban and rural regions of the country is also very pronounced between non-indigenous rural and indigenous areas. Poverty among the indigenous is twice as high as in non-indigenous rural areas and is rising (Map V.1). The discrepancy is more striking for the extreme poor. Over 40 percent of the extreme poor live in non-indigenous and indigenous rural areas, and 16 percent live in urban areas. Only 8 percent of Panama's

⁶⁸ The Ngobe-Bugle are the largest poor group (175,000 people), living mainly in the Bocas del Toro (bordering Costa Rica) and Chiriqui provinces; the Kuna on the Caribbean coast are the second largest (92,000 people); and the Embera-Woonan (33,000) live mainly in the rainforest of the Darien (bordering Colombia) and Panama provinces. The Ngobe-Bugle have the least political leverage, and this group's culture and livelihoods are under threat. The Embera-Woonan and some smaller indigenous groups also have a weak political voice, and this group's livelihoods are under threat because of lawlessness and safety problems, resulting in strong out-migration. The Kuna have a strong political and administrative structure, thanks to strong local leadership.

⁶⁹ Based on the detailed analysis in World Bank (2007).

population live in the indigenous areas, but 90 percent of the population in those areas live in extreme poverty.⁷⁰

Map V.1. The Tourism Sector Has the Potential to Bridge the Poverty Divide



Note: District-level poverty estimates generated with ENV 2003 and 2000 Population Census data. Districts with darker shading have higher poverty rates (general poverty line).

Source: Poverty mapping data by the Ministry of Economy and Finance (2005); Tourism Masterplan (2008:220).

While the gap between the welfare levels in the non-indigenous rural and in the urban areas slightly narrowed during 1997–2003, it has widened between the indigenous areas and the rest of the country. Over 98 percent of the indigenous were poor and over 90 percent were extreme poor in 2003. Similarly, levels of malnutrition are substantially higher in indigenous areas, and schooling levels are significantly lower. A considerable reduction in inequality during 1997–2003 has helped significantly reduce the rate of extreme poverty in non-indigenous rural areas, but it has not been sufficient to improve poverty in indigenous areas.

Growth of the tourism sector can be a major new source of off-farm income in rural and in some indigenous areas, resulting in a significant decline in rural and indigenous poverty. This reduction can occur through several channels: employment creation, higher wages, and access to newly provided infrastructure and community services developed as part of the tourism area. Tourism development can also benefit the local population through indirect effects, such as changing prices for land and agricultural products.

⁷⁰ World Bank estimates using 2003 LSMS data.

But tourism growth can also have adverse social and poverty consequences at the local level. Communities can lose access to natural resources, such as traditional fishing grounds and forests; water quality may deteriorate with development of mass tourism and real estate construction in coastal areas; and households that are net consumers of agricultural commodities and services would be adversely affected if their prices rise. In some circumstances, the social fabric in the indigenous communities may be damaged by tourism development. Despite the significant aggregate gains from the growth of the tourism sector for the country, at the local level this impact may be ambiguous. The direction and the magnitude of the welfare impact at the province, district, and community levels crucially depends on the extent to which the growth of economic activities associated with the tourism sector stimulates the local economy, and to what extent the poor and indigenous community participate in this growth.

4. Approaches to Measuring Economic and Social Impact at the Local Level

The tourism sector can play an important role as part of a country's overall growth strategy and contribute to poverty reduction, and from a macroeconomic perspective the sector is clearly an important source of economic growth in Panama. However, the tourism sector's impact on the local economy and people at the destination level is unclear. Global experience reveals that tourism can have significant direct benefits at the local level by generating employment and improving wages, and several indirect effects such as stimulating growth in tourism-related activities (for example, services, transportation, and handicrafts). On the flip side, many of these benefits may accrue to people and factors of production outside of the region. This "leakage" of benefits increases when hotels and other tourism establishments hire non-local labor and use other inputs, including agricultural products, which originate outside the region. Tourism development can also have negative cultural and social effects on local communities, negating many of its economic benefits.

Benefits to the poor from tourism development do not depend so much on the type of tourism as on how the tourism economy is structured.⁷¹ The key factors are (a) the way supply chains work, (b) how far backward and forward linkages extend into the economy and reach the poor, and (c) how tourists spend their money. For example, a recent comparison of case studies of tourism development in Ethiopia, Lao PDR, The Gambia, and Tunisia has contrasting findings with respect to the impact on the poor. The scale of tourism activities is not comparable in these locations, but the general observations from this qualitative comparison are illustrative. Cultural tourism destinations—Lalibela in Ethiopia and Luang Prabang town in Lao PDR—dramatically differ in the levels of spending on the local economy. Although 90 percent of the tourists visit Ethiopia's main cultural site Lalibela, craft sellers earn only 1 percent of tourist revenues, while handicrafts are the second-most-important sub-chain after the food and beverages sub-chain in Luang Prabang town. The strong handicrafts sector, abundance of small locally owned enterprises, high quality of local goods and services, and safety enabling tourists to walk around at any time of day and night, are the secrets of success in Luang Prabang. Of around US\$23 million spent by tourists in Luang Prabang every year, around 27 percent accrues to skilled and semi-skilled people.

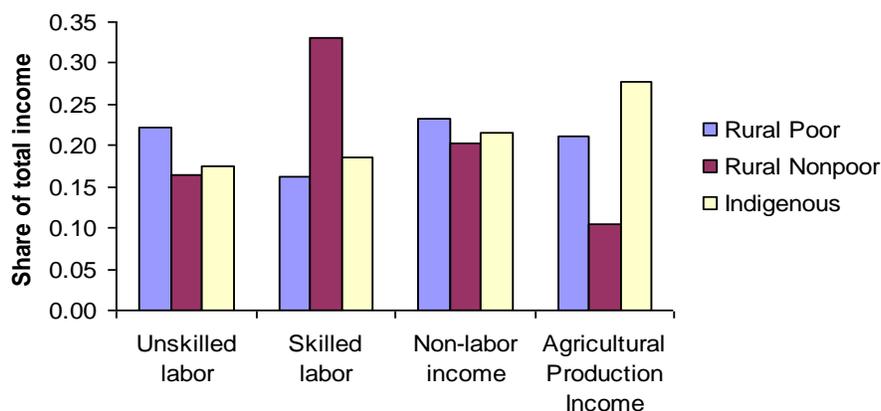
Package tourism in Tunisia's beaches creates many jobs and a market for local food—over 90,000 jobs are created in hotels, and an estimated 90 percent of hotels' foods and beverages are

⁷¹ The following review of the four case studies is based on Ashley (2006).

made in Tunisia—but there are weak linkages with artisans and vendors. In Tunisia, receipts per visitor are less than half that in Morocco and Egypt, with out-of-pocket spending by tourists in Tunisia of as little as US\$8 per day. Some of the reasons for such low spending levels are the physical separation of resorts from towns, a limited range of high-quality products offered by street vendors, and little incentive for beach tourists to leave hotels other than for organized excursions. In contrast, beach package tourism in The Gambia has very strong linkages with food markets and local shopping, and tourists’ out-of-pocket expenditures there average US\$53 per person per day and US\$574 over a typical 11-day stay—a high level both internationally and compared to the cost of the package. Local initiatives have helped boost these linkages to the local economy, such as an agricultural supply chain project that has boosted the local fruit and vegetable supply, a project to train informal sector operators (juicers, crafters, guides), and upgrading by hotels of the quality of services and sales levels.

Tourism development can become a particularly important source of off-farm income in rural and peripheral areas in Panama, and for some population groups it may exceed the importance of agricultural activities (Figure V.2). In Panama, income from agricultural production contributes only around 10 to 20 percent to total household income in rural areas, with the exception of indigenous areas, where it is close to a third of total income, and nearly 40 to 50 percent of total income is from skilled and unskilled labor.⁷² By creating new employment opportunities and through the effect on wage levels, the tourism sector is likely to have a significant impact on the local economy, particularly high for the poor and in the indigenous communities. In terms of employment in rural areas, dependence on agriculture is highest among the poor and for indigenous households; employment in the services sector (large- and small-scale commerce and repairs) tends to be higher among the non-poor. Since these types of services will be affected by tourism growth, tourism can have significant indirect benefits for the poor.

Figure V.2. Off-farm Income Exceeds the Share of Agricultural Income



Source: Authors’ calculations from 2003 ENV household survey data.
National average data for Panama.

Assessing the magnitude of the economic impacts of tourism development is not straightforward because of a wide range of activities associated with growth in this sector and the difficulty in defining tourism as an industry (Box V.1).

⁷² Some of this is agricultural labor.

Box V.1. Methodological Approaches to Measuring Tourism Sector Impacts^a

The true size of the tourism sector, more accurate than a partial picture provided by national accounts, can be measured using Input-Output (I-O)^b and Tourism Satellite Account (TSA) tables.^c These methods can provide reasonably accurate estimates of the contribution of the sector to overall output, incomes, jobs, and sales. The drawback of these approaches is their static nature (they take prices as given), and they do not allow substitution among sectors and do not facilitate distributional analysis or prediction of the effects of a change in tourist expenditures. These models do not shed light on the distribution of earnings from tourism development.

Within a Social Accounting Matrix Model (SAM)—which is another static approach used in modeling tourism sector impacts—apart from the overall economic impact, it is also possible to address distributional effects across different types of households and institutions. The SAM describes the relevant features of socioeconomic structure and the relationship between the structure of production and distribution of income and expenditure among households in a particular area. This methodology combines I-O tables with tables on the distribution of payments to factors of production, including labor, in each economic sector. The multipliers, estimated using SAM tables, measure the extent of backward and forward linkages in the tourism sector and distribution of benefits. A regionally disaggregated SAM model enables distributional analysis at subnational level.

Computable General Equilibrium (CGE) models are the only dynamic approach that captures intersectoral linkages and models prices as endogenous. Traditionally, these models looked at households as a single category and assessed aggregate welfare changes for this group. Recent modeling efforts have combined CGE with SAM tables to obtain disaggregated welfare measures by household group. This type of analysis has been undertaken for several years in Denmark to assess economy-wide and distributional impacts of tourism growth using the Local INterregional Economic Model (LINE) (Zhang, Madsen, and Jensen-Butler 2008). However, this method is computationally complex and demanding in terms of the data requirements. Many policy questions, especially if the main focus is on short- to medium-term impacts, can also be answered within the context of a SAM model.

a. Based on Zhang, Madsen, and Jensen-Butler (2008); Singh, Birch, and McDavid (2006); De Agostini and others (2005); and Brida, Pereyra, and Such Devesa (2008).

b. I-O tables decompose GDP into a matrix of inputs and outputs.

c. This approach was developed by the World Tourism Organization with a view of implementing a universal measurement methodology for the tourism industry and the tourism sector.

The Social Accounting Matrix (SAM) multiplier model of tourism impacts developed as part of this CEA, permits ex ante assessment of the direction and magnitude of the local economic and poverty impacts of the growth of the tourism sector. This model provides estimates of the disaggregated direct and indirect effects of an increase in tourist expenditures on the local economy and on households with specific income and skill levels. The model translates an increase in tourism expenditures at the aggregate level into regional impacts, using information from surveys of tourist expenditures, consumption, expenditure and employment patterns of Panamanian households, and the general structure of the economy.

Data for the model stem from three sources: (a) the structure of income and expenditures at the regional level calculated from the 2003 Living Standards Measurement Survey for Panama, (b) visitation and expenditures by domestic and foreign tourists at the regional level calculated from the tourism survey recently carried out by the *Contraloría* for the Tourism Satellite Accounts (TSA),⁷³ and (c) I-O and aggregated SAM tables that represent the structure of the Panamanian

⁷³ Surveys of foreign tourists were implemented at two main entry points into the country—Tocumen Airport and Canoas Pass—over six weeks throughout different seasons in 2006 and 2007 and include data for 1,626 foreign tourists (surveyed at the Tucuman Airport and at Paso Canoas) that account for 4,687 trips. Surveys of domestic tourism were implemented in July 2006 and April 2007 and collected data on trips completed throughout 2006; these surveys collected data for 3,498 Panamanian households (of which 34 percent reported having gone on trips in the previous year). Data on expenditures are available for 1,604 foreign tourists in the sample; 252 tourists traveled with a package and their expenditures are not included in the calculations in this chapter. Thus, results shown here

economy at the national level. A SAM multiplier model is estimated using these data sources as inputs. These data sources are sufficient to estimate the magnitude of the impacts on income and employment at the province level for different categories of households.

The SAM model shows the overall direct and indirect impacts and impacts on income and employment disaggregated by province and by household type. Four province archetypes have been selected for the analysis: Panama Province, Bocas del Toro, Chiriquí, and the rest of Panama. Showing disaggregated results for the *comarcas* was not possible because of the lack of statistical significance of these results, as very few foreign tourists in the tourism survey sample report visiting the *comarcas*. Modeling results are disaggregated for the following social strata: urban poor, urban nonpoor, rural poor, rural nonpoor, indigenous, nonindigenous poor, and nonindigenous nonpoor.

5. Tourist Spending at the Province Level in Panama

The aggregate economic impact of the tourism sector on the Panamanian economy is very significant; according to the data from the national accounts, expenditures by foreign tourists reached around 7 percent of GDP in 2006. Arrivals of foreign tourists in Panama exceeded 2 million visitors in 2006, of which over 1 million were in direct transit, and total expenditures by foreign tourists totaled US\$960 million (Table V.3).⁷⁴ Nearly half of all foreign tourists are in direct transit and a quarter visit Panama for recreation.

Table V.3. Tourism in Panama

	Data from the National Accounts (2006)				Estimates from TSA Tourism Surveys	
	Number of People	Percent of All Tourists	Total Expenditures, US\$ '000	US\$/Trip	Percent of all Tourists	US\$/Trip
Recreation	569,323	24%	409,947	720	63%	509
Business	309,993	13%	151,859	490	21%	767
Transit (indirect)	312,004	13%	54,598	175	6%	226
Transit (direct)	1,140,430	48%	313,481	275	na	na
Other	54,160	2%	30,182	557	10%	536
All tourists	2,385,910		960,067	402	100%	549

Average expenditures differ significantly across tourist types. According to the national accounts, they range from around US\$200 per person per trip for transit tourists to more than three times that amount for recreation tourists (Table V.3.) Recent data from TSA surveys are broadly consistent with the national accounts. Average expenditures per tourist are on average US\$549 per person per trip compared to the slightly lower average from the national accounts. The latest round of TSA data for tourists in direct transit is not yet available, so the TSA data are representative of recreation, business, and other types of tourism and not of direct and indirect transit passengers. Since survey results are regarded as a more accurate measure of tourist expenditures, these findings suggest that the national accounts may overestimate expenditures by recreational tourists and underestimate business tourists' expenditures.

are based on averages for 1,352 foreign tourists with non-missing data on expenditures and who did not travel with a package.

⁷⁴ Tourists in direct transit are defined as visitors that stay in the airport less than 10 hours, do not leave the airport area, and proceed to other destinations.

Data on tourists' expenditures from TSA surveys, which are based on a sample of 1,626 foreign tourists, are scaled-up to the national level, taking the total number of foreign tourists—1,245,480 tourists excluding direct transit visitors—as given (Table V.3). In the aggregate, the largest single expenditure items are lodging and hotel expenses and personal shopping, apart from the cost of international travel. Total expenditures for foreign tourists from the survey data are allocated to each province using the information on the share of time (the number of days) each tourist spent at each destination.⁷⁵ For domestic tourists—or Panamanian residents that travel within Panama—the information on both travel rates and expenditures by destination stems from a survey of 3,498 Panamanian households. The results of the TSA surveys need to be interpreted with caution because the sample of foreign tourists does not appear to be representative of tourists by their country of origin—an important factor influencing the types of activities and spending tourists undertake—and of types of tourism. Thus, a very small sample of tourists in the survey reports engaging in ecotourism, precluding desegregation of economic impacts by type of tourism. Furthermore, transit tourists were not included in the survey sample. Since the economic impact of transit tourism is likely to be concentrated in the area of Panama City and the international airport and have less impact on the economy of other provinces, this omission does not bias the results. Development of a revised sampling procedure for the TSA surveys is underway in Panama.

Preliminary data indicate that foreign tourism has a much higher impact on the economy than domestic tourism. In absolute terms, foreign tourism expenditures are highest in Panama Province, but in relative terms they may contribute up to a fifth of the GDP in peripheral areas with low levels of provincial GDP, such as Bocas del Toro (Table V.4).

Table V.4. Estimated Foreign and Domestic Tourism Expenditures as a Share of Province GDPa

⁷⁵ The database on foreign tourist expenditures includes expenditures for all destinations and information on which destinations tourists visited on the same trip, but no information on expenditures by destination. The estimates of expenditures by province are made here using two methods. First, total expenditures are disaggregated by province in the same proportion as the share of time (the number of days) all tourists in the sample spend in each province. An adjustment is made for a slightly higher level of average spending by tourists that visit only Panama and Colón. This is the lower bound on the estimate of total expenditures by province reported in Table VI.4. Thus, this approach takes the total aggregate expenditures by all tourists in the sample and allocates them to each province in the same proportion as the share of time spent in each province (adjusting for the higher spending in Panama and Colón). The second method used the estimated daily per capita expenditures by foreign tourists (all tourists and tourists that only went to Panama and Colón) and multiplies these expenditures by the cumulative number of days spent at each destination. This method can be described as a “bottom-up” approach, while the previous method is “top-down.” Estimates using the second method result in the upper bound estimates of total tourist expenditures by province in Table VI.4. Expenditures by tourists in direct transit (not part of the TSA survey) are assumed to occur in Panama Province and contribute a further 3 percent to its GDP. These results are shown in brackets in Table VI.4.

	Province GDP 2005, Million US\$	Percent of Tourist Nights Spent by Foreign Tourists at Each Destination	Foreign Tourist Expenditures, Million US\$/Year^b	Domestic Tourist Expend- itures, Million US\$/Year	Foreign Tourism Expend- itures, % of GDP^b	Domestic Tourism Expenditures, % of GDP
Panama	9,392	71%	452–642 [+313] ^c	3.8	5–7 % [+3%] ^c	0.04%
Bocas del Toro	165	4%	17–31	0.9	11–19%	0.57%
Chiriquí	1,036	12%	53–94	4.3	5–9%	0.41%
Rest of Panama	3,413	13%	57–100	8.8	2–3%	0.26%
Total	14,005	100%	579–867 [+313]	17.8	4–6% [+3%]	0.13%

a. For details about the estimate procedure and the meaning of the ranges, see text footnote 15.

b. Expenditures in the national accounts and the survey data in this table exclude the cost of international travel by air and land.

c. In addition, tourists in direct transit (that is, tourists that spend less than four hours in Panama and do not leave the airport) spent a further US\$313 million in 2006. This constitutes an additional 3 percent of the GDP of Panama Province. This brings total tourism expenditures for the whole country to 7 to 9 percent of GDP.

Source: Preliminary estimates from tourism survey data for the Tourism Satellite Accounts (2008).

6. Growth Linkages from Tourism Activities in Panama

Tourism revenues have benefits beyond those accruing directly to hotel operators and employees, tour operators, restaurants, and shops that sell goods and services to tourists. Incomes earned from these expenditures by tourists are typically spent at least in part on local goods and services, thereby further raising output and incomes. To the extent that local goods and services are elastic in supply and can thus expand in the face of increased demand, the multiplier effects of tourism (or increases in other sector outputs) can be substantial.

Thus, the total effects of tourism on income distribution and poverty reduction depend on more than just the level of spending by tourists on various commodities and services, and who receives direct employment and income from these purchases. The overall impact of tourism also depends on the size of the multiplier effects on output of other sectors, and the distribution of the revenues from increased production to various factors (labor and capital) and ultimately to household groups (poor and non-poor). These multiplier effects are particularly important for spreading the benefits of Panama's tourism industry to the poor, since many of the poor do not have direct contact with tourists, themselves.

Tourism and Income Distribution

The multiplier effects of tourism revenues (and growth in outputs of other sectors) can be estimated using a semi-input-output (SIO) model of Panama's economy. In the SIO model, output of some sectors, typically those producing tradable goods, is assumed to be fixed (completely inelastic), and does not expand in response to increases in demand. For these products, increased demand results in increased net imports. For elastically supplied products, however, increased demand is assumed to induce increases in output.⁷⁶

⁷⁶ In the Panama SIO model used here, economic output of the Panama Canal, the Zone Colón, maize, fruits, shellfish, other agricultural exports, minerals, processed milk, other domestic manufacturing, textiles, other export

The database for the model is a Social Accounting Matrix (SAM) for Panama for 2003, which describes the input-output structure of production, the distribution of earnings of labor and capital to various household groups, and patterns of spending. In order to enable the simulation of distributional effects of policy, the SAM includes nine productive factors (four types of labor, agricultural land, and four types of capital) along with eight household groups (urban poor and non-poor, rural poor and non-poor for each of four regions Panama City and the Canal Zone, Bocas del Toro, Chiriquí and Other Panama) defined using household survey data (Table V.5).

Table V.5: Panama: Size and Expenditures of Major Household Groups, 2005

	Population (’000)	Population (percent)	SAM Income (\$m)	SAM Income (percent)	SAM Income / Capita (\$)
Urban Poor – Panama City	209.9	6.9%	371	3.2%	1,770
Urban Non-Poor Panama City	1,076.7	35.2%	7,466	64.7%	6,934
Urban Poor – Bocas del Toro	19.1	0.6%	31	0.3%	1,601
Urban Non-Poor Bocas del Toro	20.2	0.7%	111	1.0%	5,504
Urban Poor – Chiriquí	40.9	1.3%	84	0.7%	2,059
Urban Non-Poor Chiriquí	148.7	4.9%	749	6.5%	5,039
Urban Poor – Other Panama	101.0	3.3%	89	0.8%	878
Urban Non-Poor Other Panama	238.4	7.8%	615	5.3%	2,579
Rural Poor – Panama City	83.9	2.7%	80	0.7%	953
Rural Non-Poor Panama City	79.3	2.6%	235	2.0%	2,966
Rural Poor – Bocas del Toro	54.1	1.8%	67	0.6%	1,246
Rural Non-Poor Bocas del Toro	11.3	0.4%	42	0.4%	3,709
Rural Poor – Chiriquí	105.6	3.5%	132	1.1%	1,250
Rural Non-Poor Chiriquí	120.0	3.9%	359	3.1%	2,993
Rural Poor – Other Panama	513.9	16.8%	520	4.5%	1,012
Rural Non-Poor Other Panama	236.8	7.7%	584	5.1%	2,468
Urban Poor	370.9	12.1%	575	5.0%	1,550
Urban Non-Poor	1,483.9	48.5%	8,941	77.5%	6,025
Rural Poor	757.5	24.8%	800	6.9%	1,055
Rural Non-Poor	447.3	14.6%	1,220	10.6%	2,728
All Panama	3,059.6	100.0%	11,536	100.0%	3,770

Source: Calculated from 2003 Panama SAM.

Table V.6 shows the effects of a US\$1 exogenous increase in value added from the various tradable goods sectors. For example, on average, a US\$1 increase in the output of goods and services from the Zone Colón leads to an additional US\$0.42 increase in value added from non-traded goods and services (national economy simulation).⁷⁷ This gain is due mainly to consumer spending effects as incomes earned in various activities are spent in the domestic economy. Multipliers are smallest (1.30 to 1.64) in sectors such as the Panama Canal sector, mining, and

manufacturing, and the hotel and restaurant sectors is assumed to be fixed (completely inelastic in supply). The remaining sectors (rice, oil seeds, poultry, small livestock, dairy, other domestic agriculture, large livestock, fish, meat, milled grain, electricity/water, construction, trade, transport/communications, private services, and public administration) are assumed to be elastic in supply.

⁷⁷ The value-added multipliers vary little across regions because the input-output structure and patterns of factor payments to households are assumed to be the same across regions (since regional input-output tables are not available).

textiles) where there are few production linkages (much of the inputs are imported; much of the outputs are exported) and much of the income accrues to formal capital (enterprises).⁷⁸ In contrast, the multipliers for the fruits, shellfish, and other agricultural exports are especially large because much of the income earned accrues to rural households that spend a high proportion of their incomes on non-tradable goods and services in the local economy. The multiplier for the tourism industry (hotels and restaurants) is the largest of all the sectors: an additional US\$1 in value added (approximately US\$2.80 in total tourism spending) results in US\$2.87 in total income. This large multiplier is due to strong backward linkages in terms of demand for local food products and forward linkages of household spending.⁷⁹

Table V.6: Panama: Multiplier Effects of Various Sectors^a

	National	Bocas del Toro	Chiriquí
Canal	1.64	1.66	1.63
Zone Colón	1.42	1.42	1.42
Maize	1.41	1.46	1.37
Fruits	2.02	2.07	1.98
Shellfish	2.23	2.28	2.19
Other agricultural exports	2.18	2.23	2.15
Mining	1.55	1.56	1.55
Textiles	1.30	1.31	1.29
Tourism	2.87	2.90	2.84

a. Total gain in income from a US\$1 exogenous increase in value added from the specified sector.

