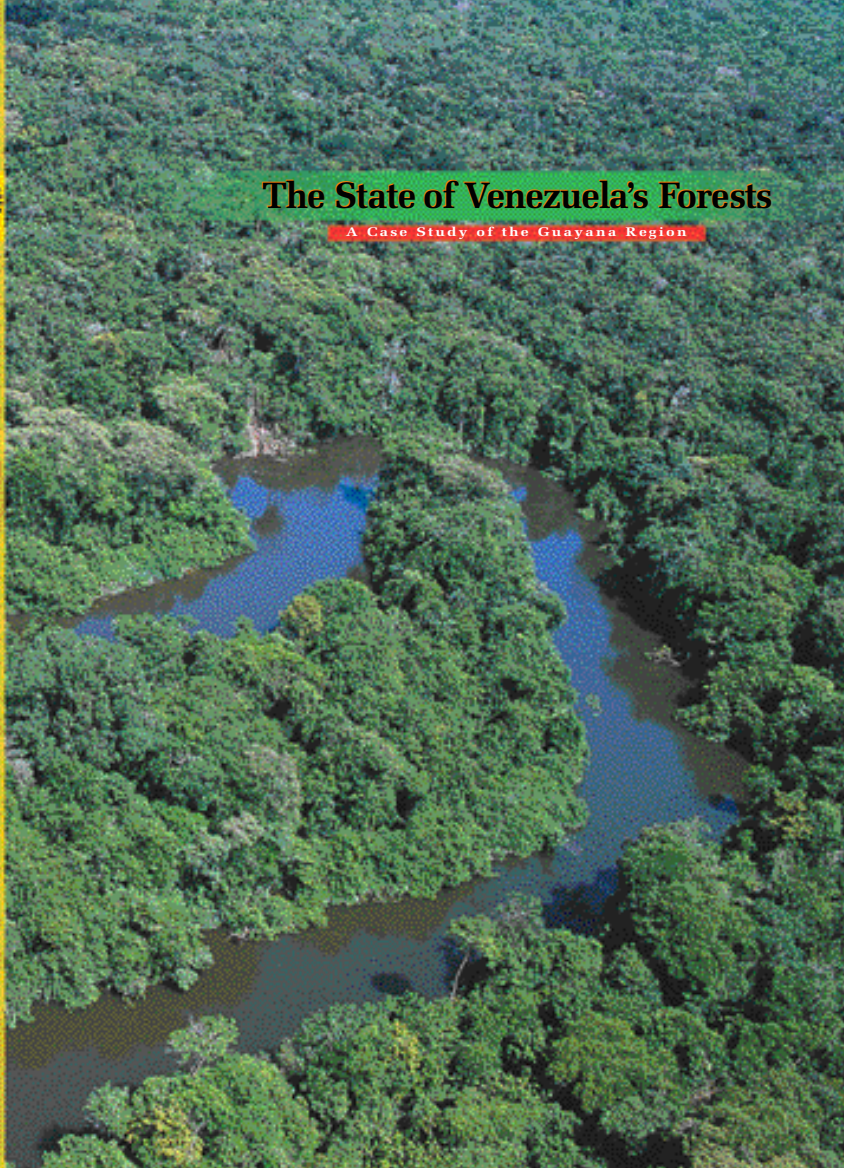
The State of Venezuela's Forests

A Case Study of the Guayana Region



GLOBAL FOREST WATCH

The State of Venezuela's Forests: A Case Study of the Guayana Region • GLOBAL FOREST WATCH

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A Case Study of the Guayana Region

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FUNDACIÓN POLAR IS A NONPROFIT INSTITUTION FOUNDED IN 1977 BY EMPRESAS POLAR. IT WAS CREATED TO SUPPORT AND PROMOTE SUSTAINABLE INITIATIVES THAT CONTRIBUTE TO IMPROVE THE QUALITY OF LIFE AND STRENGTHEN THE VENEZUELAN SOCIETY.

TO FULFILL ITS MISSION AND ACHIEVE THE OBJECTIVES IT HAS SET ITSELF, FUNDACIÓN POLAR WORKS WITHIN EIGHT SPHERES OF ACTION: AGRICULTURE, ENVIRONMENT, SCIENCE, FOOD SYSTEM, ECONOMICS, CULTURE, EDUCATION AND COMMUNITY DEVELOPMENT, VENEZUELAN HISTORY AND HEALTH AND SOCIAL WELFARE.

Presentation

Man has become increasingly aware of the absolute need to preserve nature, and to respect biodiversity as the only way to assure permanence of life on Earth. Thus, it is urgent not only to study animal and plant species, and ecosystems, but also the inner harmony by which they are linked.

Venezuela, and mainly the Guayana region, has forest areas that offer multiple opportunities for sustainable development. In a way, we have the responsibility, that even surpasses national frontiers, to make this region become an important worldwide conservation element. And there are many risk factors that contribute to minimize the environmental characteristics of this strategic area, among them: indiscriminate logging, mining, agriculture, and population pressures. It is, therefore, necessary to study and record complete and updated information on this subject.

The book that we are hereby presenting is the result of the study carried out by member institutions of the Global Forest Watch Venezuela and the World Resources Institute (WRI), who focused on Guayana as the "Venezuelan last frontier forest." We trust this book will be welcome by the people responsible of the decision making issues that affect this important area of our national territory.

Leonor Giménez de Mendoza

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Approximately half of the forests that initially covered our planet have been cleared, and another 30 percent have been fragmented, degraded, or replaced by secondary forest. Urgent steps must be taken to safeguard the remaining fifth, located mostly in the Amazon Basin, Central Africa, Canada, Southeast Asia, and Russia. As part of this effort, the World Resources Institute in 1997 started Global Forest Watch (GFW).

Global Forest Watch is identifying the threats weighing on the last frontier forests –the world's remaining large, relatively undisturbed forest ecosystems. By 2005, our goal is to have Global Forest Watch chapters up and running in 21 countries. These nations account for about 80 percent of the world's remaining forests. In the longer term, GFW monitoring will extend to nonfrontier forest regions, where ongoing development threatens smaller tracts of unique, and often highly diverse, natural forests.

GFW is an independent network of national and/or local organizations that monitor and map logging, mining, road building and other forest development within major forested regions of the world. Each organization gathers and reports similar information, with an emphasis on comparable, preferably mapped information that covers entire forest ecosystems.

We also recognize that forests straddle political boundaries. At the global level, we hope that the publication of national reports using comparable data and mapping techniques will provide, in the aggregate, a valuable picture of global trends in development activities and environmental conditions in the world's forests.

GFW's principal role is to provide access to better information about development activities in forests and their environmental impact. By reporting on development activities and their impact, GFW fills a vital information gap. By making this information accessible to everyone, including governments, industry, NGOs, forest consumers, and wood consumers, GFW promotes both transparency and accountability. We are convinced that better information about forests will lead to better decisionmaking about forest management and use, which ultimately will result in forest management regimes that provide a full range of benefits for both present and future generations.

To this end, GFW (i) tracks existing and planned development activities, (ii) identifies the actors –including companies, individuals, government agencies, and others– engaged in this development, (iii) monitors the implementation of laws and regulations established in the interest of forest stewardship, and (iv) provides data on forest ecosystems to highlight the environmental and economic trade-offs that development options entail.

GFW is an information service. Our mandate is strictly limited to providing objective, credible, peer-reviewed data and making that information widely available.

All Global Forest Watch publications are available from the World Resources Institute as well as on our website at www.globalforestwatch.org.

Global Forest Watch Venezuela (GFW Venezuela) is an affiliate of the international Global Forest Watch program. It is currently composed of four Venezuelan nongovernmental organizations (NGOs): Asociación Venezolana para la Conservación de Áreas Naturales (ACOANA), Fundación para la Defensa de la Naturaleza (FUDENA), Provita, and Universidad Nacional Experimental de Guayana (UNEG). The national network relies on the input and advice of experts representing NGOs, government agencies, universities, and other research institutions. These experts are brought together in national workshops to comment on the development of indicators, product design, and content. The GFW International network, with help from other partners, provides technical support for GFW Venezuela, with the goal of building capacity for independent, locally driven monitoring and reporting within the country.

All data presented in this report are available at www.globalforestwatch.org or by contacting the authors directly.

Foreword

Forests help to slow global warming, because they store vast quantities of carbon. They control flooding, purify water, and cycle nutrients and soil, ultimately influencing food production for billions of people. And they house an incredible array of living organisms that provide the genetic material for valuable new products and a foundation for the resilience of natural systems. Until recently, there were few systematic data on the condition of the world's forests. No-one knew how much forest had been lost, or how much remained as large, intact, and fully functioning natural ecosystems –frontier forests.

This report, *The State of Venezuela's Forests: A Case Study of the Guayana Region* is the first Global Forest Watch product to examine the state of forests in the Guiana Shield region, one of the world's most important forest frontier regions. Launched by the World Resources Institute in 1998, Global Forest Watch (GFW) is a remarkable new alliance that unites nongovernmental organizations (NGOs), universities, scientific researchers, and local leaders from forested countries around the world. GFW links satellite imagery with on-the-ground investigation by local groups to assemble powerful information about the risks to the world's great forests, and then uses the Internet to make the information widely available.

Until now forest monitoring efforts have tracked deforestation and forest degradation after it has happened. Once a frontier forest has been cleared or degraded, critical values are lost, and it is generally too late to manage the impacts. GFW provides early warning data on forest development and the environmental and economic trade-offs development entails. GFW empowers local organizations to monitor and report on their forests, assisting growing civil society institutions to gain access to remote sensing technology and the power of the Internet. These organizations are connected to a worldwide network of partners bound together by a commitment to accurate information and open dialogue about forest management. Grounded in the idea that more public information helps create better outcomes, GFW aims to become an independent source of timely and practical information on who is developing forests, where, and how.

In 2000, Global Forest Watch partners in Cameroon, Canada, and Gabon published reports on the state of their nation's forests. Based on maps of forest cover and development, these reports documented the values of forests in Africa and North America, identified the location and ownership of logging concessions, and examined the capacity of governments to adequately monitor large-scale development in forests. Each report revealed the extent to which the lack of high-quality, publicly available information impedes effective forest management.

The Global Forest Watch-Venezuela project builds on previous research conducted by WRI and its partners in Venezuela, which resulted in the publication in 1998 of *All That Glitters is Not Gold: Balancing Conservation and Development in Venezuela's Frontier Forests*. In that report, we examined forest and mining policies in the Guayana region of Venezuela, cautioning that further large-scale development in the country's most biologically diverse forest ecosystems should seek to maintain other non-extractive values provided by these forests at a local and national level.

The State of Venezuela's Forests: A Case Study of the Guayana Region both confirms our findings from previous research, and provides new, previously unpublished data on development activities in the country's largest block of forests. Our Venezuelan partners have documented the rich biological diversity harbored in forests of the Guayana region. However, these forests are under threat from large-scale development activities and population pressures. While a significant proportion of the forests are protected as national parks and natural monuments, uncertainties regarding protected area boundaries and overlaps with other areas designated for extractive uses mean that fragile ecosystems could be opened for large-scale extractive activities. Our partners sought to compile the best available data on the forests of the Guayana region. However, information on the Guayana region is lacking, and even basic cartographic data are not available for some areas. This lack of information is one of the most serious threats to forest conservation in the Guayana region, as it precludes sound planning and management.

GFW seeks to make information available rapidly to an ever wider audience by providing forest information and maps on-line and developing a state-of the-art website (www.globalforestwatch.org) to post results from its multiple field activities in Cameroon, Canada, Chile, Gabon, Indonesia, Russia, the United States, and Venezuela. Reports, maps, and information from credible sources will be available for downloading. Anyone with access to the Internet can consult GFW data and contribute by providing information or views directly on-line. We hope that the array of products and activities will lead to a more constructive dialogue between forest managers and users at the local, national, and international levels.

Global Forest Watch would like to thank the following donors for their overall support of Global Forest Watch activities: AVINA, IKEA, the Turner Foundation, UK Department for International Development (DFID), the Netherlands Ministry of Foreign Affairs.

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Jonathan Lash

President
World Resources Institute

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Contents

List of Figures, Maps, Tables and Boxes

Figures

Maps

Tables

Boxes

Glossary

Ecological diversity: For the purposes of this report, ecological diversity refers to patterns of variety and relative abundance of ecological groups across spatial and temporal scales in the natural world. Criteria for defining diversity include food preferences (frugivores, carnivores, insectivores, nectarivores, etc.), strategies for the use of space (terrestrial, arboreal, flying, etc.), and the choice of roosts, among others.

Enrichment strip planting: A silvicultural management practice applied by loggers after selective harvesting. Corridors measuring approximately 3 to 5 meters wide are cut through the remaining forest every 30 to 50 meters. Loggers plant saplings of native or exotic species to stimulate re-growth of valuable commercial species in the forest.

Greenstone belt: A large geological formation spanning up to 250 kilometers. Occurring in ancient volcanic and sedimentary basins, greenstone belts are indicative of potential gold mineralization.

Guayana region: The southern half of Venezuela, including Delta Amacuro, Bolívar, and Amazonas States (see Map 1).

Guiana Shield: An ancient geological formation which spans the countries of French Guiana, Suriname, Guyana, Venezuela, and parts of Brazil and Colombia.

Guyana: An independent nation bordering Venezuela to the east.

IUCN Protected Areas I-VI: A global classification system of protected areas developed by the IUCN (World Conservation Union), which groups protected areas according to management objectives. The classification systems ranges from nature preserves and wilderness areas (categories Ia and Ib) to national parks (category II), natural monuments (category III), habitat/species management area (category IV), protected landscapes and seascapes (category V), and managed resource protected areas (category VI). The categories generally range in degree of human activity allowed, with category I being the most restrictive and category VI being the least restrictive.

"Junior" mining company: A mining company of limited capital ($10 to $50 million) that focuses primarily on exploration and, to a limited extent, extraction activities. Once a junior company discovers an economically viable deposit, it usually enters into a joint venture partnership to develop the deposit or sells it to a larger company for development.

Llanos: A landscape designation roughly corresponding to a plain. The Venezuelan llanos cover most of the country's land north of the Orinoco River and include a variety of vegetation types, including grasslands and forests in the northwestern part of the country (see Map 1).

Protected areas for natural resource use: Areas protected for sustainable natural resource uses, including logging and other extractive uses. Encompassing IUCN (World Conservation Union) categories V and VI, these areas in Venezuela include forest reserves, forest areas under protection, forest lots, biosphere reserves, and protected zones. In this study, wildlife reserves are also included under this definition because their primary objective is wildlife use, although they are listed as IUCN category IV.

Protected areas: All areas protected for conservation, recreation, and sustainable natural resource use, as defined by IUCN (World Conservation Union) categories I through VI. In this report, protected areas also include national hydrological reserves, which are not included in the IUCN protected areas categories but are protected under Venezuelan law for the conservation and sustainable use of watersheds. In addition, this study includes forest lots (*lotes boscosos*) because these areas are designated for logging, although they are not technically part of Venezuela's protected areas network.

Strictly protected areas: Areas protected for conservation purposes, as defined by the IUCN (World Conservation Union) Categories I through IV. In Venezuela, these correspond to national parks, natural monuments, and wildlife refuges. Logging and mining are not allowed in strictly protected areas.

Reduced-impact logging: Logging practices that seek to reduce the impact of logging on forests, namely by limiting road building and skidder trails, mapping the location of trees to be harvested, and felling trees in a direction that minimizes damage to surrounding stands.

Taxonomic diversity: The richness in numbers of taxonomic components (species, genus, family, etc.) in a given community, ecosystem, or locality.

Tepui: A unique table-top mountain found only in the Guiana Shield. The summits of these mountains may reach up to more than 2,500 meters in altitude and contain many plants and animals found nowhere else in the world.

Acronyms

ABRAE: Áreas Bajo Régimen de Administración Especial (Venezuela's protected areas network)

AVHRR: Advanced Very High Resolution Radiometer

CVG: Corporación Venezolana de Guayana

FAO: Food and Agriculture Organization of the United Nations

GFW: Global Forest Watch

IUCN: World Conservation Union

MARN: Ministry of Environment and Natural Resources (formerly Ministry of Environment and Renewable Natural Resources –MARNR).

MEM: Ministry of Energy and Mines

NOAA: U.S. National Oceanic and Atmospheric Administration

TREES: Tropical Ecosystem Environment Observations by Satellites Project

WRI: World Resources Institute

Key Findings

Venezuela is still home to large tracts of intact forest, which offer tremendous opportunity for conservation and sustainable development.

- Approximately half of the country is forested, and most of the forests can be found south of the Orinoco River in the Guayana region.
- Approximately one fifth to one third of the country's forest land is protected for conservation purposes.
- Forest ecosystems of the Guayana region are home for much of the country's wildlife and other non-timber forest species, which help sustain the livelihoods of indigenous peoples.

Forests of the Guayana region are at risk from logging, mining, agriculture, and population pressures.

- Colonization of the forest by small-scale farmers and miners represents the greatest pressure on forest ecosystems of the Guayana region.
- Population pressures and conflicts in land use create the potential for forest loss. Logging, mining, agricultural communities, and indigenous settlements overlap throughout Bolívar State, and especially in the Imataca Forest Reserve.
- Current logging and mining practices promote forest degradation and, where population pressures are high, facilitate deforestation in the Guayana region.
- The legal status is unclear for half of the area protected for conservation purposes in the Guayana region. This lack of clarity results from overlaps between protected areas with conflicting objectives and uncertainty regarding protected area boundaries established in official documents.

Basic data on Venezuela's forest ecosystems are out-of-date or incomplete. Key forest ecosystems may disappear before scientists have an opportunity to study them.

- Venezuela has not conducted any forest inventories and the most recent publicly available vegetation map at a national scale was produced in 1983.
- Official records do not accurately identify the location or ownership of mining concessions. The most recent database is over five years old.
- Venezuela lacks basic cartographic data, especially for the Guayana region, where accurate and complete topographic maps are not publicly available.

Venezuela's forests include much of the country's biological diversity and its indigenous peoples. Spanning a wide range of ecosystems, these forests have long been used by local populations to satisfy subsistence needs and wood production at a national level.

Beginning in 1999, the Global Forest Watch Venezuela team set out to document the state of the country's forests, identifying values associated with, and threats to, forest ecosystems. The team focused data collection efforts around a series of themes that included forest cover, protected areas, wildlife, non-timber forest product use, logging, mining, and populations. The scope of each theme was limited by the availability of data, the expertise of team members, available resources, and time. This analysis was meant to complement and update earlier research published in the WRI publication *All That Glitters is Not Gold: Balancing Conservation and Development in Venezuela's Frontier Forests*, as well as to provide an initial overview of forest ecosystems primarily focusing on the Guayana region of Venezuela. As such, this is only the beginning of future monitoring efforts planned by GFW Venezuela.

This analysis is focused primarily on the Guayana region (see Map 1). Located south of the Orinoco River, the Guayana region comprises the largest remaining block of intact forests in Venezuela. While many forest fragments in the country's northern half are more threatened, GFW Venezuela chose to begin its forest monitoring activities south of the Orinoco River, because these ecosystems offer the greatest opportunity for long-term sustainable management.

This report addresses the following questions:

- What is the extent of Venezuela's forests and how well are forest ecosystems protected?
- Why are forests in the Guayana region important?
- Where are development activities occurring and how do they impact the forests and indigenous communities of the Guayana region?
- What are the economic benefits of these activities and who are the beneficiaries?
- What are the forest regulations and laws, and are they being followed?

The analysis is organized in thematic chapters, which seek to balance the benefits provided by forests with the potential costs of large-scale economic development. Each chapter includes a series of questions used to address the theme. Maps, graphics, and other indicators provide underlying data for each question.

Our results show that the forests of the Guayana region are relatively intact and a significant proportion is protected for conservation purposes. These ecosystems are among the most culturally and biologically diverse in Venezuela, harboring most of the nation's biodiversity and indigenous peoples. To date, population and development pressures in neighboring Amazonian countries, such as Brazil, have resulted in higher rates of deforestation than that experienced in the Venezuelan Guayana region. Thus Venezuela is faced with a unique opportunity to maintain one of the world's largest tracts of forest intact for future generations.

However, the forests of the Guayana region are experiencing considerable change. The most serious potential threats to forest conversion are from agricultural encroachment, ranching, and small-scale mining. These threats are exacerbated by recent increases in population, changes in settlement patterns, road building, and the allocation of logging and mining concessions in otherwise intact forests, which contribute to increased pressure on and access to these forests. Furthermore, incompatible land uses overlap with one another, creating the potential for conflict at the expense of the integrity of the forests.

GFW Venezuela has attempted to collect the best available data to document these trends. However, there is a lack of basic data and information on the forests of the Guayana region. While northern Venezuela has been relatively well researched, much of the Guayana region lacks even basic cartography such as detailed topographic maps and an accurate hydrology map. The lack of data is especially problematic because it precludes sound planning and informed decision making.

Access to data and information is also a problem. Important information on forest cover, the status of mining concessions, compliance with environmental permitting, and sanctions against both mining and logging concessions are either not available or considered confidential. This makes it difficult for citizens to hold those that own and manage forest resources, such as companies and government officials, accountable for their decisions. Even GFW Venezuela's requests for basic cartographic data (such as the official territorial boundary) have not been answered to date.

The Guayana region represents the last major forest frontier in Venezuela. The results of this report outline the early stages of a development trend that could lead to significant deforestation in the absence of immediate action. Decision makers in the Guayana region face a considerable challenge to generate sound development strategies that both ensure the sustainable use of natural resources and improve the livelihoods of local populations.

CHAPTER 1

An Overview of Venezuela's Geography, Population, Economy, and Forest Legislation

Geography

Venezuela has a land area of approximately 890,000 square kilometers, of which half is forested. Venezuela can be divided into three physical regions:

• *The coastal and Andean mountain chains* have maximum altitudes ranging from 2700 meters (near the coast) to over 5000 meters (in the Andean highlands) above sea level. Vegetation in the mountain region varies from cloud forests to alpine scrub (*páramos*), including mountain savanna and xerophytic ecosystems.

• *The Orinoco plains* encompass much of the central part of the country north of the Orinoco River and reach 250 meters above sea level. This region covers approximately one fifth of the national territory and includes dry savanna shrub land and evergreen and semi-deciduous forests in the Western plains (*llanos*) closest to the Andean mountain range.

• *The Guayana region* is the largest of the three physical divisions, consisting of half of the national territory. Characterized by a diverse topographical landscape (from sea level to over 3000 meters above sea level), this region is comprised primarily of evergreen forests, especially in the south. Semi-deciduous forests can be found in the north, near the Orinoco River; and savanna vegetation dominates near the Guri Reservoir and in the southeast, near the border of Brazil and Guyana.

The Guayana region is part of the larger Guiana Shield, an ancient geological structure covering parts of Colombia, Brazil, Venezuela, Guyana, Suriname, and French Guiana. The Venezuelan Guayana region is characterized by unique geological features known as *tepuyes*, or table-top mountains, which can reach above 2000 meters in altitude. Many plant species living on the tops of these mountains are found nowhere else in the world.

Country boundaries for Venezuela from National Imagery and Mapping Agency and Centro de Procesamiento Digital de Imágenes (CPDI). See Annex 1 for futher source information.
*According to the Geneva Agreement of February 7, 1966, Venezuela claims two-thirds of the territory of Guyana.

Venezuela's population consists of approximately 24 million inhabitants, of which more than 85 percent live in urban areas north of the Orinoco River (see Map 1). The country's average population density is twenty-six people per square kilometer. In comparison, the Guayana region is sparsely populated. As of 1990, approximately one million people lived in this region, with a density of about two people per square kilometer.[1]

In the past, urbanization has served to benefit the forests of the Guayana region by concentrating the majority of the nation's people in towns and cities along the coast.[2] However, Venezuela's recent economic crisis has resulted in increased pressure on the forests. The decline of opportunities in northern cities has led to a mass migration of people into the Guayana region forests to seek new opportunities (see Chapter 4, Question 11).[3]

Twenty-eight indigenous groups live in Venezuela, and in 1992 they represented 1.5 percent of the total population.[4] Over 80 percent of these groups live in the forests of the Guayana region, comprising about one tenth of the region's population. Non-indigenous populations in the Guayana region include small-scale farmers, military troops, miners, logging employees, and service providers (e.g., tourist operators and merchants).

Settling primarily along major rivers, indigenous communities are relatively small, with anywhere from four to 1,100 inhabitants per community (see Map 2). Most communities have fewer than one hundred inhabitants. Larger communities provide important services, such as health care, schools, and other infrastructure. Because smaller settlements lack these services, indigenous peoples living in small settlements rely strongly on larger settlements for access to infrastructure and markets.

A few non-indigenous settlements are located in forests, mostly near rivers and roads. These settlements tend to function as isolated enclaves within indigenous territories. Small-scale miners are the most mobile of the non-indigenous populations, as they tend to follow gold and diamond strikes. However, some mining communities have become stable over time, acting as service centers for miners and their families. In these settlements, miners can obtain access to schools, telecommunications, and health care, among other services. Such settlements facilitate the dispersal of non-indigenous populations further into the forest.

MAP 2 **Settlements in the Forests of the Guayana Region**

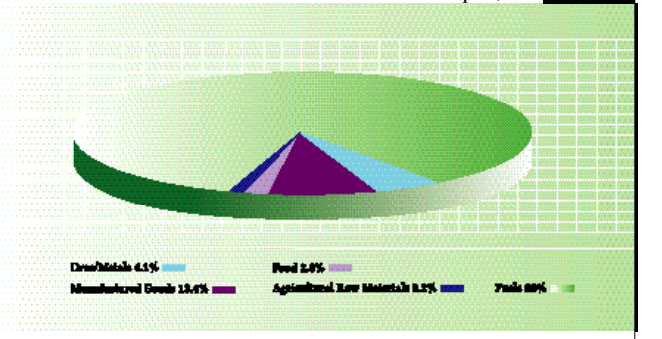
Agriculture, indigenous, mining, tourist, and other settlements as well as encampments and services centers have less than 2500 people. See Annex 1 for source information.
*According to the Geneva Agreement of February 7, 1966, Venezuela claims two-thirds of the territory of Guyana.

The country's forests provide an array of economic, social, and ecological services that are of vital importance to the nation's economy and culture. For example, forested watersheds in the Guayana region help regulate the flow of water for the Guri Dam, which provides almost three quarters of the nation's electricity.[5] Venezuela's forests also harbor many species of plants and animals, which are important sources of food, medicine, and construction materials for forest dwelling communities.

The Venezuelan economy is highly dependent on petroleum income, which generated 27 percent of GDP in 2000 and is a significant source of growth for the manufacturing and services sectors.[6] Fuel exports make up 80 percent of export revenues (see Figure 1). Logging contributes little to the national economy, providing less than one percent of Venezuela's GDP.[7] Mining also contributes little to the national economy, although Venezuela is an important producer of some metals, such as iron ore and aluminum.

The decline in oil prices in the mid- to late-1980s resulted in increased pressure on the nation's forests. A stronger emphasis was placed on developing the southern half of the country, particularly for gold and diamond mining.[8] A combination of low gold prices and higher petroleum prices slowed industrial development in this region in 2000, but the Venezuelan government continues to express an interest in increased mining exploitation.

Venezuela's Exports, 1997 **FIGURE 1**



Source: Inter-American Development Bank, *Basic Socio-Economic Data for 21 December 2000,* (Washington, DC: IADB, 2001).

Forest Legislation and Institutions

As the first country in Latin America to establish an environment ministry (1977), Venezuela has a long history of environmental awareness. Over the last fifty years, the wealth generated from oil has allowed the country to develop the most extensive protected areas system in Latin America.

Venezuelan laws are organized hierarchically, with the constitution representing the highest order of law, followed by framework laws, ordinary laws, presidential decrees, and ministerial resolutions (see Table 1). The latter are generally established to set norms for implementing specific laws.

Venezuelan legislation has long recognized the importance of maintaining forest cover for the health of watersheds, especially given the arid nature of much of the northern half of the country. Major legislation linking forest conservation with watershed protection dates back to 1965, when the Forest, Soils and Water Law (*Ley Forestal de Suelos y de Aguas*) was passed. Subsequent decrees have prohibited activities that can have negative impacts on watersheds, especially mining (e.g., Decree 269). Many of the country's protected areas, the largest of which are located in the Guayana region, were created to protect watersheds and to guarantee the nation's supply of water and electricity. For example, Canaima National Park was extended to include the greater Caroní River basin, precisely to protect the source of hydropower for the Guri reservoir.[9] However, evidence presented in this report suggests that Venezuela's positive history of enacting environmental legislation has not necessarily been followed by successful implementation.

In 1998, the Venezuelan people elected a new president, who by popular referendum created a Constitutional Assembly of elected representatives, whose task was to re-write the Venezuelan constitution.[10] The new constitution reaffirms the state's commitment to ensuring a clean and healthy environment for its current and future citizens. It also recognizes the access rights of indigenous communities to information regarding the use of natural resources in their territories, which was not acknowledged in the previous constitution. Environmental laws created under previous administrations remain in force.

A key campaign promise of the new administration was to annul a controversial presidential decree that zoned a major forest reserve entirely for logging and mining activities (see Box 1). Following the election, officials of the Ministry of Environment announced their intent to annul this decree,[11] but as of August 2001 this has not occurred.

In the Guayana region, natural resources management falls under the purview of three institutions: the Ministry of Environment and Natural Resources (MARN), the Ministry of Energy and Mines (MEM), and the Corporación Venezolana de Guayana (CVG) –a state-owned development corporation. The Forest Service, Wildlife Service, Parks Service, Planning and Zoning Department, Cartography, and Vegetation Department are all part of the Ministry of Environment. In addition, monitoring the use of natural resources is primarily the responsibility of the Ministry of Environment, although the National Guard plays a role in enforcing laws.

In 1998, the Venezuelan Forest Service (SEFORVEN) was re-named the Forest Resource Department (*Dirección General de Recursos Forestales*) and downgraded from a semi-autonomous service to a department within the Ministry of Environment. Under new leadership, the Forest Resources Department has emphasized community involvement in forest management. A key component of this new direction is the creation of a "Management of Environmental Conflicts Unit," which seeks to implement community forestry and to address on-going population conflicts in forest reserves.[12] As of mid-2001, the scope of this unit was not yet clear, nor was it apparent how local communities would be involved in the management of forest reserves.

In 1999, the president issued Decree 369, partially revising the Framework Law of Central Administration by redefining the roles and responsibilities of several government entities. Article 33 of the Decree 369 states that the mandate of the Ministry of Production and Commerce's (MPC) is to plan and execute activities related to the "development and protection of commercial agricultural production… ranching, fishing, and forestry; food security, agrarian reform and the rural cadastre, in coordination with the Ministry of Environment."[13]

However, Article 39 of Decree 369 assigns forestry duties to the Ministry of Environment: "The Ministry of Environment is responsible for regulation, formulation, and monitoring of environmental policy in the Venezuelan state [and] … the management and control of forest resources…"[14] The question of which Ministry has final responsibility for the management of forest resources was put before the Attorney General, whose ruling on the matter had not been made public as of August 2001. For the time being, the Forest Resources Department remains the responsibility of the Ministry of Environment. But if the new law is interpreted to mean that the Forest Resources Department falls under the responsibility of the Ministry of Production and Commerce, it would be a shift in policy that would place more emphasis on the commercial value of wood and less on the sustainable management of forests for other ecosystem values.

TABLE 1 **Primary Legislation Relevant for Protection of Venezuela's Forests and Forest Peoples (in order of legal hierarchy)**

Legal Instrument	Year	Relevance
Constitution of the Bolivarian Republic of Venezuela	1999	•Recognizes the right of all individuals to a safe and healthy environment. •Recognizes the right of indigenous communities to prior informed consent with regard to the use of natural resources in their territories. •Gives responsibility to the Venezuelan government for developing land use plans which take into consideration the principles of sustainable development. •Gives responsibility to the Venezuelan government for protecting the environment for current and future generations.
Framework Law for Land Use Zoning 1983	1983	•Establishes processes for national land-use zoning. •Requires land-use zoning. •Establishes administrative procedures for planning in protected areas.
Framework Law of the Environment	1977	•Establishes guiding principles for environmental conservation, including the creation and protection of forest reserves and the use of natural resources.
Framework Law of Central Administration	1976	•Creates the Ministry of Environment and defines its responsibilities.
Demarcation and Guarantee of Indigenous Habitat and Lands Law	2001	•Requires the state to demarcate indigenous lands. •Establishes that the Ministry of Environment will coordinate demarcation, with the last indigenous census used as a baseline for existing settlements.
Biodiversity Law	2000	•Favors biodiversity conservation of forests. •Recognizes that forests harbor a large portion of the nation's biodiversity.
Mining Law	1999	•Defines requirements for concessions and operating permits. •States that mining cannot damage the environment. •Requires mitigation of negative impacts on ecosystems. •Allows the Ministry of Environment to set an amount for a bond, which is returned to the concessionaire once reclamation is complete.
Penal Environmental Law	1992	•Establishes penalties for: 1) acts that degrade the environment, based on the minimum wage, and jail sentences; and 2) public sector employees who permit activities that damage the environment without an environmental impact assessment.
Law Protecting Wildlife	1970	•Establishes wildlife reserves, wildlife refuges, and wildlife sanctuaries. •Establishes norms for hunting, with the acquisition of the necessary permits.
Law of Forests, Soils, and Water	1965	•Regulates conservation and use of natural resources found in forests. •Prohibits extractive activities in national parks. •Establishes protected zones for major watersheds. •Prohibits deforestation or annexation of forest reserves without prior approval from the congress.

Legal Instrument	Year	Relevance
Decree 369	1999	•Partially updates the Framework Law of Central Administration. •Gives the Ministry of Production and Commerce the mandate to define policies, planning, and regulate forestry activities. •Simultaneously gives the Ministry of Environment the mandate to manage forest resources.
Decree 363	1999	•Revises fees charged for administrative services, including logging fees. •Defines fees in a standardized "tax unit" which is targeted to inflation.
Decree 1257	1996	•Establishes regulations for developing environmental impact assessments. •States that timber concessionaires who develop management plans are exempt from producing an environmental impact assessment.
Decree 2214	1992	•Establishes norms for regulating activities in forest reserves, forest lots, and other forested protected areas. •Defines land-use zones to be considered in forest reserves.
Decree 1742	1991	•Prohibits the use of mercury, except in specialized labs and facilities. •Assigns the regional Corporación Venezolana de Guayana (CVG) the responsibility of regulating and controlling the use of mercury, with coordination and assistance from the Ministries of Environment and Mines.
Decree 1738	1991	•Prohibits any mining that can destroy the environment. •Requires environmental impact studies to define which mining activities have the potential for irreparable damage to the environment. •Assigns monitoring of mining activities to the Ministry of Environment, with support from the Ministry of Mines and the National Guard.
Decree 1740	1991	•Prohibits the act of burning mercury in open air or using techniques that allow mercury to escape into the environment. •Requires any person using mercury to get necessary permits from the Ministry of Environment.
Decree 636	1990	•Prohibits any activity in forest reserves or forest lots that are contrary to the objectives for which the reserve or lot was created.
Decree 276	1989	•Defines administration and management of national parks and natural monuments. •Prohibits certain activities, such as mining, in national parks or natural monuments.
Decree 269	1989	•Prohibits any mining in Amazonas State.
Decree 2552	1978	•Prohibits any logging in Amazonas State.

Note: The above legal instruments are organized by legal hierarchy
Source: Adapted from Miranda et al., *All That Glitters is Not Gold: Balancing Conservation and Development in Venezuela's Frontier Forests* (WRI: Washington, DC, 1998), p. 5.

BOX 1 Zoning the Imataca Forest Reserve

Located in the Guayana region, the Imataca Forest Reserve has been the source of much conflict. Originally created in 1961 and then subsequently enlarged in 1993, the reserve encompasses over 3.6 million hectares. Imataca was legally designated a production forest, thus providing a wood supply, while ensuring the integrity of forest ecosystems. Since 1965, the government has also given out mining concessions in the reserve, sometimes overlapping with logging concessions (see Map 13). By the 1990s, illegal small-scale miners had succeeded in invading and clearing significant areas of forest in the southern portion of the reserve.

In 1997, the government issued Decree 1850, a land-use and zoning plan (*Plan de Ordenamiento y Reglamento de Uso*) for the reserve, in an attempt to put order into a chaotic land-use situation. The plan essentially divided the reserve almost equally between mining and logging concessions.[1] Environmentalists subsequently filed a lawsuit, arguing that mining was incompatible with the objectives of the reserve, and that the government had failed to comply with the requirement for stakeholder consultation. The Supreme Court issued a moratorium on any new logging or mining concessions in the reserve until it had ruled on the case. As of August 2001, the case remained in the Supreme Court.

In 1999, the government, under the new administration, solicited the help of the World Bank in developing a new version of the zoning decree. In an attempt to provide up-to-date baseline information toward the consultation and publication of the new decree, an internal commission of the Ministry of Environment contracted national consultants to analyze the region's social and environmental conflicts, characteristics of the flora and fauna, and water quality. The World Bank-funded commission identified key issues needing to be addressed in the development of a new zoning plan, including:[2]

- *Lack of institutional and intersectoral coordination among government entities at the local and national levels.* The commission recommended promoting interministerial coordination through the clarification of institutional roles, communication regarding the process for developing the new zoning plan, and through public participation.
- *Lack of evidence that mining or logging as currently practiced are environmentally sustainable or result in an improved quality of life for local communities:* Citing studies that questioned both logging and mining practices, the committee recommended that logging concessions and small-scale miners be subject to environmental impact assessments and that the Ministry of Environment seek to develop non-timber forest products and other values of the Imataca Forest Reserve.
- *Lack of adequate monitoring and control over activities in the reserve.* The commission cited the lack of human and financial resources on the part of the entities responsible for monitoring and policing the reserve. Recommendations included the incorporation of indigenous and local communities in monitoring activities as well as involving local communities in decision making regarding the reserve.

1. Miranda et al, *All That Glitters is Not Gold: Balancing Conservation and Development in Venezuela's Frontier Forests* (Washington, DC: WRI, 1998).
2. G. Colomine et al., "Estrategia para la Elaboración del Plan de Ordenamiento y Reglamento de Uso de la Reserva Forestal Imataca," Paper presented at 2º Congreso Forestal Venezolano, Caracas, Venezuela, November 2000.

Forest Cover and Protection

This chapter evaluates the state of knowledge regarding the nation's forests and the degree of protection provided by existing protected areas. To determine the status of Venezuela's forests, we analyzed available information on forest cover and protected areas. Specifically, we sought to answer the following questions:

- Where are Venezuela's forests and how has forest cover changed over the last decades?
- What is the status of protected areas in Venezuela's forests and in the Guayana region specifically?
- How have protected areas been managed in Venezuela?

To answer these questions, we used government maps of protected areas, a regional map of forest cover developed by the Tropical Ecosystem Environment Observations by Satellites Project (TREES), derived from the use of the NOAA Advanced Very High Resolution Radiometer (AVHRR) sensor, and a national vegetation map published in the mid-1980s. We compared these map data to statistics released by the Food and Agriculture Organization (FAO) for national deforestation. These results reveal significant inconsistencies between datasets, and raise questions about the reliability of current forest cover estimates.

We encountered several difficulties in analyzing the protection status of forest cover, due to the lack of a georeferenced map of protected areas and an official map of political boundaries. Schematic maps available from government offices have technical deficiencies resulting from the fact that protected areas are mapped individually and then transferred onto a national scale map using outdated cartographic methods and inaccurate base maps. Until 1998, presidential decrees establishing protected areas did not require prior technical consultation with the official cartographic office (*Instituto Geográfico de Venezuela "Simón Bolívar"*), which resulted in cartographic errors in delineating the boundaries of these areas. We also encountered difficulties mapping the large number of established protected areas (362 total) because of overlap between protected area boundaries; the extent of overlap suggests a lack of information and poor coordination on the part of government officials when delineating protected areas.