Households reap about 56 percent of the total gains in income from tourism expenditures; the remainder of the gain in income accrues to formal enterprises and the government (Table V.7). Which households benefit the most, however, depends very much on the region in which the tourism revenues are generated. In the national model simulation, which broadly reflects average tourist expenditures in Panama (so that much of the revenues are spent in the Zone of Colón), most of the gains in household income (63 percent) go to urban non-poor households. Only 20 percent of the income gains accrue to poor households. In contrast, in the simulation of tourism multipliers in Bocas del Toro, poor households (which account for a larger share of the regional labor force in this region than they do nationally), earn 43 percent of the total increase in household income, and the percentage gain in household income is nearly the same across household groups. The results for Chiriquí are similar to the national simulation in terms of share of household income gains received by the poor (19 percent), though the share earned by rural households is higher (46 percent in the Chiriquí simulation compared to 32 percent in the national simulation).

Table V.7. Panama: Multiplier Effects of Tourism

	National	Bocas del Toro	Chiriquí
Output multiplier	1.03	1.04	1.02

⁷⁸ In these multiplier simulations, investment is held constant and income gains to enterprises are not distributed as dividends (income) to domestic households.

⁷⁹ These simulations may understate the multiplier somewhat because the hotels and restaurants are exogenously fixed in supply. Thus, there are no demand linkage multiplier effects for this sector (apart from the initial simulated increase in demand and output). Note that in the regional simulations, it is assumed that the demand for elastically supplied goods and services is assumed to be met from firms within the region.

Value-added Multiplier	2.87	2.90	2.84
HH Income Gain / Value Added Shock			
All Households	1.62	1.63	1.60
Income Share of Households	56.4%	56.1%	56.4%
% Change Household Income			
Urban Poor	—	7.1%	1.3%
Urban NonPoor	—	6.3%	1.1%
Rural Poor	—	8.2%	1.8%
Rural Non-Poor	—	7.9%	1.6%
Share of Benefits			
Urban Poor	5.3%	12.1%	6.2%
Urban NonPoor	62.7%	38.7%	47.9%
Rural Poor	14.4%	30.8%	13.2%
Rural Non-Poor	17.7%	18.5%	32.7%
Total	100.0%	100.0%	100.0%
Poor	19.6%	42.8%	19.4%
Non-Poor	80.4%	57.2%	80.6%
Urban	67.9%	50.8%	54.1%
Rural	32.1%	49.2%	45.9%

Source: Panama semi-input-output model simulations.

Implications for Growth and Poverty Reduction

Because of data uncertainties and simplifying assumptions used, the above analysis of the effects of increases in agricultural output on incomes in the Panama economy illustrates only the broad order of magnitude of the effects. Nonetheless, the broad structure of production, and the structure of household incomes and demand are reflected in the analysis.

It is important to note, however, that the simulations imply an even distribution of the gains to returns to labor and capital across all owners of these factors. This assumption is valid if labor markets function well, so that increases in labor demand are reflected in general rises in wage rates that benefit all workers. Yet, location of activities matters a lot for local labor markets and especially for returns to capital and backward linkages to agriculture. The implication is that including much of the rural poor (and minorities) in the benefits of growth in tourism will require that these households are well integrated in product and factor markets where the investments take place.

Some of the assumptions underlying this model cannot be verified without destination-level data. For example, it is necessary to ascertain such underlying basic facts as whether certain household groups tend to be precluded from employment in all-inclusive resorts, whether local agricultural products are deemed as suitable for purchase by hotels and restaurants, or whether any obstacles exist to development of handicrafts and local services as hotels are built. To answer these kinds of questions and develop monitoring of local-level impacts, it is necessary to conduct destination-level surveys of at least a few selected areas where tourism has already developed.

7. Impact of the Tourism Sector on the Environment

The links between the tourism sector and the environment go in two directions—the ecological footprint of tourism through its potential adverse effects and the potential of nature-based tourism for stimulating the local economy, generating jobs, and earmarked financing for the management of Protected Areas. Two types of nature-based tourism in Panama—beach tourism, in coastal areas and adventure and ecotourism in protected areas and other valuable areas in terms of biodiversity—can have significant environmental implications. The impacts of real estate development and the purchase of retirement homes or second homes in Bocas del Toro, Chiriquí, and some other coastal areas on the Atlantic and Caribbean coast also need to be considered in devising strategies and policies for ensuring environmental sustainability of the impending real estate boom in these environmentally sensitive areas.

Despite the high potential for developing ecotourism in Panama’s Protected Areas—they cover over a third of the country’s territory—very few of them have been developed for public use. Panama’s national parks—with a total area of about 25,000 square kilometers—draw close to 30,000 visitors a year (Table V.8). Even if this is an underestimate, since not all national parks maintain records on visitation rates, tourism visitation of Protected Areas in Panama is far below that in Costa Rica.⁸⁰ Total international arrivals reached 1.7 million people in 2005, and—if 1996 figures are a guide—66 percent of foreign tourists in Costa Rica visited national parks, despite relatively high entrance fees.^{81,82}

The modern concept of a “Protected Area” (PA) has its origins in the 19th century movement in the then “new” nations of Australia, Canada, New Zealand, South Africa, and the United States. By the 20th century, the concept spread throughout the world, and over 44,000 sites covering around 10 percent of the land surface of the planet meet the definition of a PA of the International Union for the Conservation of Nature (IUCN). As the network of PAs grew, the understanding of what is meant by PAs also changed; most recently, concern with coastal and marine PA has been rising. Approaches to resource planning and management shifted toward the concept of integrated resource management with the advent of the science of ecology in the 1960s. The classification of PAs developed by the IUCN (1994) reflects the concern with biodiversity conservation as the starting point, but also the recognition of the importance of other PAs’ objectives such as recreation and tourism (IUCN 2002). Thus, depending on the characteristics of a PA and its conservation objectives, certain levels of public use can be consistent with the conservation objectives and can be an integral part of a park’s management plan and can be an important source of financing park management and conservation activities (Table V.8).

Table V.8. Matrix of Management Objectives and IUCN Protected Areas (PAs) Categories

	Ia	Ib	II	III	IV	V	VI
Scientific Research	1	3	2	2	2	2	2

⁸⁰ For comparison, Costa Rica’s national parks, wildlife refuges, and biological reserves cover over 6,300 km².

⁸¹ Martha Honey cited in IUCN (2002:25); and Martha Honey, personal communication, 04/15/2008.

⁸² Park entrance fees in Costa Rica were US\$1 for both nationals and foreigners in the 1980s, generating US\$1 million annually. However, in the 1990s, fees were raised to US\$15, decreasing visitation rates but quadrupling the revenues. The increase was met with opposition and fees were subsequently reduced. In 1996, Costa Rica moved to a two-tiered fee system, with foreigners paying six times as much as nationals in entrance fees (US\$6 for foreigners and US\$1 for residents). Surveys have revealed a much higher willingness to pay by both foreigners and nationals for park entrance (IUCN 2002:136).

Wilderness Protection	2	1	2	3	3	—	2
Preservation of Species and Genetic Diversity (biodiversity)	1	2	1	1	1	2	1
Maintenance of Environmental Services	2	1	1	—	1	2	1
Protection of Specific Natural/Cultural Features	—	—	2	1	3	1	3
Tourism and recreation	—	2	1	1	3	1	3
Education	—	--	2	2	2	2	3
Sustainable Use of Resources from Natural Ecosystems	—	3	3	--	2	2	1
Maintenance of Cultural/ Traditional Attributes	—	—	—	—	—	1	2

Key: 1 = Primary objective; 2 = Secondary objective; 3 = Potentially applicable objective; — = not applicable.

Category	Description
I	Strict Nature Reserve/Wilderness Area: PA managed mainly for science or wilderness protection.
Ia	Strict Nature Reserve: PA managed mainly for science.
Ib	Wilderness Area: PA managed mainly for wilderness protection.
II	National Park: PA managed mainly for ecosystem protection and recreation.
III	Natural Monument: PA managed mainly for conservation of specific natural features.
IV	Habit/Species Management Area: PA managed mainly for conservation through management intervention.
V	Protected Landscape/Seascape: PA managed mainly for landscape/seascape conservation and recreation.
VI	Managed Resource Protected Area: PA managed mainly for the sustainable use of natural ecosystems.

Source: Adapted from IUCN (2002:10–11). Based on IUCN (1994) guidelines.

In Panama, of the total of 65 areas included in the National System of Protected Areas (SINAP), only 19 have management plans, and not all of these plans include a public use component. The exception is the network of private nature reserves (*Red de Reservas Naturales Privadas de Panamá*), which offers ecotourism services. Other important natural assets and tourist destinations are two biosphere reserves in Panama, two World Natural Heritage sites (including National Park Coiba—part of the biological marine corridor of East Tropical Pacific), and two World Cultural Heritage sites. Visitation rates are highest in the Chagres and Sarigua National Parks and in the National Marine Park Isla Bastimentos (Table V.9).

The National Environmental Authority (ANAM) has envisioned tourism and ecotourism development in nine natural PAs as a strategic priority, including national parks Soberania, Coiba, General de Division Omar Torrijos Herrera, Altos de Campana, Marino Isla Bastimentos, La Amistad, Darien, Chagres, and Volcan Baru (ANAM 2006). But ANAM has not proposed any specific measures to achieve this, for example, through the engagement of the Panama Tourism Institute (IPAT), or through development of management plans that would facilitate public use of PAs. Some progress has been made in the implementation of a pilot ecotourism program in Soberania. ANAM also supports development of self-financing mechanisms in PAs, including through public use, and development of basic infrastructure to sustain it. No ecological zoning plans in PAs that would facilitate public use have yet been developed.

Table V.9. Tourist Visitation Rates in Panama’s Protected Areas, 2006

	National Tourists		Foreign Tourists	
	Number	Percent of All Tourists	Number	Percent of All Tourists
National Marine Park Isla Bastimentos	4,609	17%	517	2%
International Park La Amistad-S. Atlántico	198	1%	186	1%

International Park La Amistad-S. Pacifico	1,800	7%	913	3%
National Park General Omar Torrijos Herrera	323	1%	150	1%
National Park Portobelo	–	0%	–	0%
National Marine Park Golfo de Chiriqui	30	0%	8	0%
National Park Volcan Baru	405	1%	1,396	5%
National Park Darien	17	0%	58	0%
National Park Sarigua	3,307	12%	86	0%
National Park Cerro Hoya	–	0%	–	0%
National Park Altos de Campana	1,206	4%	290	1%
National Park Chagres	1,668	6%	9,895	37%
Total	13,563	50%	13,499	50%

Source: IPAT, Sustainable Tourism Masterplan, (2008:231).

Growing importance of cruise ship tourism is another type of tourism with potentially serious adverse consequences for the environment. Cruise ship tourism is relatively new in Panama, but despite the tourists' brief stay in the country, transit tourists have significant economic impact. Approximately 300 cruise ships pass through the Panama Canal in a season, and the number of visitors from cruise ships reached 131,000 during the 2000/2001 season (ETG 2002). Further developing cruise ship tourism has significant economic potential, but it can be particularly problematic from the environmental and social point of view (IUCN 2002). Large cruise ships carry many tourists, and they can quickly cause significant environmental damage in coastal and marine protected areas. As the plans to make Colon the Home Port for the Royal Caribbean Cruise Lines materialize, it becomes increasingly important to develop the capacity of the port and the municipality to manage potentially large environmental impacts.

Adverse environmental impacts from cruise ships stem from the discharge of ballast water used to maintain ship's stability, which can introduce non-native and invasive species in coastal waters, discharges of wastewater, hazardous waste, solid waste, oil bilge water (i.e., water that is contaminated with oil leaking from the ship's engine and machinery). Cruise ship tourism can also result in damage to coral reefs and disturb their functions as fish nurseries; approximately a quarter of the total worldwide fish production in developing countries comes from coral reefs. They play other important roles including coastline protection from storm damage, erosion and flooding. In the Caribbean, more than 60 percent of the coral reefs are under threat. Coastal development, degradation of water quality, ship anchors and unmanaged tourism activity are some of the reasons for the reefs' deterioration. A single cruise ship's anchor and chain can damage up to 195 square meters of ocean bottom in a single anchorage site; further damage results from smaller boats anchoring during tourist excursions to the reefs—a chief attraction of cruise ship visitors. Damage to the reefs can be reduced through implementing strict regulations on wastewater discharges, anchoring sites and provision of information to cruise ship tourists through such communication tools as the awareness-raising International Coral Reef Initiative (ICRI). Some cruise ship lines have successfully contributed to reef protection and conservation through partnering with local conservancy organizations.⁸³ Establishment of marine protected

⁸³ This discussion is based on Sweeting, James and Wayne, Scott (2003). "A Shifting Tide. Environmental Challenges and Cruise Industry Responses." Interim Summary Report. Washington, D.C: Conservation International.

areas—such as the U.S. Virgin Islands National Park—and devising tourism management plans is another important tool to help reduce the adverse environmental impacts of cruise tourism.⁸⁴

Sufficient management capacity and resources are essential for minimizing adverse environmental consequences in environmentally sensitive areas. Specific measures and policy recommendations to address this have been proposed in the institutional assessment of the potential to use territorial and ecological zoning in Panama and the model ecological zoning plan, developed in a background study for this CEA (Box V.2).

Box V.2. The Limited Capacity of the Panamanian Authorities to Implement Territorial and Ecological Zoning

Territorial and ecological zoning is globally regarded as a fundamental policy instrument for attaining environmentally sustainable growth, and they are particularly critical for Panama, given the rapid growth of the tourism sector. In this sector, the objectives of ecological zoning are to harmonize and make tourism growth consistent with (a) the need to share resources with other productive sectors of the economy, (b) protection of the environmental quality, and (c) protection of the ecosystems' carrying capacity. More effective coordination mechanisms that span institutions and sectors are urgently needed in Panama in order to attain these objectives.

An in-depth review of the institutional capacity of the relevant public policy authorities has been conducted as part of this CEA. It has assessed the capacity of the National Environmental Authority (ANAM), the Panama Canal Authority (PCA), the National Council on Sustainable Development (CONADES), the Panamanian Tourism Institute (IPAT), the Ministry of Agricultural Development (MIDA), the Ministry of Housing, and the interinstitutional coordination mechanisms to implement the objectives of ecological zoning and make tourism growth compatible with environmental objectives.

This review has revealed severe limitations in terms of the legal framework for ecological zoning, capacity of some key institutions, coordination mechanisms, and public participation. The first set of conclusions pertains to the legal and regulatory framework for territorial zoning. Proliferation of laws and overlapping regulations that guide territorial planning create confusion regarding the modality of ecological zoning. A worrisome discrepancy exists between ecological zoning, the environmental impact assessment process, and the Sustainable Tourism Masterplan. This is compounded by a lack of clarity in terms of the division of responsibilities across the different public agencies. Public participation has been marginal, and territorial (ecological) zoning has not been used as a mechanism to resolve conflicts with respect to land use. The lack of monitoring and evaluation mechanisms weakens the role of the Inter-institutional Environmental System (SIA) as the coordinating entity for zoning policy in Panama.

The second set of recommendations pertains to the institutional capacity of the relevant public agencies. Analysis of institutional networks reveals deficiencies in the coordination across institutions. The principle cause of the problem is that ecological zoning is seen as the responsibility of ANAM, while other agencies are merely recipients of information. The lack of active involvement of other agencies in the process of ecological zoning is an obstacle to developing environmental policies aimed at resolving intersectoral conflicts. Close cooperation of ANAM and IPAT is particularly important in order to enhance sustainability of tourism growth.

Key recommendations of this assessment include (a) integrating various modalities of ecological zoning within a single technical and methodological framework; (b) ecological zoning needs to become the basis for a single integrated vision and to help identify the areas of primary concern from the environmental point of view, and a set of indicators to monitor the effects of the tourism sector are needed; (c) in protected areas ecological zoning needs to complement the management plans; and (d) management schemes in national parks need to incorporate the concept of carrying capacity and develop relevant indicators. Similarly, carrying capacity needs to be an integral part of the management schemes in coastal or port zones under pressure from tourism development, such as the Home Port of Colón and the Portobello area.

Source: Background paper for the CEA by Luis A. Bojórquez Tapia.

⁸⁴ Conservation International (2007). "From Ship to Shore. Sustainable Stewardship in Cruise Destinations." Washington, D.C.

8. Recommendations for Enhancing Sustainability in the Tourism Sector

Recommendations in this CEA fall into three broad categories: (a) general recommendations: using tourism as the key element of a strategy to reduce poverty in rural and indigenous areas, identification and development of public use of Protected Areas while ensuring that the conservation objectives are met, and reducing environmental impacts of other forms of tourism, such as cruise ships and residential development in environmentally sensitive areas; (b) specific recommendations stemming from the institutional assessment of the capacity of the Panamanian authorities to use territorial and ecological zoning and enhancing the process for broad-based stakeholder participation; and (c) a set of criteria and a description of the data requirements for developing social and environmental indicators to measure and monitor impacts of tourism at the national level and at the destination level.

The tourism sector has an enormous significance for the Panamanian economy because of very high and rapidly increasing arrivals of foreign tourists and high levels of spending. This is evident from very large contributions of the sector to GDP—6 to 9 percent, arrivals of foreign tourists that exceed 70 percent of the country's population over a year, and particularly high economic significance in relative terms in peripheral areas such as Bocas del Toro. Furthermore, the tourism sector has the highest multiplier effects on the economy—nearly double the multiplier of Zone Colón and the Canal—because of very high backward and forward linkages. The sector also has an enormous potential to benefit the poor—most of the gains in household incomes from Zone Colón, the Canal, and other sectors of the economy accrue to urban non-poor households, while simulations in this chapter suggest that the poor earn a far greater share of the total increase in income from tourism. These findings strongly suggest that the tourism sector must be seen as the cornerstone of the efforts of Panamanian authorities to reduce poverty in this highly dual economy. But as suggested by the global experience, poverty benefits from the tourism sector are not automatic, and whether or not they receive a significant share of the benefits depends on the way the supply chains are structured and the way tourists spend their money.

Targeted government policies and interventions on the supply-side, guidelines and monitoring systems are needed for enhancing the benefits of the tourism sector to the poor, marginalized and disadvantaged communities. Community-based tourism and other forms of tourism with strong local involvement often require a set of complementary investments in infrastructure, education and training, and support to associations of local producers, service providers and indigenous groups. South Africa's relatively successful experience is illustrative; it started with a government strategy to develop responsible tourism and resulted in a set of guidelines and indicators for measuring tourism impacts on the community (Box V.3). An appropriate set of guidelines and indicators can be instrumental in Panama for reducing the supply-side constraints and barriers to participation of new entrepreneurs from the local communities. Specific guidelines would need to result from a process involving broad-based consultation with the relevant stakeholders.

Box V.3. Economic objectives and indicators for responsible tourism in South Africa.

After a wide consultation process with stakeholders, the South African government produced a White Paper on development and promotion of tourism in a socially sustainable manner. The 1996 White Paper and the subsequent Responsible Tourism Guidelines proposed by the Department for Environmental Affairs and Tourism in 2002 identified an agenda for the future, a set of guidelines and indicators for monitoring the social impacts of tourism sector's growth published in the *Responsible Tourism Manual for South Africa* (2002). The guidelines, whose objective is to support associations, enterprises and entrepreneurs develop responsible tourism, are explicit about the opportunity and importance of including the poor in the industry's benefits, the importance of developing economic linkages to forest local economic development, and implementing supply-side measures such as technical assistance, capacity building and training in support of broad-based community involvement in the industry. A sample of these guidelines illustrates the types of grassroots measures that can enhance benefits to the poor and alleviate some of the supply-side bottlenecks for community-based tourism development.

Assess economic impacts as a pre-requisite for developing tourism

- Consider opportunity costs of tourism for local communities and their livelihoods; avoid over-dependency on tourism and encourage economic diversity
- Plan initiatives and investment to contribute to the broader local economic development strategy (e.g., Integrated Development Plans for the area)
- Encourage business and land tenure arrangements that directly benefit local communities and/or conservation

Maximizing local economic benefits—increasing linkages and reducing leakages

- Encourage all establishments to upgrade their standards of service, particularly small and medium enterprises
- Buy locally made goods and use locally provided services from locally owned businesses; monitor the proportion of goods and services from businesses within a specified range and set quantitative targets on the amount of goods and services originating from those businesses
- Help local communities or emergent entrepreneurs to develop their product; provide education and support services
- Assist local crafts workers to develop new products to meet market demand

Ensure communities are involved in and benefit from tourism

- Redress previous imbalances and enable historically disadvantaged groups to engage in the tourism sector; for example, encourage or require businesses to source a specified percentage of services and products from historically disadvantaged groups
- Develop partnerships and joint ventures in which communities have a stake; support these initiatives with capacity building efforts; provide marketing and mentoring support for developing community-based tourism products
- Encourage visitors to spend more money in the local economy
- Be transparent when reporting community benefits, distinguishing between benefits to employees, to emerging or community based entrepreneurs, and community benefits (e.g., benefits distributed as household income in the local area)

Marketing and product development

- Enhance market access to support growth of new enterprises through such measures as information provision and advertisement of local services and attractions
- Include local cultural elements and emphasize richness of the local complementary products

Equitable business

- Develop transparent systems of sharing the benefits of tourism through equitable contracts
- Recruit and employ staff in accordance with specified targets on local employment, female participation and indigenous groups
- Invest in local skills and capacity development, such as specialized tourism and hospitality training and language courses

a. Based on World Tourism Organization (2004). "Tourism and Poverty Alleviation. Recommendations for Action"; and World Tourism Organization (2002). "Tourism and Poverty Alleviation."

Given the importance of the tourism sector and its potential to result in large benefits for the poor, devising a set of indicators and effective monitoring schemes is of paramount importance. These indicators fall into three categories: (a) accurately measuring the flows of tourist

expenditures to provinces and to *comarcas*, which is not possible with the available data; (b) measuring the impact of tourism on local employment and wage levels at hotels, restaurants, and other tourism-related enterprises; (c) measuring the extent to which tourism establishments affect local food and beverage production and devising complementary projects to enhance agricultural productivity and improve access of local, particularly smallholders and poor farmers, to the supply chains; (d) stimulating production and availability of quality handicrafts and artisan products in areas with high potential for these industries and measuring impacts of tourism on these subsectors; and (e) measuring availability of infrastructure and services to assess the degree of connectivity to markets, and the ease of travel within the country's more peripheral areas.

The household-level data and data from tourism surveys (Satellite Tourism Accounts) that are needed for monitoring local impacts of tourism growth are already available in Panama. The CEA has identified the data needs in order to carry out a more comprehensive and accurate assessment of local impacts of aggregate growth in tourism expenditures—survey data at the level of tourism destinations. No data are available to help determine which specific types of employment and specific subsectors of the economy the incremental income from the tourism sector accrues to. For example, it is not possible to distinguish how much of the increased demand for agricultural products and services is met through local providers, and how much is imported from outside the region. Availability of such data from destination level studies, such as value chain analysis, would greatly enhance the possibility of accurate monitoring of local impacts of tourism development.

Environmental impacts of the growing tourism sector are also likely to be very large. An in-depth institutional assessment conducted for this CEA has revealed proliferation of overlapping legal and regulatory instruments with respect to territorial and ecological zoning that create confusion and a lack of clarity in terms of responsibilities of each institution and a dearth of effective coordination mechanisms. Territorial zoning is a widely used instrument that can be effective in enhancing the sustainability of the tourism sector, but it cannot be viewed as the sole responsibility of the environmental agency and requires effective coordination among all the relevant public agencies. Furthermore, carrying capacity and ecological assessments need to be an integral part of management plans for Protected Areas, as plans to develop ecotourism go forward and of the planned establishment of Colon as the Home Port for cruise lines. The key recommendation of the institutional assessment is the need to integrate various modalities of ecological zoning within a single technical and methodological framework.

VI. Forestry and Conservation Challenges

Conservation and forestry challenges are inextricably linked in Panama, where deforestation and habitat fragmentation are the main threats to the country's rich biological diversity. Panama is heavily forested and arable land available for cultivation is limited. Together with a high concentration of landownership and rapid population growth, this has led to increasing cultivation on marginal lands, and to deforestation and soil erosion. Further, deforestation and degradation affect a large share of the remaining forests. The reasons include changes in land use, unmanaged exploitation for fuelwood and illegal logging, and land tenure insecurity. This chapter analyzes the causes of deforestation and the governance framework of the sector. It then analyzes conservation, where, despite the designation of one-third of the country's territory as Protected Areas (PAs), a vast array of plant and animal species, many of them endemic, are endangered. Finally, it assesses the ability of conservation policies and institutions to address present and future conservation challenges in a context of rapid economic and population growth.

1. Deforestation: Importance and Causes

Forests in Panama provide a number of vital services, including: provision of food, fuel, wood, and fiber; regulating climate and floods; housing communities with unique cultures and values; sheltering wildlife; and regulating watersheds that supply most of the drinking water and the water that is used in essential economic activities, like the operation of the Panama Canal and agriculture. And yet, as Table VI.1 illustrates, forest coverage in Panama has been steadily declining.

Table VI.1 Forest Cover Estimates 1947–2000

Year	Surface (ha)	Territorial Percentage
1947	5,245,000	70.0
1970	4,081,600	53.0
1974	3,900,000	50.0
1992	3,695,160	49.3
2000	3,364, 591	45.0

Source: GEO Panama (2004).

In 2000, the largest forest areas were found in the provinces of Darien (853,125 ha), Panama (497,832 ha), Embera-Wounaan (397,614 ha), Bocas del Toro (352,252 ha), Ngobe-Bugle (293, 982), Veraguas (283,053 ha), and Colon (260, 626ha), whereas the Darien, Panama, and Ngobe-Bugle provinces had the highest deforestation rates (2, 1.7, and 3.5 percent, respectively). Deforestation is a serious problem because it has decreased biodiversity, increased soil erosion and desertification, affected indigenous communities, and contributed to global warming.

As in other Latin American countries, the expansion of the agricultural frontier has been the main cause of deforestation (GEO 2004). Apart from the usual market failure considerations (that is, the private value of marginal land devoted to agriculture is greater than the private value of marginal forested land, whereas the social value of marginal forested land exceeds the social value of marginal agricultural land), the expansion of the agricultural frontier has been promoted by government policies (like providing subsidized credit and facilitating titling of agricultural plots).

In addition, over- and selective exploitation of precious woods, like mahogany and cedar, is a cause of deforestation and forest degradation. Even with well-defined property rights, forest owners face perverse incentives. Harvesting equipment is large and expensive and most of the time it does not pay for the forest owners to invest in them and to become familiar with sustainable practices, much less implement them. Furthermore, small forest owners have poor access to credit.

Other causes include lack of effective environmental management instruments (like zoning and Strategic Environmental Assessments) that could mitigate the impact of large-scale development projects such as highways, hydroelectric dams, aquaculture tanks, urban expansion, and mining and tourism projects. Finally, a slow and cumbersome permit process and ineffective enforcement that make informality more attractive also contribute to the degradation of forests.

2. Governance in the Forest Sector

The Forestry Law (1994) classifies forests into three categories: production forests (those with products of high commercial value and that can be intensively but sustainably exploited); protected forests (those considered of national or regional interest to protect watersheds and public infrastructure works, prevent erosion, shelter wildlife, and contribute to national security); and special forests (those dedicated to preserve areas of scientific, historic, cultural, educational, and recreational value).

The National Environmental Authority (ANAM) is responsible for environmental protection and the management of forest resources on government lands, including water resources, wildlife, and biodiversity, and the National System of Protected Areas (SINAP). The Aquatic Resources Authority of Panama (ARAP) is responsible for the administration, enforcement, and sustainable management of coastal marine resources, which includes mangrove forests, except those in PAs.

Management of the forestry sector within ANAM is the responsibility of the Department of Development and Forest Management, within the National Directorate for Integrated Watershed Management. Currently, the department has only 13 technicians with a wide range of responsibilities. Under these conditions, a significant number of essential management tasks are underperformed, including control of deforestation, protection of non-productive natural forests on private lands, sustainable forest management in commercial forestlands, prevention of forest fires, and technical assistance for small and mid-sized forest enterprises.

ANAM is also responsible for administrative supervision of the forest sector.⁸⁵ The Public Ministry is responsible for regulating mangrove use outside PAs.⁸⁶ ANAM is authorized to assess civil fines up to US\$10,000 dollars per violation, while the Public Ministry can request criminal penalties of up to five years of prison. However, due to lack of personnel, enforcement remains a problem.

The frequency and types of enforcement actions vary across the country. Each ANAM regional agency schedules its inspections independently. These may be scheduled periodically for authorized logging, or as needed to respond to public accusations. At times, the central office launches national campaigns to prevent forest fires, or to respond to illegal logging and timber

⁸⁵ See Forest Law 1, Wild Life Law 24, and General Environment Law 41.

⁸⁶ See Law 5 of crimes against the environment and Panama Aquatic Resources, Law 42 of 2006.

transport. ANAM has two permanent checkpoints for permits and timber in transit. Both stations are located in eastern Panama (Agua Fria in Darien and Chepo in the Province of Panama). With the support of local police, permits are inspected at temporary checkpoints (Metetí in Darién, Bayano Bridge, Province of Panamá, and Guabalá in Chiriquí Province). Timber without proper documentation is seized and criminal charges are filed by ANAM.

The private sector is represented by several organizations. The National Association of Reforesters and Citizens of Panama (*Asociación Nacional de Reforestadores y Afines de Panamá*, ANARAP) was created in 1985 to represent reforestation companies and to promote reforestation. Following the elimination of tax incentives in 2005, ANARAP lost 35 percent of its members. The Loggers Union represents the small logging companies. These companies operate through forest concessions on public lands, rather than on private forestlands. The Association of Timber Industries represents sawmills and other wood-processing operations. Unfortunately, there is very little participation by these groups in defining forest policies and developing forest regulations.

3. Transparency, Accountability, and Information

A new geo-referenced database of logging operations in the Darien has been developed. The public formats include jpg map files, together with databases that include volume, species present, permit type and length, and other descriptive data. Each logging permit is also geo-referenced and includes the data from the tree census. Unfortunately, information from individual permits is not aggregated into regional databases, maps, or Geographical Information Systems.

The basic data on forest statistics are collected and forwarded to ANAM by field personnel in the regional agencies. The central office consolidates the data from all the regions and sends it on to the *Controlaría General*, which periodically publishes statistics on forest cover, reforestation, biomass in forest plantations, prices of timber and non-timber forest products, value of imports and exports, number and extent of forest fires, environmental impact studies, and complaints lodged for cases of deforestation and illegal logging. ANAM also makes annual reports to the *Controlaría* concerning technical assistance provided to small producers, timber seizures, review of transport permits, authorizations for agricultural burns, forest fires, nursery production of seedlings, registration of chainsaws and portable sawmills, and authorizations and permits to transport timber.

All this information is available online, but the lack of integration and analysis does not make possible much of a base for developing forest policies. Due to its recent creation, ARAP has not yet begun to collect statistics on aquatic resources.

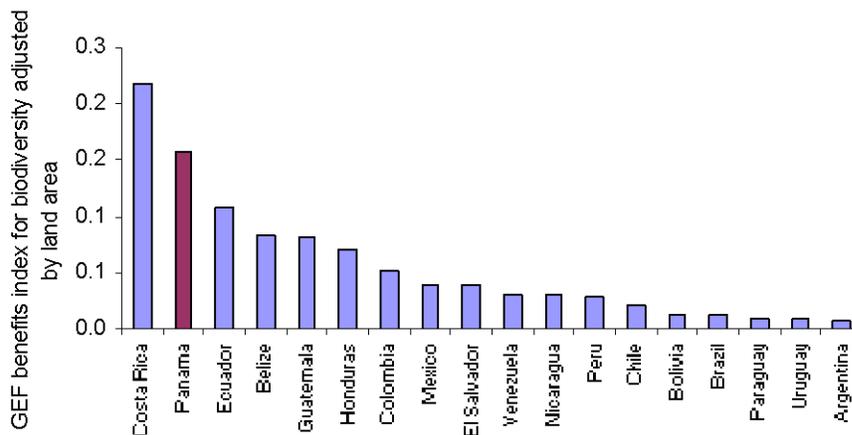
ANAM's web page does support environmental education efforts aimed at the public, and provides useful information to political decisionmakers concerning the institutional objectives, pilot projects, forest regulations and laws, descriptive information on PAs, the National Environmental Program, results of environmental impact studies, and the overall system of environmental information. The National Secretariat for Science, Technology and Innovation (SENACYT) has developed a national forest strategy that calls for the formation of a "forest cluster" to better focus efforts in the sector. Funding remains scarce.

4. The Value of Conservation

Panama is a critical link in the Mesoamerican Biological Corridor and is host to more than 12,600 plant species and 2,950 species of vertebrates. Panama ranks 19th of the countries in the world with the greatest diversity of flowering plants, and is 4th among countries in North and Central America. It has the richest, most diverse reef ecosystems in the entire region in terms of both quality and diversity of coral, with 58 distinct coral species off the Caribbean coast, and 18 in the Pacific. In terms of fauna, it is estimated that Panama is home to approximately 4 percent of the total number amphibian species, and 3.5 percent of the reptile species, in the world. Moreover, 10 percent of the world’s identified bird species are present in Panama, and as many as 5 percent of known mammals. One-hundred forty of Panama’s 1,307 marine fish species are of commercial interest, as are 25 percent (56 species) of the freshwater fish species that are endemic to Panama.

Panama is second only to Costa Rica in terms of animal and plant diversity adjusted by land area (Figure VI.1). The largest concentrations of all of these species reside within designated PAs, which cover 33 percent of the country’s territory. Growing economic pressures and climate change, however, are resulting in the loss of habitat for many species. Deforestation, at 40,000 hectares per year, and habitat fragmentation, are the main drivers of biodiversity loss.

Figure VI.1: Panama is Uniquely Rich in Biodiversity



Note: The Global Environmental Facility (GEF) benefits index for biodiversity was divided by land area (square kilometers) to adjust for country size.
Source: *The Little Green Data Book* (World Bank 2007).

Uncontrolled settlement expansion in PAs, expansion of the agricultural frontier, and illegal logging are important causes of both deforestation and the loss and fragmentation of wildlife habitats. In addition, rising pressures from tourism development and road building, planned expansion of mining operations and, more generally, the construction boom in the rapidly growing Panamanian economy, increase the urgency of improving management of PAs.

Since the beginning of the last century, the Government of Panama (GOP) has incorporated into its policies actions to conserve the country’s natural heritage. The first site designated for conservation was the Forest City “Colmón of Macaracas,” established in 1918. During the ensuing six decades, however, the effort to protect national territory was slow. By the end of the 1970s, only 500,000 hectares had been protected. It was only in the 1980s that a continuous and

strong effort began. This momentum has ultimately led to a fivefold increase in protected lands. Thus, in only 30 years Panama has reached the current number of 65 PAs, encompassing 2,600,018.50 ha (ANAM 2006b).

Especially in the past four years, Panama's efforts to consolidate and conserve its natural heritage have been remarkable. Even so, this goal still faces many obstacles, as will be discussed in this chapter.

5. Development of Conservation Policies

The GOP has ascribed considerable importance to the protection of its natural heritage. It has developed a National Strategy for the Environment, and through a very extensive process of consultation, a National Biodiversity Policy, which arose through the guiding principles of conserving the natural heritage of Panama. It created the ANAM and the SINAP, both of which are of great relevance to the conservation of natural ecosystems.

Of the 65 PAs, eight are considered to be the most important because of their size. These eight areas represent 71 percent of the total area under protection, and they are listed in Table VI.2.

Table VI.2: The Eight Most Important Protected Areas in Panama

Protected Area	Hectares (in thousands)
Bosque Protector Palo Seco	125
Parque Internacional La Amistad	207
Parque Nacional Chagres	129
Bosque Protector Alto Darién	211.96
Reserva Forestal Chepigana	257.2
Parque Nacional Darién	579
Parque Nacional Coiba	270
Área Silvestre Corregimiento Nargará 1	100
TOTAL	1,879.16

SINAP recognizes 17 categories of PAs, although in practice this has expanded to 27. These categories can be compared with those of the International Union for the Conservation of Nature (IUCN). The strictest form of protection applies to those areas designated as national parks. This category permits only scientific and recreational activities. Typically, these PAs have been maintained in a good state of preservation, with more than 80 percent of forest cover remaining (ANAM 2006c). There are 12 national parks considered to be the most important because of their size (more than 10,000 ha each). Together they encompass 1,411,000 hectares, or 54 percent of SINAP (Table VI.3).

Table VI.3: Twelve Largest, Most Important National Parks in Panama

Protected Area	Hectares (in thousands)
PNM Isla Bastimentos	13.2
PNM Golfo Chiriquí	14.7
PN Volcán Barú	14
PI La Amistad	207
PN General de División Omar Torrijos	25.2
PN Chagres	129.6
PN Portobelo	35.9
PN Darién	579
PN Cerro Hoya	32.5
PN Soberanía	19.5
PN Coiba	270
PN Santa Fe	72.6
TOTAL	1,413.20

Other categories of PAs allow the sustainable management of natural ecosystems (Wildlife Refuges, Wilderness Areas, Forest Reserves, Protected Forest Biological Corridors, Multiple Use Areas, and so forth). Eleven of these PAs are considered to be the most important because of their size (more than 10,000 ha each), and cumulatively they represent 33 percent of SINAP (Table VI.4).

Table VI.4: Most Important Protected Areas in Panama, because of their Size

Protected Area	Thousands of Hectares
BP Palo Seco	125
RF Fortuna	19.5
BP Alto Darien	211.95
RF Canglón	31.6
RF Chepigana	257
CB Serranía de Bagre	31.2
R H Serranía Filo del Tallo	24.7
RF Montuoso	10.3
RVS Isla de Cañas	25.4
RF La Tronosa	20.6
Á S Corregimiento Nargará 1	100
TOTAL	857.25

There are five protected wetlands areas that are recognized for their special ecological significance. These PAs represent 5.5 percent of SINAP (Table VI.5).

Table VI.5: Five Protected Wetlands of International Importance in Panama

Protected Area	Hectares
San San Pond Sak	16,125
Lagunas del Volcán	142.5
Punta Patiño	13,805
Maman – Guariviara	24 089
Golfo Montijo	89,452
Bahía de Panamá	48,919
TOTAL	138,484.00

In order to manage these PAs, the GOP has developed a policy of conservation, a regulatory framework, and tools for planning. In addition, it has created an institutional framework and has earmarked financial resources and trained personnel to work within it. However, some of these initiatives remain in development, while others have not been as effective as projected. The following describes some of the problems.

The existing instruments for environmental management are insufficient to deal with the pressures caused by economic growth.

Chapter II of Title VI of the General Law of the Environment (GLE) calls for the creation of the National System of Protected Areas (Article 66), and calls on the State to promote the creation of PAs in private lands (Article 68) and to support conservation both within and outside PAs (Article 67). In addition, Resolution AG-0170-2006 approves the procedure for the management, development, and approval of management plans for PAs.

An Environmental Impact Assessment (EIA) is also used for conservation, but as was discussed in Chapter II, there are three problems with the use of this environmental management instrument in Panama. First, with the growing pressures of economic growth within the country, there is concern that existing systems and procedures, which are largely centralized, cannot respond with sufficient agility. Second, EIAs, which operate at the lower end of the decisionmaking process, are not well suited to address cumulative impacts and large-scale projects such as those of the hydroelectric sector (see Box VI.1). Panama is currently building the Bonyic and Chan I and II projects which typify many of the environmental and social challenges of infrastructure development in general, and hydroelectric projects in particular. These challenges include: (a) full consideration of environmental and social factors in decisions over project siting (such as where to locate future hydroelectric dams, and, conversely, which rivers or tributaries to leave permanently undeveloped); (b) effectively addressing the cumulative environmental impacts of multiple projects in the same general area (such as multiple dams in the same river system); (c) adequate field supervision and enforcement of agreed and required environmental measures during project construction; (d) effective control of access along new or improved roads in forests or other sensitive ecosystems, to prevent land invasions and deforestation; (e) applying the principles of ecological compensation (environmental offsets) and/or payments for environmental services to ensure that infrastructure projects invest in the improved management of PAs (ideally producing a “win-win” net gain from a conservation standpoint); (f) recognizing land tenure issues during infrastructure project planning and (where

feasible) addressing these issues in the course of project design and implementation; (g) effective and inclusive stakeholder consultation, before and during the project; (h) adequate economic benefit-sharing with project-affected local populations; and (i) mechanisms to address project-related grievances and local conflicts, so that they do not escalate and become unnecessarily polarizing.

Finally, supervision and enforcement of agreed mitigation plans is very poor.

**Box VI.1: Hydroelectric Power Development in the
Palo Seco Protection Forest, Bocas del Toro Province**

Two new, large hydroelectric dams (Bonyic and Chan I) are under construction in the Rio Changuinola watershed of Bocas del Toro Province, and a third (Chan II) is in the advanced stages of planning and government approval. The 30 megawatt (MW) Bonyic project is located on the Quebrada Bonyic, a tributary of the Rio Teribe, which then flows into the Rio Changuinola. Bonyic is designed to provide peaking power, by releasing the most water from the reservoir during the time of day when electricity demand is greatest (typically late morning to mid-afternoon). The sponsor of the Bonyic project is Hidroelectrica del Teribe, S.A., in which the main investor is *Empresas Públicas de Medellín*, based in Colombia. Construction has begun on a new access road to the dam site, although the main civil works are not yet underway.

The larger (257 MW) Chan I project is on the Rio Changuinola; the foot of the dam will be at 75 meters above sea level (for this reason, the project is also known as Chan 75). The project sponsor is AES, a United States-based private company that manages several other Panamanian hydroprojects (including the large Bayano Dam in eastern Panama). Construction of the Chan I dam and its associated facilities is already well underway. AES also intends to build Chan II (aka Chan 140) a short distance above the tail of the future Chan I reservoir. Chan II is in the advanced planning stages, but construction is not expected to begin for at least a few more years. Plans for one additional dam (Chan 220) have been dropped; instead, AES intends to raise the height of the Chan II dam to capture most of the hydropower potential of Chan 220. Unlike Bonyic, Chan I and II are intended to provide baseload electricity, so water releases from the reservoir for power production would be relatively constant.

The reservoirs of the Bonyic, Chan I, and planned future Chan II projects will all be entirely within the 167,000 hectare (ha) *Palo Seco* Protection Forest (*Bosque Protector Palo Seco*, BPPS), an extensive, multiple-use PA that permits infrastructure such as hydroelectric dams (within specified zones). In fact, an important part of the Government's official rationale for establishing BPPS in 1983 was to help protect the watershed for the planned future development of water resources, including hydropower. The reservoirs of the Bonyic (18 ha) and Chan I (1,375 ha) will have a combined surface area of about 1,400 ha, or 0.8 percent of BPPS; with Chan II (2,500 ha), the cumulative area would be about 3,900 ha (2.3 percent of BPPS). While all three dams will flood forested ecosystems with high biodiversity, they are not expected to threaten the survival of any native animal or plant species. The dams and reservoirs will inevitably also impede the migrations of native fish and shrimp, but all of the aquatic species known from the affected tributaries (Quebrada Bonyic and main branch Rio Changuinola) also occur within the unaffected tributaries of the Rio Changuinola system, and elsewhere in Panama and in other countries. Most notably, the sponsors of Bonyic and (especially) Chan I have promised to invest substantial funds in improving the long-term protection and management of BPPS. If these promises come to fruition, there may be the potential for a net gain from an environmental standpoint, in which the loss of a relatively small portion of BPPS (to reservoir flooding) would be offset by the more effective conservation of a much larger area.

The National Environmental Authority (ANAM) is a specialized institution of the government. However, the hierarchical level of ANAM in the public administration limits the potential for the consolidation of national environmental policy.

A general problem is that ANAM has an inadequate position within the civil service, given the importance of the topic. It is an autonomous entity that depends on a National Environmental Council (NEC) formed by three Ministers of State appointed by the President (currently the Ministers of Economy and Finance, of the Presidency, and of Health). The relatively low profile of ANAM in the hierarchy of public administration hinders its ability to influence high levels of decision-making. This becomes a limiting factor, preventing the vision of sustainable

environmental development from receiving equal consideration. Environmental concerns do not receive equal weight in governmental debate compared to economic and social concerns.

At the same time, component monitoring and enforcement of the law is very weak, and there is currently no governmental body that specializes in this function. This has resulted in recurrent violations of the law in land use changes, territorial occupation, and resource extraction, all of which impact the conservation of natural ecosystems and the various PAs.

The GLE provides mechanisms for interagency coordination to achieve synchronization of public policies with the environment. However, environmental considerations have not yet been effectively incorporated into sectoral policies.

Article 16 of the GLE established the SIA as a mechanism to coordinate different sectors and government levels. However, as discussed in Chapter II, this important coordination mechanism has been weakened by lack of staff dedicated to establishing and overseeing meaningful sectoral agendas, ANAM's low convening power vis-à-vis powerful agencies and ministries, and weak environmental units in key ministries.

ANAM has given high priority to the consolidation of the National System of Protected Areas (SINAP). However, its ability to achieve this goal has been structurally limited.

Over the past two years, ANAM has made very significant changes in its organizational structure, creating, restructuring, and strengthening its technical directorates and units, and reordering its regional administrations. It also has been linked to the Career Management System in accordance with the Law on Administrative Careers.

The Directorate General of Protected Areas and wildlife will be reorganized into a Department of Management of Protected Areas, another of Biodiversity and Wildlife, and a third of Biological Corridors, in addition to a separate administrative unit.

While this system is an improvement over the previous structure, it still presents several limitations. The most significant among these include:

- Its representative is responsible for all issues regarding the regulation and management of wildlife within the SINAP. This includes the workload and various issues related to wildlife management (that is, permits) and to international agreements (that is, the Convention on International Trade in Endangered Species), preventing this person from paying the necessary attention to SINAP.
- The person directly responsible for SINAP has the civil service hierarchical rank of a "head of department," and hence that level of compensation. This does not correspond to the importance of their responsibility. The SINAP controller therefore does not report directly to the Director of ANAM, but rather to the Director-General.
- Those directly responsible for PAs belong to the structure of regional administrations, and therefore report directly to the Regional Administrator. In other words, those responsible are not directly appointed by the Directorate of Protected Areas and Wildlife. This institutional arrangement does not provide the person responsible for the PA an adequate level of authority to manage and negotiate directly with local actors at the highest level. Nor does it allow the management of a PA to be within a single administrative structure, and thus a single line of command. In this structure, the hierarchical level of responsibility for a PA is very low, and the person responsible has very little authority to deal with local interests. Their ability to perform their duties has no force, and is therefore compromised.

6. Challenges for Conservation and Natural Resources Management

There are very strong economic pressures on the use of land, including areas where there are PAs, and the existing environmental instruments are not sufficiently robust to deal with these pressures.

Population and economic growth in Panama have generated very strong pressures on land use, and continue to pose a significant threat of drastic changes in land use, including the exploitation of natural resources within PAs. Tourism, mining, urban sprawl, and road building offer good examples of this trend.

Panama is becoming a very important tourist destination, and tourism activities have grown considerably. Part of the attraction is the scenic beauty of natural areas and activities related to nature. One of the most worrisome cases is that of the Bocas de Toro archipelago, although part of this archipelago is protected within the Isla Bastimentos National Marine Park. However, the park covers only a portion of the dry land and waters of Isla Bastimentos, and the remainder is subject to the pressures of major tourism growth. The development of hotel infrastructure and residential housing, the lack of infrastructure for water treatment, and the destruction of native mangrove habitat put the sustainability of the entire region at risk. In addition, the ecotourism activities that are offered are not properly designed.

Another source of environmental pressures is mining operations and hydropower developments (Box VI.1). An emblematic case is that of Empresa Minera Petaquilla S.A, and Petaquilla Minerals Ltd in Coclé. This company has begun activities (construction of a road and activities related to the construction and operation of the mine) without the appropriate EIA authorization. The company has presented several studies regarding the separate projects to build the necessary infrastructure, but there is no comprehensive impact assessment. Moreover, the company has expressed interest in developing some areas of the Panamanian Atlantic coast, but again there is no evidence of any Environmental Impact Assessment of the complete project.

In several areas of Panama, there is a great deal of pressure for urbanization, particularly in the Bay of Panama and the archipelago of Bocas del Toro, with developments being built to serve as residences of foreign retirees. This growth is not accompanied by any planning process for the occupation of the territory, which can lead to significant problems, particularly in the demand for services.

The growth of infrastructure, and particularly roads that connect areas that are incommunicado, include plans to cross major extensions of natural ecosystems that are currently in a perfect state of preservation. The opening of these roads will drastically transform land use and increase deforestation.

7. Conclusions and Recommendations

The interest of President Martín Torrijos' Administration in conservation issues presents an opportunity to further conservation goals. On the other hand, society is interested in discovering new opportunities for participation, but there are no clear and effective ways to influence decisionmaking, and to make the society as a whole an ally in the struggle to continue the process in the long term.

Environmental protection must become a national priority and be understood as a strategic area to achieve sustainable development. In this context, the report suggests a set of guidelines for

strengthening the national capacity to improve the management of natural resources and the conservation of Panama's natural heritage.

7.1 Priorities to Strengthen Forest Governance and the Development of the Forest Sector

ANAM needs to convincingly demonstrate that forestry can be both environmentally sound and also significantly contribute to national development and poverty elimination. The institution also needs to engage the industry and other stakeholders in the definition of forest policies and regulations to strengthen the sector.

The current state of information management is inadequate and needs to be standardized nationally. Geo-referenced databases should be developed that can be easily integrated with Geographical Information Systems, facilitating analysis and reporting on the sector, and more informed decisionmaking by stakeholders.

Community forestry should be supported in order to help generate local income and develop experience with co-management of communal forest resources.

A National Forest Development Plan is being prepared. Its adoption and integration with other environmental policies is urgent. The plan should include a financial sustainability strategy, and develop and implement a forest investment program.

The issuance of forest permits and concessions must be consistent with the time frame required by sustainable forest management.

A national "forestry culture" should be promoted, along with greater technical assistance for those that desire to get involved in forest management.

Forest monitoring and protection needs strengthening, as does the development of a comprehensive forest information system.