Our findings indicate the following:

- Lack of reliable data on Venezuela's forest cover makes it extremely difficult to ascertain the extent of and change in the country's forests. This is due primarily to different methodologies used to determine forest cover, as well as to inconsistencies in government data.

- Venezuela has succeeded in establishing a complex protected areas system, which protects a significant portion of the nation's forests. However, overlaps in different types of protected areas, uncertainty regarding protected area boundaries, and the lack of systematic, on-the-ground management undermines the country's forest conservation efforts. This is particularly the case in the Guayana region, where most of the largest protected areas are found.

While the exact extent of forests is not known, it is clear that a significant portion of the country's forests remain intact. A key challenge for continued conservation of these forests will be to develop the capacity to manage the existing protected areas network, as well as to address important legal and administrative concerns regarding the status of some protected areas in the Guayana region.

QUESTION 1 Where are Venezuela's forests and how has forest cover changed?

Venezuela's forests encompass a diverse range of ecosystems.

Approximately half of Venezuela's national territory is forested. Most of this forest (nearly 90 percent) is located south of the Orinoco River, in the Guayana region (see Map 3). Venezuela's forests can be classified as predominantly lowland forest (see Figure 2).

The exact extent of Venezuela's forest cover is not known.

Estimates of Venezuela's current forest cover can be obtained using regional and global maps produced by various international organizations based on satellite imagery. The estimates derived from these sources vary depending on the definitions and methodologies they used to identify forest cover. Because of these variations, establishing a reliable and accurate baseline estimate for Venezuela's forest cover is extremely difficult, and estimates of forest cover are not directly comparable to each other.

International estimates of Venezuela's forest cover can be divided into two categories: those that rely on data retrieved from coarse-resolution satellite imagery and those derived from national inventories and government data. The most recent satellite-based estimate places Venezuela's forest cover at 427,000 square kilometers in 1996 (see Annex 1 for details about the sources of satellite-based estimates), while FAO (relying on official government data) estimates that Venezuela's forest cover in 2000 was about 495,000 square kilometers, a difference of about 68,000 square kilometers.

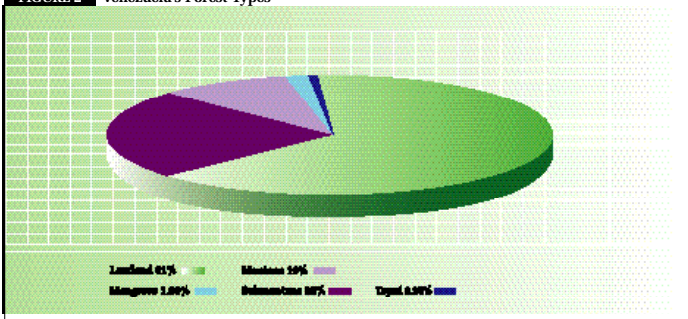
Even historic forest cover estimates vary widely. Satellite-based estimates of Venezuela's forest cover vary by about 40,000 square kilometers (ranging from 433,000 square kilometers to 472,000 square kilometers for the early 1990s). In contrast, FAO estimates that in 1990 Venezuela's forest cover was 519,000 square kilometers, a difference of about 47,000 to 86,000 square kilometers from the satellite-based estimates. The lack of a consistent baseline for forest cover greatly limits the accuracy of current forest cover and deforestation estimates.

Forest Cover **MAP 3**

Data on forest cover comes from TREES, A Forest of South America, unpublished data. Forest cover is based on 1km resolution satellite imagery from 1996. See Annex 1 for more information and details on methodology.

* According to the Geneva Agreement of February 7, 1966, Venezuela claims two-thirds of the territory of Guyana.

FIGURE 2 **Venezuela's Forest Types**



Sources: O. Huber and C. Alarcón, *Mapa de Vegetación de Venezuela* (Caracas: MARNR, TNC, 1988); O. Huber, *Venezuelan Guayana Vegetation Map* (CVG EDELCA, Missouri Bot. Gardens, 1995); H. Eva and S. Jones, "A Forest Map of South America," TREES, unpublished.

Government and FAO statistics on forest change reveal inconsistencies, making it difficult to assess deforestation rates.

Government estimates for deforestation do not provide a consistent and transparent picture of how much forest has been lost over different regions and time periods. FAO's estimate in *Forest Resources Assessment 2000* indicates that Venezuela's deforestation rate between 1990 and 2000 was 0.4 percent, which is about average for South America.[15] However, the government data on which this estimate is based are not internally consistent. The Venezuelan government has never conducted any forest inventories,[16] and the satellite imagery the government used to determine national vegetation cover is more than ten years old. As a result, the Venezuelan government provided the FAO with a variety of forest cover estimates based on various maps that are difficult to compare (see Box 2). A review of government forest cover statistics reveals the following:

- *Lack of clarity regarding the reference date for estimates.* Government estimates for the early 1980s were based on a 1983 vegetation map, but the satellite imagery used to produce this map is dated between 1972 and 1977. Likewise, the government's 1995 vegetation map appears to have been based on 1988 satellite imagery, (see Box 2).[17]

- *Lack of comparability in historical data.* In 1996, the government published historical forest cover data for 1982 for thirteen of Venezuela's twenty-three states. Additional historical forest cover data were provided for the remaining ten states, but these estimates are from 1975 to 1988 and thus not comparable to the 1982 numbers.[18]

- *Lack of transparency regarding methodologies and source data.* The government's 1995 forest cover estimates were derived from an apparently updated vegetation map. However, this map has never been published. Thus the methodology and definitions used to calculate the 1995 forest cover estimates remain unclear.

• *Lack of consistency in results.* A 1996 government publication presenting forest cover estimates derived from the 1995 vegetation map reports inconsistent numbers, which may be due to computational error.[19] Although the government reported an annual deforestation rate of 0.5 percent in thirteen states between 1982 and 1995, a re-calculation of the data revealed that the annual deforestation rate in these states appears to have been slightly less than 1.0 percent, approximately twice that reported by the FAO for the 1990s (see Annex 1 for details).[20] There is no explanation given in the government's deforestation estimates to account for this discrepancy.

Government Forest Cover Estimates **BOX 2**

The Venezuelan government has produced several different vegetation maps, generally derived from two baseline maps of vegetation. However, these maps differ in their definitions of forest cover and other vegetation types, making it difficult to compare vegetation classes between maps. A partial list of the vegetation maps used by the Venezuelan government and by FAO follows.

Baseline vegetation maps

The "1982/83" Map of Actual Vegetation Cover: This map was produced at a 1:250,000 scale, using radar and Landsat satellite imagery. While it is sometimes referred to as a 1982 or 1983 vegetation map, the imagery used to produce it dates from 1972 to 1977. It is the only publicly available map showing Venezuela's actual vegetation cover. According to this map, Venezuela's forest cover in 1977 was 56,985,121 hectares.

The "1995" Vegetation Map of Venezuela: This map has never been published, but provides the baseline for the Ministry of Environment's forest cover estimates for 1995. These are the same estimates used by FAO to determine Venezuela's forest cover in 2000. While the forest cover estimates derived from this map are dated 1995, the map reflects satellite imagery from 1988, on average. According to this map, Venezuela's forest cover in 1988 was 49,665,815 hectares.

Additional vegetation maps

The "1985" Land Use Zoning Map of Venezuela's Forests: This map was used by FAO as a historic baseline for estimating forest cover change. The reference date given was 1981. Forest cover according to this map was 52,843,007 hectares in 1981.

The "1979" Vegetation Map: The government also provided the FAO with a 1979 vegetation map, which indicated that Venezuela's forest cover in 1979 was 67,185,977 hectares.

Sources: MARNR, *Mapa de la vegetación actual de Venezuela, 1982/83*, Sistemas Ambientales de Venezuela, Serie II, Sección I, No. 4: código II-1-4, (Caracas, Venezuela: MARNR, 1982/83); MARNR, *Balance Ambiental de Venezuela, Apéndice 1996* (Caracas, Venezuela: MARNR, 1996), p. 8); J. Malleux, FAO, personal communication, July 18, 2001; H. Ortiz-Chour, FAO, personal communication, July 13, 2001.

Most of Venezuela's deforestation has occurred north of the Orinoco River.

In the last forty years, about 80 percent of Venezuela's estimated deforestation has occurred north of the Orinoco River.[21] Most forest loss has occurred in moderately diverse forests, especially in the lowland and submontane forests of the Western plains (*llanos*), as Table 2 illustrates.[22] From 1825 to 1950, forest cover in the *llanos* grew due to farmers abandoning rural areas, as a result of political unrest in the countryside and migration to urban centers. However, from 1950 to 1975, forest cover decreased dramatically largely due to the development of roads and an increase in population (see Table 2).

TABLE 2 **Forest Change in the *Llanos*, 1825-1988**

Period	% Forest change
1825-1950	+116.8
1950-1975	-32.5
1975-1988	-45.3

Sources: J.P. Veillon, "Las deforestaciones en los Llanos Occidentales de Venezuela desde 1950 hasta 1975," in L. Hamilton et al., *Conservación de los Bosques Húmedos de Venezuela* (Caracas, Venezuela: Sierra Club, Consejo de Bienestar Rural, 1977); A. Catalán, *El Proceso de Deforestación en Venezuela entre 1975-1988* (Caracas, Venezuela: MARNR, 1989).

Between 1975 and 1988, more than a third of all forests north of the Orinoco River were converted primarily for agricultural uses. Two of the most critical areas affected were the area south of Maracaibo Lake (loss of 90 percent of forests) and the *llanos* (loss of 45 percent of forests).[23] According to the Venezuelan government, deforestation has five principle causes: expansion of the agricultural frontier, illegal logging in natural forests, permanent settlement of forest areas designated for forestry, poorly planned mining, and forest fires.[24]

QUESTION 2 What is the status of protected areas in Venezuela's forests and in the Guayana region specifically?

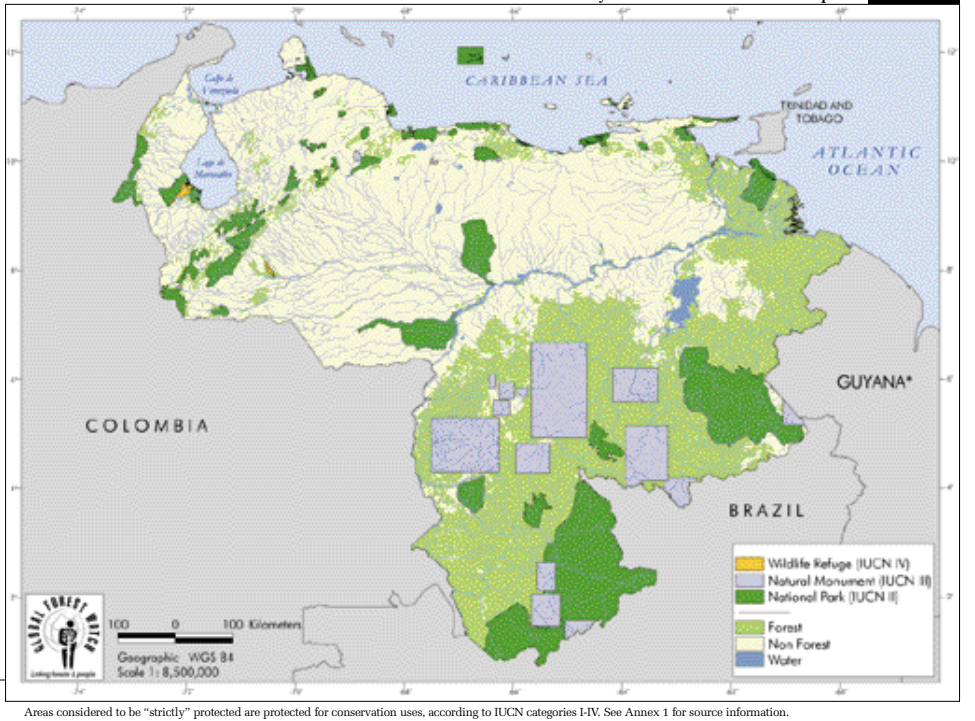
Venezuela has an extensive protected areas network, but not all forest ecosystems are equally protected.

Designated as "Areas Under Special Administration" (ABRAE), protected areas in Venezuela are managed for specific purposes according to special laws. National legislation defines twenty-five categories of ABRAE, with management objectives ranging from strict protection of natural ecosystems to use of natural resources. As of August 2001, 362 ABRAE had been established, representing approximately 46 percent of the national territory (for total area by category see Annex 1).[25]

Map 4 shows Venezuela's strictly protected areas, defined in this study as national parks, natural monuments, and wildlife refuges. Analysis of protected area data shows the following trends:

- Depending on how the land area allocated for protected areas is measured (see Figure 3 and Box 2), between 17 and 32 percent of Venezuela's forests are strictly protected in these categories, demonstrating the country's commitment to conservation of its natural heritage.[26]

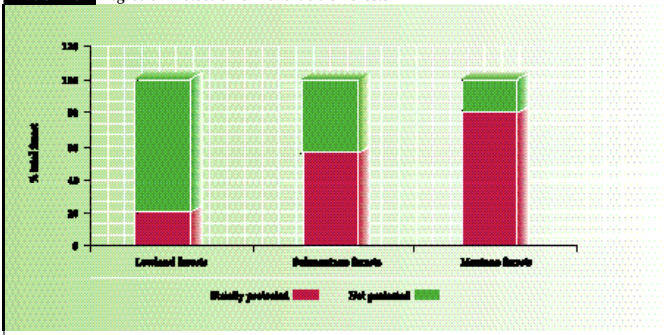
- Of the country's forest types, lowland forests are the least well-protected. Assuming that 32 percent of the nation's forests are strictly protected, only 20 percent of lowland forests are strictly protected (see Figure 3), even though they make up more than 60 percent of the nation's forests.



Areas considered to be "strictly" protected are protected for conservation uses, according to IUCN categories I-IV. See Annex 1 for source information.
*According to the Geneva Agreement of February 7, 1966, Venezuela claims two-thirds of the territory of Guyana.

• Natural monuments in southern Venezuela protect a majority of montane and submontane forests, although how much protection they actually provide remains uncertain (see Box 3).

FIGURE 3 **Degree of Protection of Venezuela's Forests**



Source: GFW Venezuela, 2001. See Annex 1 for details.

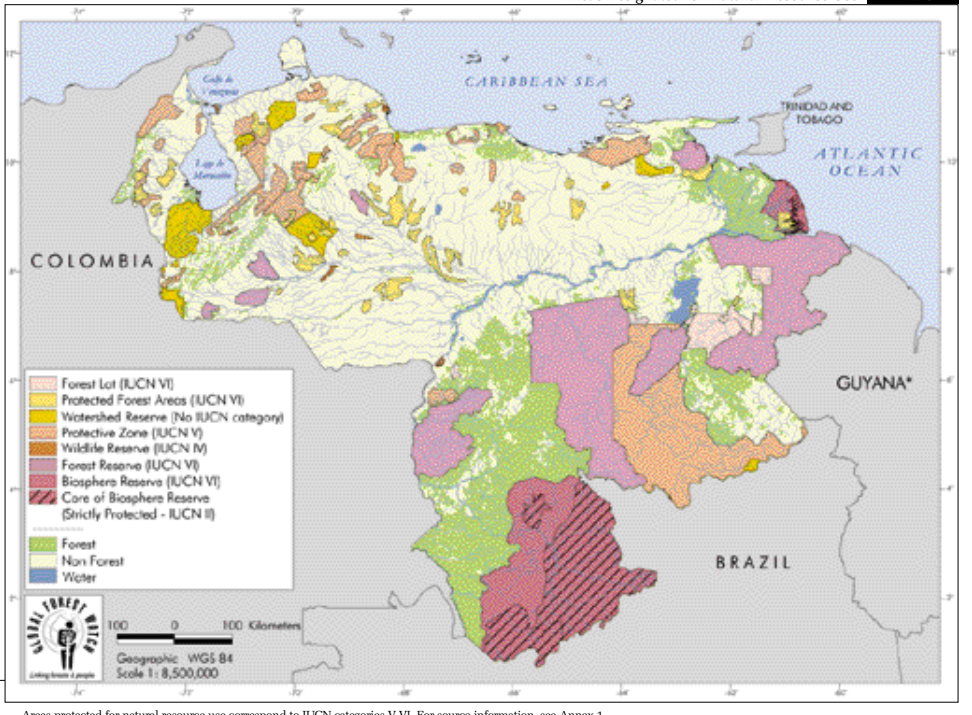
BOX 3 **Protecting the Guayana Highlands through Natural Monuments: How Much is Actually Protected?**

In 1991, the Venezuelan government issued a decree to protect the biological and ecological richness of the upper sections of all the remaining *tepuyes* (table-top mountains) in Bolívar and Amazonas States that were not already protected in national parks. The intent of Decree 1233, called "Tepuyes Natural Monuments," was to conserve the highly specialized plant communities and unique natural ecosystems harboring numerous endemic species in two provinces: the Pantepui Floristic Province (with elevation largely higher than 1500 meters) and the Central Guayana Province (uplands and mountains roughly 300 to 1500 meters in elevation).

Although the decree defined the natural monuments as areas with elevations of more than 800 meters, the coordinates given by the Ministry of Environment for the monuments are not limited to such parameters. The coordinates designate relatively large square polygons constituting a series of strictly protected areas that collectively comprise over 7 million hectares, far more than originally intended in the presidential decree and the official gazette, (see Map 4). The larger polygons were reportedly designed explicitly to protect the ecosystem surrounding the tepui, although this was not articulated in the decree. Also, not all of the area within the polygons is above 800 meters. In the case of some monuments, only a small part of the area is above the 800-meter cut-off. Because the decree does not determine which boundary prevails, it is unclear whether the entire polygon is protected or only the portion above 800 meters.

The inconsistency in the decree's provisions creates the potential for land-use conflicts (see Map 6), particularly where overlap already exists between natural monuments and other areas designated for natural resource uses (e.g. between natural monuments and forest reserves). Conflicting interpretations of the decree are also possible where the mountain range is almost entirely below 800 meters. However, the fact that the Ministry of Environment has chosen to include buffer areas could imply it is committed to protecting these diverse ecosystems beyond an arbitrary 800-meter elevational limit.

Sources: O. Huber, Conservation of the Venezuela Guayana. In Berry, P.E., Holst, B.K., Yatskievych, K. (Eds.), *Flora of the Venezuelan Guayana, Introduction* (Portland, Oregon: Missouri Botanical Garden, Saint Louis and Timber Press, 1995), pp. 193-202; República de Venezuela, "Decreto Número 1233," *Gaceta Oficial* Nº 4250 (Caracas, Venezuela: Government of Venezuela, Jan. 18, 1991); O. Huber, "Notas Explicativas Sobre el Decreto de los Tepuyes," *Pantepui* No 5 (Caracas, Venezuela, 1993); O. Huber, personal communication, April 27, 2001.

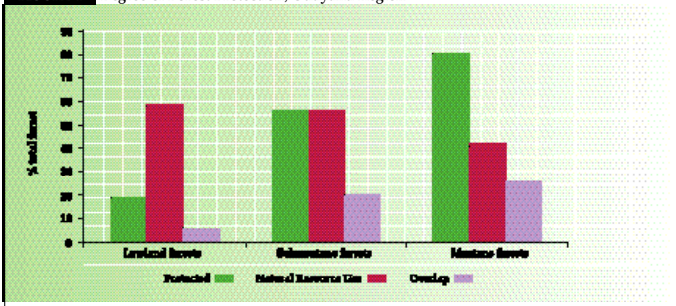


Areas protected for natural resource use correspond to IUCN categories V-VI. For source information, see Annex 1.
*According to the Geneva Agreement of February 17, 1966, Venezuela claims two-thirds of the territory of Guyana.

The status of protection of almost half of the forests in the Guayana region is unclear.

Map 5 shows protected areas allocated for natural resource uses (e.g., logging, hunting and watershed conservation). Many of Venezuela's protected areas (ABRAE) overlap partially or totally with one another, an aspect recognized in article 17 of the Framework Law for Land Use Zoning. According to this law, "It is not considered incompatible to assign one or more types of protected areas to the same land area, as long as these are compatible with one another." However, it is not clear which category prevails in the case of overlap between protected areas with competing objectives (e.g., overlap between areas designated for natural resource use and those protected strictly for conservation purposes).