7.2 Strengthen Planning Capacity

Develop the strategic lines of conservation of natural heritage in the National Environmental Management Strategy for Sustainable Development

This is an important ongoing consultation regarding the Environmental Management Strategy for Sustainable Development. It is an opportune time to establish in this strategy guiding principles for the conservation and use of biodiversity and plans for long-term consolidation of the National System of Environmental Protection. The discussion process should ensure the participation of society and the concurrence of the various levels of government and the central institutions related to the subject (tourism, economic development, and agriculture, fisheries, and water).

Conclude the Strategic Plan of the National System of Protected Areas and the National Policy on Biodiversity

The Strategic Plan of the National System of Protected Areas and the National Policy on Biodiversity are under discussion. These documents, discussed with key stakeholders, can become instruments of a policy that guides environmental protection for the long term. It would be ideal if these documents could be presented publicly by the President of the Republic, an act that would provide great visibility and establish a long-term vision.

Develop a national program for the Protected Area system

This will not adequately achieve a comprehensive strategy, but it is essential that a National Program be established for the system of PAs, including priorities, specific targets, timetables, and economic resources for compliance, all to ensure results of the strategic initiatives.

7.3 Strengthen the Regulatory Framework

Reform the Political Constitution of Panama to incorporate the State's responsibility to protect the natural heritage and establish and manage the National System of Protected Areas (SINAP). While SINAP is already defined in the GLE, if this is mandated by the Constitution it will have a much more powerful presence for society, for other institutions, and for local authorities.

Formally issue a Law of the National System of Protected Areas

This has been an important ANAM initiative, and since January 2007, it has forwarded a draft law to the legislative body through the Cabinet Council. It should be a priority for this administration to finalize this project. This requires continuing to work closely with both society and legislators. Some public activities could be scheduled (seminars, workshops, conferences) to discuss the relevance of the topic, inviting personalities who advocate its virtues along with representatives of countries that have a vested interest in creating the necessary consensus.

Also, ANAM has created the procedures for the development of management plans and for establishing PAs. However, in order to define its obligations, to avoid ambiguity, and to prevent disputes, it is important that these are explicitly described in the proposed law.

Increasing SINAP Representation

Designate new PAs of great ecological and social significance, particularly dry forest, which is underrepresented in the SINAP.

Strengthen the Legal Framework for Environmental Zoning (*Ordenamiento Ambiental Terriotrial*, OAT) by: (a) integrating the various forms of land use planning within a common methodological and technical framework; and (b) improving ANAM's technical and operational capabilities, especially in terms of communication, supervision, and monitoring of sectoral activities.

7.4 Strengthen Institutions

Create an agency that specializes in managing SINAP. It would be desirable to improve the standard hierarchical management of PAs, and separate it from the issues of wildlife management. The SINAP would be a second-level body that responds directly to the Director of ANAM, and would also have financial and administrative autonomy.

Appoint PA directors who specialize in the subject, and who would be subsidiary to, and report directly to, the new SINAP management agency. Those responsible for the management of PAs should be specialized personnel, of a good professional level, with a remuneration and hierarchical level in the civil service that enables them to fulfill their responsibilities to manage and conserve natural resources and the environment. They can act as partners with local actors, authorities, business, society, and so forth. These directors should be coordinated with the Regional Administration, *but not* dependent upon it. The PA directors should have direct dialogue with local authorities at the highest level.

Strengthen ANAM’s interagency decision mechanism. The SIA should be used for planning coordinated and synchronized public policies of different sectors for the conservation of the natural heritage. The results of this planning effort could be the basis of the Program of the National System of Protected Areas, where each institution would reconcile their actions, targets, timetables, and economic resources. The execution of this SIA task could involve the President to compel the presence of directors of different institutions. Subsequently, the work can continue with the immediate subordinates. However, if the mandate comes from the President, and he establishes a requirement to receive a report in a relatively short time, the various directors cannot disengage from the process, even though they delegate the actual work.

Establish permanent mechanisms for interagency coordination at the level of each PA, in which are presented the reports generated by the SINAP program, and also provides a medium for conflict resolution.

Strengthen the implementation and monitoring of the law, allocating more economic, human, and material resources. Open discussion on the relevance of separating the regulatory function and management policies from those of surveillance and law enforcement, as in other countries. This should be an Attorney General or other law enforcement official that specializes in environmental enforcement.

7.5 Strengthen Social Participation

Establish a National Council of Environmental Protection, with the participation of different sectors of society (academics, social organizations, entrepreneurs) and government institutions linked to environmental protection, to support a decisionmaking process whose functions are to:

- Analyze and achieve consensus on the national strategy for SINAP
- Facilitate the integration of policies
- Propose management criteria
- Assist in preventing and resolving conflicts
- Establish mechanisms for monitoring and evaluation
- Inform the public.

Establish local councils for the most complex PAs to:

- Analyze and achieve consensus on the Management Plan
- Facilitate local integration policy
- Prioritize actions
- Assist in preventing and resolving conflicts
- Establish mechanisms for monitoring and evaluation
- Inform the public

7.6 Decentralize and Co-manage Non-priority PAs

After a thorough and detailed analysis, ANAM can be decentralized or co-managed, in order to be relieved of its sole responsibility, and to better involve both society and local authorities. Co-management can significantly increase funding for PAs, provide greater continuity of management, facilitate complimentary programs, and increase local participation and local acceptance of the park. Challenges could include unclear rights and responsibilities in the co-administration agreements, communication problems, distrust, and the institutional weaknesses of the partners. The case of Bolivia’s largest PA is described in Box VI.2 as good practice.

7.7 Strengthen the Dissemination and Communication of Information

Develop an intensive nationwide campaign to raise awareness in the general public of the importance of, and benefits to, society derived from PAs, and their value as a national natural heritage. The campaign should target society, along with private companies (optimally by the Council) to achieve greater credibility, and should be self-financing. The important thing is that government and society work together.

7.8 Financing of SINAP

Calculate the real cost of SINAP, which includes a minimum payroll, infrastructure, equipment, operating costs, maintenance, and surveillance, and in the process ensure that these basic costs can be met by government resources.

Diversify SINAP revenues:

- Collection of fees for access to PAs. Those PAs that generate significant income (that is, Bocas del Toro) should subsidize the PAs that receive no visitors.
- Continue developing instruments and strategies to create systems for the payment of environmental services in PAs, such as those developed for hydropower projects in Bocas del Toro Province.
- Develop within ANAM the internal capacity to create proposals for projects that avoid deforestation, in compliance with the Kyoto Protocols.

Box VI.2: The Izoceno Indians and Bolivia's Largest Protected Area

Since before colonial times, the Izoceno Indians roamed the wide expanses of dry Chaco between Bolivia and Paraguay. Beginning in the 1970s, an ominous threat appeared on the horizon—the rapid destruction of the Chaco for mechanized agriculture (principally soybeans). At that time, none of the Chaco was protected and the Izocenos lacked title to the land they occupied.

The Izoceño organization, *Capitania del Alto y Bajo Izozog* (Leadership of Upper and Lower Izozog, CABI), represents the 8,000 Izocenos living in 23 communities. In the early 1990s CABI's leaders concluded that establishing a Protected Area (PA) would be the best option to legally halt the advance of the agricultural frontier and provide a framework for Chaco conservation. CABI approached the Wildlife Conservation Society (WCS), which had been collaborating with them on wildlife management. The WCS agreed to provide technical assistance. Their partnership was successful, and in September of 1995 the Government of Bolivia created the Kaa-Iya del Gran Chaco National Park and Integrated Management Area (KINP). CABI was named co-administrator.

Covering 3.4 million hectares, Kaa-Iya is the largest PA in Bolivia. It contains the largest area of dry tropical forest under protection in the world and is one of the few PAs in the Americas established as a result of the initiative of a Native American People.^a

In 1995, USAID and WCS formed an alliance with CABI to help them meet their new responsibilities as co-administrator of Kaa Iya. The program strengthened CABI's administrative capacity and helped them assume their leadership role. These capacities soon proved important. Proponents of the largest infrastructure project in South America—a gas pipeline running from Bolivia to Brazil—proposed that it cross Kaa Iya. With the support of USAID, the World Bank, and the Inter-American Development Bank, CABI negotiated directly with the pipeline sponsors.

On December 8, 1997, the parties reached a comprehensive agreement, an important precedent for indigenous groups in Bolivia. The project sponsors agreed to a US\$1.5 million land titling program. For the first time, a Bolivian indigenous organization received definitive titles to its territories. This halted the speculative land titling process occurring adjacent to the park by creating a buffer zone. The agreement also established a US\$1 million trust fund (which has since grown to US\$2 million), which provides a permanent source of funds to finance conservation activities defined as priorities in the park's management plan. This has been the key source of complimentary funding for the park described elsewhere in this document.

While protecting the park, the Izoceños have also consolidated 1.9 million hectares of indigenous territory that now serves as its buffer zone. Thus, they now administer an area totaling 5.3 million hectares. The experience has been remarkably successful, demonstrating that indigenous peoples and park authorities can effectively partner to achieve shared goals.

a. M. Painter personal communication.

8. Prioritize Actions

It is necessary to prioritize certain actions in order to lay a solid foundation for the continuation of a sound conservation policy.

The priorities may not cover many aspects of environmental protection, but they need to be significant. Within ANAM there could be a rapid process of evaluation involving senior officials, in order to define certain high-impact conservation actions that are viable to be accomplished in the short term. This would involve the concurrence of the different areas of ANAM and of society in general.

The actions related to forestry are:

- Engage the industry and other stakeholders in the definition of forest policies and regulations to strengthen the sector.
- Develop geo-referenced databases that can be integrated with Geographical Information System to facilitate the analysis, reporting, and decisionmaking process.
- Finalize the National Forest Development Plan.

- Strengthen the forest monitoring and information system.

The actions related to conservation are:

- Conclude the Strategic Plan of the National System of Protected Areas and the National Policy on Biodiversity.
- Prioritize management efforts (of both economic and human resources) in the most relevant PAs.
- Decentralize and co-manage non-priority PAs.
- Diversify SINAP revenues.
- Increase SINAP representation.
- Conclude and issue the regulation of ecotourism activities in PAs. This regulation has been in debate since 2006.
- Strengthen environmental zoning.

VII. Mining and the Environment: Balancing Two Forms of Natural Capital

1. Background

This chapter describes the current state of Panama's institutional capacity to assess and manage environmental and social risks associated with large-scale mining, mineral processing, and associated infrastructure. The chapter provides a snapshot of Panama's mining industry and reviews the current legal framework with respect to Environmental Impact Assessment (EIA) and related social impact assessment; evaluates current human resource and financial resource capacity to implement existing laws, and discusses the current experience with respect to commercial-scale mining developments.

Given that the development of mineral resources is, to some degree, inevitable, and given the significant environmental and social concerns about the sector, the Government of Panama should consider proactively pursuing initiatives to promote sustainable management of the sector and its risks. The chapter makes specific recommendations for activities in four key areas: creating a shared vision for the development of mineral resources; strengthening human resource capacity to anticipate, plan, and manage the sector; adopt cutting-edge practices to reduce or eliminate risks; and develop strategic partnerships with leading industry and civil society organizations.

2. Panama's mining sector

Panama is fortunate to be endowed with mineral resources, but historically mining and mineral processing have not been a major factor in Panama's economy. In the past, Panama has produced clay limestone and salt, and there are commercially available copper and gold deposits, but these have been exploited on a small scale, as have bauxite, phosphates, and coal. Mining has never accounted for a large proportion of the country's gross domestic product (GDP), and at times has accounted for less than 0.5 percent of GDP. The U.S. Geological Survey (USGS) (Doan 1999) estimates that mining accounted for only .25 percent of Panama's GDP in 1999. Mining also presents relatively low multiplier effects compared with investment in other economic sectors (see chapter V Table V.6).

However, Panama's mining sector recently passed through a period a relative dormancy, driven partly by market conditions, lack of quality investors due to concern over ambiguous licensing procedures, and social opposition to large-scale development in the sector (see Table VII.1 for a snapshot of mineral production during 1994–98). While global markets and the financial economics of mineral extraction have not always been favorable for Panama, a recent surge in certain global commodity prices is stimulating stronger interest in the potential for commercial-scale development of the country's mineral resources. This is particularly true with respect to gold, copper, and other minerals in high global demand, where recent price signals are attracting strong interest from international private sector mining companies. Private companies operate most of the mineral industry in Panama and some, such as Petaquilla, are poised to develop their large mineral reserves.

One indicator that Panama's mining sector may be in the midst of a resurgence is the number of new licenses for operations and exploratory activities. Among the best-known examples are the interests of the Canadian and Panama mining company Petaquilla Minerales SA, which has been actively pursuing new gold and copper operations in Colón province. Other signs of revival for the sector include an increase in exploration authorizations owing to the recent rise in mineral prices. In development for more than a decade, Petaquilla has been touted as one of the largest

untapped copper deposits in the world, with the potential to produce an average 411 million pounds of copper, 95,000 ounces of gold, and 8.6 million pounds of molybdenum a year over a 23-year mine life (*Globe and Mail 2008*).

Panama has been expected for many years to become a major producer of copper, gold, and manganese, and is considered to have strong potential (Doan 1999). A 2001 Mineral Inventory Report financed by the Inter-American Development Bank (IDB) in collaboration with Panama's Department of Mineral Resources identified the following areas as being of potential commercial interest to mining companies: Rio Mamoni (Panama Province, Chepo District), Capira and Cacao (Panama Province, Capira District), Hato Chami and Cuvibora (Chiriqui, in the Remedios District), Rio Liri Areas, (Veraguas Province between Palmas and Mesa), Rio Cricamola (Bocas del Toro Province), and Calizas de Rio Boqueron (Chiriqui Province).

Table VII.1 Mineral Production 1994–98

(Metric tons unless otherwise specified)

Commodity	1994	1995	1996	1997	1998
Cement	615,000 ^{3/}	615,000 ^{3/}	647,000 ^{3/}	700,000 ^{r/}	750,000 ^{3/}
Clays:					
For cement	400,000	300,000	117,616 ^{3/}	40,112 ^{3/}	45,000
For products	7,250	7,000	5,170 ^{3/}	7,217 ^{3/}	7,200
Gold kilograms	245	1,100	834 ^{3/}	1,202 ^{3/}	1,500
Lime	1,750	2,000	6,767 ^{3/}	3,246 ^{3/}	3,500
Petroleum refinery products thousand 42-gallon barrels	10,000	10,000	10,000	10,000	10,000
Salt, marine	20,000 ^{3/}	22,000	22,000	22,000	22,500
Silver kilograms	175	175	1,307 ^{3/}	2,178 ^{3/}	2,000
Stone, sand and gravel:					
Limestone:					
For cement	700,000	700,000	550,798 ^{3/}	263,338 ^{3/}	270,000
For other uses	57,000	62,000	62,000	62,500	62,500
Sand and gravel thousand tons	2,700	3,000	3,000	3,000	3,000
Sand and silica	22,500	23,000	23,000	--	--

r/ Revised

1/ Estimated data are rounded to three significant digits or less.

2/ Includes data available through June 1, 1999.

3/ Reported figure.

Source: Doan (1999).

At the same time, enthusiasm for development of the sector needs to be balanced by the costs of developing specific projects. In some cases, developers are facing escalating cost estimates for developing projects, which could undermine their start-up and long-term viability.

3. Environmental and social issues in Panama's mining sector

Global and regional experience in the development and exploitation of mineral resources has a relatively poor track record with respect to appropriate treatment of environmental and social impacts. The legacy of mining in both developed and developing countries is often one in which local communities bear the brunt of the environmental and social costs and often do not share in the benefits of the mineral exploitation. Poorly managed mining operations can have significant impacts on public health, and cause environmental degradation. The impacts can be serious and long-term due to the persistent nature of the pollution associated with mining.

In most cases, the mine and mineral-processing facilities are not the only infrastructure concerns associated with mining. Very large operations often require transport infrastructure, including roads and port facilities, and can place great demands on power supply. Often independent power

production facilities must be developed to support mining operations. In other cases, projects could almost be presented as integrated regional development projects.

To be sure, mining does offer opportunity for community development and is a source of revenue for government. In addition to national revenues, mining investments can generate local employment and can be used to finance social and environmental initiatives in affected areas that might not otherwise receive funding support. In some case, communities are direct beneficiaries, and in other cases they may be bystanders with only an indirect benefit from a project.

Clearly, the development of the mining sector holds promise for economic and social development, but it also comes with significant environmental and social risks if not managed properly. Global and regional experience clearly shows that the exploitation of mineral resources comes with important social and environmental risks that must be systematically assessed, mitigated, or offset if the development of the sector is to enjoy long-term sustainability. (See Box VII.2 for a summary of risks and impacts). This is especially true in Panama, where large-scale commercial exploitation of gold and copper could pose significant threats to the country's rich biological and social heritage (See Figure VII.1 for a map of Petaquilla surface mine activities).

Panama has a strong interest in ensuring that the development of the mining sector does not have large-scale or irreversible impacts on its significant natural heritage. Mining and resource extraction projects face a demanding set of environmental and social challenges. Divergent viewpoints on the benefits of development and the impact of projects on communities and the local environment are part of the complex operating environment of the mining and minerals extraction business. Weak governments, the lack of local capacity, the spread of misinformation, and the absence of an internal skill set to deal with them are factors that must be addressed. Effective engagement among companies, government, communities, and other interests in order to align the project with local development priorities will often make the difference between project success and failure.

Mining operations worldwide have been subject to severe criticism, such as those relating to human rights abuses, severe impacts on social well-being, and lack of equity in benefit sharing. Mining projects have been the target of sharp attacks, which have resulted in project delays or even mine closures. We are reminded by the Mining Minerals and Sustainable Development project that "Simply meeting market demand for mineral commodities falls far short of meeting society's expectations of industry. The process of producing, using, and recycling minerals could help society reach many other goals—providing jobs directly and indirectly, aiding in the development of national economies, and helping to reach energy and resource efficiency targets, among many others. Where industry is falling far short of meeting these objectives, it is seen as failing in its obligations and is increasingly unwelcome."

Figure VII.1: Photo of Petaquilla Surface Mining Activities



Source: *The Panama News*, (http://www.thepanamanews.com/pn/v_13/issue_23/business_03.html).

Box VII.1. Summary of Common Environmental and Social Risks Associated with Mining

(a) Common Environment Risks

- Impacts associated with mine tailings management such as air, water quality
- Loss of protective vegetation cover leading to increased instability of slopes in and around production and processing sites
- Impacts associated with ancillary works such as road access to site, power generation and transmission, quarry and excavation sites for construction materials, establishment of work camps
- Persistent hazardous chemicals used in the mining and milling operations
- Public health and safety associated with transportation of hazardous materials
- Loss of wildlife habitats associated with land clearing and other mine operations
- Post-closure legacy risks of untreated waste or unimproved lands after surface associated with mine closure and decommissioning
- Mine tailings management, acid drainage and runoff, sedimentation in streams.

(b) Common Social Risks

- Land acquisition and land loss associated with mine siting and operations including ancillary works such as roads, power generation, and other supporting activities
- Loss of livelihoods when large operations move in and disrupt local economies
- Lack of community support resulting from inequitable benefits sharing
- Failure to include local stakeholders in the planning and development of mine operations
- Loss of land tenure security especially on communal lands
- Mine safety and worker health
- Social issues after mine closure.

Large-scale mining activities and associated works in Panama are just one of many threats to the important biodiversity contained within the Meso-American Biological Corridor, one of the most biologically significant regions in the world. In an effort to control and protect the country's biodiversity from some of the growing threats to its resources, such as mining, Panama has created 63 Protected Areas (PAs) that comprise almost 33 percent of the national territory. This includes two PAs that are recognized internationally as both World Heritage Sites and Biosphere Reserves—Darren National Park and La Amistad International Park. In 2005, Coiba National Park earned recognition as a World Heritage Site for its outstanding marine biodiversity, becoming the third PA in Panama with this distinction.⁸⁷ Many of these PAs are either directly or potentially affected by proposals to develop and exploit mineral resources.

Closely related to biodiversity management is the importance of these resources to indigenous communities, many of which rely on the resources for livelihoods and subsistence. In many respects, it is virtually impossible to distinguish the impacts on the forests and biological diversity and the people that rely on those resources. According to the nongovernmental organization World Rainforest Movement, “The Panamanian Natural Resources Directorate has reported that 70 percent of the approximately 20,000 square kilometers km² of the national territory deemed to have mining potential is on land claimed by indigenous groups.” Because mining activities are often located in the most remote areas, it is frequently indigenous communities that face the effects of poorly planned and managed mining activities.

Any successful development of mineral resources in Panama will need to take into account the social context and will need to develop specific strategies to address the concerns of stakeholders and potentially affected people. Many of the existing mining concessions directly overlap with indigenous territories and/or national parks. Many if not most indigenous groups would view mining as a threat to their culture and their way of life. Many groups and individuals are seriously questioning whether the impacts and risks of mining are warranted, especially when the alternative economic values of biodiversity are considered (Hevia 2007).

Another important consideration with respect to mining is the long time frame over which principles of environmental and social sustainability must be implemented. In many cases the problems that exist and persist “after” the mine has been closed and left are as or more important than those encountered during construction and operations. Thus a life-cycle approach to environmental and social sustainability is an important consideration.

4. Legal and regulatory framework governing mining

Panama's mining activities are governed by its national constitution, civil legal system, the overarching Code of Mineral Resources enacted by means of Decree Number 23 of August 22, 1963, and by other national laws specifying various aspects of development in the sector. The principle regulatory body for the mining industry is the Ministry of Trade and Industry, which is in charge of regulating the mining industry. At present there are no international treaties governing mining in Panama.

Panama's basic legal instruments governing mining include:

⁸⁷ The Nature Conservancy website (<http://www.nature.org/wherewework/centralamerica/panama/>).

- The National Constitution of 1972 (which provides national protection for certain areas and their appropriation, including areas for mining exploration);
- Law No. 33 of November 8, 1984, whereby some articles of the Code were amended;
- Law No. 20 of December 31, 1985, whereby various articles of the Code were amended;
- Law No. 8 of June 16, 1987, which creates a special regime for the hydrocarbons sector;
- Law No. 3 of January 21, 1988, whereby the Code was amended; and
- Law No. 32 of February 9, 1996, whereby some sections of the Code were amended.

Historically, Panama has operated under a system in which mineral resources are property of the State, with resource exploration, extraction, transportation, and processing concessions being awarded on various terms ranging from 2 to 25 years depending on the type and location of the resources.⁸⁸ Private parties carrying out mining are required to pay taxes and royalties and, according to the USGS, mining companies pay taxes and royalties ranging from 2 to 4 percent of gross production, depending on the type of mineral production.

In 2001, the IDB commissioned a review of Panama’s mining laws and regulations. At that time, there were concerns that the country’s systems of licensing and permitting, taxation rates, and concessions were not attractive to investors because of their ambiguous nature and their lack of correspondence with international norms. This was particularly true with respect to environmental and social standards and worker and community health and safety requirements. Proposed reforms to mining laws at that time would have taken into consideration important social concerns over indigenous land rights, but the law has not been passed.

5. Legal and regulatory framework governing environmental and social protection

Panama has created a basic legal framework for addressing environmental and social issues but it is not clear the extent to which these laws and regulations are implemented on the ground. In addition to Panama’s National Constitution, the Environmental Law, the Code of Mineral Resources, contains an entire chapter dedicated to “Safety Provisions and Waste Prevention” (Hevia 2007). Some of the key aspects of the legal and regulatory provisions are outlined below.

General Law of the Environmental (Law 41)

Panama’s Environmental Law regulated by Decree 59 of 2000, establishes that exploitation of metallic and non-metallic minerals shall be performed after an Environmental Impact Assessment (EIA). Panama’s basic environmental legislation for EIA is the GLE (Articles 23 to 31) and Decree 59 of March 16, 2000. This law is further supplemented by supporting regulations, specifically Executive Decree 209 (December 5, 2006). This law lays out the basic organizational and institutional requirements for an EIA and specifies the types of analytical work that apply to different levels of investments. ED 209 does not require the systematic analysis of alternatives to a proposed project. This constitutes a significant gap with the World Bank policies and perhaps other multilateral development banks as well.

Strategic Environmental Assessments

ED 209 does provide an explicit recognition that alternative methods of environmental analysis would be acceptable. It recognizes that strategic environmental assessment is a tool that could address many issues not normally covered within a conventional EIA. This allows ANAM to

⁸⁸ For a detailed description of the types of concessions, the system of duties and royalties, and tax incentives, see Hevia (2007).

ascertain the regional, induced, or indirect impacts of a proposed project. Title XI only requires a Strategic Environmental Assessment (SEA) for plans and programs, and it is not clear whether the ED would require the study of regional or cumulative impacts of a large-scale project such as a major mining operation.

Public consultation and disclosure

Title IV Chapter 1 of ED 209 provides the basic regulations with respect to civil society involvement and the rights of people impacted by large investment projects. A basic expectation for each environmental risk category is defined in the ED. Proponents of a project are expected to formulate a Plan de Participacion de Ciudadana, describing the obligations of the proponent with respect to public meetings, document disclosure, and the various public forums to be carried out during project preparation and implementation. The ED provides specific procedures that projects proponents are required to follow in order to ensure citizen participation and disclosure of documents. Project proponents are required to inform concerned citizens about the content and scope of an EIA and applicable EMPs prepared both by the proponents and by the government authorities.