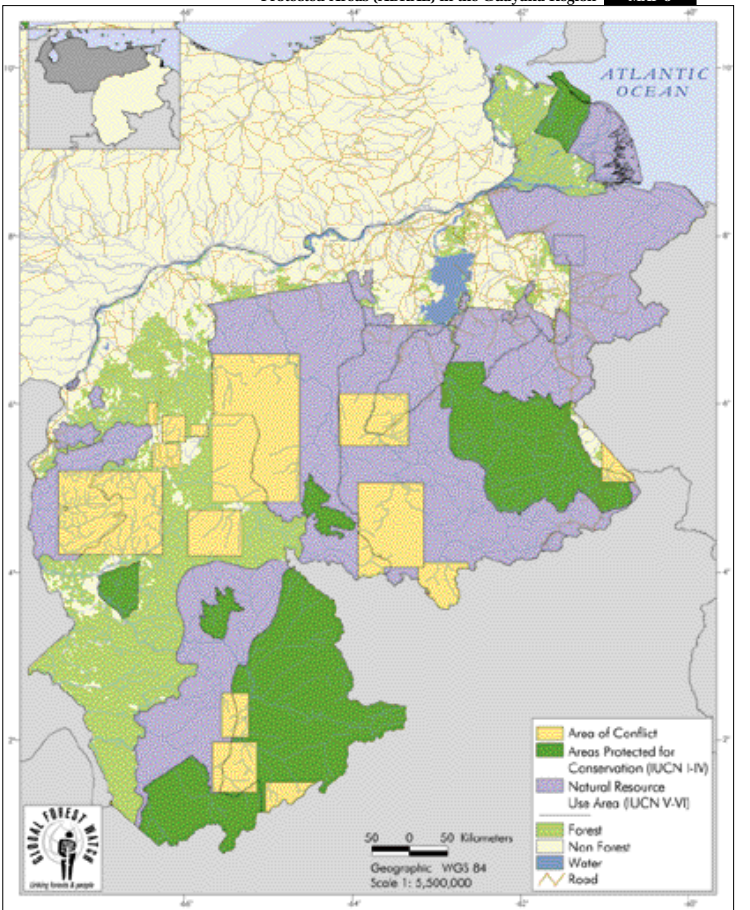
FIGURE 4 **Degree of Forest Protection, Guayana Region**



Note: Does not include forests not protected in IUCN I-VI. Thus protection categories for lowland forests add up to less than 100%.
Source: GFW Venezuela, 2001. See Annex 1 for details.

- Approximately half of all forests in the Guayana region have been allocated for natural resource uses, specifically logging and hydrological services (see Figure 4).
- Overlap between protected areas with competing objectives is particularly evident in the Guayana region. As can be seen in Figure 4, the degree of overlap between categories is most noticeable in the case of submontane and montane forests.
- According to data underlying Map 6, approximately 4 million hectares of strictly protected forest in the Guayana region overlap with areas designated for natural resource use. These management categories are not necessarily compatible with one another, creating a degree of uncertainty with respect to the legal protection of forest cover.
- The legal status of the large blocks designated as natural monuments in the Guayana region is also uncertain because their boundaries were not well defined when they were created (see Box 3). Taking into account overlap between protected areas and the uncertain status of natural monuments, the legal status of nearly half of the forests classified as strictly protected in the Guayana region is subject to some degree of uncertainty.[27]

Actual and Potential Conflicts Between Protected Areas (ABRAE) in the Guayana Region **MAP 6**



An area of conflict is defined as an overlap between protected areas with conflicting objectives or an area where uncertainty exists over the specificities of the protected area decree. For information on conflicts see Chapter 2.
*According to the Geneva Agreement of February 7, 1966, Venezuela claims two-thirds of the territory of Guyana.

Lowland forests can be considered the most vulnerable of forest types in the Guayana region, given the small percentage (less than 20 percent) of these forests under strict protection and the relatively large percentage (58 percent) that has been allocated for extractive uses. These forests include key ecosystems for the conservation of certain groups of wildlife species that demonstrate a high degree of diversity in neotropical environments (see Chapter 3). In addition, lowland forests are important for the conservation of the nation's socio-cultural diversity represented by its indigenous heritage (see Chapter 4, Questions 10-11).

QUESTION 3 How have protected areas been managed in Venezuela?

Lack of on-the-ground management hampers the conservation of existing strictly protected areas.

Although the protected areas network is extensive, little has been done to manage these areas effectively (see Box 4). For example:

- Only 15 percent of protected areas in Venezuela have approved land-use and zoning plans (*Planes de Ordenamiento y Reglamento de Uso*), a fundamental tool for protected areas management. This situation is especially problematic in the Guayana region, where only the Imataca Forest Reserve and the eastern sector of Canaima National Park have approved these administrative tools (see Table 3).

- Even in these protected areas, the land-use plans have not been implemented. The zoning plan for the Imataca Forest Reserve has been challenged in court (see Box 1), and the land-use plan for the eastern sector of Canaima National Park has not been updated since its approval in 1991.

Another management problem that has not been adequately addressed is that indigenous peoples have not been incorporated into protected areas management plans. Many indigenous groups are long-time residents in protected areas and may have been living in these areas before they were designated as protected.[28] Given the increasing pressures to convert these areas to other uses (see Chapter 4), it is unlikely that conservation measures will succeed if local inhabitants continue to be excluded as managers of these areas.

The creation of protected areas has been strongly supported in Venezuela, beginning in the 1960s when the National Parks and Reserves Office was created under the Ministry of Agriculture. However, institutional reviews of the protected areas network have identified budget and personnel limitations in the administration and management of national parks. At present, half of the national parks and nearly all the natural monuments in the Guayana region lack the necessary personnel to implement zoning plans and ensure the integrity of protected areas. In addition, medium and long-term management strategies are lacking for most protected areas. Consequently, the decision-making authority of protected area officials is significantly limited.

The protected areas network is characterized by a lack of systematic planning and poorly articulated regulations, which has led to: a) total or partial overlap of incompatible protected area categories (see Question 2 and maps 4-6); b) lack of consistency in designating management categories within protected areas; c) contradictions between prohibited and accepted activities and; d) the extensive protection of some ecosystems while other vulnerable areas remain unprotected.

Furthermore, zoning and land-use plans for protected areas often differ in concept and methodology. Management programs are identified by diverse names without clear definition of terminology and objectives. In addition, zoning and land-use decrees are usually limited to a statement of the strategic vision and an outline of implementation programs, which identifies the relevant authorities for executing tasks, their corresponding responsibilities, a list of programs, subprograms, and activities. However, these plans are often not economically or operationally viable because they do not have a comprehensive implementation plan. Zoning plans often lack key elements such as prioritized activities; delineated development stages; a timeline for execution; requirements for personnel, infrastructure, and equipment; and an estimated budget. These elements are essential if protected area managers are to plan activities, manage resources, and effectively monitor compliance with government regulations.

Sources: M. Bevilacqua, "Áreas Bajo Régimen de Administración," in M. Aguilera et al. (eds.) *Biodiversidad en Venezuela* (Caracas, Venezuela: CONICIT, Fundación Polar, in press); M. Bevilacqua and J. Méndez, "Manual Técnico para la Creación, Ordenación, Reglamentación de ABRAE en Venezuela" Serie de Informes Técnicos (Caracas, Venezuela: Ministerio del Ambiente y de los Recursos Naturales Renovables, DGSPOA, 2000); MARNR, "Plan del sistema nacional de áreas protegidas. 1ª Etapa: Marco conceptual," Serie de Informes Técnicos DGSPOA / IT / 213 (Caracas, Venezuela: Ministerio del Ambiente y de los Recursos Naturales Renovables, 2000); M. Miranda et al., *All That Glitters is Not Gold: Balancing Conservation and Development in Venezuela´s Frontier Forests*, (Washington, DC: WRI, 1998).

TABLE 3 **Zoning and Land-Use Plans by Type of Protected Area (ABRAE)**

Protected Area Type (ABRAE)	TOTAL No.	%	With Zoning and Land-Use Plans	Without Zoning and Land-Use Plans
STRICTLY PROTECTED (IUCN I-IV)				
National Parks (IUCN II)	43	11.9	20	23
Natural Monuments (IUCN III)	36	9.9	5	31
Wildlife Reserves (IUCN IV)	4	1.1	0	4
Wildlife Refuges (IUCN IV)	7	1.9	1	6
NATURAL RESOURCE USE (IUCN V-VI)				
Protected Zone (IUCN V)	58	16.0	14/23*	44/35*
Biosphere Reserves (IUCN V)	2	0.6	0	2
Forest Areas Under Protection (IUCN VI)	39	10.8	0	39
Forest Reserves (IUCN VI)	11	3.0	2	9
OTHER (NO IUCN EQUIVALENT)				
National Hydraulic Reserves	14	3.9	1	13
Critical Areas with Priority for Recuperation	7	1.9	2	5
Areas for Protection of Public Works	18	5.0	3	15
Areas for Protection and Environmental Recuperation	4	1.1	1	3
Integrated Rural Development Areas	5	1.4	0	5
Deep Water Coastal Marine Areas	1	0.3	0	1
Area of Historic Heritage	1	0.3	0	1
Agricultural Development Zone	6	1.7	1	5
Area Reserved for the Construction of Reservoirs and Dams	2	0.6	1	1
Area of Touristic Interest	13	3.6	2	11
Security Zone	85	23.5	1	84
Frontier Security Zone	6	1.7	0	6
Total	**362**	**100**	**54/63****	**308/299****

*For protected zones 14 zoning plans and 23 land-use plans have been approved separately, such that 44 zoning plans and 35 land-use plans have yet to be approved. For the rest of the protected areas, zoning and land-use plans have been approved together.
**Of the 362 protected areas, 54 have zoning plans and 63 have land use plans; 308 do not have zoning plans and 299 do not have land use plans.
Source: MARN-DGSPOA-DOT, 2001

Non-Extractive Value of Forests of the Guayana Region

Venezuela's forests are valued for a range of ecosystem goods and services, including wildlife, non-timber forest products, and the potential for hydropower and ecotourism, to name a few. In the following section, we assess the importance of some biological resources in the forests of the Guayana region, based on existing information for two components: wildlife and non-timber forest products.

Although Venezuela's forests have many values (e.g., carbon storage, vegetation, and nutrient cycling), we chose to focus on a few representative indicators due to limits in data availability and resources. Thus, although we include general data on biodiversity, the bulk of our analysis focuses on wildlife (restricted in this report to vertebrate groups, for which there is more information). In addition, we have not assigned economic values to these indicators because of the lack of data. Rather, the indicators represent values and services provided by the forests of the Guayana region, which can be contrasted with the potential costs of future economic development in the region (see Chapter 4).

The data were drawn from published and unpublished studies. To the degree that particular regions or taxonomic groups have not been adequately researched, our data do not represent a complete inventory of biological resources. As such, any conclusions are limited by gaps in information, and further research is needed to fully determine the nature and importance of the Guayana region's wildlife and indigenous use of non-timber forest products.

The results of our analysis show that:

- Forests of the Guayana region harbor an array of plant and animal species that are important for maintaining the overall health of forest ecosystems, as well as for sustaining livelihoods of traditional forest peoples.

- Half of all wildlife species in the region are forest dependent. Some species are found in areas threatened by development activities. Thus maintaining forest cover is critical to these species' survival.

- A significant proportion of species used for non-timber forest products by indigenous and local communities is at risk of local extinction. This indicates that resources critical to sustaining traditional livelihoods could disappear, greatly impoverishing the lives of indigenous peoples throughout the Guayana region.

While the data limitations make it impossible to quantify the economic value of the Guayana region forests, these forests clearly provide important ecological services and help to sustain the livelihoods of forest communities. Such values must be taken into consideration when evaluating the relative benefits to be gained from rapidly extracting the region's natural resources.

Biodiversity

Venezuela harbors a significant portion of the world's biodiversity.

- Venezuela stands out globally for the biodiversity it harbors. The country also ranks in the top twenty countries for number of endemic plants, amphibians, birds, and reptiles (see Table 4).

- Proportionate to its size, Venezuela is home to large numbers of plant and animal species. The country ranks among the top twenty in the world in terms of birds, amphibians, and plants per 10,000 square kilometers of land area.

The forests of the Guayana region contain over half (58 percent) of the known wildlife species in Venezuela, representing nearly all of the orders and families recorded nationwide.

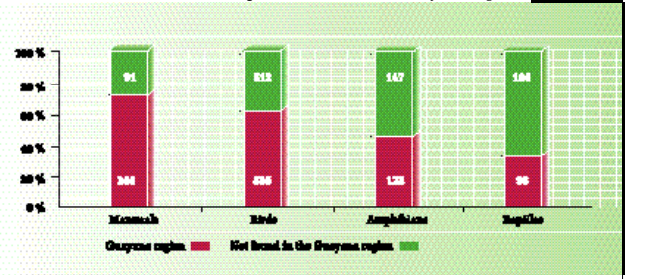
- Mammals and birds are among the taxonomic groups with greatest representation in the forests of the Guayana region (75 percent and 63 percent of the known species in Venezuela, respectively), while the proportion of amphibians and reptiles has been estimated at between 47 percent and 34 percent respectively (see Figure 5).

TABLE 4 **Venezuela's Global Rank in Terms of Biodiversity**

Category	Total Number of Endemic Species	World Rank	Estimated Number of Species Per 10,000 km^2	World Rank
Plants	8,000	5th	4,752	11th
Amphibians	122	11th	55	11th
Birds	40	15th	302	12th
Reptiles	66	19th	64	27th
Mammals	15	26th	79	29th

Note: Species per 10,000 km^2 is based on a species area curve. See Annex 1 for details.
Sources: WRI, *World Resources Report, 2000-2001* (Washington, DC: WRI, 2001) for plants, amphibians, birds, and reptiles; Mammals data from J. Ochoa G. and M. Aguilera, "Mamíferos," in M. Aguilera et al. (eds.), *Biodiversidad en Venezuela* (Caracas, Venezuela: CONICIT, Fundación Polar, in press).

Wildlife Species Richness in the Guayana Region* **FIGURE 5**

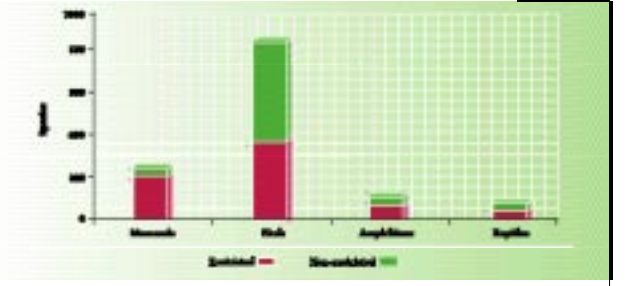


* Compared with total number of species in Venezuela.
Source: GFW Venezuela 2001. See Annex 1 for details.

Of the total wildlife present in the forests of the Guayana region, almost half (49 percent) is restricted to these ecosystems. As such, they are vulnerable to habitat loss resulting from clearing and degradation of forests.

The vertebrate communities that inhabit the forests of the Guayana region show a high degree of taxonomic and ecological diversity, signifying that forests of this region are rich in number of both taxa (species, genus, family) and ecological groups (defined by the presence of species with different trophic roles, reproductive patterns, roosts, etc.). In particular, species that depend on tree cover for their dietary or mobility needs are prevalent in forests (e.g., arboreal or semi-arboreal mammals, reptiles and amphibians; and frugivorous birds and bats associated with the canopy). The majority of these animals act as key regulators of forest dynamics and are highly sensitive to changes in the condition of their habitats (see Box 5). Mammals, reptiles and amphibians in particular have high proportions of species that occur only in forest ecosystems (see Figure 6).

Wildlife Restricted to Forests of the Guayana Region **FIGURE 6**



Source: GFW Venezuela, 2001. See Annex 1 for details.

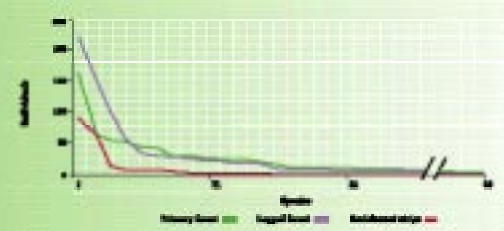
BOX 5 **The Relationship between Forest Cover and Wildlife**

Studies have shown that logging in tropical forests can change the composition of wildlife in direct proportion to forest disturbance.[1] Selective logging and subsequent silvicultural techniques (e.g., enrichment strip planting) can result in a dramatic change in forest condition, reducing the presence of those animal species dependent on primary habitats. For example, an investigation of understory birds in Venezuela found that of the twenty-two bird species occurring in primary forest, two increased in number after selective logging but sixteen declined and four were no longer recorded. The creation of enrichment strips changed the composition even more.[2]

For some species of small tropical mammals (e.g. bats, small rodents, and marsupials), logging provides several benefits, including more food resources provided by pioneer plants, fungi, and invertebrates on the forest floor and more roosting cavities associated with fallen trees.[3] However, logging is usually only beneficial to a relatively small number of species, and the loss of other sensitive species may have ecological consequences. Many wildlife species affected by logging provide fundamental services and regulate key ecological processes in forest ecosystems (e.g., pollination, dispersion of seeds and micorrhiza, regeneration of degraded areas, and control of insect populations). Their absence in logged forests therefore can also have negative impacts on plant population dynamics. Furthermore, declines in the population of some animals (or even local extinction) can have repercussions on the survival of their predators as well.

Changes in bat communities have been observed in logged areas of the Venezuelan Guayana region. Figure below shows the relationship between the absolute numbers of individuals and the number of different species under three scenarios: primary forests, selective logging, and selective logging with enrichment strips. Note that the curve for enrichment strips has the lowest level for both numbers of individuals and numbers of species, with only three species representing approximately 65 percent of individuals. A similar pattern was found in logged forests without enrichment strips (70 percent of individuals represented by only five species), even though the abundance of individuals and species richness was higher. The reduced diversity in intensively logged areas may have negative impacts on the regenerative capacity of the forest and its potential for wood production. For example, commercially valuable trees such as *Pachira quinata* (saqui saqui) and *Ceiba pentandra* (ceiba) depend on particular bat species for pollination.