Social Impact Assessment

While ED 209 specifies that social impacts are one of the key criteria that are to be evaluated as part of the EIA process, the ED does not provide specific mechanisms or principles such as Resettlement Action Plans or Indigenous Peoples Plans as mechanisms for ensuring adequate treatment of these concerns. Within the suggested outline of an EIA, proponents are expected to describe the baseline social conditions and to estimate the impacts and costs. There is no equivalent mechanism within the EIA process for establishing appropriate management plans. ED 209 specifically identifies cultural property as one of the five key criteria for evaluating project impacts. While the definition is not as explicit as that of the World Bank, for example, the policy does explicitly mention this type of impact.

ED 209 does recognize displacement of people, land acquisition, and resettlement as important considerations in the ranking or project impacts. Beyond that, the guidance provided is limited and does not specify the principles on which compensation for lost assets will be calculated, nor does it specify eligibility criteria or mechanisms for dispute resolution in the event that individuals or communities feel they are not compensated adequately for displacement or loss of assets and livelihoods.

6. Recommendations for enhancing sustainability in the mining sector

While some impacts of mining may be inevitable, most of these social and environmental impacts are avoidable or can be mitigated if mine operators and regulators operate according to best available management practices. In recent years, there are signs that the global industry and some governments are beginning to change. Industry associations such as the International Council on Mining and Metals (ICMM) have an industry mandate to lead and promote sustainable mining. National organizations like the Mining Association of Canada are also leading in the development of principles, frameworks, and cutting-edge methods to guide and assist field practitioners.

Box VII.2 Towards Sustainable Development for the Mining Sector. Industry Perspectives on Core Principles and Good Practice

Within the mining industry there is a growing recognition and acceptance that there is a need for improved performance across a range of issues. While there is no globally accepted standard of best practice in the mining sector there is an emerging consensus both on the need for promoting good practice as well as the adaptation of core principles to guide corporations and governments in their respective roles. In 2003, for example, the International Council on Mining and Minerals (ICMM) committed its membership to measure their performance against 10 core principles. These principles were developed through international forum and an analysis of a number of existing international policies, regulations, declarations and initiatives. The core principles include:

- (1) Implement and maintain ethical business practices and sound systems or corporate governance.
- (2) Integrate sustainable development considerations within the corporate decision-making process.
- (3) Uphold fundamental human rights and respect cultures, customs and values in dealings with employees and others who are affected by our activities.
- (4) Implement risk management strategies based on valid data and sound science.
- (5) Seek continual improvement in health and safety performance.
- (6) Seek continual improvement of our environmental performance.
- (7) Contribute to conservation of biodiversity and integrated approaches to land use planning.
- (8) Facilitate and encourage responsible product design, use, re-use, recycling and disposal of our products.
- (9) Contribute to the social, economic and institutional development of the communities in which we operate.
- (10) Implement effective and transparent engagement, communication and independently verified reporting arrangements.

Others initiatives such as the Mining, Minerals and Sustainable Development (MMSD) Project sponsored by IIED have carried out extensive analysis of sustainability issues facing the mining sector. Whereas the ICMM principles are more focused on corporate performance, MMSD offers their own set of Sustainable Development Principles which are broader in scope. MMSD organizes its principles according to four spheres: (i) the Economic Sphere; (ii) the Social Sphere; (iii) the Environment Sphere; and (iv) the Government Sphere. Like the ICMM principles MMSD clearly recognize the importance of multi-stakeholder analysis and multi-criteria planning. MMSD's principles recognize the legitimacy of different stakeholder views and strongly encourage a development planning perspective to the problems facing the sector.

In addition to the establishment of core industry principles to guide the development of the sector there are growing numbers of initiatives aimed at disseminating information about international good practice, professional development and education in the mining sector. For example, the website Good Practice for Sustainable Development in the Mining and Minerals sector is an excellent source of information on established and emerging good practices. This website has been jointly developed by the International Council on Mining and Metals (ICMM), the United Nations Conference of Trade and Development (UNCTAD), the United Nations Environment Programme (UNEP), and the UK Department for International Development (DfID) to provide access to a library of good practice guidelines, standards, case studies, legislation and other relevant material that are leading examples of their kind globally.

Internationally, more attention is being paid to concepts such as corporate social responsibility and environmental sustainability as they become more ingrained in corporate cultures. Many lenders are beginning to adopt the Equator Principle, and organizations such as the International Finance Corporation (IFC) are beginning to adopt performance standards and principles rather than the more prescriptive safeguards policies. Panama stands to benefit if it, too, moves toward adoption of recommendations of the industry leaders.

Despite the fact that Panama has established environmental legislation, it is clear that a significant effort to build human-resource capacity, improve quality of implementation, and strengthen strategic partnerships is essential if the country is to move toward sustainable development of its mineral reserves. These challenges are significant but not insurmountable. This brief analysis recommends a series of actions that could be taken in the short to medium term to address issues: creating a strategic vision, strengthening human resource capacity,

reducing environment and social risks, and establishing strategic partnerships. One area where the country could benefit would be to consider adoption of core sector development principles in line with leading industry associations.

Four broad areas are recommended for Panama to explore as it considers the future development of the mining sector: (a) create a shared strategic vision for the sector, (b) strengthen human-resource capacity to anticipate and manage environmental and social risks in the sector, (c) reduce environmental risk through adoption of cutting-edge practices, and (d) develop strategic partnerships with industry and civil society leaders. Each theme is explored below.

(a) Create a shared strategic vision for the sector: Even a cursory glance at the mining sector in Panama gives the impression that a business-as-usual approach to mineral exploitation will lead to continued acrimony and intense debate among stakeholders and people affected by mining and minerals processing. Part of this vision must, as Veiga and others (2007) point out, be to adopt a development approach to the sector whereby communities realize a net improvement in the physical, biological, social, and economic health of the community. First, Panama should consider initiating a national dialogue on adoption of sustainable and/or responsible mining principles. This could be done through workshops, professional forums, industry roundtables, and focus group discussions. There are many examples emerging in the global practice that illustrate how this might be done.

Second, Panama should make every effort to learn about how such principles are being put into action from industry leaders such as ICMM. These industry leaders provide operational advice and guidance on stakeholder involvement and building better coalitions. Third, Panama could use its EIA legislation and regulations to promote and conduct strategic options assessments, making better use of emerging tools such as Strategic Environmental and Social Assessments to identify risks and opportunities before specific actions are taken on the ground. Finally, the country could work toward development and acceptance of the Mining Industry Codes of Practice, which incorporate international good practice.

(b) Strengthen human resources capacity to manage social and environmental risks: One of the biggest challenges to an effective system of management and control in Panama is not with its regulatory framework, which seems comprehensive, but instead lies in the implementation. Implementation is severely constrained, not so much by lack of clarity in the overall goals and objectives of the system as by human and financial resource constraints. ANAM staff, given the responsibility for the EIA review process, are typically overworked and are required to handle large numbers of project reviews simultaneously across a range of project types. Staff, especially in regional offices, may not have had appropriate training in specific fields such as mining or other projects that have large regional impacts and social implications, such as hydropower or major transportation projects.

Specific measures that could be considered include the following. First, promote training in the use of industry toolkits and methodologies such as the Community Development Toolkit developed by ICMM and the World Bank. There are many valuable resources now available that are sector specific and that are based on developing-country experiences relevant to Panama. Second, conduct thorough human resource capacity assessment of ANAM with a view to developing long-term staff capacity-building programs. Such an assessment would identify critical capacity gaps, especially in the planning and management of projects with large-scale regional impacts such as gold and copper mining. Third, Panama should seek resources to support staff training through on-the-job experience building. Fourth, Panama could seek opportunities for formal education and training through organizations like InfoMine and

associated universities offering online and in-person courses. Finally, there are numerous opportunities to learn from others. Study tours for environmental staff to visit operating mine sites and mines in the process of closure would be particularly valuable at this time.

(c) Reduce environmental and social risk through cutting-edge practices: While Panama has developed basic EIA legislation and has some capacity to execute its responsibilities under existing legislation, the country has yet to develop and apply the full range of tools required for effective management of risks associated with mining projects. Specifically, Panama should extend its EIA procedures to include comprehensive social impact analysis. At the moment, EIA regulations do provide for land acquisition and resettlement, but there is little specific guidance on how to address specific development concerns of impacted communities. There is insufficient opportunity for allowing discussion among and between affected people.

As part of the strategy, Panama should seek opportunities for awareness raising among key stakeholders in the government and private sector on current weaknesses in Environmental and Social Impact Analysis capacity. Some companies claim to be adhering to national regulations and law. This may be true, but there has not been sufficient analysis of the strengths and weakness of the system. All stakeholders in the sector need to recognize that the EIA instrument is not sufficient on its own to achieve environmental stewardship and protection of resources and assets, and other tools are required. To address this concern, Panama could undertake analysis of experience with respect to community benefits sharing to ensure greater social acceptability and greater development impact of mining, and explore opportunities for training and case study development in Strategic Environmental Assessment (EA). The World Bank could support this development through offering its introductory course to a range of stakeholders in the sector.

(d) Develop strategic and equitable partnerships with industry, civil society organizations, and affected communities: In most of the available accounts on Panama, there is little published on the potential for joint actions. Stakeholders are often portrayed as having widely divergent points of view. Companies are typically portrayed as having selfish interests, with little interest in social benefit sharing or environmental problems, while civil society groups are often seen as obstacles to development of a legitimate industry. Clearly, there is more scope for effective partnerships. To this end, Panama could work to identify and establish more effective partnerships with companies that show an interest in promoting good socially and environmentally sustainable corporate practices.

The Government's role could be to increase opportunity for meaningful dialogue among and between divergent stakeholders in Panama and to broker more trust among stakeholders through roundtables and public forums. Clearly, while not new, concepts such as communications, education, cooperative decisionmaking, and diversification are all important elements in any long-term strategy (Viega 2001).

(e) Develop and implement additional environmental standards: There is an overall lack of key environmental standards. Despite whatever improvements could be made in other areas, there remains a crucial need to implement key regulatory standards for discharges to air, soil and water.

7. Conclusions

With recent surges in global prices for metals such as gold and copper, Panama's mining sector may be on the verge of an increase in interest from international developers, after a period of relative dormancy. With these changes come both risks and opportunities to communities that

must carry the burden of environmental and social impacts. Since the distribution of Panama's mineral resources directly overlap with sensitive ecological and cultural zones, it is imperative that government, private sector, and civil society work closely together to ensure responsible development of the sector.

Developing the mining sector in a more sustainable manner will require much greater attention to anticipating, planning, and managing environmental impacts, and greater commitment to using large developments as a way to finance social and economic development in affected communities. While Panama has developed a legal and regulatory framework that addresses some fundamental concerns regarding environmental impact assessment, it must be recognized that an EIA, on its own, is a weak instrument and development of the mining sector will require a much deeper analytical underpinning. Major stakeholders will need to bring in a much broader range of tools, methodologies, and instruments to assess regional and site-specific impacts.

Accomplishing these ambitious goals will also require significant investments in technical capacity building. Capacity building will not only be required in government agencies tasked with assessment and enforcement, but also in the developers, local communities, and civil society. Finally, since the sector is still at a relatively early stage of development, Panama is well positioned to learn from the experiences of the international community. Emerging interest among industry groups and the experiences of countries with a long history of mining would greatly benefit Panama. An aggressive program of learning and adopting the emerging lessons and the cutting-edge practices would serve Panama's interests for many years to come.

VIII. Conclusions and Recommendations

Panama, a small country with rich natural resources, needs to ensure the best affordable environmental management that will allow the country to sustain its high rate of economic growth and turn this growth into better living conditions that improve the welfare of all, especially of the poor. To a large extent, Panama's competitiveness depends on the quality and abundance of its natural resources (water, forests, marine resources, land, and biodiversity). However, these resources are coming under increasing pressure and, in the absence of improved environmental management, could be quickly degraded by the processes unleashed by rapid economic expansion. The following are the main conclusions and recommendations.

1. Conclusions

The report estimates the cost of pollution-related health problems. Environmental health risks, such as those from inadequate water and sanitation, and indoor and urban air pollution, and their associated costs, represent a significant burden on Panama's economy—amounting to about US\$225 million annually.

- Urban air pollution is a growing concern in Panama City and other urban centers—resulting in an estimated 275 premature deaths and 424 new cases of chronic bronchitis in Panama every year.
- While the reported level of water supply and sanitation coverage is high on average, sharp inequalities in coverage exist, with poor service quality in urban poor areas and scanty coverage in rural indigenous areas. Analysis for this report estimates that there are almost 130 premature deaths, and about 1 million additional cases of diarrhea in children under age 5 attributed to poor water sanitation and hygiene.
- Indoor air quality remains a major health problem in the country's rural indigenous areas, where 93 percent of households continue to use biomass for cooking. More than a half-million annual cases of acute respiratory illness (ARI) in rural areas and more than 50,000 cases in urban areas—predominantly in children under 5 years of age and women—may be linked to indoor air pollution. About 32 children under 5 years of age die from ARI in Panama annually.

The report uses a cost-benefit analysis framework to rank interventions to address these environmental health risks. The cost estimates of pollution-related health problems and the ranking of interventions to address these problems represent useful new information for ANAM and should be useful to establish environmental policy priorities.

The Panama Canal Watershed (PCW) has been and will continue to be a major asset for Panama, from which a variety of environmental services and other benefits are derived. Among them, the PCW harbors some of the most biologically diverse ecosystems in the world, as a result of its privileged location in the narrowest region in the Isthmus of Central America - linking two large land masses and separating two major oceans. The PCW is also the sole source of water for the Metropolitan populations of Panama City and Colon - with about 1.5 million people directly depending on its waters-, and for the operation of the Panama Canal - a major asset to the Panamanian economy, and the engine of its accelerated rate of growth. Unfortunately, this same economic boom has generated processes, such as rapidly growing water demands and urban sprawl that challenge the long-term environmental sustainability of the watershed. The impact of climate change will also affect the capacity of the PCW to provide environmental services.

The CICH's coordinating goals represent a paradigm shift in the way watershed management has been done in Panama, and many other places in developing and developed countries. The CICH and its Technical Secretariat seem to be functioning reasonably well and providing the needed intersectoral mechanism for agreeing upon and coordinating the diverse actions required for the management of the PCW. The PCA's reliance on the CICH and the various line ministries to carry out their institutional mandates within the agreed framework for the PCW's management is also proving to be a good formula. The main challenge facing the CICH at this time is establishing the institutional and implementation strategies and arrangements for implementing the "*Plan for the Sustainable and Integrated Management of the Panama Canal Watershed's Water Resources*".

The integrative management of watersheds is not an easy task, as it involves many local and external stakeholders, both at the individual and institutional levels, and the implementation of new ways to work. Most importantly, changing the way in which agencies are accountable for the use of their own human and financial resources, towards a shared goal. The CICH has been visionary in taking the lead in championing such an approach within the PCW. The PCA and the GOP shall continue to provide and expand their support to the CICH, and guide official agencies to contribute their best efforts towards the achievement of the sustainable management goals of the watershed's natural resources.

The tourism sector has an enormous significance for the Panamanian economy because of very high and rapidly increasing arrivals of foreign tourists and high levels of spending. Furthermore, the tourism sector has the highest multiplier effects on the economy because of very high backward and forward linkages. The sector also has an enormous potential to benefit the poor. The new findings from modeling undertaken as part of this Country Environmental Analysis (CEA) reveal that the poor earn a far greater share of the total increase in income from tourism than from growth in other sectors. Thus, the tourism sector must be seen as the cornerstone of the efforts of Panamanian authorities to reduce poverty in this highly dual economy. But as suggested by the global experience, poverty benefits from the tourism sector are not automatic, and whether or not they receive a significant share of the benefits depends on the way the supply chains are structured and the way tourists spend their money. The booming tourism sector is also likely to have a large environmental footprint. Given the importance of the tourism sector and its potential to result in large benefits for the poor and its significant environmental impact, devising a set of indicators and effective monitoring schemes is of paramount importance. Strengthening ANAM's capacity to plan and implement zoning regulations is essential to manage the environmental impact of the rapid growth of tourism infrastructure.

Conservation and forestry challenges are inextricably linked in Panama, where habitat loss due to deforestation and habitat fragmentation are the main threats to the country's rich biological diversity. Panama is heavily forested and arable land available for cultivation is limited. Together with a high concentration of landownership and rapid population growth, this has led to increasing cultivation on marginal lands, and to deforestation and soil erosion. Further, deforestation and degradation affect a large share of the remaining forests. The reasons include changes in land use, unmanaged exploitation for fuel-wood and illegal logging, and land tenure insecurity.

Deforestation, at 40,000 hectares per year, and habitat fragmentation, are the main drivers of biodiversity loss. Other causes of habitat loss are the rising pressures from tourism development and road building, the planned expansion of mining operations and, more generally, the construction boom in the rapidly growing Panamanian economy. Panama's efforts to consolidate

and conserve its natural heritage have been remarkable. Even so, this goal still faces important obstacles, including: (i) insufficient environmental management instruments to deal with the pressures caused by economic growth; (ii) limited convening and coordination capacity of ANAM vis a vis ministries and agencies; and (iii) structural weakness of SINAP.

With recent surges in global prices for metals such as gold and copper, Panama's mining sector may be on the verge of an increase in interest from international developers after a period of relative dormancy. With these changes come both risks and opportunities to communities that must carry the burden of environmental and social impacts. Since the distribution of Panama's mineral resources directly overlap with sensitive ecological and cultural zones, it is imperative that government, the private sector, and civil society work closely together to ensure responsible development of the sector. The chapter makes specific recommendations for activities in four key areas: creating a shared vision for the development of mineral resources; strengthening human resource capacity to anticipate, plan, and manage the sector; adopt cutting-edge practices to reduce or eliminate risks; and develop strategic partnerships with leading industry and civil society organizations.

The GOP has undertaken major efforts to establish institutional and organizational frameworks for environmental management. The following aspects stand out as the most salient strengths:

- Panama has in place an environmental management law that provides a sound basis for regulating environmental pollution and resource conservation.
- The country has established institutions for developing and implementing environmental policies. Key ministries have environmental units and the SIA provides a strategic foundation to mainstream environmental considerations into sectoral policies.
- Several mechanisms encourage public participation, which can provide useful inputs to policy development and foster higher levels of compliance with regulations. In addition, valuable contributions to environmental protection in Panama may also be expected from a series of nongovernmental organizations that are engaged with environmental issues at different levels.
- There is an increasing awareness at many levels within ANAM of the environmental management framework's weaknesses, and the desire to address them. There is a generalized recognition of the need to strengthen environmental management while at the same time eliminating unnecessary hurdles for economic activity.
- Valuable contributions to environmental protection in Panama may also be expected from a number of municipalities that are engaged with environmental issues at different levels (Panama City and Colón stand out).

Specific ongoing efforts will continue to make the system more resilient, adaptable, and active. Among these initiatives, the following merit attention:

- The head of ANAM was granted ministerial rank and now ANAM will have its own seat at the Presidential Cabinet.
- A series of standards on air quality and emissions will be enacted.
- The National Consultative Commission on the Environment will begin operations.
- New staff has been added to both the central and regional offices of ANAM to strengthen its enforcement capacity.

- A budgetary increase has been granted to ANAM to operate and maintain PAs.

Notwithstanding this progress, the overall environmental framework still faces the following significant challenges that could not only hinder the country from achieving sustainable development in the long term, but also minimize the benefits that Panamanians can draw from their rich natural capital:

- After 10 years in operation, ANAM needs to be reinforced through improved priority setting, planning, convening, and coordination capacities, information processing, and funding.
- A renewed effort to establish effective cross-sectoral coordination mechanisms is needed.
- Panama needs to improve its environmental information systems as a means to better support decision making and monitoring.
- Despite important progress, public participation and consultation processes still face a number of weaknesses, particularly with regard to projects in indigenous communities' lands.
- Compliance and enforcement are perhaps the weakest aspects within the country's institutional framework for environmental and natural resource management. Without effective compliance and credible enforcement, the deterrent, corrective, and guiding effects of an environmental management framework, and its credibility, are jeopardized.

The CEA concludes with specific recommendations summarized in the attached table in the areas of coordination; priority setting and resource allocation; EIA and other instruments; compliance and enforcement; and information and public participation.

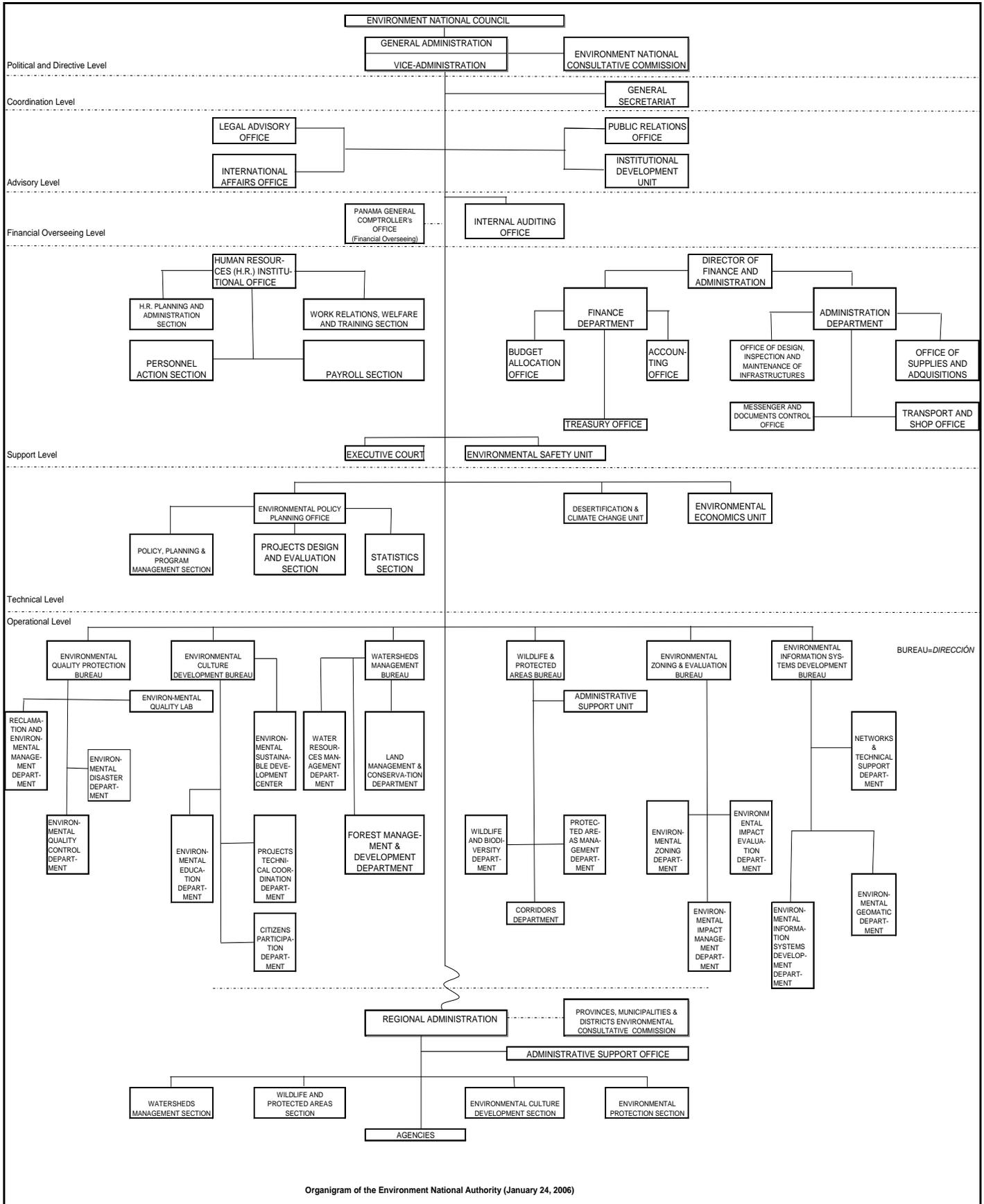
The administration's interest in environmental issues creates opportunities for advances in addressing these challenges. Managing the environmental impact of current and future economic activities requires that Panama learns from its experience and strengthens and adapts its institutions and organizations.

2. Recommendations

Priority Area	Recommendation
<i>Institutional Coordination</i>	<ul style="list-style-type: none"> • Establish or strengthen Environmental Units (UAs) in key agencies and major municipalities. • Encourage ANAM to develop and drive agendas appealing to sectoral ministries or agencies, such as on environmental health with the Ministry of Health (MINSA), tourism and environment with the Panamanian Tourism Institute (IPAT), or on infrastructure and environment with the Ministry of Public Works (MOP). • Ensure that the functions of existing UAs are broadened from promoting environmental permits to actively mainstreaming environmental management within each agency.
<i>Priority Setting and Resource Allocations</i>	<ul style="list-style-type: none"> • Establish national environmental priorities with quantitative goals. • Reflect the stated priorities in the national budget allocation for environmental protection nationally, and develop a “whole of government” accounting system to monitor the use of budgetary resources. Where needed, reassign financial resources and personnel and provide additional sustainable funding. • Reform ANAM’s organization, balancing the preeminence of the Environmental Impact Assessment (EIA) focus inside the agency with reforming of the instrument, and developing specific mandates, capacities, and staff to identify, address, monitor, and achieve the new priorities. • Establish targets and appropriate results indicators for the agencies that form CICH and allocate budgets accordingly.
<i>EIA and Complementary Management Instruments</i>	<ul style="list-style-type: none"> • Adopt detailed guidelines for project proponents in preparing EIAs, and adopt detailed criteria for ANAM in reviewing EIAs and granting environmental permits. • Strengthen environmental zoning by: (a) integrating the various forms of land use planning within a common methodological and technical framework; (b) improving ANAM’s technical and operational capabilities, especially in terms of communication, supervision, and monitoring of sectoral activities. • Launch a pilot Strategic Environmental Assessment (SEA) project to develop this instrument as a complement to the EIA process, and select pilot sectors or regions of the country. • Complement the EIA adjustment and SEA implementation with technical guidelines and norms such as contract specifications, and with guidelines to mainstream design and environmental management best practices.