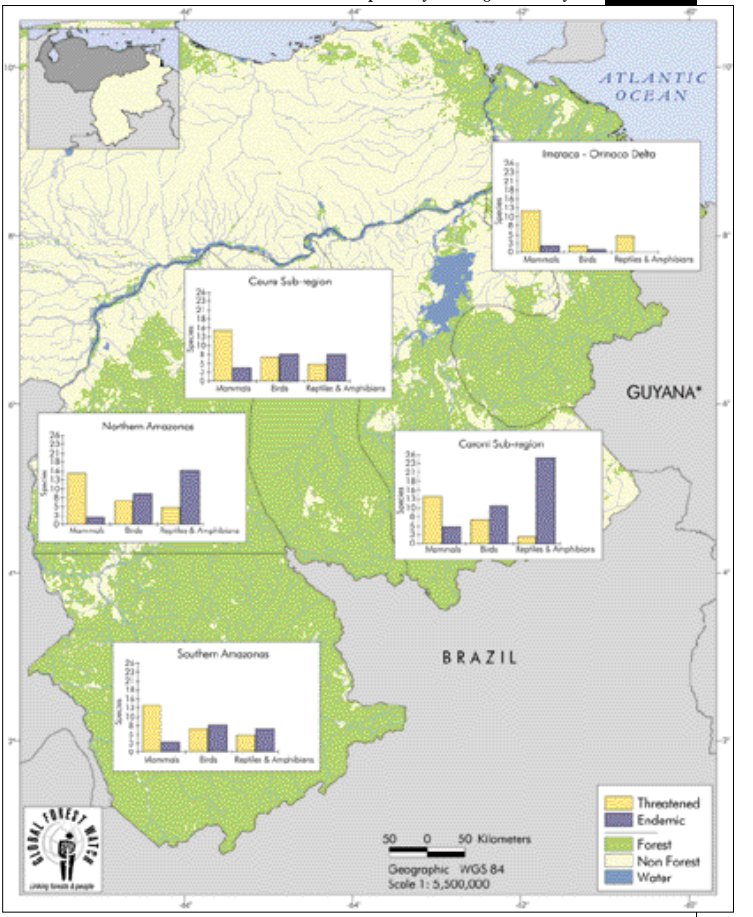
Effects of Logging on Bat Populations in the Guayana Region



Notes:

1. F.E. Putz et al., "Biodiversity conservation in the context of tropical forest management," The World Bank Environment Department Papers, Biodiversity Series-Impacts Studies (Washington, DC: World Bank ,), 75: 1-80; J.M. Thiollay, "Influence of selective logging on bird species diversity in a Guianan rain forest," *Conservation Biology* vol. 6: 47-63 (1992); D.J. Mason, "Responses of Venezuelan understory birds to selective logging, enrichment strips, and vine cutting," *Biotropica* vol. 28: 296-309 (1996); J. Ochoa G., "Efectos de la extracción de maderas sobre la diversidad de pequeños mamíferos en bosques de tierras bajas de la Guayana Venezolana," *Biotropica* vol 32: 146-164 (2000).
2. D.J. Mason, op.cit.
3. P. Charles-Dominique, "Inter-relations between frugivorous vertebrates and pioneer plants: *Cecropia*, birds, and bats in French Guyana," in A. Estrada y T. H. Fleming (Eds.), *Frugivores and seed dispersal*, pp. 119-135. (Dordrecht, Holand: Dr W. Junk Publishers, 1986); J. Kikkawa and P.D. Dwyer, "Use of scattered resources in rain forest of humid tropical lowlands," *Biotropica* vol. 24: 293-308 (1992); J. Ochoa G., "Efectos de la extracción de maderas sobre la diversidad de pequeños mamíferos en bosques de tierras bajas de la Guayana Venezolana," *Biotropica* vol 32: 146-164 (2000); A.D. Johns, "Effects of 'Selective' Timber Extraction on Rain Forest Structure and Composition and Some Consequences for Frugivores and Folivores," *Biotropica* vol.20: 31-37 (1988).

Threatened and Endemic Species by Sub-Region of Guayana **MAP 7**



These are schematic sub-regions based on general geographic and administrative zones. For source information, see Annex 1.
*According to the Geneva Agreement of February 7, 1966, Venezuela claims two-thirds of the territory of Guyana.

Some of the areas under greatest development pressure within the Guayana region exhibit exceptional reptile, amphibian, and bird endemism (species found nowhere else on earth).

According to Map 7, the Caroní watershed and the northern sector of the State of Amazonas have the highest concentrations of endemic wildlife species in Venezuela. Both of these subregions are characterized by a high degree of development pressure, which could negatively impact forest ecosystems and associated wildlife. This poses challenges in the case of some species whose known distribution is limited to Venezuela and therefore constitute a high conservation priority (e.g., *Lonchorhina fernandezi* –bat; *Crypturellus casiquiare* –mountain chicken; *Colostethus sanmartini* –frog). The Imataca-Orinoco Delta subregion, although subject to a high degree of intervention in its natural ecosystems, has a lower degree of known endemism.

Wildlife of the Guayana region includes thirty-five species whose populations are at risk, with mammals and birds representing the groups with the most taxa in this condition.

To determine the potential status of wildlife populations in the Guayana region, we evaluated species whose populations may be at risk of local extinction due to a combination of development pressures and the species' degree of sensitivity to changes in habitat (see Annex 1 for details). Amazonas State and the Caura subregion show the greatest number of species that are at risk for local extinction (see Map 7). Both of these subregions demonstrate a growing amount of forest degradation. Hunting, bushmeat trade, and forest conversion from natural resource extraction (shifting cultivation, logging, and mining) are among the primary activities affecting wildlife. In particular, some large mammals subject to high pressure from hunting, such as the tapir (*Tapirus terrestris*) and the capybara (*Hydrochaeris hydrochaeris*), are among the least abundant in the Guayana region.[29]

Non-Timber Forest Product Use in the Guayana Region

Non-timber forest resources are widely used by indigenous groups living in the Guayana region.

Non-timber forest resources consist of biological resources other than wood found in forest ecosystems. In the Guayana region, traditional and local communities use these resources as sources of food, construction materials, cosmetics, handicraft materials, and for religious purposes.

Our analysis of non-timber forest product use included a literature review of over one hundred published materials (see Annex 3 for a complete list). These sources indicate the direct use by local groups of at least 505 wild species (112 animals and 393 plants), of which the most commonly reported use is for food and medicine (54 percent and 42 percent, respectively). Bushmeat satisfies most of the protein needs of traditional indigenous communities and it comprises an important part of the diet of small-scale farmers living in the Guayana forests. Most bushmeat comes from hunting tapirs, white-lipped peccaries, large rodents, primates, currasows, and armadillos.[30] While mammals and birds are more commonly used for food,[31] more than 30 percent of the bibliographic references cite the use of invertebrates as an important source of protein during periods of meat and fish scarcity.

At least thirteen plants and animals found in forests of the Guayana region are known to be used by more than half of the local indigenous groups, and many non-timber forest species have multiple uses (see Table 5). For example:

- Four palm species (*Bactris gasipaes, Mauritia flexuosa*, *Leopoldinia piassaba*, and *Euterpe precatoria*) and four mammal species (*Tapirus terrestris, Tayassu pecari, Agouti paca,* and *Cebus* species) are reportedly used by more than 60 percent of the Guayana region's indigenous groups.

- Most of the species with reported traditional uses are plants, many of which have multiple uses (see Figure 7). For example, in the case of the moriche palm (*Mauritia flexuosa*), the roots, leaves, shoots, fruit, seeds, stem, and even the pulp and larvae of a beetle found on the stem are used for food, medicine, handicrafts, and the construction of housing.

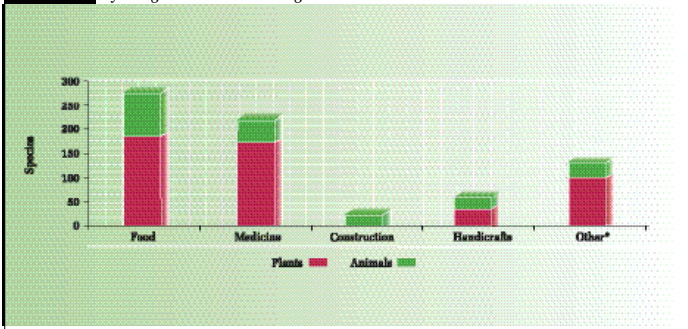
However, very few indigenous communities rely solely on wild flora and fauna to satisfy subsistence needs.[32] Currently, non-timber forest products complement the diets of local communities, who meet their caloric needs in part through shifting agriculture practiced within the forest.[33]

Selected Non-Timber Forest Resources Used by Indigenous Groups in the Guayana Region **TABLE 5**

Scientific name	Common name	Examples of uses	Indigenous groups
Bactris gasipaes	Pijiguao (Pejibaye)	Food, construction, medicine	Baniva, Curripaco, Guajibo, Piaroa, Yanomami, Warao, Hoti, Ye'kuana
Mauritia flexuosa	Moriche palm	Food, medicine, handicrafts, construction, religious	Baniva, Curripaco, Piaroa, Warao, Yanomami, Ye'kuana, Hoti, Pemón
Leopoldinia piassaba	Chiqui-chiqui palm	Food, medicine, handicrafts, construction	Baniva, Curripaco, Guajibo, Piaroa, Yanomami, Warao, Ye'kuana
Euterpe precatoria	Mavaca palm	Food, construction, medicine	Ye'kuana, Baniva, Curripaco, Guajibo, Piaroa, Warao, Hoti
Attalea maripa	Cucurito palm	Food, handicrafts, construction, games for children	Baniva, Curripaco, Guajibo, Ye'kuana, Yanomami, Hoti
ANIMALS			
Tapirus terrestris	Danta (tapir)	Food, medicine, handicrafts	Ye'kuana, Yanomami, Guajibo, Pemón, Hoti, Panare, Piaroa, Warao
Tayassu pecari	Baquiro (white lipped peccary)	Food, medicine, handicrafts	Ye'kuana, Piaroa, Pemón, Guajibo, Panare, Yanomami, Hoti
Agouti paca	Lapa (paca)	Food, medicine, handicrafts	Piaroa, Ye'kuana, Yanomami, Pemón, Guajibo, Panare, Hoti
Cebus olivaceus	Mono capuchino (Capuchin monkey)	Food, medicine, handicrafts	Pemón, Panare, Hoti, Ye'kuana, Guajibo, Piaroa, Yanomami
Panthera onca	Tigre (jaguar)	Food, medicine, handicrafts	Ye'kuana, Yanomami, Pemón, Guajibo, Piaroa, Panare
Tayassu tajacu	Chácharo (collared peccary)	Food, medicine, handicrafts	Ye'kuana, Piaroa, Pemón, Guajibo, Panare, Yanomami
Hydrochaeris hydrochaeris	Chigüire (capybara)	Food, medicine, handicrafts	Ye'kuana, Piaroa, Pemón, Guajibo, Panare, Yanomami

Note: Because the above list was compiled from information in the available literarure it is not comprehensive.
Source: GFW Venezuela, 2001. See Annex 1 for details.

FIGURE 7 **Proportions of Plants and Animals Used by Indigenous and Non-Indigenous Communities**



*Other includes construction of tools, utensils and magical/religious uses.
Note: Some species are used for multiple purposes.
Source: GFW Venezuela, 2001. See Annex 1 for details.

Non-timber forest products found in the Guayana region have important commercial uses for both indigenous and non-indigenous groups.

Unfortunately, non-timber forest product use has not been quantified. Data on the volume and value of products extracted are not available, although there appears to be interest on the part of some sectors of government in stimulating the development of these products.[34] However, the available literature suggests that the majority of indigenous communities sell part of the resources they obtain from forests to purchase ammunition and other manufactured goods.[35] For example, the Piaroa communities closest to Puerto Ayacucho take products derived from forest resources, such as seje palm oil, wild honey, handicrafts, and smoked meat to sell in the local market.[36]

Among the species most frequently associated with commercial uses are three species of palm (*Mauritia flexuosa*, *Leopoldinia piassaba,* and *Euterpe oleracea*) and one of liana (*Heteropsis spruceana*) (see Box 6 for a more detailed discussion of the commercial value of *Heteropsis spruceana*). Of these species, three are used to produce fibers and materials for handicrafts and furniture manufacturing. *Euterpe oleracea,* which is harvested in Delta Amacuro State, is the only species used to produce commercially marketed hearts of palm. In 1998, Venezuela exported more than 73,000 kilograms of palm heart, with an approximate value of $US 99,000.[37] The total export value of non-timber forest products in Venezuela was reported to be $US 5 million in 1998. This does not take into account the value of non-timber forest products consumed domestically, for which there are no data.

The capture and collection of parrots, toucans, macaws, and other species as pets is very common in the region. A large proportion of these animals is smuggled through the Orinoco Delta and enters neighboring Guyana as contraband, thus forming a part of the international wildlife trade.[38] In addition, some non-timber forest species have been evaluated in pharmaceutical tests to identify active agents with potential promise for Western medicine.

Some plant and animal species used by indigenous communities in the Guayana region are at risk of extinction at a national level.

We compared our database of species reportedly used by indigenous and local communities to those listed in the Venezuelan red books of species (*Libro Rojo de la Flora Venezolana* and *Libro Rojo de la Fauna Venezolana*). These books categorize plant and animal species according to their level of threat of extinction (see Annex 1 for details). Our findings indicate that:

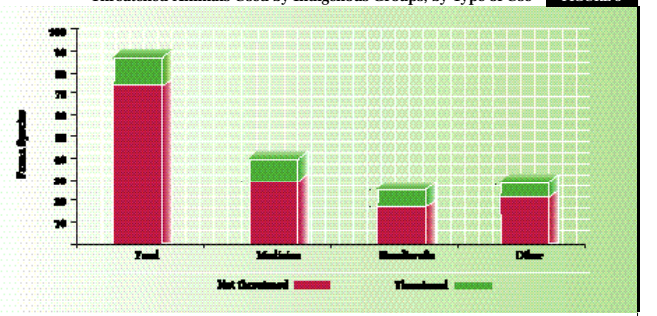
- Of the plants and animals reportedly used by indigenous communities, 16 percent are registered as threatened according to both Venezuelan red books.[39] Of these, the giant armadillo (*Priodontes maximus*), used by indigenous communities for medicine, food, handicrafts, and religious purposes, is at greatest risk for extinction in the near future.

- Approximately one-third of animal species used for handicrafts and one quarter of those used for medicine are classified as threatened (see Figure 8). Parrot feathers, toucan beaks, and the nails of various animals are the items most frequently used.

- Nearly two thirds of plants used for construction and more than one quarter of those used for handicrafts are threatened (see Figure 9).

- Some of these threatened plants are considered irreplaceable. For example, the Ye'kwana of the lower Caura watershed have observed the decline of certain plant species considered to have no other substitute for the manufacture of handicrafts.[40]

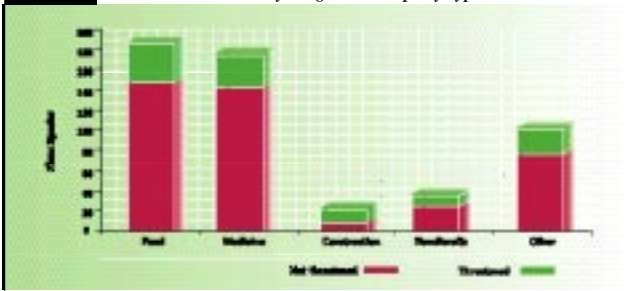
Threatened Animals Used by Indigenous Groups, by Type of Use* **FIGURE 8**



*Does not reflect intensity of use.

Sources: GFW Venezuela, 2001. See Annex 1 for details; J.P. Rodríguez and F. Rojas-Suárez, *Libro Rojo de la Fauna Venezolana*, 2d ed. (Caracas, Venezuela: Provita, Fundación Polar, 1999).

FIGURE 9 **Threatened Plants Used by Indigenous Groups, by Type of Use***



*Does not reflect intensity of use.
Sources: S. Llamozas et al., *Libro Rojo de la Flora Venezolana* (Caracas, Venezuela: Fundación Instituto Botánico de Venezuela, Provita, Fundación Polar, in press); GFW Venezuela, 2001. See Annex 1 for details.

Because the Guayana region remains relatively intact, plant and animal species found in this region demonstrate a better state of conservation than elsewhere in Venezuela. However, some of the species identified as threatened or vulnerable at a national scale are found primarily in the Guayana region. The literature indicates that local populations are beginning to report a decline of wildlife species near their communities, which is related to the sedentarization of indigenous communities, an increase in indigenous populations, and the use of firearms (see Chapter 4, Question 11). In many cases, this trend is evident in the greater distances indigenous peoples travel to hunt and harvest non-timber forest products. The loss of species critical for subsistence needs could decrease the nutritional value of the diets of traditional communities, as well as limit the options for commercialization of non-timber forest products.[41]

BOX 6 **Commercial Use of Non-Timber Forest Products: The Case of *Mamure***

Known locally as "mamure," the *Heteropsis spruceana* is a liana with hanging roots that climbs trees native to the lowland forests of the Guayana region. The roots have been used since ancestral times by indigenous communities in the construction of housing, furniture, woven baskets, and other items. The fruit of the liana is also traditionally eaten during hunting activities. The roots are increasingly being used in furniture manufacturing on local, national, and international levels. The furniture is similar to rattan, but production costs are lower.

Between 1990 and 1994, a total of 78 tons of "mamure" were harvested for furniture production in Amazonas State. Between 1994 and 1999, total production had decreased to 21 tons. Extensive areas of forest have been impacted to satisfy the demand for furniture. For instance, overharvesting has resulted in exhausting the roots of highest commercial value in areas near the indigenous community of Cataniapo.

Although liana harvesting for commercial uses has declined since 1996, the lack of data regarding the species, its reported scarcity, and its restriction to forest ecosystems of Bolívar and Amazonas indicate the need for greater control and management of extraction to guarantee the sustainable use of the species.

Source: I. Sánchez, "Algunos aspectos ecológicos del mamure (*Heteropsis spruceana Schott*) de interés potencial para su domesticación y manejo," Master's Thesis (Caracas, Venezuela: UCV, Facultad de Agronomía, 1999).

Forest Development Trends

Venezuela's forests are the source of a variety of economic and social activities. This section addresses indicators focusing on three major themes: logging, mining (gold and diamond), and human settlements. While not inclusive of all human-related activities in the country's forests, these represent some of the socioeconomic factors impacting forests, especially in the Guayana region.

Our objective was to answer the following questions:

- How important are mining and logging for the national economy?
- Who is involved in development activities in the forests of the Guayana region?
- Are companies complying with policies and regulations?
- What is the impact of development activities (especially logging and mining) in the region's forests?
- What are the impacts of population change on the forests of the region?

Data for this analysis were difficult to collect, and in many cases not publicly available. Venezuela does not maintain a cartographic database of logging and mining concessions. As in the case of protected areas, concession boundaries are identified through publication of geographic coordinates in an official gazette. However, no map accompanies the decree establishing these boundaries and in many cases there are no geographic coordinates. In the case of mining concessions, we were only able to represent the general area where mining concessions have been allocated because more than half of the concession boundaries have not been officially registered at the national level and geographic coordinates provided by government officials were incomplete.

At the moment, reliable data on the area and location of agricultural activities can only be obtained through satellite imagery. We did not map agricultural activities, as this would have required purchase and interpretation of recent, high-resolution satellite imagery, which was beyond the scope of this initial work. However, we have provided an indicator of agricultural activity by mapping settlements dedicated to raising crops, and we supplemented this with secondary sources. In the future, we hope to identify areas of agricultural activity in a select group of forest development zones, which will allow us to analyze these issues in more detail.

Our analysis found the following:

- Logging and mining contribute marginally to the national economy in terms of revenue collected. Logging fees were updated in 1999, but they still account for only 12 percent of the value of production. Royalties collected from mining accounted for only one percent of the value of reported production.

- The population of the Guayana region is growing rapidly and becoming more concentrated in urban areas on the forest edge. As these settlements grow, the demand for forest resources has also increased.

- The impacts of logging, mining, and population growth on the forests of the Guayana region are difficult to determine, due to the lack of regional data. However, the limited available data suggest that left unchecked these activities could lead to forest degradation, especially where land uses conflict.

- The lack of data on these activities and how they affect forest ecosystems represents the greatest threat to forests of the Guayana region because it precludes sound decision making and planning.

The current model of industrial development may provide some benefit to those directly involved in extractive activities, but this benefit is likely to be short-lived and will not improve the livelihoods of the majority of the Guayana region's inhabitants in the long run. Furthermore, the already evident population pressures in some parts of the region could undermine any attempt at sustainable development of the region's natural resources, if competing land uses are not addressed.

Logging

QUESTION 1 What is the relative importance of logging to the national economy?

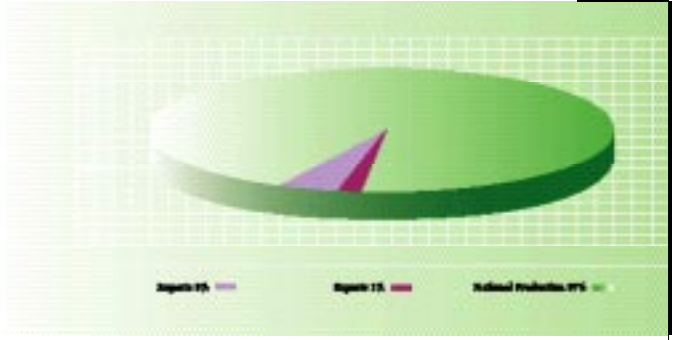
Nearly all of Venezuela's wood production serves a domestic market.

Venezuela's wood production satisfies a domestic market. Most wood logged from natural forests is processed as sawnwood (for construction and roofing materials), plywood (for interior uses), and veneer (for furniture). An analysis of import and export data shows that:

- Domestic consumption of roundwood is satisfied primarily by national production, with a relatively small proportion attributed to imports and exports (see Figure 10).

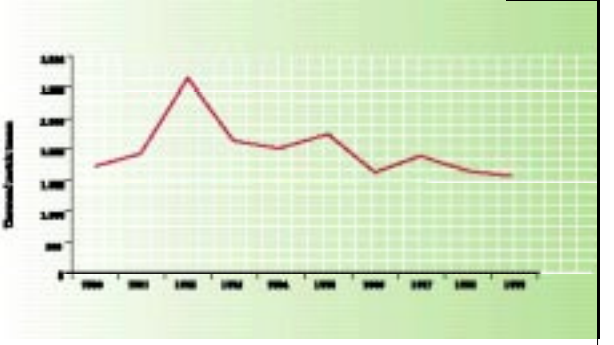
- Venezuela imports a significant portion of its pulp and paper, which is used primarily for newspaper and packaging for food products.[42] In 1999, imports represented 35 percent of consumption, although imports have declined throughout the 1990s (see Figure 11).[43]

Imports, Exports, and National Production of Roundwood, 1993-1998* **FIGURE 10**



*Values represent the average of production between 1993 and 1998.
Sources: MARNR, *Boletín Estadístico Forestal*, No 2 (Caracas, Venezuela: Ministerio del Ambiente y de los Recursos Naturales Renovables, 1999), p. 67.

Pulp and Paper Imports, 1990-1999 **FIGURE 11**



Note: Total imports according to FAO differ from official statistics.
Sources: FAO, "Pulp and Paper Imports Forestry Statistics, 2000." Online at: http://www.fao.org/forestry/include/frames/ (July 6, 2001).

It is possible that imports of some wood products (such as plywood and veneers) could rise in the future. Wood product imports from Brazil and Peru appear to be cheaper and of higher quality than wood products produced in Venezuela. For example, to construct the new Caruachi dam in southern Venezuela, wood products have been imported from Brazil, and the demand for veneer is increasingly satisfied by imports from Peru.[44] The significance of this trend at a national level is not yet clear.

Venezuela's overall wood production declined in the last twenty years and an increasing share comes from plantations.

Sawnwood comes from both plantations and natural forest concessions. Concessions also provide wood for plywood and veneer. Pine plantations currently provide pulpwood for production of hardboard, and plans are in place to produce particleboard and medium density fibreboard for global export. An oriented strandboard project is also being developed to use this same resource.[45] Analysis of wood production in Venezuela reveals that:

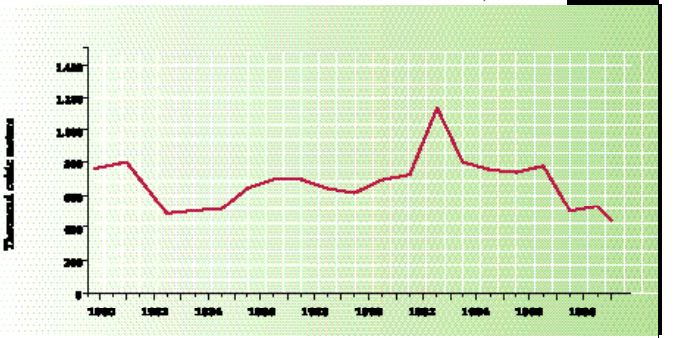
- Industrial wood production has declined since 1980, although production peaked in 1992 (see Figure 12).

- In the period from 1993 to 1998, wood production from plantations increased nearly 2.5 times, while production from cutting licenses declined by more than half (see Figure 13). Government policy has shifted away from promoting wood production from unregulated cutting licenses, also known as "deforestation" licenses, to production from logging concessions.[46] However, these figures do not reflect illegal logging that occurs sporadically throughout the Guayana region.[47]

- As of 1998, plantations covered approximately 729,000 hectares, of which nearly 75 percent are managed by state-owned companies (e.g., CVG-Proforca, Conare)[48] (see Table 6). Most plantations are located outside of natural forests.

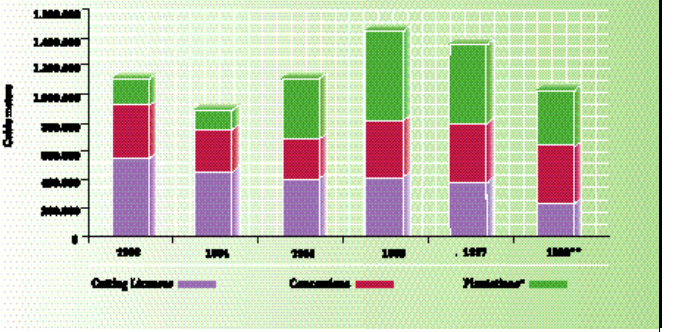
- In 1998, Caribbean pine (*Pinus caribaea*), which is produced solely on plantations, comprised more than half of national roundwood production.[49] This suggests that plantations could be a viable alternative to logging in natural forests. However, it is too early to assess the sustainability of plantations in Venezuela, given that most have not completed more than one rotation.

Industrial Wood Production, 1980-1999 **FIGURE 12**



Note: Industrial wood in roundwood equivalents (industrial roundwood=1; Plywood=2.3; Sawnwood=1.82; Veneer sheet=1.9).
Sources: FAO,"FAOSTAT, 2000." Online at: http://www.fao.org/forestry/include/frames/ (July 6, 2000).

Wood Production by Source, 1993-1998 **FIGURE 13**



* Caribbean pine plantations.
** Official estimate.
Sources: MARNR, *Boletín Estadístico Forestal*, Nº 2 (Caracas, Venezuela: MARNR, 1999).

TABLE 6 **Forestry Plantations in Venezuela, 1998**

Company	Location (State)	Area (ha)	Species
PUBLIC SECTOR		**542,000**	
MARN	Anzoátegui, Barinas, Mérida, Portuguesa, Táchira, Trujillo, Yaracuy	550	Teak, Pine, Eucalyptus, Cedar, Apamate, Mahogany, Pardillo, Bamboo
CVG-Proforca	Monagas, Anzoátegui	518,000	Caribbean pine
CVG-Programa Caucho Natural	Amazonas	230	Rubber
CONARE	Aragua, Barinas, Lara, Mérida, Portuguesa, Táchira, Trujillo, Yaracuy, Carabobo, Cojedes, Guárico, Zulia, Monagas	22,000	Caribbean pine, Eucalyptus, Pino oocarpa, Apamate, Mijao, Cedar, Mahogany, Pardillo, Teak, Leucaena, Bucare, Guayabon, Cipres, Fresno, Acacia
Other Projects	Barinas	1,400	Teak, Melina, Mahogany, Cedar, Pine, Pardillo, Bamboo, Jobo, Saman, Jabillo, Apamate
PRIVATE SECTOR		**187,000**	
Corp. Forestal Guayamure e Imataca	Monagas, Anzoátegui	72,500	Caribbean pine
SMURFIT Cartón de Venezuela	Portuguesa, Lara	31,000	Caribbean pine, Eucalyptus
Desarrollo Forestal San Carlos (DEFORSA)	Cojedes	4,400	Caribbean pine, Eucalyptus
Forestal Anzoátegui	Anzoátegui	2,000	Eucalyptus
Forestal Orinoco	Anzoátegui	550	Caribbean pine, Eucalyptus
TRACFOR, CA	Anzoátegui	4,500	Caribbean pine, Eucalyptus
Asociación de Agrotecnicos La Tentación	Anzoátegui	3,000	Caribbean pine, Eucalyptus
Plantation established in natural forests as part of management plans	Bolívar, Barinas	69,000	Teak, Melina, Puy, Saman, Mureillo, Pardillo, Zapatero, Mahogany, Mijao, Algarrobo, Cedar
TOTAL		**729,000**	

Source: MARNR, *Boletín Estadistico Forestal*, Nº 2, Año 1998 (Caracas, Venezuela: MARNR, 1999), p. 32.

Fees and royalties were increased substantially in 1999, but they still remain low compared to the value of production.

Logging companies are charged a range of fees and taxes. Area taxes are low, averaging about $US 0.06 per hectare in each annual cutting plan. Logging fees include a "technical services fee," a fiscal fee, and a documentation fee, all of which are assessed on a per cubic meter basis. The technical services fee, which is meant to pay for services provided by the Forestry Department, was established by law in 1994. The law set fees at Bs. 880 per cubic meter for primary species and Bs. 500 per cubic meter for secondary species. Because fees were set in national currency, the percent of fees relative to the value of production declined over the years due to high rates of inflation.

In 1999, the government published Decree 363, which updated the law establishing fees for government services. A review of the new law reveals that:

- Fees are now set in "tax units," whose value varies according to inflation. This is a marked improvement on the previous law, as it prevents fees from decreasing in value.
- Technical services fees charged per cubic meter of wood extracted were revised upward, resulting in a more than ten-fold increase (see Table 7).

• In 1997, royalties and fees comprised approximately 3 percent of the value of production of the Guayana region. In 1999 fees were estimated to be 12 percent of the value of production in the Guayana region.

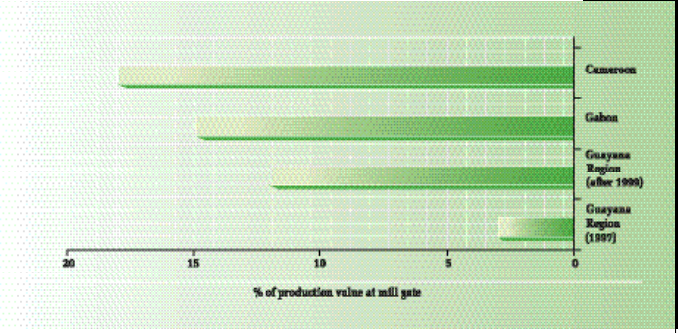
• These revisions have resulted in greater returns from logging to public coffers. However, compared to other tropical wood producing countries, Venezuela's logging fees are still somewhat low (see Figure 14). If Venezuela had collected fees at the same rate as Cameroon, it would have received an additional $US 200,000.

Logging Fees Applied to the Guayana Region **TABLE 7**

Fee	1997 (Bs./cubic meter)	$US/ cubic meter	After 1999 (Bs./ cubic meter)	$US/cubic meter
Technical service fees (*Ley de Timbre Fiscal, 1994*)	697	$1.43		
Revision of technical services fee (Decree 363, 1999)			9,292	$15.37
Documentation tax (Guía y planilla)	28.80	$0.06	28.80	$0.05
Fiscal tax (participación fiscal)	1,056.6	$2.17	1,056.6	$1.75
TOTAL	**1,782.4**	**$3.66**	**10,376.8**	**$17.16**

Average exchange rates: 1997: $ 1 US=Bs. 487.59; 1999: $ 1 US=Bs. 604.69.
Sources: GOV, *Ley de Timbre Fiscal*, Gaceta Oficial No. 4727. Ex., 27/5/94 (Caracas, Venezuela: Government of Venezuela, 1994); MARNR, "Planilla de Recolección de Información de Concesiones" (Caracas, Venezuela: MARNR, no date); GOV, Decreto 363, Gaceta Oficial No. 5391 Ex., 22/10/99 (Caracas, Venezuela, Government of Venezuela, 1999).

Logging Fees as a Proportion of Production Value in the Guayana Region and Other Tropical Countries **FIGURE 14**



Source: J.G. Collomb et al., *A First Look al Logging in Gabon* (Washintong, DC: WRI, 2000); J.G. Collomb et al., *An Overview of Logging in Cameroon* (Washington, DC: WRI, 2000).

QUESTION 2 Where are logging concessions located and how are they allocated?

Logging concessions make up less than 7 percent of the forests of the Guayana region. Over half of the concessions are inactive.

Logging concessions are granted in forest reserves created by presidential decree or in forest lots established by the Ministry of Environment. The land is owned by the state and leased out to concessionaires for 20 to 40 years. The majority of logging on forestry concessions in Venezuela takes place in the Guayana region, particularly the eastern portion.

Nearly all the logging concessions were given out to national companies operating with private capital. One concession (CVG-Sierra Imataca) was given out to a regional state-run company, although it is currently inactive. Two concession requests from educational institutions are under review as of August 2001; if awarded, will be granted for research purposes, to study the sustainability of logging in southern Venezuela. Because these are experimental plots, the operators are exempt from paying taxes. A review of the area under concession shows that:

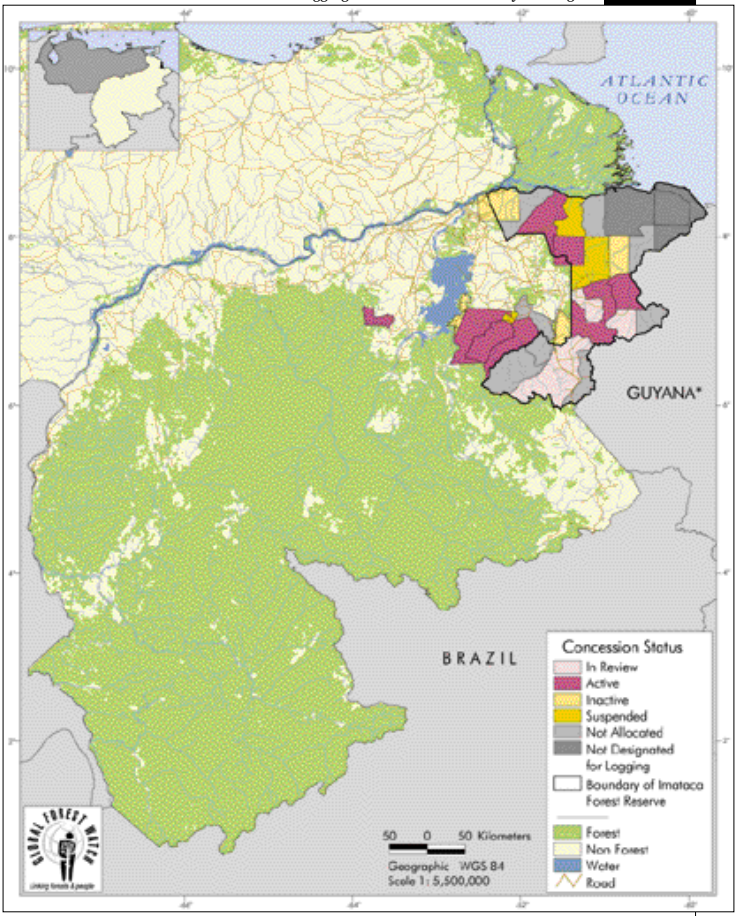
- Of the area in forest reserves and forest lots in the Guayana region, 20 percent is under concession (see Map 8).
- More than half of the nineteen logging concessions are inactive.

QUESTION 3 What are the administrative and legal requirements for logging?

Logging concessions are granted primarily on public lands (forest reserves and forest lots). Because the land is publicly owned, logging concessionaires are expected to follow administrative requirements to ensure that the commercial value of the forest remains intact. Concessions follow an administrative process from initial project phase to the development and execution of cutting cycles (see Figure 15). In theory, concessions are granted at public auction, but information about such a process is not available publicly and the criteria for awarding concessions are considered confidential.

In order to log, concessionaires are required to develop a management plan that includes a forest inventory estimating how much wood will be harvested per year and the relative abundance of existing commercial species. Each year, the concessionaire presents an annual cutting plan, from which the Forest Resources Department assigns a quota of wood to be extracted. Concessionaires are only allowed to extract trees greater than 40 centimeters in diameter at breast height (dbh). The volume extracted varies according to each concession, and logging fees are assigned based on the annually established quota. Thus concessionaires have an incentive to meet their quotas, as the tax rate remains the same no matter how much wood is extracted. To ensure contributions to the local economy, Venezuelan forest policy requires all concessionaires to operate their own sawmills.

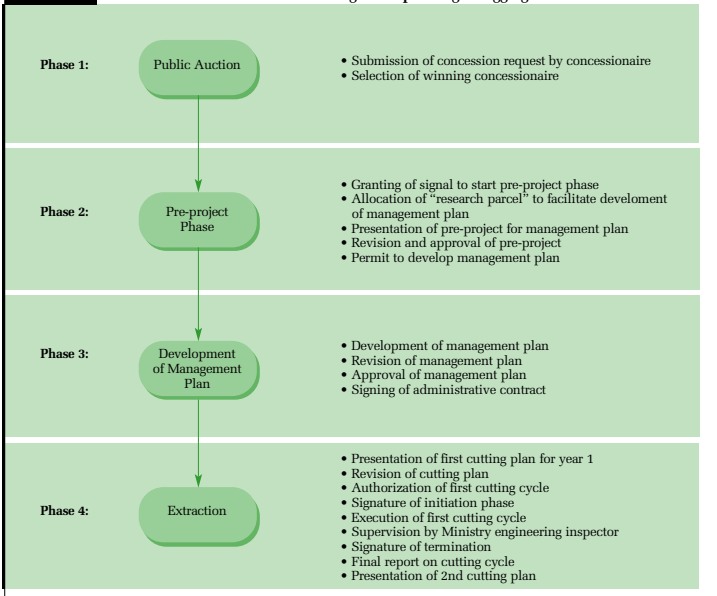
Status of Logging Concessions in the Guayana Region **MAP 8**



To date, concessions have only been allocated in Bolívar State. "Active" = concessions currently being logged; "Inactive" = concessionaires have stopped logging; "Suspended" = logging has stopped pending government investigation of infractions; "In review" = inactive pending government review of the management plan. For information on sources see Annex 1.
* According to the Geneva Agreement of February 7, 1966, Venezuela claims two-thirds of the territory of Guyana.

After extracting valuable commercial wood species, concessionaires are normally required to establish plantation corridors (enrichment strips) in some areas of logged compartments. These corridors are thirty to fifty meters apart and three to five meters wide. All remaining trees in the enrichment strips are cleared to make room to plant valuable commercial species, which concessionaires must maintain throughout the life of their contracts.[50]

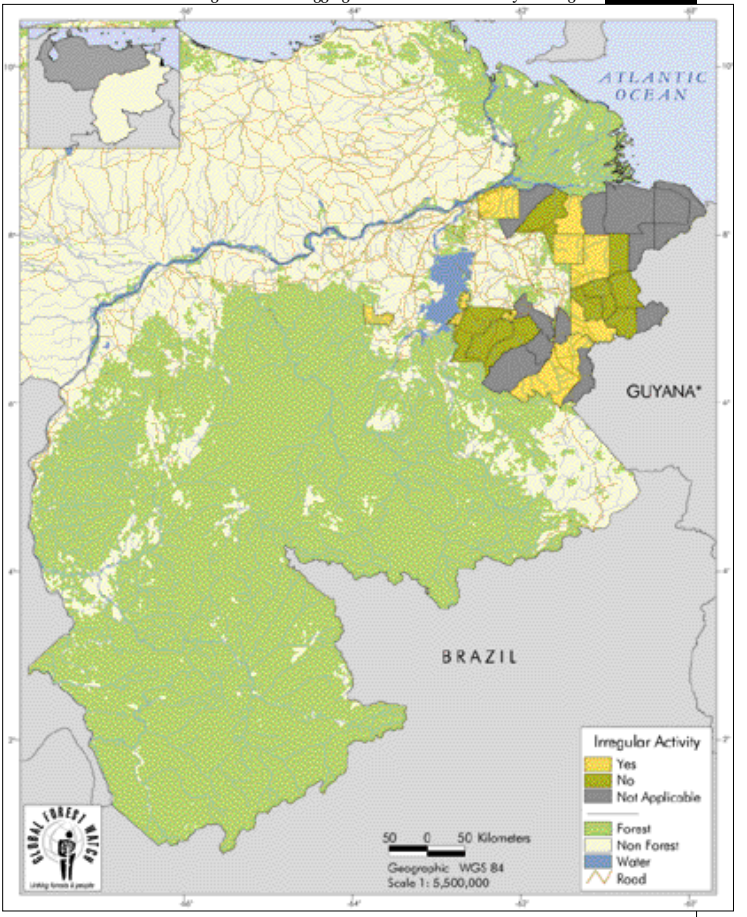
FIGURE 15 **Administrative Process for Obtaining and Operating a Logging Concession**



Data indicate that concessionaires have trouble complying with existing policies and regulations.