Priority Area	Recommendation
<i>Compliance and Enforcement</i>	<ul style="list-style-type: none"> • Establish a Compliance Promotion Program monitored periodically by the National Environmental Council to bring the regulated community—including municipalities and other government entities—into compliance. • Improve staffing, training, and equipment of the enforcement unit of ANAM and strengthen the capacity of the Environmental Prosecutor. • Ensure availability of laboratories to support inspections and evidence gathering by the Environmental Prosecutor. • Step up the creation of independent environmental certification and auditing entities to foster third-party verification in support of government enforcement and voluntary compliance.
<i>Information and Public Participation</i>	<ul style="list-style-type: none"> • Step up implementation of indicators to be used by government officials to steer policy priorities, for instance, concerning water balances, registry of users, and point sources of pollution. • Develop climate models to help better predict the effects of ENSO events on the PCW. • Implement an independent monitoring program of water quality in Gatun Lake. • Consolidate the SINIA by acquiring equipment, adding staff, and providing training, as needed. • Improve current water and air-quality monitoring. • Create an inventory of wastewater discharges and point-source air emissions. • Step up efforts to make operational an environmental accounting system to determine the cost of environmental degradation. • Step up actions to begin the operation of the National Consultative Commission on the Environment (<i>Comisión Consultiva Nacional del Ambiente</i>). • Improve consultation mechanisms on proposed policies, laws, regulations, and norms, by organizing workshops or target groups to discuss proposals.

Annex I: ANAM Organizational Chart



Organigram of the Environment National Authority (January 24, 2006)

Annex II: Public Environmental Expenditure Review

Public Environmental Expenditure Reviews (PEERs) offer a way of systematically assessing the equity, efficiency, and effectiveness of public environmental spending. The starting point for a PEER is an understanding of a government's appropriate role in managing natural resources and regulating environmental quality. A low level of public environmental spending is not in itself an argument for more expenditure; the question is whether government expenditures are effective in meeting environmental priorities. A comparison of targeted and actual outputs provides information on cost-effectiveness and promotes emphasis on program delivery and on the effective use of public resources and the government capacity for budget execution.

Based on the available information on budget allocation and disbursements of various environmental entities in Panama, we assess here the efficiency of budget execution in Panama and analyze its consistency with various challenges identified elsewhere in the Country Environmental Analysis (CEA).

ANAM's **allocation has steadily increased but fluctuated in recent years**. As shown in Table AII.1, over the past seven years total expenditures have risen only modestly, by about 4 million balboas during 2001–07 after falling dramatically in 2003. The environmental expenditure has been quite constant both as a percent of government expenditure and of GDP, although both have been rising steadily during this period.

Table AII.1: ANAM Government Expenditures, 2001–07

	2001	2002	2003	2004	2005	2006	2007
Government Expenditure (in millions of balboas)	2685	2764	3020	3194	3290	3862	4195
GDP (in millions of balboas)	11,807.5	12,272.0	12,933.2	14,179.3	15,464.0	17,133.8	19,739.8
Environmental allocation (in millions of balboas)	24.6	26.1	20.0	22.3	26.7	26.4	29.0
Environmental allocation (% of Government Expenditure)	0.9	0.9	0.7	0.7	0.8	0.7	0.7
Environmental allocation (% of GDP)	0.2	0.2	0.2	0.2	0.2	0.2	0.1
Real growth (%)		6.3	-23.6	11.6	19.6	-1.0	10.1
Inflation	0	1.8	1.2	2	3.5	3	

Source: ANAM and Ministerio de Economía y Finanzas.

Among the middle-income countries of Latin America, Colombia is perhaps the best comparator since it has similar levels of per capita income and share of government expenditures in GDP. Panamanian expenditures on environmental protection compare somewhat less favorably with Colombia and, as expected, are lower than the levels seen in higher-income countries such as Chile and Mexico (Table AII. 2). These figures, however, are

only indicative, since there is no guarantee that environmental expenditures are defined similarly across different jurisdictions in other countries. Furthermore, there is no “correct” level of expenditure on the environment—the use of public resources should be proportional to the environmental benefits they create, and these can vary widely across countries, with varying environmental conditions and levels of development. It is nonetheless useful to benchmark environmental expenditures across countries.

Table AII.2: Environmental Expenditure as Share of GDP and Central Government Expenditure

	Percent of GDP	Percent of Central Gov. Expenditure
Ghana	0.02%	0.10%
Madagascar	0.47%	2.00%
Namibia	0.24%	0.70%
Panama	0.15%	0.70%
Argentina	0.10%	0.55%
Chile	0.48%	2.57%
Colombia	0.30%	0.96%
Mexico	0.65%	4.22%

Sources: Panama, ANAM, Namibia, State Revenue Fund 2005/06 Ministry of Environment and Tourism; Ghana 2005 Appropriation Act, Ministry of Environment and Science; Madagascar Ministry of Finance (Loi des Finances 2005); Latin American countries: World Bank 2006, “Environmental Priorities and Poverty Reduction: A Country Environmental Analysis for Colombia,” World Bank, Washington, D.C. (Figures for Latin America are for 2003).

Of the total budget allocation for environment, the share of operational expenses has been steadily increasing during the last seven years, and especially during 2006–07. This is indicative of increasing amounts going toward payment of wages and salaries and other non-salary recurrent expenditures (for example, overtime and transport expenditures), and are deconcentrated at the regional offices. The share of investment expenditure at around 65 percent has accounted for a large share of the budget allocation for most of the time, except for the last two years, when it has shown a declining trend (Table AII.3).

Table AII.3: Budget of Operations and Investments, 2001–07

	2001	2002	2003	2004	2005	2006	2007
Operations	7,838,300	8,096,399	7,478,401	7,917,087	9,429,559	11,543,150	14,581,507
<i>(% of total)</i>	31.9	31.0	37.4	35.5	35.4	43.7	50.2
Investments	16,751,400	18,050,176	12,494,703	14,370,248	17,231,533	14,851,769	14,467,727
<i>(% of total)</i>	68.1	69.0	62.6	64.5	64.6	56.3	49.8
Total	24,589,700	26,146,575	19,973,104	22,287,335	26,661,092	26,394,919	29,049,234

Source: ANAM.

About 80 percent of the operational budget goes toward administration expenses. However, there has been a marked increase in the budget allocation to general administration expenses and a decline in share of the regional administration units. As seen in Table AII.4, the budget allocation to general administration has increased from 28 percent in 2001 to 42 percent in 2007, while the regional allocation has fallen from 54 percent in 2001 to 40 percent in 2007. Some of this could be attributed to an increase in environmental functions taken up by the general

Conservation and sustainable development	3,945,150	5,195,109	4,958,545	4,276,142	4,894,393	2,245,250	3,263,148
Institutional strengthening	7,845,710	8,692,781	4,166,175	5,880,752	8,315,880	8,635,669	5,722,089
Total	16,751,400	18,050,176	12,494,703	14,370,248	17,231,533	14,851,769	14,467,727
Research and management of natural resources	29.6	23.1	27.0	29.3	23.3	26.7	37.9
Conservation and sustainable development	23.6	28.8	39.7	29.8	28.4	15.1	22.6
Institutional strengthening	46.8	48.2	33.3	40.9	48.3	58.1	39.6
Total	100	100	100	100	100	100	100

Source: ANAM.

ANAM's execution performance related to investment expenditures is very weak. While the spending patterns for operational expenses have been within reasonable limits of the allocation, the execution of investments have been consistently underperforming over the years. This is especially true for “institutional strengthening” and “conservation and sustainable development” components. This is similar to symptoms experienced in other countries on implementation delays of investment projects due to cumbersome procurement procedures and other administrative bottlenecks. The severe underspending in 2004/05 especially highlights some weaknesses in ANAM's budget implementation capacity. The performance of regional operational units in Panama is in line with the general administration. This is notable, as in many countries where the regional units are often underfunded and weak on budget management (Table AII.6).

Table AII.6: Budget Execution of Operations and Investments, 2001–07 (percent)

	2001	2002	2003	2004	2005	2006	2007
Operations							
General administration	88	87	91	87	91	92	76
Management and development of the natural heritage	90	88	99	90	92	91	88
Environmental management	90	88	99	90	91	88	90
Regional administration	89	90	98	96	94	89	92
Total	89	89	96	92	92	90	85
Investments							
Research and management of natural resources	76	55	70	52	79	85	76
Conservation and sustainable development	82	48	54	45	16	75	35

Institutional strengthening	49	32	74	56	42	84	67
Total	65	42	65	52	43	83	63
Grand Total	72	56	77	66	61	86	74

Source: ANAM.

External sources continue to play an important role in promoting environmental conservation. ANAM is also responsible for execution of a number of projects and programs funded by external sources. These include multilateral organizations such as World Bank/Global Environmental Facility (GEF) and the Inter-American Development Bank (IDB) and bilateral organizations such as JICA, the United States Agency for International Development, and the European Union. Some of the funds have also been channeled through NGOs such as the World Wildlife Fund and the Nature Conservancy for “debt-for-nature swap” arrangements. As shown Table AII.7, the external contribution for these projects has generally been around 5 million to 10 million balboas, and the internal complementary contribution around 2 million to 4 million balboas. The internally generated resources (ANAM’s own generated resources through fines and fees) have shown a remarkable improvement in 2008 to the tune of 2 million balboas. It is to be seen if this can be sustained. Also, the loan component has increased to almost 6 million balboas, suggesting an increased commitment to borrow on the part of the GOP to finance environmental protection and nature conservation.⁸⁹

Table AII.7: Projects and Programs Executed by ANAM from Externally Funded and Own Sources

(In balboas)					
2006					
	National Contribution	External Contribution	Own Resources	Loans	Total
Research and management of natural resources	684,050	3,437,800	125,000		4,246,850
Conservation and sustainable development	599,000	1,911,400	47,400		2,557,800
Institutional strengthening	832,150	5,199,100	66,000		6,097,250
Total	2,115,200	10,548,300	238,400		12,901,900
2007					
	National Contribution	External Contribution	Own Resources	Loans	Total
Research and management of natural resources	1,479,100	5,429,600	155,000		7,063,700
Conservation and sustainable development	514,800	2,449,000	47,300	1,510,300	4,521,400
Institutional strengthening	770,900	2,750,000	116,000	1,264,000	4,900,900

⁸⁹ The loan components co-finance the natural resources and rural poor projects co-funded by IDB and GEF and Standardization for the Modernization of Environmental Management for Competitiveness of the National Environmental Program co-funded by IDB.

Total	2,764,800	10,628,600	318,300	2,774,300	16,486,000
	2008				
	National Contribution	External Contribution	Own Resources	Loans	Total
Research and management of natural resources	1,409,500	3,830,100	1,030,100		6,269,700
Conservation and sustainable development	197,500	1,198,300	454,200	2,200,000	4,050,000
Institutional strengthening	650,800	793,400	475,000	3,500,000	5,419,200
Total	2,257,800	5,821,800	1,959,300	5,700,000	15,738,900

Source: ANAM.

Panama could consider introducing “economic instruments” to generate revenue to meet increasing expenditure needs and to address environmental problems simultaneously.

However, this would necessitate having institutions in place to monitor pollution levels and enforce the new regulatory regime. Given that it would take some time to develop capacity in this area, a way forward would be to introduce environment-friendly taxes within the existing tax structure. That would imply relying on product taxes such excise taxes, carbon tax etc. Similarly, the needed reduction in public expenditure could be achieved by targeting certain environmentally-harmful subsidies in the water, energy and agriculture sectors. ANAM has drafted a proposal of a law on payment for environmental services. The objective of this proposed law is to provide incentives to actions that promote good watershed management practices. The proposal calls for utilities to finance two funds, the Socio-environmental Community Investment Fund (which would support the provision of potable water, sanitation, electricity, health and other services) and the Payment of Environmental Services Fund (which would pay communities for some of their environmental services). This proposal is currently under discussion both in the executive and legislative powers.

Forest resources are currently under-priced and over exploited. There is considerable potential for increasing revenue from forestry through introducing fiscal instruments (taxes, fees etc.) at various stages in the production-distribution chain. This should be complemented with adequate regulatory framework to monitor illegal harvesting. Conservation areas are stressed due to lack of adequate finances. Charging appropriately determined payment for the environmental services--especially from foreign tourists--would help maintain and protect these critical areas and at the same time generate resources to improve existing infrastructure necessary for promoting nature-based tourism. Also, well designed carbon financing and sequestration schemes also offer opportunities for promoting conservation and at the same time bring down the country’s economic burden.

Annex III: The “Degazetted” Western Watershed

A study developed by the TLBG/University of Panama (TLBG/UP/STRI) Consortium (2003) found that the condition of the forests within the Western (expanded) Region of the PCW was worsening. The Consortium performed a Land Cover Change analysis, overlaying Landsat Satellite imagery, 1:50,000 topographic maps, vegetation maps, and videography.

The PCW’s Western Region, located in the Central part of the Panamanian Isthmus and the Panama Canal, covers an area of 213,112 hectares (ha), and encompasses three sub-watersheds: The Indio River sub-watershed (38,746 ha), the *Miguel de la Borda/Caño Sucio* River watershed (11,804 ha), and the *Coclé del Norte* sub-watershed (162,562 ha). The *Indio* River sub-watershed borders the Eastern side of the PCW.

The eastern side of the Coclé del Norte sub-watershed partially overlaps the boundaries of the *General de División Omar Torrijos Herrera* National Park, with 13,335 ha within the park.⁹⁰

Their findings showed that by 2000, 138,791 ha, or 65 percent of the original forest cover in the Western Region, were already lost to other land uses (that is, converted to pasturelands and shrublands). By 2000, only 35 percent of the total area of the Western Region remained under forest cover. The remaining forest areas were unevenly dispersed as forest patches of various sizes, embedded within shrub and pasturelands.

The largest remaining forest patches were found in the upper regions of the Coclé del Norte River, and Indio River watersheds (Tables III.1 and III.2).

Table AIII.1. Original and Current Forest Cover in the PCW’s Western Region by Habitat Type

Habitat Type: Tropical Evergreen Ombrophilous Broadleaf Forest^a	Original Forest Area (ha) by Forest Type	Current Forest Area (ha) by Forest Type	Lost Forest Area by Forest Type (ha)	Percent Lost Forest Area (%)
Lowland	196,642	64,122	132,520	67 %
Submontane	14,757	8,795	5,962	40 %
Montane	1,709	1,400	309	18 %
TOTAL	213,108	74,317	138,791	65 %

a. During fieldwork verification (*ground-truthing*), researchers found two additional habitat types: *Tropical Lowland Evergreen Ombrophilous Broadleaf Forest-Palm Forest Association*, and *Tropical Montane Evergreen Ombrophilous Broadleaf Forest-Cloud Forest*. These two forest types were not included in the analysis for the following reasons: The *Palm Forest* association is not cartographically distinguishable from the main type. On the other hand, the *Cloud Forest* is indeed cartographically distinguishable, although it is immersed within the Montane Forest, covering an area of approximately 280 ha.

Source: TLBG/UP/STRI Consortium(2003).

⁹⁰ The Panama Canal Watershed’s Western Region was added by Panamanian Law 44 of August 31, 1999. However, Law 44 was repealed on June 21, 2006, returning the definition of the PCW to that contained in Law 19 of June 11, 1997; effectively revoking the PCA’s responsibility for managing the lands within the Western Region.

Table AIII.2. Land Cover within the PCW’s Western Region, as of 2000, According to Habitat Type

Habitat Type: (<i>Evergreen Ombrophilous Broadleaf Forest</i>) ⁽¹⁾	Hectares	Percent of Total Area Covered
Lowland ⁽¹⁾ (< 500m) ^a	63,843	30%
Submontane ⁽¹⁾ (500 to 10,000m)	8,790	4%
Montane ⁽¹⁾ (> 1,000m)	1,402	1%
Shrubland	93,005	43%
Pastureland	46,070	22%

a. The lower value for *Lowland Evergreen Ombrophilous Broadleaf Forest* area reported in this table is due to deducting the area occupied by the *Palm Forest Association*, 280 ha, from the estimated area of the *Tropical Lowland Evergreen Ombrophilous Broadleaf Forest*. The *Palm Forest Association* was found embedded within the *Lowland Evergreen Ombrophilous Broadleaf Forest*.
 Source: TLBG/UP/STRI Consortium (2003).

The TLBG/UP/STRI Consortium (2003) study identified 14 patches of remaining forest, each having a size of at least 1,000 ha. The Consortium recommended that these patches should be given immediate legal protection to ensure the conservation of viable populations of critical species and ecological processes.⁹¹ The general location of these 14 patches is summarized in Table III.3.

Table AIII.3. General Location of the Remaining Patches of Forest within the PCW’s Western Region

Remaining Forest Patches of at least 1,000 Hectares within the PCW’s Western Region	
Sub-watershed	1,000-Hectare Forest Fragments
Coclé del Norte Sub-watershed	12
Río Indio Sub-watershed	2
Caño Sucio Sub-watershed	0
Total	14

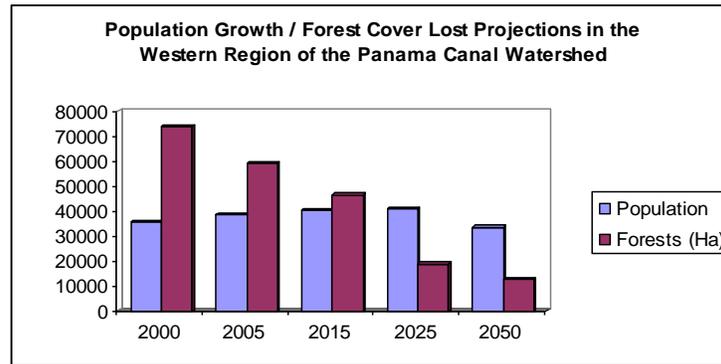
Source: TLBG/UP/STRI Consortium (2003).

The western-most polygon within the Rio Coclé sub-watershed is a large forest tract with an estimated area of 19,445 ha. The Consortium recommended the protection of this area, along with two additional nearby forest polygons: the first is a 58,337 ha *Lowland Evergreen Ombrophilous Broadleaf Forest* patch, and the second is a 97,275 ha *Submontane Evergreen Ombrophilous Broadleaf Forest* patch. Protecting these forest tracts would help consolidate and protect important sections of the proposed Mesoamerican Biological Corridor (CCAD 2005).

⁹¹ The proposed 1,000-ha threshold was based on a bibliographical review of ocelot’s (*Leopardus pardalis*) home-range estimates—that is, the spatial extent of an animal’s movement during the course of its everyday activities. The ocelot, a species reported within the PCW’s Western Region, can be considered an “umbrella” or “keystone” species. Studies done in Venezuela and Belize estimated that ocelot males cover an average area of about 1,000 ha—their home ranges. Female ocelots occupied smaller home-ranges (<http://www.cich.org/mapas/mapa1.html>).

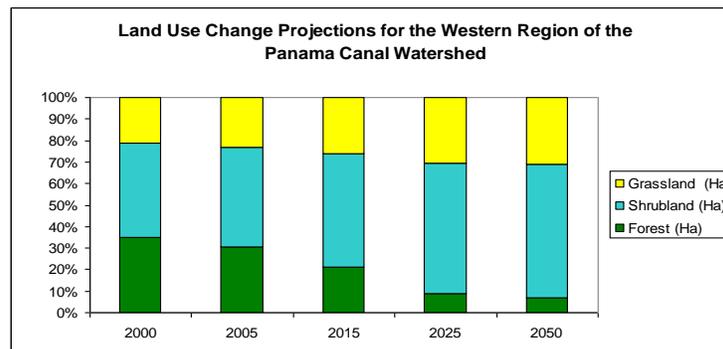
Based on current land use practices within the Western Region, and population growth projections, the TLBG/UP/STRI Consortium projected that, without the immediate implementation of a Land Zoning Plan, by 2050 most forest areas in the Western Region would be lost (Figure III.1 and Table III.4).

Figure AIII.4. Projected Trends in Forest Cover Lost, and Land Use Changes, under the No-Land Zoning Plan Implementation Scenario



Source: TLBG/UP/STRI Consortium (2003).

Table AIII.4. Projected Change in Land Use, under the No Land Zoning Plan Implementation Scenario



Source: TLBG/UP/STRI Consortium (2003).

This scenario becomes more real when we are reminded that the Western Region of the PCW is no longer officially designated as part of the Panama Canal Watershed⁹² and as such there is not a champion agency or organization chartered with its sustainable use and development.

In the rural areas, the challenges are primarily those of management of critical lands, of minimizing negative impacts of productive activities, and of achieving equitable development through provision of opportunities to the rural poor. Currently, the direct impacts of the rural sector on the watershed's function do not appear to be high-level threats compared to the previously mentioned threats arising from urban population pressure and urban-induced activities.

At this time the primary response by the GOP is the IDB-co-financed "Priority Activities Hydrographic Basin Panama Canal" project, initiated in 2005. It was conceived while the PCW

⁹² See footnote 1 for an explanation of this legal designation change.

included the 2,131 square kilometers of the “Western Region” and focuses its investments in that annexed region, home to approximately 36,000 people living in 500 small settlements, many with high levels of poverty and little access to basic services. This project is expected to help local authorities in Panama respond to demands posed by the communities and establish the basis for a future sustainable development program for that region. While an in-depth analysis of the existing and future condition of the Western Region is beyond the scope of this report, given the importance of this (degazetted) Western Watershed as a potential source for additional water for the growing populations in and around the PCW, a general assessment of the region is included in Annex III of this report. The CICH is coordinating the implementation of the “Priority Actions in the Panama Canal Watershed” project, funded with GOP and IDB funds. The project is oriented toward the implementation of the recommendations of the Immediate Action Plan (*Plan de Acción Inmediata*, PAI). The project agreement was signed in February 2005 by the GOP and IDB. Currently under implementation, the project is expected to be completed in 2010. The rationale of the project was to attend to critical needs of the local communities within the PCW, and to strengthen the dialogue between the government and local PCW communities, ensuring that government agency interventions are coordinated to ensure an integrated management approach.

The GOP agency contribution to this project is estimated at US\$15.14 million (43 percent). IDB’s contribution is US\$19.86 million (57 percent). The project is expected to invest approximately US\$35,000,000 in a portfolio of reforestation, and basic infrastructure projects within the Eastern (traditional) and Western (expanded) Regions of the PCW. The project is implemented under the coordination of CICH. The main components of the Project are:

- Land titling in the Western Region (component implemented by PCA)
- Expansion of the Hydro-meteorological Network and development of management tools for the watershed (component implementation by PCA)

Community-based Initiatives (component implementation by CONADES).

Annex IV. Formulating a Carbon Policy: Panama's Carbon Footprint

1. Global and National Context

There is a broad scientific consensus that human-induced climate change is happening and poses a substantial threat to global development efforts. It risks undermining the welfare of people in the various sectors, in the many pockets of the society, and could impede progress toward meeting the Millennium Development Goals. Temperatures in Central America are projected to increase between 2.5 °C and 4°C by 2100 (IPCC 2007), likely resulting in yield losses for crops. An increased occurrence of extreme events (such as hurricanes, droughts, and floods) and associated health impacts (for example, outbreaks after prolonged droughts) due to changing climate will affect the poor most, and can cause a significant loss of property and life. In the longer term, an acceleration of sea level rise would affect low-lying coastal areas in Panama, and the costs of building walls along the zones vulnerable to sea level rise are deemed to be prohibitive. In some regions, such as the Azuero Peninsula, where severe water stresses could be expected, water supply and hydroelectric generation would be seriously affected. Therefore, successful global efforts to mitigate and moderate climate change are consistent with Panama's national interest.

Panama emitted only 0.16 percent of the world's total carbon dioxide (CO₂) emissions (including land-use change and forestry) in 2000.⁹³ However, Panamanians contributed about 18 tons of CO₂ per person in the same year—higher than several big emitters like Indonesia (14), Brazil (10), China (3), and India (1). Table AIV.1 presents carbon performance of LAC countries, ranked by total CO₂ emissions from energy consumption. It shows that the countries fare differently by several measures such as total CO₂ emissions, emission intensity of GDP, and the rate of emission growth. In terms of total emissions, Panama was ranked 89th out of all countries in the World in 2005. In the same year, Panama came 14th among the countries from LAC region.