Map 9 shows two kinds of irregularities in concession activities: a) not owning a sawmill and b) being under investigation by the Ministry of Environment for infractions. According to interviews with sawmill operators and an analysis of management plans:

Irregularities in Logging Concessions in the Guayana Region **MAP 9**

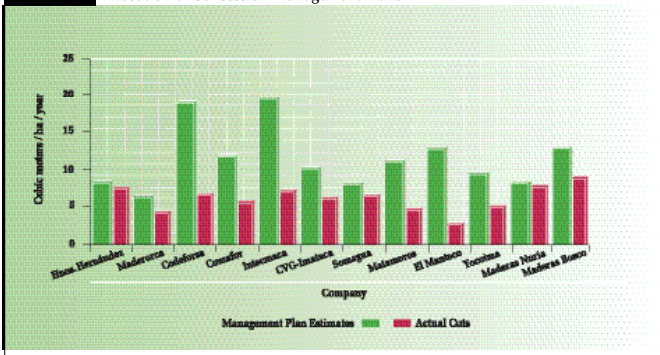


By Venezuelan law, all concessionaires must operate a sawmill. "Irregular" concession holders are defined as those who are currently under investigation for forestry infractions or do not operate a sawmill. For information on sources see Annex 1.
*According to the Geneva Agreement of February 7, 1966, Venezuela claims two-thirds of the territory of Guyana.

- Nearly half of the concessions (42 percent) do not have their own sawmills and are thus not in compliance with their contracts. Concessionaires who do own sawmills stated that they sometimes export logs outside the Guayana region. If true, this indicates a failure to capture added value at a regional level.[51] Some experts estimate that approximately half of the wood leaves the Guayana region as logs to be processed elsewhere.[52]
- One fifth of the concessions are under investigation for failing to comply with management plans. Further data on the nature of these investigations are not publicly available and are considered confidential.

Our data indicate that concessionaires have difficulty completing other aspects of their management plans as well. None of the concessionaires met the volume of cuts estimated in their management plans (see Figure 16). Indeed, 38 percent of the operating concessions harvested less than half of what was forecast in management plans, which may indicate poor underlying inventory data. Lack of such basic data implies that it would be difficult to comply with additional requirements such as adequate planning or reduced-impact logging techniques.

FIGURE 16 **Execution of Concession Management Plans**



Source: GFW Venezuela, 2001. See Annex 1 for details.

QUESTION 4 **How much wood is extracted from the Guayana region forests?**

Concessionaires practice selective logging in the forests of the Guayana region.

Wood is extracted at an average rate of approximately 2.5 trees per hectare or the equivalent of 5.3 cubic meters per hectare. Similar to the rate reported in Cameroon,[53] this rate of extraction is considered to be very low when compared to other tropical countries, including other Guiana Shield countries and the Brazilian Amazon.[54] This means that a few commercial species are extracted at a low density.

Low extraction rates in the Guayana region are due partly to the relatively low occurrence of large commercial trees (>40 cm. dbh) per hectare and partly to the fact that concessionaires use official cubic meters to report volumes extracted. The official cubic meter is a measurement calculated by the Venezuelan government to estimate the volume of sawnwood, forming the basis for reporting volume produced and calculating taxes.[55] Because this measurement underestimates roundwood volume by up to one third, it is difficult to estimate the volume of wood extracted.[56]

Logging concessionaires focus primarily on a few species of high value to satisfy the national market. The results of our analysis indicate that:

- Nearly half (46 percent) of the concessionaires in the region target fewer commercial species than when they began harvesting.[57] This trend was particularly evident in the late 1990s, when an economic recession resulted in a contraction of the national market for wood.[58]

- Because concessionaires are allowed to harvest a limited amount of wood each year, they tend to extract larger trees or those with the highest diameter at breast height. This is generally done to secure the highest economic returns on the volume of wood extracted each year.

Such low levels of extraction can result in lower levels of disturbance than more intensive logging or clearcutting. However, selective logging (or high-grading) also results in a larger area of forest accessed per unit of wood extracted, and does not necessarily result in a low level of damage to surrounding trees[59] (see Question 5 below). Furthermore, high-grading results in overharvesting of valuable species, a practice that is not sustainable over time.[60]

Sawmill capacity in the Guayana region greatly exceeds production.

In 2001, the Guayana region had thirty-six sawmills, of which eight process wood from Caribbean pine *(Pinus caribaea)* plantations. The remainder process wood from natural forests, primarily from the Imataca Forest Reserve and surrounding forest lots. Sawmills are located near major cities and towns, and close to roads.

Installed capacity in the Guayana region is twice as high as the average volume of sawnwood processed per year (see Figure 17). The total installed capacity of the sawmills in the Guayana region is about 194 thousand cubic meters of sawnwood per year, but actual production is only approximately 95 thousand cubic meters per year. Because concessionaires routinely export logs outside the Guayana region, this indicates a failure to capture added value at a regional level.

Sawmills operating in the Guayana region are obsolete, have low levels of technical staff, and generate significant waste.

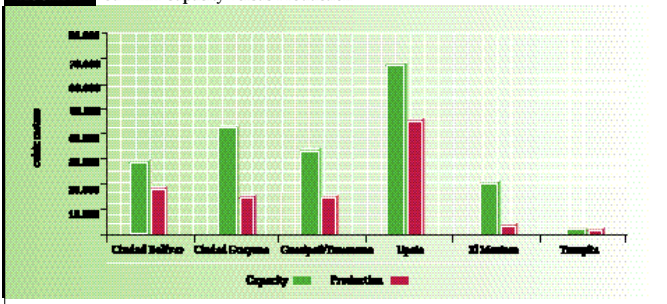
The level of technology used at the sawmills is low, and most lack trained professionals to run daily operations. In particular:

- Many sawmills processing wood from natural forests make little or no investment to improve operations. For example, the majority have neither dryers (*plantas de secado),* nor the capacity to treat processed wood against fungi or insects.[61]

• Only 18 percent of staff at the twenty-four operating sawmills in the Guayana region, are trained (see Figure 18), and nearly all of these are working in sawmills operated by concessions, where the Ministry of Environment requires the employment of trained professionals.

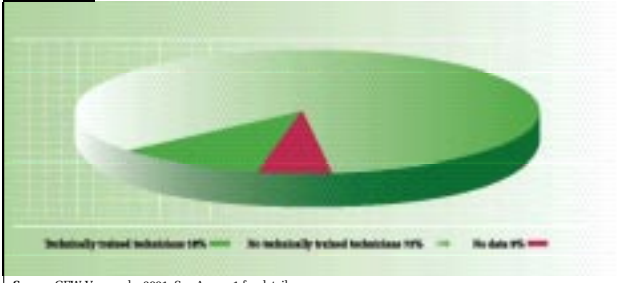
Because of outdated technology, up to half of the wood processed in sawmills is wasted.[62] Such inefficiency is similar to that observed in sawmills of neighboring Guiana Shield countries.[63] In contrast, in northern European countries, sawmill waste is considered a byproduct and is used as input to pulp or board production, or as fuel.

FIGURE 17 **Sawmill Capacity versus Production**



Source: GFW Venezuela, 2001. See Annex 1 for details.

FIGURE 18 **Proportion of Trained Staff Working at Sawmills of the Guayana Region, 2001**



Source: GFW Venezuela, 2001. See Annex 1 for details.

The Guayana region lacks a transparent and reliable system for verifying the amount of wood extracted and processed in the region's sawmills.

Data obtained for this study were based on a survey of sawmill operators. Sawmill owners are reticent to provide data on volume of wood entering the mill, and records kept by sawmills are neither reliable nor up-to-date. Our data indicate that:

- Sawmill records show discrepancies between the volume of wood entering sawmills compared and the volume of sawnwood produced. Half of the sawmills operating in the Guayana region report greater volumes of sawnwood leaving the mill than roundwood entering the mill.[64]

There is an internal market for roundwood among sawmill operators and some concessionaires are known to sell roundwood to other sawmills, either because they do not have their own mill or because they are unable to process all wood extracted from their concessions. In some cases, sawmill operators stockpile hardwood logs in order to process them during favorable economic markets. This may account for some of the discrepancy.

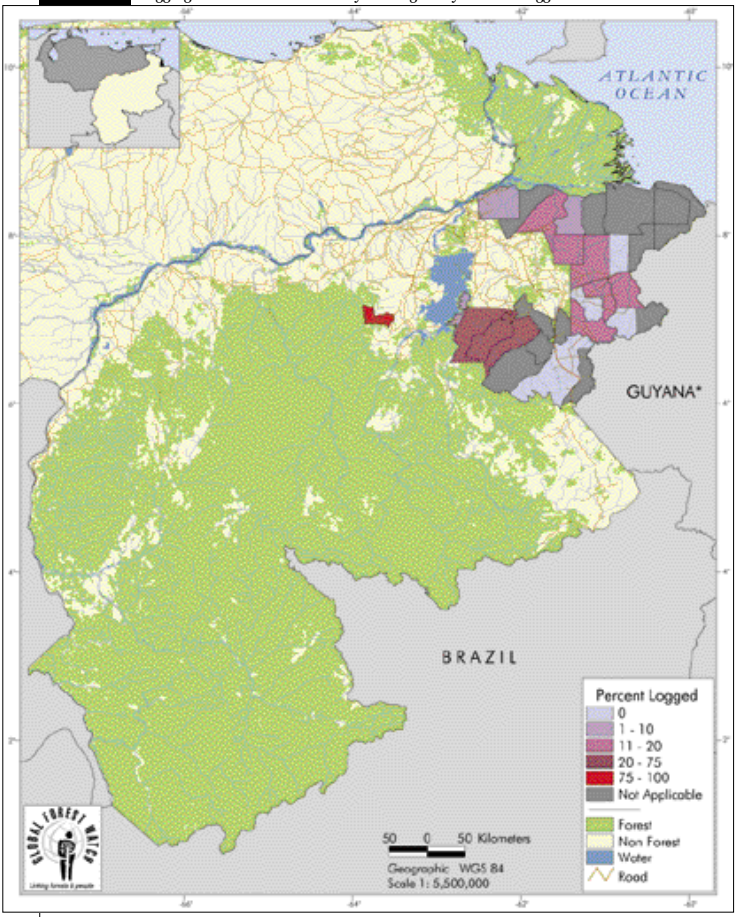
What is the impact of logging on the forests of the Guayana region? QUESTION 5

The forests of the Guayana region are still relatively intact, but poorly planned logging could facilitate deforestation by other actors.

Of the approximately 2.5 million hectares under concession in the Guayana region, approximately 15 percent have been accessed (see Map 10). Primary and secondary roads, skidder trails, and enrichment-strip planting have been established in these forests. Lack of data on the exact area of forest disturbed by logging makes it difficult to determine the impact of logging on biodiversity in a comprehensive manner. However, studies indicate that:

- Logging concessionaires do not seek to minimize road development, suggesting higher levels of forest fragmentation and disturbance per hectare than if concessionaires were to adopt reduced-impact logging techniques.[65]
- Logging in the Guayana region has been found to significantly impact the frequency with which some bird and bat species are found. Opportunistic species that thrive on disturbance become more frequent, while those that are more sensitive to changes in the canopy cover decline.[66]
- Preliminary data show that logging in the Imataca Forest Reserve killed or damaged 30 to 40 percent of the surrounding adult trees in a one-hectare area.[67] However, because these effects were observed in an area that had been recently logged, additional research is needed to establish how much regeneration occurred after extraction.

MAP 10 **Logging Concessions in the Guayana Region by Percent Logged**



For information on sources please see Annex 1.
*According to the Geneva Agreement of February 7, 1966, Venezuela claims two-thirds of the territory of Guyana.

The capacity for regeneration of commercial tree species harvested in the Guayana region is not well understood, even after seventeen years of logging in this region. With a few exceptions,[68] there have been no studies focusing on silvicultural techniques appropriate to the region, indicating the lack of scientific knowledge underlying current forestry practices. For most commercial species logged, regeneration is known to be deficient, which casts doubt whether they can be sustainably harvested in the long-term.[69]

Indirect impacts are potentially the most significant. Logging often opens up otherwise inaccessible forest to invasion by outsiders.[70] It also increases the probability of forest fires by reducing the forest canopy and allowing sunlight to dry up leaves and other dead organic material on the forest floor. For example, logging in the Amazon rainforest of Brazil has been found to greatly increase the flammability of the forest by increasing the amount of fuel available for forest fires.[71] In Venezuela, evidence strongly suggests that logging has already facilitated colonization, although there is little evidence to date of increased fires.

Logging was a contributing factor in the deforestation of forest reserves in northwestern Venezuela (see Box 7). Political interests and the agrarian reform law were also important factors promoting conversion of forests to agriculture.[72] Evidence suggests that this process is already underway in the Guayana region (see Question 11), although lack of data makes it impossible to estimate the area of forest affected. However, the boundaries of at least one logging concession in the Imataca Forest Reserve have already been adjusted to account for invasion by small-scale farmers.[73] Furthermore, local politicians in Delta Amacuro State were openly encouraging small-scale agriculture in the northern sector of Imataca in 1996.[74]

At the moment, government data do not show significant forest loss due to fires; for 1995, the Ministry of Environment reported a total of 889 forest fires, which burned slightly more than 207,000 hectares, less than 1 percent of Venezuela's forest cover.[75] Since 1990, this was the largest area of forest reported burned in a single year.[76]

Summary and Analysis

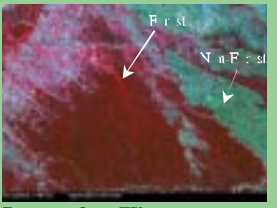
Although the extent of logging in the Guayana region is limited, current management practices result in inadequate revenue capture and potentially high environmental costs. Our data show that sawmills are inefficient, concessionaires do not follow forestry and management plan requirements, and forestry practices are likely to result in forest degradation and to facilitate large-scale deforestation in areas of high population pressure. Some environmentalists have encouraged plantation development outside of natural forests to reduce pressure on these forests.[77] Already the small number of plantations outside of forests supply more than half of the nation's demand for wood. However, more data are needed to determine the sustainability of plantations in Venezuela.

BOX 7 The Role of Logging in Deforestation in the *Llanos*

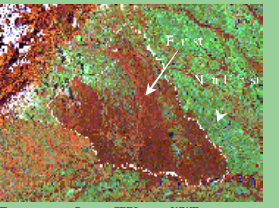
Venezuela's first forestry reserves were created in the early 1950s in the *llanos* region, and the first. concession was first awarded in 1970. Of the five original forest reserves in the *llanos*, only two have active logging concessions today. The remaining reserves have been converted to agricultural plots, and logging concessionaires have long since ceased operations.

In northwestern Venezuela, forest reserves have been intensely affected by the invasion of small-scale farmers, often with the tacit support of local political interests. A combination of population pressures, fertile soils, and political interests has resulted in forest conversion for agriculture in the *llanos*. These factors have been further aggravated by lack of political will on the part of local politicians and the National Guard to restrict access on logging roads.

Nowhere is this more evident than in the Ticoporo Forest Reserve, where only one logging concession out of three remains in operation. Created in 1955, the reserve spanned 270,000 hectares of forest. By 1972, one-third of the forest reserve had been invaded illegally by small-scale farmers who sought land under the national Agricultural Reform Law.[1] Venezuelan law explicitly prohibits deforestation in forest reserves without prior approval from the National Congress.[2] Despite this, agricultural invasions –at times accompanied by intense fires– have continued throughout the 1990s, resulting in the elimination of forest cover (see satellite images). In the remaining active logging concession, 75 percent of the area has been invaded by small-scale farmers, many of whom are illegally extracting valuable hardwoods (such as mahogany) before the concessionaire reaches the annual cutting parcel.[3]

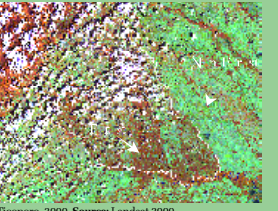


Ticoporo, 1972. **Source:** CPDI, 1999



Ticoporo, 1988. **Source:** CPDI, 1997; WWF 1998

Red= Forest
Green= Non-forest



Ticoporo, 2000. **Source:** Landsat 2000

Note: The orientation and size of the reserve differs slightly in each image.
Sources: 1972 Image: Landsat MSS, Centro de Procesamiento de imágenes, 1999, 1998 compilation of images: Top=6-54 from 1998, World Wildlife Fund, Bottom= 655 from 1/20/97, Centro de Procesamiento de Imágenes; 2000 image: Landsat 7, available at: www.usgs.landsat7.gov, 006/054 Landsat7=06/02/2000, ID=E1SC: L7RWRS.002: 2000733201, 006/055 Landsat7=06/02/2000, ID=E1SC: L7RWRS.002: 2000733208

1. O. Encinas and F. Pacheco "Country Study Venezuela: Industrial Logging in Ancient Forests" Interim Report for Greenpeace International (Amsterdam, The Netherlands: AIDEnvironment, September 1999); J.P. Veillon, "Las deforestaciones en los Llanos Occidentales de Venezuela desde 1950 hasta 1975," in L. Hamilton et al. (eds.) *Conservación de los Bosques Húmedos de Venezuela* (Caracas, Venezuela: Sierra Club, Consejo de Bienestar Rural, 1977).
2. See GOV, *Ley Forestal de Suelos y Aguas*, 1965, Title IV, Section 2, article 57 (Caracas, Venezuela: Government of Venezuela, 1965); Miranda et al., *All That Glitters is Not Gold: Balancing Conservation and Development in Venezuela's Frontier Forests* (Washington, DC: WRI, 1998).
3. O. Encinas and F. Pacheco, "Country Study Venezuela: Industrial Logging in Ancient Forests" Interim Report for Greenpeace International (Amsterdam, The Netherlands: AIDEnvironment, September 1999).

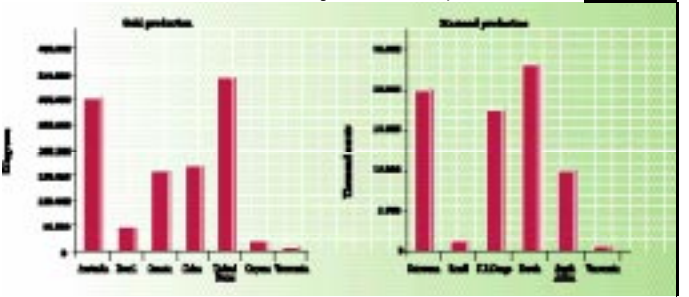
What is the relative importance of mining to the national economy? QUESTION 6

Venezuela's gold and diamond production is low, compared to major producers, although Venezuela is an important producer of some metals.

Venezuela's heavy metal production includes gold, diamonds, iron ore, aluminum, and bauxite. Gold and diamonds are mined primarily in forests of the Guayana region, while bauxite and iron ore are mined outside of forests. An analysis of metal production data shows that:

- Venezuela ranks low compared to other gold and diamond producers (see Figure 19).
- Venezuela is an important producer of iron ore, bauxite, and aluminum, ranking among the top fifteen producers globally for each metal (see Table 8).[78]

Venezuela's Gold and Diamond Production Compared to Other Major Producers, 1999 FIGURE 19



Sources: US Geological Survey, *US Geological Survey Minerals Yearbook* (Washington, DC: USGS, 1999); MEM, Dirección de Planificación y Economía Minera, *Anuario Estadístico Minero* (Caracas, Venezuela: MEM, 1999).

Aluminum, Bauxite, and Iron Ore Production, 1999 TABLE 8

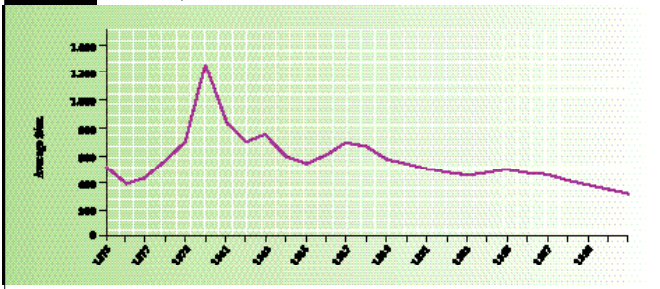
Metal	Production - 1999 (thousand metric tons)	World Rank
Aluminum	570	10
Bauxite	4,166	7
Iron ore	14,051*	11

* Gross weight.
Source: I. Torres, "Minerals Yearbook-International, Venezuela Chapter, 1999" (Washington, DC: USGS).