Table AIV.1: Carbon performance of LAC countries

Rank	Country	CO ₂ Emissions, 2005	CO ₂ intensity, PPP, 2005	CO ₂ intensity, MER, 2005	CO ₂ growth, 1995-2000	CO ₂ growth, 2000-2005	CO ₂ per capita, 2005	GDP per capita, PPP, 2005
		(MtCO ₂)	(tCO ₂ per Million \$)	(tCO ₂ per Million \$)	(%)	(%)	(tCO ₂)	(\$ per annum)
1	Mexico	398.2	339	519	3.5	0.9	3.9	7,447
2	Brazil	360.6	228	409	3.6	1.1	1.9	4,734
3	Venezuela	151.3	576	1,045	1.6	2.5	5.7	5,449
4	Argentina	146.6	350	800	2.8	1.3	3.8	4,728
5	Chile	66.2	332	557	6.5	3.6	4.1	7,297
6	Colombia	58.8	223	478	1.5	0.4	1.3	2,735
7	Puerto Rico	39.0	..	..	2.7	6.9	10.0	..
8	Trinidad and Tobago	38.2	1,874	2,355	3.9	6.6	29.2	12,417
9	Cuba	33.0	..	..	1.3	0.2	2.9	..
10	Peru	31.3	178	394	1.7	3.2	1.1	2,838
11	Ecuador	23.9	272	655	0.8	3.6	1.8	2,758
12	Dominican Republic	17.8	360	611	9.5	0.3	1.9	3,073
13	Virgin Islands, U.S.	16.1	..	..	2.8	9.9	147.7	..
14	Panama	14.3	525	925	-2.2	2.2	4.4	4,791

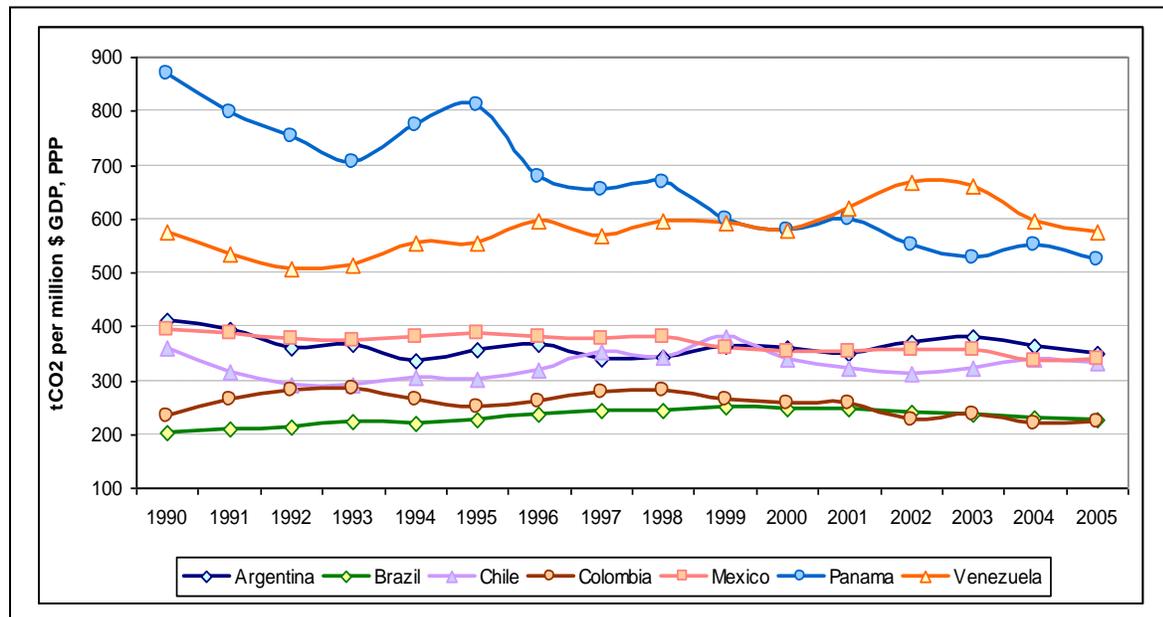
⁹³ The latest emissions data from land-use change and forestry is for 2000 from World Resources Institute: <http://cait.wri.org/>.

15	Bolivia	12.0	350	1,266	3.8	5.2	1.3	1,028
16	Jamaica	11.6	605	1,185	1.7	1.5	4.4	3,672
17	Guatemala	11.0	175	345	8.0	4.0	0.9	2,517
18	Honduras	7.1	316	860	5.6	9.0	1.0	1,151
19	El Salvador	6.2	170	363	3.4	2.4	0.9	2,467
20	Uruguay	6.0	196	362	6.7	-1.5	1.8	5,026
21	Costa Rica	5.7	151	285	1.2	2.7	1.3	4,616
22	Nicaragua	4.3	298	875	5.8	3.1	0.8	954
23	Bahamas, The	4.1	..	..	2.0	3.1	12.6	..
24	Paraguay	3.8	171	525	1.3	1.7	0.7	1,242
25	Suriname	1.9	565	1,387	1.3	3.1	4.1	2,989
26	Haiti	1.8	160	397	9.7	3.0	0.2	518
27	Guyana	1.6	653	1,996	11.1	-1.1	2.1	1,057
28	Barbados	1.4	..	466	4.9	-3.4	5.3	11,465
29	Aruba	1.0	..	..	1.9	1.2	10.1	..
30	Belize	0.9	435	845	13.9	7.1	3.2	3,786
31	Antigua and Barbuda	0.6	484	670	1.4	2.8	7.1	10,578
32	Saint Lucia	0.4	240	448	10.6	2.3	2.2	5,007
33	Grenada	0.2	248	513	-5.3	14.5	2.3	4,451
34	Saint Vincent/Grenadines	0.2	247	465	5.7	3.8	1.7	3,612
35	Saint Kitts and Nevis	0.1	202	294	2.6	5.0	2.8	9,438
36	Dominica	0.1	178	392	-0.3	6.8	1.5	3,938

Note: CO₂ emissions calculated based on different methodologies and energy statistics may differ. Source of CO₂ emissions is EIA website (as of September 18, 2007). GDP PPPs (constant 2005 US\$), GDP MER 2005 and Population data in 2005 are from World Development Indicators database.

In 2005, Panama's CO₂ intensity was relatively high, compared to top emitters in LAC region. It is worth noting that the global average CO₂ intensity was 446 tCO₂/million \$ GDP, PPP and that of high income countries was 406 tCO₂/million \$ GDP, PPP in the same period. Importantly, Figure AIV.1 shows however that Panama's CO₂ intensity has constantly declined since 1990, while the intensity levels have not improved much, if at all, in other countries. Table A IV.2 presents Panama's CO₂ performance vis-à-vis top 30 CO₂ emitters globally.

Figure A IV.1: CO₂ Intensity Trend of Select LAC countries, 1990-2005



Source: CO₂ emissions (Energy Information Administration); GDP PPP (World Development Indicators)

Table AIV.2: Carbon performance of Panama vis-à-vis Top 30 Emitters

Rank	Country	CO2 Emissions, 2005	CO2 intensity, PPP, 2005	CO2 intensity, MER, 2005	CO2 growth, 1995-2000	CO2 growth, 2000-2005	CO2 per capita, 2005	GDP per capita, PPP, 2005
		(MtCO2)	(tCO2 per Million \$)	(tCO2 per Million \$)	(%)	(%)	(tCO2)	(\$ per annum)
1	United States	5,957	480	480	1.9	0.5	20.1	41,813
2	China	5,323	998	2,372	0.5	12.1	4.1	4,088
3	Russia	1,696	999	2,218	-0.5	1.4	11.9	11,858
4	Japan	1,230	318	271	2.0	0.7	9.6	30,290
5	India	1,166	479	1,447	2.8	3.2	1.1	2,222
6	Germany	844	336	302	-0.7	-0.1	10.2	30,445
7	Canada	631	559	567	2.0	2.5	19.5	34,972
8	United Kingdom	577	305	262	0.0	0.8	9.6	31,371
9	Korea, South	500	486	631	3.0	2.5	10.3	21,273
10	Italy	467	287	265	0.8	1.0	8.0	27,750
11	Iran	451	700	2,375	4.0	6.9	6.6	9,314
12	South Africa	424	1,066	1,751	2.2	2.0	9.0	8,478
13	France	415	223	195	1.5	0.8	6.8	30,591
14	Saudi Arabia	412	841	1,331	4.3	7.1	17.8	21,220
15	Australia	407	584	555	4.2	2.9	20.0	34,106
16	Mexico	398	339	519	3.5	0.9	3.9	11,387
17	Spain	387	328	344	5.3	3.6	8.9	27,180
18	Brazil	361	228	409	3.6	1.1	1.9	8,474
19	Indonesia	359	508	1,253	4.8	5.6	1.6	3,209
20	Ukraine	343	1,303	3,977	-5.2	1.2	7.3	5,583
21	Poland	285	551	939	-1.0	-0.4	7.5	13,535
22	Taiwan	284	480	..	6.3	2.7	..	26,057
23	Netherlands	270	479	..	2.4	1.6	16.5	34,492
24	Thailand	234	526	1,329	2.2	7.5	3.6	7,061
25	Turkey	230	410	633	5.5	2.8	3.2	7,786
26	Kazakhstan	198	1,503	3,466	-0.4	7.6	13.1	8,699
27	Egypt	162	486	1,804	3.8	6.1	2.2	4,574
28	Malaysia	156	519	1,189	4.5	6.7	6.1	11,678
29	Venezuela	151	576	1,045	1.6	2.5	5.7	9,877
30	Argentina	147	350	800	2.8	1.3	3.8	10,815
(89)	Panama	14	525	925	-2.2	2.2	4.4	4,791

Source of CO₂ emissions is EIA website (as of September 18, 2007). GDP PPPs (constant 2005 US\$), GDP MER 2005 and Population data in 2005 are from World Development Indicators database.

Although land conversion and deforestation was the largest source of Panama's CO₂ emissions in 2000 (Figure A IV.2), the emissions from this source had declined during 1990–2000. In contrast, rising energy demand had caused the emissions from energy consumption to increase between 1991 and 2005 (Figure A IV.3). This is why it is important that Panama prepares for emerging challenges from energy-related sectors.

Figure A IV.2: CO₂ in 2000, by Broad Category

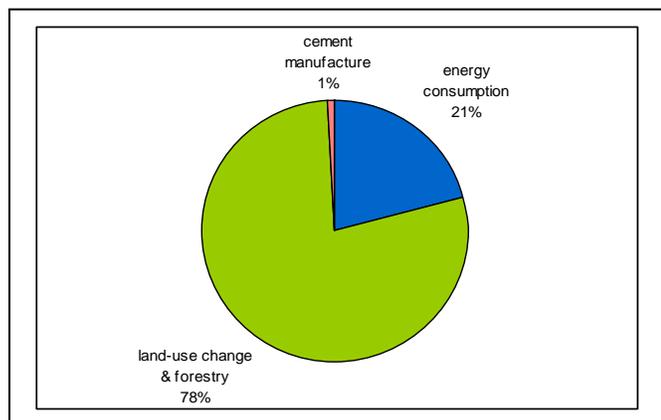
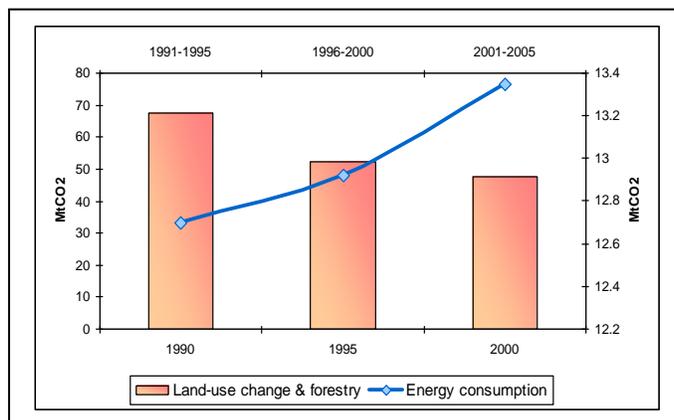


Figure A IV.3: Trends of CO₂, by Broad Category



Source: World Resources Institute; Energy Information Administration.

Panama has significant opportunities to accelerate growth while controlling the carbon intensity of its development path. International experience suggests that this can be achieved by harnessing the substantial synergies between “low carbon” and economic performance through improving the efficiency of electricity generation, reducing technical losses in the power sector, enhancing energy efficiency in various end-use sectors, augmenting hydropower and renewable capacity, and accelerating the adoption of new technologies. Moreover, there are many development benefits that Panama can capture with a well-designed strategy, including energy security, cleaner air in cities and homes, reduced congestion, and better waste management.

This chapter offers a preliminary assessment of Panama’s carbon footprint in energy-related sectors/activities, and sheds light on where and how CO₂ and other greenhouse gas (GHG) emissions are generated. It is hoped this exercise will help the Government of Panama (GOP) prioritize its efforts to improve Panama’s carbon and energy performance. It also aims to assist the GOP in identifying strategic options that address a major global and national concern about climate change without compromising—but rather reinforcing—its growth and development objectives through more efficient use of energy and tapping domestic potentials.

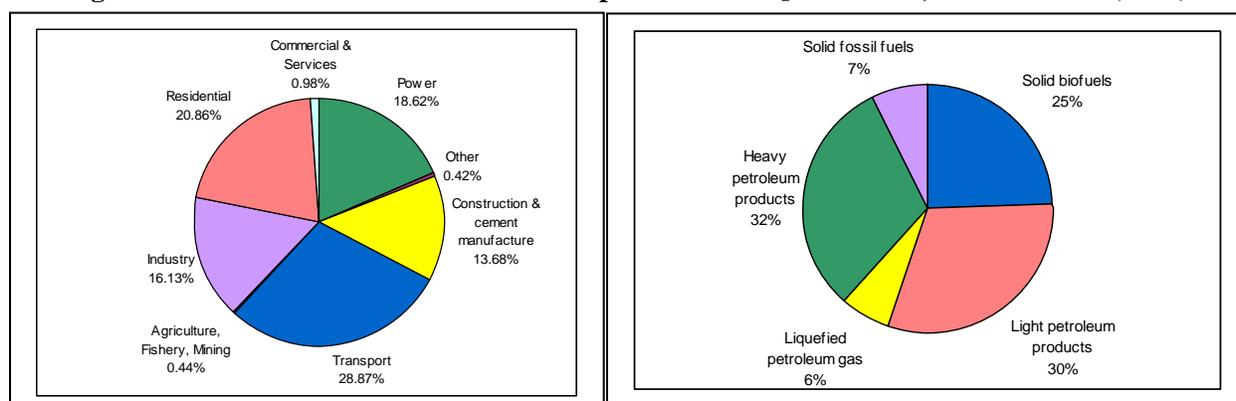
2. Energy sector: A brief overview

Panama’s energy consumption has risen rapidly, mirroring its fast-growing economy. The country’s final energy consumption had grown by 8 percent per year to a total of 3,587 kilo ton of oil equivalent (ktoe) during 2001–06, nearly 70 percent of which can be attributed to liquid fuels, and about 25 percent to biomass (Figure A IV.4b). Furthermore, there is evidence of increasing dependence on liquid fuels, particularly gasoline, diesel oil, and liquefied gas. The ratio of imported to total final consumption of liquid fuels had increased from 4:10 in 2001 to 7:10 in 2006. This will inevitably have implications on Panama’s balance of payment if the trend continues.

Electricity demand grew by about 30 percent during 2001–06. Panama’s power sector generated 6,394 gigawatt hours (GWh) in 2006, with the following fuel mix: more than 60 percent of liquid petroleum products including diesel and fuel oil, and about 33 percent of hydropower. In terms of end-use sectors, transport has been the biggest energy guzzler, consuming 1,157 ktoe in 2006, followed by residential (715 ktoe), industry and manufacturing (596 ktoe), and the commercial and services sector (305 ktoe).

Sustaining Panama's economic growth will require enhancing energy supply and electricity generation capacity in order to serve future demand. Nevertheless, both the supply- and demand-side development, if not well planned and managed, will trigger a substantial amount of CO₂ and other GHG emissions into the atmosphere. Analysis of the sources and profile of emissions will be helpful in identifying energy strategies that will not only help mitigate global climate change, but will also enhance energy efficiency in Panama's economy.

Figure A IV.4a and A IV.4b: Sectoral Composition of CO₂ Emissions, and Fuel Mix (2006)



Source: World Bank calculation

2.1 Sectoral carbon footprint

Based on Panama's energy balance statistics and default emission factors published in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, the country's energy-related sector, together with cement manufacture, emitted 12 million tons of CO₂ in 2006. Figure A IV.4a shows sectoral composition of Panama's CO₂ emissions. Although the power sector contributed nearly 20 percent of total emission, the demands for electricity originated in the end-use sectors. Almost 50 percent of total electricity was consumed by the commercial and services sector, a quarter of which was consumed by the residential sector. The proportion of electricity consumption to total electricity production in these two sectors had also risen during 2001–06. Industry used 9 percent of total electricity, while transport, agriculture, fishery, mining, and the construction sector used a negligible amount of electricity.

Table A IV.3: CO₂ Emissions and Intensity, by Sector, Based on Energy Consumption

Sector	Tons of CO ₂ (2006)	Percent (2006)	CO ₂ /Sectoral GDP (2001)	CO ₂ /Sectoral GDP (2006)
Transport	3,440,327	28.9%	1,474	1,177
Residential	3,050,459	25.6%	—	—
Industry	2,113,702	17.7%	1,723	1,982
Construction and cement manufacture	1,629,896	13.7%	3,772	2,315
Commercial and services	1,176,053	9.9%	203	202
Power (loss)	403,249	3.4%	—	—
Agriculture, fishery, mining	52,624	0.4%	—	44
Other	50,522	0.4%	—	—

Source: World Bank calculation.

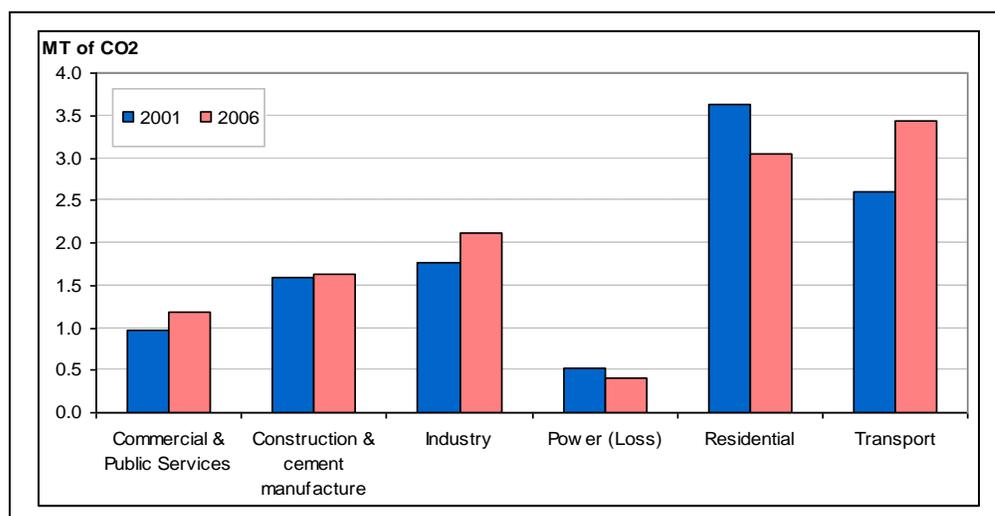
Table A IV.3 shows sectoral emissions in 2006 with an adjustment for end-use electricity demand. CO₂ emissions from the commercial, services, and residential sectors are noticeably

higher after taking into account their electricity consumption. According to Panama’s energy balance table, the construction sector is not an end-use sector. Nevertheless, it consumes energy in its process, and uses cement, the manufacturing process of which normally results in approximately 1.835 tons of CO₂ per ton of cement production. The CO₂ emissions from construction and cement manufacture are estimated at 1.6 million tons in 2006. The large number of current and upcoming construction projects, particularly in Panama City, is likely to increase the emissions from this sector now and in the future.

Table VIII.3 also presents a measure of carbon efficiency—CO₂ intensity per unit of GDP.⁹⁴ Even though construction and cement manufacture caused only 14 percent of total CO₂ emissions in 2006, the sector appeared to be the most carbon intensive. It generated over 2,000 tons of CO₂ per 1 million balboas worth of product. Despite being highly carbon intensive, the construction sector improved its energy and carbon efficiency during 2001–06 by about 10 percent per year.

The transport sector had been less carbon-intensive than construction and industry; however, its total emissions had grown as much as 1 million tons per year during the five-year period (Figure A IV.5). In contrast to the other sectors, annual CO₂ emissions from the residential sector had reduced considerably from 2001 to 2006. This is largely because the energy consumers in the residential sector switched from relatively dirty fuels (firewood and charcoal) to cleaner energies (electricity and liquefied petroleum gas [LPG]). According to the IPCC (2006), burning firewood and charcoal in residential areas emits as much as 112 tons of CO₂ per tetra joule (TJ) of energy. Use of LPG, on the other hand, generates 63 tons of CO₂ per TJ. Besides, electricity generation in Panama is fairly clean. A major proportion is produced by hydropower, which is CO₂-neutral. Another is from combustion of liquid fuels, which are clean compared to solid fuels.

Figure A IV.5: Sectoral CO₂ Emissions, 2001–06



Source: World Bank calculation.

2.2 Production sectors

A breakdown of energy use patterns by subsector is available for 2001. Assuming that the pattern within each sector had not changed in the last five years, this information—together with the latest energy statistics—allows us to get a glimpse of the comparative performance of subsectors

⁹⁴ This is only applicable to production sectors.

in 2006. Tables A IV.4–A IV.6 present the CO₂ profile of industry/manufacturing, transport, and the commercial and services sector.

Table A IV.4: Industry and Manufacturing Subsector CO₂ Profile (2006)

Subsector	CO ₂	Percent	Sectoral GDP (MB, 1996p)	CO ₂ Intensity
Food and beverages	869,577	41.1%	546	1,593
Products from oil refinery	341,574	16.2%	79	4,329
Non-metallic mineral products	276,895	13.1%	80	3,466
Paper and pulp	142,886	6.8%	43	3,331
Rubber and plastic	69,329	3.3%	30	2,319
Chemicals and chemical products	49,461	2.3%	66	753
Furniture	29,592	1.4%	28	1,064
Metals and metal products	26,633	1.3%	84	317
Transport equipment	26,421	1.3%	—	—
Other	146,057	6.9%	—	—

Source: World Bank calculation.

Food and beverages was the biggest polluter in the industry sector, and generated approximately 0.9 million tons of CO₂ in 2006. However, its emission intensity was much lower than that of several other sectors. Products from oil refinery, non-metallic mineral products,⁹⁵ paper and pulp, and the rubber and plastic industry were carbon-intensive, relative to its sector average (Table VIII.3). The calculation shows that metal and chemical-related industries were efficient in terms of energy use and CO₂ emissions. Nonetheless, these figures have been derived based on energy consumption alone, and emissions related to industrial processes have not been taken into account.

For the transport sector, it is estimated that 64 percent of CO₂ emissions in 2006 were from air transport. Moreover, the subsector was the most carbon- and energy-intensive, when compared across the entire economy. Water transport can be considered a very clean sector: it emitted only 0.3 million tons of CO₂, while generating more than twice the size of gross domestic product (GDP) from land transport. It is worth noting that about three-quarters of water transport's GDP was from the Panama Canal. With regard to the commercial and services sector, the largest potential for energy and carbon saving appeared to be in the retails. GDP breakdowns in the commercial and services sector are available only for hotels and restaurants and post and telecommunications. Their carbon-intensity levels were much lower than those in industry and the manufacturing sector.

Table A IV.5: Transport Subsector CO₂ profile (2006)

Subsector	CO ₂	Percent	Sectoral GDP (MB, 1996p)	CO ₂ intensity
Air	2,214,539	64.4%	381	5,811
Land	454,467	13.2%	475	975
Water	295,868	8.6%	1,059	279
Other	475,109	13.8%	—	—

Source: World Bank calculation.

⁹⁵ This excludes cement manufacture.

Table A IV.6: Commercial and Services Subsector CO₂ profile (2006)

Subsector	CO ₂	Percent	Sectoral GDP (MB, 1996p)	CO ₂ intensity
Retail	431,376	36.7%	—	—
Hotel and restaurants	221,568	18.8%	432.4	512
Wholesale	206,280	17.5%	—	—
Post and telecommunications	99,847	8.5%	878	114
Education, health, and social services	79,501	6.8%	—	—
Other	137,481	11.7%	—	—

Source: World Bank calculation.

2.3 Non-CO₂ greenhouse gases and emissions from other sources

Energy consumption and production not only generate CO₂, but also other GHG emissions, mainly methane (CH₄) and nitrous oxide (N₂O). It is important to measure these gases as well, since their global-warming potentials are much greater than that of CO₂ (21 times greater for CH₄, and 310 times greater for N₂O). Panama's energy use generated about 0.25 million tons of CO₂ equivalent from CH₄ and N₂O in 2006. As mentioned, Panama's electricity production has relied extensively on hydropower. It is now widely accepted that the water reservoir usually built for hydroelectric power plants emits a significant amount of CH₄ into the atmosphere. To what extent this adds to Panama's total GHG emissions requires further examination of its hydropower generation sector. Furthermore, CH₄ and N₂O are released from rice paddies. Rice is a dominant crop in Panama, and it could cause a significant amount of GHG emissions. There exist cost-effective ways that have been practiced elsewhere to change cultivation techniques and help reduce CH₄ and N₂O from rice cultivation.

As noted, Panama relied heavily on imported fuels in 2006. This is in sharp contrast with its energy pattern in 2001, when a major proportion of liquid fuels consumed were products of domestic oil refinery. During 2001, oil refinery alone emitted about 8.7 million tons of CO₂ equivalent. This resulted in about 20 million tons of CO₂ equivalent generated by the entire Panama energy system.⁹⁶ Secondary energy imports have helped the country curb its domestic GHG emissions. Nonetheless, this evidence suggests that this current analysis may have underestimated Panama's "true" emissions. A demand-based, full life-cycle analysis is likely to give a higher estimate. Another important issue is that, as the demand for energy rises, increasing import dependence will have implications for Panama's balance of payment.

The analysis so far has only dealt with GHG emissions from energy production and consumption, plus process emissions from cement manufacture. The World Resources Institute's Climate Analysis Indicators Tools reports that Panama's CO₂ emissions from land-use change and forestry in 2000 was as high as 47.5 million tons.⁹⁷ This substantial amount cannot be left out when considering total GHG emissions beyond the energy-related sectors.

⁹⁶ Note that total emissions without oil refinery in 2001 were lower than those in 2006.

⁹⁷ <http://cait.wri.org/>.

3. Conclusion

Even though the preliminary assessment in this chapter is not sufficient to provide detailed policy recommendations, some important messages can be drawn, and priority sectors/activities for GHG mitigation have emerged from the analysis. The transport sector is the biggest emitter and its emissions are on an upward trend. Most of the emissions from the sector are from air transport, which is the most carbon-intensive activity. The residential sector is ranked second in terms of total emissions; however, its emissions are decreasing, due to households switching to cleaner forms of energy. Government policies that facilitate this transition will help cut emissions.

Emissions from industry and manufacturing and the construction sector are rising and both sectors are highly carbon-intensive. This suggests that there is much room for energy efficiency improvement in the two sectors. All in all, managing emissions from energy-related sectors is primarily about providing incentives for energy efficiency/conservation, and for switching to cleaner energies. Panama's power sector is relatively clean, but there are several cost-effective measures that can further enhance plant efficiency. CH₄ emissions from hydropower reservoirs should also be factored in. Moreover, other sources of GHG emissions, such as land-use change and forestry, rice paddies, and livestock, should be included in the planning process.

The GOP's efforts should be directed toward those sectors and activities that have relatively large mitigation potential, while having comparatively low costs associated with them. A low-carbon growth strategy could be an opportunity to improve health, productivity, and quality of life, particularly for the most vulnerable populations. A more detailed analytical exercise will be needed, however, to evaluate different policy measures. Against the backdrop of Panama's current priorities and potentials painted by this chapter, it is recommended that the GOP assess the cost-effectiveness of feasible policy options for further lowering carbon intensity and enhancing the energy efficiency of Panama's economy. Essentially, it will be important to (a) establish Panama's likely future scenario to 2030 and beyond; (b) assess emissions-reduction benefits against costs associated with different policy measures—and if any—synergies, barriers, and tradeoffs; and (c) determine additional financial gaps and needs that would allow the mitigation opportunities to be realized.

4. Brief description of data and methodology

The analysis is based primarily on:

- 2001 and 2006 Energy Balance statistics obtained from the *Comisión de Política Energética*, [Ministerio de Economía y Finanzas](#).
- 2001 and 2006 GDP, at 1996 price, obtained from the *Dirección de Estadística y Censo*, *Contraloría General*.
- Default emission factors from 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

The calculations of CO₂ and other GHG emissions are based on the following equation.

$$Emission_{ij} = GWP_j \cdot EF_{ik} \cdot EC_{ik}$$

where, emissions from gas j and sector/activity i are the product of global warming potential (GWP) for gas j , and emission factors (EF) and energy consumption (EC) are associated with fuel type k in sector/activity i .

Since electricity generation consumes energy, and it is in turn demanded by end-use sectors, the calculation of emissions adjusts for these final demands by attributing emissions from electricity generation to those sectors (that is, transport, industry, residential, commercial and services, and agriculture, fishery, and mining) according to the ratio of electricity consumption to total electricity generation.

Information on energy consumption in the construction sector was available only for 2001. The calculation assumes that the percentage of energy use, by type of fuel, in this sector to total energy consumption remained unchanged from 2001 to 2006. Then, this pattern is applied to 2006's total energy use figure to calculate emissions from the construction sector in 2006. The latest data on cement production is for 2004, obtained from the World Resources Institute's Earthtrends database. CO₂ emissions from cement manufacture are calculated based on the assumption that Panama's cement production in 2006 remains as it was in 2004 (770,000 tons). Approximately 1.835 tons of CO₂ are released for each ton of cement production.

Breakdown of subsectoral energy use is available only in 2001. To calculate emissions and intensity in each subsector for 2006, it is assumed that the energy use pattern in each sector had not changed during 2001–06.

References

- American Water Works Association. 2008.
- ANAM. s/f. "Proyecto de Corredor Biológico Mesoamericano del Atlántico Panameño." CD.
- _____. 2006. "Lineamientos de Política de la ANAM 2004–2009." *Informe de Áreas Protegidas 2006*.
- _____. 2006. Normas Ambientales de Panama. "Por la cual se dicta la Ley General del Ambiente y se Crea la Autoridad Nacional de Ambiente." Publicado en la Gaceta Oficial N° 24,014 de 21 de marzo de 2000.
- _____. <http://www.anam.gob.pa/normasambientales/legislacion.htm>. (May 1, 2008).
- _____. 2006a. "Memoria 2005–2006." Panamá.
- _____. 2006b. "El Sistema Nacional de Áreas Protegidas. Panamá 2006." Informe. Dirección Nacional de Áreas Protegidas y Vida Silvestre. Panamá.
- _____. 2006c. "Indicadores Ambientales de la Republica de Panamá 2006." Panamá.
- ANAM-ACP. 2006. Convenio de Cooperación ANAM-ACP. "Monitoreo de la Cuenca Hidrográfica del Canal de Panamá. Componente de Calidad de Agua. Region Oriental de la Cuenca del Canal."
- _____. 2006. Convenio de Cooperación ANAM-ACP. "Monitoreo de la Cuenca Hidrográfica del Canal de Panamá. Programa de Vigilancia de la Cobertura Vegetal. Región Oriental de la Cuenca del Canal."
- ANAM-USAID. 2008a. Normas Ambientales de Panama. "Por la cual se dicta la Ley General del Ambiente y se Crea la Autoridad Nacional de Ambiente." Publicado en la Gaceta Oficial N° 24,014 de 21 de marzo de 2000.
- _____. <http://www.anam.gob.pa/normasambientales/legislacion.htm>. (May 1, 2008).
- _____. 2008b. Proyecto de Digitalización–Legislación Ambiental de Panamá. Ley 44 de 5 de agosto de 2002. "Que establece el Régimen Administrativo especial de manejo, protección y conservación de las cuencas hidrográficas de la República de Panamá."
- "Año 2006. "Informe del Monitoreo de la Calidad del Aire. Ciudad de Panamá." 2007. Universidad De Panamá. Instituto Especializado De Análisis. Sitio del Instituto especializado de Análisis en Corozal (SIEAC). Laboratorio de Evaluaciones Ambientales "Juan A. Palacios D."
- Ashley, Caroline. 2006. *How Can Governments Boost the Local Economic Impacts of Tourism? Options and Tools*. Overseas Development Institute. London, U.K.
- Autoridad Nacional del Ambiente. No Date. Memoria 2005/2006.
- _____. No Date. Memoria 2004/2005.
- _____. 2002. "Estrategia Nacional del Ambiente – Panamá." Documento Principal. Segunda Edición. Febrero 2002.

- _____. 2004. "Informe del Estado del Ambiente." Geo Panamá.
- _____. 2005. "Conservación para el desarrollo sostenible." Lineamientos de política de la Autoridad Nacional del Ambiente, 2004–2009. Setiembre.
- _____. 2005. "Conservation for Sustainable Development." Environmental National Authority Policy Guidelines, 2004–2009. Panama. September.
- _____. 2007. "Conservación para el Desarrollo Sostenible. Avances y Desafíos."
- _____. 2007. Documentales. "Conservación para el desarrollo sostenible." Río Chiriquí. "Calidad, Conservación y desarrollo." Protejamos el Río Zarati. Río la Villa. "Un proyecto para el futuro."
- _____. 2006. "Indicadores Ambientales de la República de Panamá."
- _____. 2008. Oficina de Planificación de la Política Ambiental. Proyectos GEF.
- Aylward, B. 2002. "Strategic Framework for the Program for the Sustainable Management of the Rural Areas in the Panama Canal Watershed." MIDA/World Bank/FAO Investment Centre of FAO. Consulting Report for MASAR-CHP.
- Bell, C. L. G., and P. B. R. Hazell. 1980. "Measuring the Indirect Effects of an Agricultural Investment Project on its Surrounding Region." *American Journal of Agricultural Economics* 62(1), February.
- Blumberg, K. 2007. "Costs and Benefits of Lower Sulfur Fuels and Improved Vehicles in Central America and the Rest of the World." Quito, Ecuador.
- Brida, J. G., J. S. Pereyra, and M. J. Such Devesa. 2008. "Evaluating the Contribution of Tourism to Economic Growth." Mimeographed.
- Carabias, J., J. de la Maza, and R. Cadena. 2003. "Capacidades Necesarias para el Manejo de Áreas Protegidas." TNC, WCPA, UICN.
- Castillo, Sergio. 2004. "Estudio de Tendencias y Perspectivas del Sector Forestal en América Latina." Documento de Trabajo. Informe Nacional Panama. ANAM-FAO. Rome.
- Castro, Ligia de Doens. No Date. "Estrategia de Gestión Ambiental para el Desarrollo Sostenible 2008–2012." National Environmental Authority (ANAM). PowerPoint Presentation.
- CCAD (Comisión Centroamericana de Ambiente y Desarrollo). 2005. Proyecto Corredor Biológico Mesoamericano. Managua, Nicaragua.
- CELADE. División de Población. 1999. "Latin America Total, Urban and Rural Population and Urban Percentage, by Quinquennium and Countries." Demographic Bulletin N° 63. January. <http://www.eclac.org/celade/publica/bol63/BD6311.html>.
- CICH. 2007. Informe del Estado Ambiental de la Cuenca Hidrográfica del Canal de Panamá.
- _____. 2008a. "Plan de Desarrollo Sostenible y Gestión Integrada de los Recursos Hídricos de la Cuenca Hidrográfica del Canal de Panama. Segundo Borrador." Panama.
- _____. 2008b. Mapas de la Cuenca. <http://www.cich.org/mapas/mapa1.html>, May.

- Cleaner Vehicles Task Force. 2000. "The Report of the Alternative Fuels Group of the Cleaner Vehicles Task Force. An assessment of the Emissions Performance of Alternative and Conventional Fuels." DTI Automotive Directorate, London.
- Coates, A. G. (Ed.). 1997. *Central America: A Natural and Cultural History*. Paseo Pantera Project. Paseo Pantera Project Staff. New Haven: Yale University Press.
- CONADES. 2008. "Actividades Prioritarias de la Cuenca Hidrográfica del Canal de Panamá." <http://www.presidencia.gob.pa/conades/secciones.php?boton=03>, May.
- Consejo Internacional de las Maderas Tropicales. 2004. "Consecución del Objetivo 2000 y la Ordenación Forestal Sostenible en Panamá." Informe de la Misión de Diagnóstico. Japan.
- Consortio TLBG/Universidad de Panamá (TLBG/UP). 2005. "Análisis de Escenario de Desarrollo y Plan Indicativo de Ordenamiento Territorial Ambiental de la Región Occidental de la Cuenca del Canal de Panamá." Elaborado para la Autoridad del Canal de Panamá.
- Consortio TLBG / UP / STRI. 2003. "Estudio de Recopilación y Presentación de Datos Ambientales y Culturales en la Región Occidental de la Cuenca del Canal de Panamá." Informe Final de la Región Occidental de la Cuenca del Canal. <http://www.pancanal.com/esp/cuenca/rocc/>.
- Cordero, Sarah, R. Montenegro, M. Mafla, I. Burgués, and J. Reid. 2006 "Análisis de costo beneficio de cuatro proyectos hidroeléctricos en la cuenca Changuinola - Teribe."
- Curtis, V., and S. Cairncross. 2003. "Effect of Washing Hands with Soap on Diarrhoea Risk in the Community: A Systematic Review." *Lancet Infectious Diseases* 3.
- De Agostini, P., S. Lovo, F. Pecci, F. Perali, and M. Baggio. 2005. "Simulating the Impact on the Local Economy of Alternative Management Scenarios for Natural Areas." Working Paper No. 139.2005. Fondazione Eni Enrico Mattei. Milan.
- "Debilidades de la Extracción Forestal." La Prensa. <http://mensual.prensa.com/mensual/contenido/2007/07/28/hoy/negocios/1062662.html>.
- De la Cruz, Roberto. No Date. "Instrumentos de Gestión Ambiental." National Environmental Authority (ANAM). PowerPoint Presentation.
- Delft Hydraulics. 2004. "Saltwater Intrusion Analysis for Panama Canal Locks. Future Situation: Post-Panamax Locks."
- _____. 2005. "Executive Summary – Saltwater Intrusion Analysis for Post-Panamax Locks. Study, Modeling, and Analysis of Saltwater Intrusion Mitigation Systems for Revised 3-lift Lock Configurations." Contract No. 135358.
- Development Alternatives, Inc. 2005. "Evaluation of USAID's Strategic Objective for the Panama Canal Watershed." Final Report.
- Doan, David B. 1999. "The Mineral Industry of Panama." USGS.
- Donoso, M., C. Vargas, M. Castillero, D. Martinez, K. Leaman, and M. Nakayama. 2000. "Panama Canal Case Study: Impacts and Responses to the 1997–98 El Niño Event." For: Reducing the Impact of Environmental Emergencies through Early Warning and

Preparedness: The Case of the 1997–98 El Niño. *Lessons Learned from the 1997–98 El Niño: Once Burned, Twice Shy?* UNEP/NCAR/UNU/WMO/ISDR Assessment. October.

Dorosh, P., and S. Haggblade. 2003. “Growth Linkages, Price Effects and Income Distribution in Sub-Saharan Africa.” *Journal of African Economies* 12(2).

Elton, Charlotte. 1977. “Panamá: Evaluación de la sostenibilidad nacional.” Charlotte Elton; coordinadora, 1era edición. Panamá: Centro de Estudios y Acción Social Panameño.

ETG (Economic Transformations Group, Inc.). 2002. *Compite Panamá. Diagnostico del Cluster de Turismo*.

Fewtrell, L., and J. Colford Jr. 2004. “Water, Sanitation and Hygiene: Interventions and Diarrhoea – A Systematic Review and Meta-analysis.” HNP Discussion Paper. World Bank, Washington, D.C.

Fundacion Natura. 2008. FONDO USAID-ACP -II Fase (2007–2009). “Fondo Conservación de Biodiversidad de la Cuenca del Canal de Panama.” http://www.naturapanama.org/index.php?option=com_content&task=view&id=13&Itemid=1 (May).

Gaceta Oficial. 1998. Ley 41 de 1 Julio de 1998 por la cual se dicta la Ley General de Ambiente de la República de Panamá y se Crea la Autoridad Nacional del Ambiente. No 23,578 del 3 de Julio.

Giannini, A., Y. Kushnir, and M. A. Cane. 2002. “Interannual Variability of Caribbean Rainfall, ENSO, and the Atlantic Ocean.” *American Meteorological Society Journal Online, Journal of Climate*, 13(2): 297–311 (January).

Globe and Mail. 2008. Canada, February 8.

Harmon, Russell, S. (Ed) 2005. *The Rio Chagres, Panama. A Multidisciplinary Profile of a Tropical Watershed*. Springer, The Netherlands.

Harza, M. W. 2001. “Long-term Forecast for Municipal and Industrial Water Demand and Raw Water Consumption.” Panama Canal Authority Consultant Report #32314.

_____. 2003. “Feasibility Design for the Rio Indio Water Supply Project / Feasibility Study.” Panama Canal Authority Consultant Report # 30817.

Heckadon, Stanley (Ed.). 1999. Sumario del informe final del Proyecto de Monitoreo de la Cuenca del Canal de Panamá (PMCC): “La Cuenca del canal: deforestación, urbanización y contaminación.” Balboa, Panama: Smithsonian Tropical Research Institute (STRS), USAID, and ANAM, p. 120.

Hevia, Juan Carlos Baquero. 2007. “Getting the Deal Through – Panama.” Mining. USGS. Paton, Moreno and Asvat.

<http://mensual.prensa.com/mensual/contenido/2007/10/28/hoy/negocios/1157826.html>.

<http://mensual.prensa.com/mensual/contenido/2007/11/15/hoy/panorama/1175669.html>.

<http://www.drinktap.org/consumerdnn/Home/WaterInformation/Conservation/WaterUseStatistics/tabid/85/Default.aspx>, May.

- Ibáñez, D. R., R. Condit, G. R. Angehr, S. Aguilar, T. García, R. Martínez, A. Sanjur, R. F. Stallard, S. J. Wright, A. S. Rand, and Moreno S. Heckadon. 2002. “An Ecosystem Report on the Panama Canal: Monitoring the Status of the Forest Communities and the Watershed: Environmental Monitoring and Assessment,” 80:65–95.
- IDAAN. 2008. Proyectos. <http://www.idaan.gob.pa/>, May 1.
- “Informe de la Comisión Interinstitucional y Multidisciplinaria sobre Deforestación.” 1993. Panamá.
- International Resources Group, Ltd. 2000. “Manejo Integral de la Cuenca del Canal de Panamá. El Papel de la Comisión Inter-Institucional de la Cuenca Hidrográfica (CICH).” Report submitted to Panama/USAID Task Order No. 831 Contract No. PCE-I-00-96-00002-00. Septiembre.
- INTRACORP. 2007. “Estudio de la Migración Rural-Urbana, Hacia la Región Metropolitana y Areas Aledañas, como Posible Efecto del Proyecto de Ampliación del Canal.” Informe Final. Presentado a la ACP.
- IPAT (Instituto Panameno de Turismo). 2008. *Sustainable Tourism Masterplan*. Draft.
- IPCC. 2007. Fourth Assessment Report, Working Group II.
- ITDG (Intermediate Technology Development Group). 2004. *Smoke – The Killer in the Kitchen: Indoor Air Pollution in Developing Countries*. United Kingdom: ITDG.
- IUCN (The World Conservation Union). 2002. “Panama, Compete. Diagnostic of the Cluster of Sustainable Tourism in Protected Areas.” Guidelines for Planning and Management.
- _____. 2002. *Sustainable Tourism in Protected Areas. Guidelines for Planning and Management*.
- Larsen, B. 2004a. “Cost of Environmental Degradation: A Socio-Economic and Environmental Health Assessment in Damietta, Egypt.” Prepared for SEAM II, Cairo, Egypt.
- _____. 2004b. “Columbia. Cost of Environmental Damage: A Socio-Economic and Environmental Health Risk Assessment.” Final Report. Prepared for the Ministry of Environment, Housing and Land Development of Republic of Colombia.
- _____. 2005. “Cost of Environmental Damage: Analysis by Department.” Prepared for MAVDT, Colombia.
- Marielos, Alfaro. 2002. “Estudio de Tendencias y Perspectivas del Sector Forestal en América Latina.” Informe Subregional. Centroamerica y Mexico. Rome: FAO.
- Ministerio de Economía y Finanzas. 2007. Decreto Ejecutivo No. 33. *Por el cual se aprueba la Política Nacional de Supervisión, Control y Fiscalización Ambiental sus principios, objetivos y líneas de Acción*, 26 de febrero.
- _____. 2007. Decreto Ejecutivo No. 34. *Por el cual se aprueba la Política Nacional De Gestión Integral De Residuos No Peligrosos y Peligrosos, sus principios, objetivos y líneas De Acción*, febrero.
- _____. 2007. Decreto Ejecutivo No. 35. *Por el cual se aprueba la Política Nacional de Cambio Climático, sus principios, objetivos y líneas de Acción*, 26 de febrero.

- _____. 2007. Decreto Ejecutivo No. 36. *Por el cual se aprueba la Política Nacional de Producción Más Limpia, sus principios, objetivos y líneas de Acción*, 1 de marzo.
- _____. 2007. Decreto Ejecutivo N° 82. *Por el cual se aprueba la Política Nacional de Descentralización de la Gestión Ambiental, sus principios, objetivos y líneas de Acción*, 9 de abril.
- _____. 2007. Decreto Ejecutivo N° 83. *Por el cual se aprueba la Política Nacional de Información Ambiental sus principios, objetivos y líneas de Acción*, 9 de abril.
- _____. 2007. Decreto Ejecutivo N° 84. *Por el cual se aprueba la Política Nacional de Recursos Hídricos, sus principios, objetivos y líneas de Acción*, 9 de abril.
- Ministerio de Vivienda. 2007. “Estimación del Déficit Habitacional por Provincia.” República de Panamá. Dirección. Tabla. General de Planificación y Presupuesto.
- MOP (Ministerio de Obras Publicas). 2008. Autopista Panama-Colón. http://www.mop.gob.pa/Autopista_Panama_Colon.htm, May.
- Panama Living Standards Measurement Survey (*Encuesta Nacional de Vida*). 2003.
- PAHO (Pan-American Health Organization). 2006. *Atlas of Health in Latin America*. Washington, D.C.
- PCA (Panama Canal Authority). 2006a. Plan Maestro del Canal de Panamá.
- _____. 2006b. “Proposal for the Expansion of the Panama Canal. Third Set of Locks Project.”
- _____. 2008. “Sexto Informe Trimestral de Avance de los Contratos del Programa de Ampliación.” 31 de Marzo.
- PMCC. 1999. “Panama Canal Watershed Monitoring Project. Final Report.” Panama: U.S. Agency for International Development, Autoridad Nacional del Ambiente, Smithsonian Tropical Research Institute.
- PNUMA–CEPAL. 2001. “La Sostenibilidad del Desarrollo en América Latina y el Caribe: Desafíos y Oportunidades.” LC/G2145(CONF.90/3). 5 de octubre.
- PROARCA-UICN. 2005. “Centro América en el Límite Forestal. Desafíos para la Implementación de las Políticas Forestales en el Istmo.” Costa Rica.
- Rabl, A. 2000. “Criteria for Limits on the Emission of Dust from Cement Kilns that Burn Waste as Fuel.” Centre D’Energetique, Paris.
- “Resultados de encuesta Dichter & Neira.”
<http://mensual.prensa.com/mensual/contenido/2007/06/23/hoy/panorama/1025703.html>.
- Shibuya, K., C. Mathers, and A. Lopez. 2001. “Chronic Obstructive Pulmonary Disease (COPD): Consistent Estimates of Incidence, Prevalence, and Mortality by WHO Region.” Global Programme on Evidence for Health Policy. World Health Organization. November.
- Sierra Research. 2000. “A Comparative Analysis of the Feasibility and Cost of Compliance with Potential Future Emission Standards for Heavy-Duty Vehicles Using Diesel or Natural Gas.” Sierra Research Inc., Sacramento, California.

- Singh, D. R., A. Birch, and H. McDavid. 2006. "Impact of the Hospitality-Tourism Sector on the Jamaican Economy, 1974–1993: An Input-Output Approach."
- "Sistema de Consultas de Estadísticas de Comercio Exterior." Contraloría de la República: http://www.contraloria.gob.pa/dec/Comercio_Exterior/.
- Stallard, R. F., and D. A. Kinner. 2002. "Soil Avalanching, Erosion, and the Effects of Deforestation in the Panama Canal Basin." Presentation in Session: Watershed Processes within Tropical Montane Catchments." Geological Society of America Annual Meeting, Denver. Proceedings.
- TNC. 2008. Chagres/ Panama Watershead. <http://www.parksinperil.org/wherewework/centralamerica/panama/protectedarea/chagres.html>, May.
- Veiga, Marcell. 2001. "Mining with Communities." Elsevier Science Ltd.
- Water Systems Council. Wellcare. 2002. "Information for You about Total Dissolved Solids (TDS)." http://www.watersystemscouncil.org/vaiwebdocs/wscdocs/2010920tds_final.pdf, April 29.
- WHO (World Health Organization). 2001. "Global Burden of Disease 2001." Washington, D.C.
- World Bank. 2006. "Republic of Colombia: Mitigating Environmental Degradation to Foster Growth and Reduce Inequality." World Bank, Washington, D.C.
- _____. 2007. "Panama Poverty Assessment: Toward Effective Poverty Reduction."
- _____. 2007. "Republic of Peru: Environmental Sustainability: A Key to Poverty Reduction in Peru." Washington, D.C.
- WTO (World Trade Organization). 2007. "Trade Policy Review by the Secretariat. Panama. Revision." Report No. WT/TPR/S/186/Rev.1. Geneva.
- Zhang, J., B. Madsen, and C. Jensen-Butler. 2008. "Regional Economic Impacts of Tourism: The Case of Denmark." *Regional Studies* 41(6):839–853.