The prices of major minerals are at near record lows.

Gold prices have been on a downward trend for the last twenty years (see Figure 20). Prices for other commodities have declined as well. Low prices generally mean that mining companies scale back on mineral exploration activities. For example, since 1998, the number of foreign mining companies with holdings in Venezuela has declined by more than 25 percent.[79]

FIGURE 20 **Price of Gold, 1975-2000**



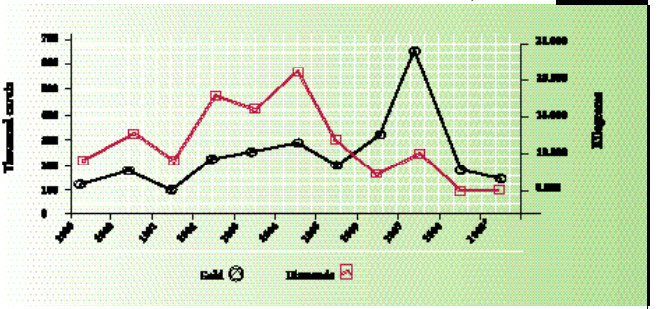
Note: Adjusted for inflation.
Sources: World Gold Council, "Gold Demand Up 11% in Q4 2000," *Gold Demand Trends* 34, Feb. 2001, Online at: http://www.gold.org/Gedt/Gdt34/Gdt34.pdf (June 28, 2001); The Gold Institute, 2001; IMF, July 2001.

Currently, gold and diamond mining contribute little to the national economy, but new tax legislation could generate greater revenue.

In 1999, Venezuela reported production of 5,946 kilograms of gold, with an estimated value of $US53 million. Although this does not include gold produced by illegal operators, it represented less than one tenth of one percent of Venezuela's GDP.[80] Between 1993 and 1997, mining companies paid a total of approximately $US 9 million in taxes, accounting for one percent of the value of production.[81] Our analysis shows that:

- Gold production peaked in 1997, and has been declining since (see Figure 21). Diamond production has been declining steadily since reaching a high of 583,000 carats in 1994.
- In theory, royalties on precious minerals (gold and diamonds) are 3 to 4 percent of the value of the refined mineral. This compares favorably with royalties in other mineral-producing countries, which range from 1 to 3 percent of the value of the mineral.[82] However, the president has the discretion to reduce royalties to 1 percent of the value of production (see Table 9).
- The new mining law substantially increased area taxes and set them in tax units pegged to inflation. Although area taxes increase over time, they are offset by the amount of the royalty paid once exploitation begins.[83]

Venezuelan Gold and Diamond Production, 1989-1999 **FIGURE 21**



*Estimate.
Source: MEM, Dirección de Planificación y Economía Minera, *Anuario Estadístico Minero*, (Caracas, Venezuela: MEM, 1999).

Mining Royalties **TABLE 9**

Type of tax	Value
Area (adjusted depending on size of concession)	0.17 tax units for 2,052 hectare concession (Bs. 2,244 or $US 3.12) per month
Royalties	3-4% of the value of refined gold and diamonds, but can be reduced to 1% by the president
Income tax	34% of net income from mining companies

Notes: (1) Tax unit value was assessed at 13,200 bolívares as of July 9, 2001. Exchange rate= Bs. 720.75 / 1 $US. (2) Area tax rates vary according to the total size of the concession. The area tax rate is shown for years 4-6 of a 2,052 hectare concession as that is roughly approximate to the size of mining concessions in the Guayana region.
Sources: Government of Venezuela, "Decree 295: Decree with the Same Status and Effects of a Mining Law," (Caracas, Venezuela: GOV, 1999, translated from Spanish original, available at: http://www.camiven.com/msg8.htm, last accessed: July 18, 2001); Miranda et al., *All That Glitters is Not Gold: Balancing Conservation and Development in Venezuela's Frontier Forests* (Washington, DC: WRI, 1998), p. 34.

Gold and diamond mining play an important role at a regional level.

Small-scale mining is a regionally important activity in Bolívar State, as it generates employment and provides an economic alternative for low-skilled workers during times of recession.[84] The number of small-scale miners operating in the region tends to increase during times of national economic crisis.

Illegal small-scale miners, the majority of whom operate in the Guayana region, are estimated to produce 10 to 15 tonnes of gold per year, with a value of approximately $US90 to $US130 million.[85] This is in addition to production that is officially reported by the Venezuelan government.

QUESTION 7 Where are mining concessions and how are they allocated?

Legislation regarding concession allocation has resulted in overlapping mandates.

The Venezuelan state holds the rights to minerals found beneath the soil. The rights to extract these minerals are given out through a concession system managed by the Ministry of Energy and Mines (MEM). Concessions last for up to twenty years, with possible extensions not to exceed an additional twenty years. Originally, MEM held sole responsibility for allocating mining concessions. However, in the early 1990s, MEM delegated this responsibility to the state-owned development corporation, known as the *Corporación Venezolana de Guayana* (CVG), located in the Guayana region. The CVG was given the mandate to issue contracts with third parties, while MEM retained its right to issue mining concessions. As a result, mining concessions and contracts have been allocated according to a complicated system that includes eight separate legal mechanisms (see Table 10).

In theory, CVG and its joint venture partners were required to apply formally to the MEM for a concession, but this process rarely occurred. The CVG's right to issue contracts with mining companies was rescinded in 1996 by presidential decree and a new regulation was established in 1999, requiring all concessionaires to register their claims with the MEM.

TABLE 10 Legal Mechanism for Granting Mining Concessions in the Guayana Region

Legal instrument	Date	Purpose
Decree 1046	1986	Designates El Dorado, Chicanan, Km 88 as mining areas
Resolution 106	1986	Ministry of Energy and Mines delegates authority for granting contracts under Decree 1046 to the CVG
Decree 845	1990	Designates Icabarú, San Salvador de Paúl, Guaniamo, Los Picachos de Oris and other areas for mining
Decree 1409	1991	Designates new areas for mining expansion in Bolívar State
Resolution 2	1991	Ministry of Energy and Mines delegates authority for granting contracts under Decree 1409 to the CVG
Decree 3281	1993	Allows the CVG to enter into contract agreements with third parties
Decree 1384	1996	Annuls Decree 3281
Mining Law	1999	Returns right to grant concessions to the MEM; defines and regulates mining at a national level

The new mining law issued in 1999 defines the terms and types of concessions. It places the mandate for administration of concessions squarely with the Ministry of Energy and Mines and includes the following main provisions:

- Minerals extraction is emphasized and concession owners are discouraged from holding on to undeveloped properties. Exploration is limited to a period of three years, with a possible one-year extension.
- No concession owner can hold more than 12,312 hectares.

- Concession owners are required to place a "faithful performance" bond of 5 percent of the estimated income from annual sales. This bond is to guarantee that the property is developed, rather than to ensure adequate reclamation or environmental performance.
- Small-scale miners are allowed to apply for concessions through a cooperative or association.

The new mining law is expected to simplify the concession system and centralize responsibilities. At the same time, it clearly provides incentives for mineral extraction, demonstrating the government's commitment to developing mineral resources. As of August 2001, however, all concession requests in the Imataca Forest Reserve are placed on hold pending a ruling from the Supreme Court on the legal merits of the current zoning plan. Because most mining concessions and contracts are located in this reserve, the impacts of the current law are not yet known.

A large number of mining concessions have been allocated, but most are in exploration or prospecting stages.

According to official records, a total of 1.8 million hectares has been given out in mining concessions in the Guayana region, representing approximately 4 percent of the total land area of the region. On average, mining concessions and contracts average 2,400 hectares each. The Guayana region has only 3 operating industrial mines (El Albino, La Camorra, Tomi) and one mill (Revemin) operated by foreign multinational companies. An analysis of the concessions and contracts allocated to mining companies reveals that:

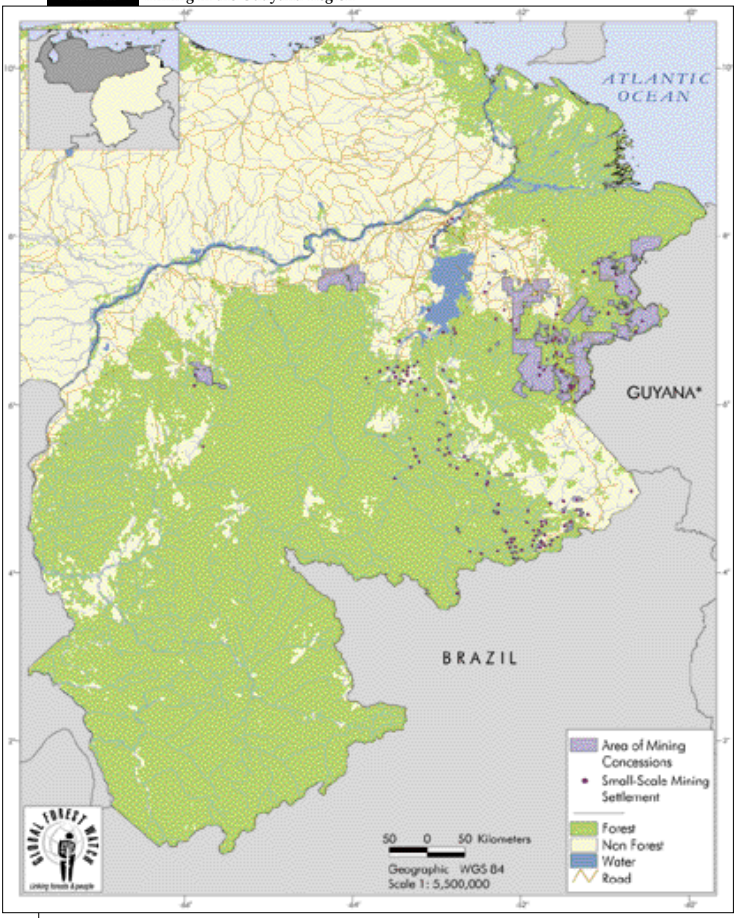
- Most concessions and contracts are located in the Imataca Forest Reserve, which has the mineral rich "greenstone belt". This is also the same area where logging takes place.
- Of the 750 mining concessions and contracts in the Guayana region, most are in stages of prospecting or exploration.

A significant proportion of mining concessions has been allocated to foreign "junior" mining companies.

Twenty-six foreign mining companies were identified as having interests in Venezuelan mining concessions and contracts, of which the vast majority (85 percent) are "junior" companies, focusing primarily on exploration or prospecting (see Table 11). Junior companies are characterized by limited capital. They engage in speculative exploration activities and cash in on their investments when they sell the development rights to another junior or a major mining company. A breakdown of mining concessions and contracts revealed the following:

- The CVG owns approximately 40 percent of the area in concession and contract, while almost one quarter of the area can be linked to foreign companies (see Figure 22). The area owned by the CVG may eventually have foreign ownership, as the CVG generally seeks joint venture partnerships with other companies to develop properties allocated to it by the MEM.
- We were unable to link 14 percent of the area under concession to either the CVG or foreign mining companies. The majority of these owners are likely either national companies without foreign affiliations or individual small-scale miners.
- Most of the foreign mining companies are Canadian or American, with a few companies headquartered in other regions.

MAP 11 **Mining in the Guayana Region**



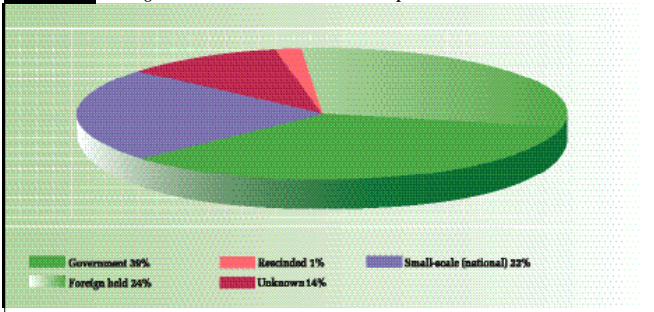
This map represents areas where concessions have been allocated. These concessions may or may not be active. For information on sources of mining concessions data, see Annex 1.
*According to the Geneva Agreement of February 7, 1966, Venezuela claims two-thirds of the territory of Guyana.

Foreign Mining Companies with Holdings in the Guayana Region, by Size of Total Holdings **TABLE 11**

Parent Company	Headquarters	Area (ha)	Subsidiaries	Stock Exchange
Gold Fields Ltd.	South Africa	134,398	Guayana Gold Fields, Chivao Gold Fields, Caroní Gold Fields, Precambrian Gold Fields, Cuyuní Gold Fields, Orinoco Gold Fields, Chicanan Resources, Chicanan Gold Fields, Yuruan Gold Fields, Lo Increíble Resources, Vetas D'Vuelvan Caras	Johannesburg, Paris, NYSE, TSE
Crystallex	Canada	77,410	Inversora Mael CA, Minera Venamo CA	TSE, AMEX
Zaruma Resources Inc	Norway	45,296	Minera Río Carichapo, Minetoco	TSE
Tombstone	Canada	37,069	Intemin CA, Minera 6560433, Corporación Minera 410879, Corporación 1818, Tombstone AVV (Aruba)	Toronto
Hecla Mining Co.	US (Idaho)	35,181	Hecla Resources Investments Limited, Hecla de Venezuela	NYSE
Greenwich Resources	UK	23,000	Greenwich Resources de Venezuela, Greenwich Resources Investments NV	London
Vannessa Ventures	Canada	16,809	Grupo Vannessa Ventures SA, Venezuelan Mining Co Ltd (Aruba), Inversiones Vipego CA, Minera Tapaya CA, Minex CA, Corporación Mineral Sor Teresita CA, Representaciones Carson Gold International CA	CDNX
DiamondWorks	Canada	13,738	Minera La Fortuna, Santa Rosa Holdings (Aruba), Tecnogeo	TSE
Placer Dome	Canada	13,381	Minera Las Cristinas (70%), Placer Dome de Venezuela	TSE
Golden Bear	Unknown	13,360	Not known	CNDX
Chesbar	Canada	9,500	Minera Guaiquinima CA	TSE
Athlone Resources	Canada	8,106	Mirko y Marquez Mining II CA	CNDX
Mylan Ventures	US (N. Dakota)	8,035	Minera Vericoa, Minera Los Frijoles, Minerfrica	CDNX
Dragon Diamond Corporation	US (Arizona)	6,335	Compañía Minera Adamante CA	OTCBB
GIC Special Investments	Singapore	5,000	Grossi Minas, CA, Vencap Holdings	Not traded
Augusta Co.	Canada	5,000	Unknown	CDNX
Cadre Resources	Canada	2,100	Unknown	CDNX
CanAlaska Ventures Ltd.	Canada	1,850	ARAPCO (51%)	CDNX
Quattro Resources	Canada	1,362	Mirca, CA	CDNX
Consolidated Odyssey Exploration Inc.	Canada	1,350	Corporación Nucore Resources de Venezuela SA	CDNX
Gold Reserve	Canada	1,053	Compañía Aurífera del Cuyuní	TSE
Earth Sciences Inc.	US (Colorado)	488	Minera Antabari, Venezuelan Mineral Exploration CA, Recursos Minerales ESIGEO CA, Recursos Minerales VENESI, CA	OTCBB
Consolidated Magna Ventures	Canada	200	Corpoaurífera CA	CDNX
Novagold	US (California)	NA	NA	TSE
RJK Minerals	Canada	NA	Minera RJK SA	CDNX
South African Diamond Corp.	South Africa	NA	Compañía Minera Adamante, CA	Not traded

Note: The above table represents the latest available data. Current status of some mining concessions and foreign companies may be unknown.
Source: GFW Venezuela, 2001. See Annex 1 for details.

FIGURE 22 **Mining Concession and Contract Ownership**



Source: GFW Venezuela, 2001. See Annex 1 for details.

Official records are out of date and do not accurately identify concession owners.

We obtained data from both the MEM and the CVG. Both datasets are dated 1996 and are considered to be the most up-to-date available. An analysis of this data and annual corporate reports revealed that:

- Since 1996, at least 10 percent of the concessions have been sold to other companies. In most cases, this has occurred as a result of a junior company selling its shares of a national subsidiary to another mining company, which then incorporates the property into its own subsidiary.
- Only one of the four producing mines is listed in official records. We were unable to locate an official record of the La Camorra and Tomi mines, or the Revemin mill, despite the fact that information on all three can be obtained easily from corporate documents. Furthermore, a review of foreign company annual reports revealed an additional twenty mining concessions that are not listed in official records.
- The official records do not consistently identify foreign companies as concession owners. Venezuelan law requires foreign companies to operate through national subsidiaries. However, because government records do not list the parent company, it is much harder to track concession ownership, making it difficult for government officials to ensure that only responsible mining companies invest in Venezuela.
- One fifth of the companies operate their Venezuelan subsidiaries through holding companies in the Caribbean, particularly Aruba, Netherlands Antilles, or Antigua. These small island nations are known for being havens for their non-disclosure banking policies.[86] The lack of transparency in financial transactions makes it difficult to establish mining companies' track records.

Many mining concessions can be considered speculative ventures, and the companies may have neither the capital nor the intent to develop a mine.

By nature, mining is a speculative activity, especially gold and diamonds. Mining often starts with exploration activities led by junior mining companies. Typically, these companies make high-risk investments in places with political uncertainty or unproven reserves in the hopes of striking a major find that can be sold to another junior or a major mining company. Our data indicate that:

- More than half (59 percent) of the junior mining companies trade exclusively on the Canadian Venture Exchange (CDNX) or the U.S. over-the-counter Bulletin Board (OTCBB). These markets are made up of very small, speculative companies engaged in high-risk activities. They are more likely to go bankrupt than other, more established companies.
- Nearly one quarter of the foreign companies are either not engaged in mining at all or are involved additionally in other non-mining related activities. One company engages in venture capital deals; that is, it invests in highly speculative business enterprises. Four companies are either exploring alternative investments or have acquired technology and Internet companies. For example, Bolívar Goldfields, Ltd owned exploration rights to over 40,000 hectares of land in Venezuela until recently when the company sold its mining rights to Crystallex in the year 2000 and became a data storage company named Storage @ccess Technologies as of February 2001.[87]

Small-scale miners operate near rivers and roads, as well as in mining concessions allocated to corporations.

The number of small-scale miners is difficult to estimate, but some studies indicate that they number at least 30,000 to 40,000.[88] While some of these miners are operating under legal government contracts, an unknown number are illegal. Illegal miners do not have government permits to operate, and/or they are operating within national parks or other protected areas. The data we obtained on small-scale mining contracts were incomplete and did not include geographic coordinates for all of the contracts. According to our analysis:

- Slightly more than one fifth of the area under concession has been given out to small-scale miners, although this may be an overestimate due to potential overlap in contracts.
- Small-scale mining occurs primarily along major rivers, especially the Guaniamo, Upper Caroní, Lower Paragua, and Cuyuní rivers in Bolívar State. Mining is illegal in Amazonas State, but it has been known to occur within the Yapacana National Park and in the Manapiare Valley.[89]

Do mining concessionaires abide by norms and regulations? QUESTION 8

Most mining concessions and contracts lack the required environmental permits.

Mining companies are required to obtain three types of environmental permits, which are obtained at successive stages of mine development: a permit to occupy the concession, a permit to allow exploration, and a permit allowing extraction. An Environmental Impact Assessment is required at both the exploration and extraction phases, although there is no requirement that it be made public.[90] We analyzed data provided by the CVG, listing environmental permits by contract. The status of environmental permits for concessions allocated by the MEM was not available. The data revealed that:

- Only slightly more than 20 percent of contracts awarded by the CVG for medium and large-scale mining have up-to-date permits for occupying the area of the concession. Nearly three quarters of the contracts awarded by the CVG lack environmental permits for exploration. None of the contracts listed in CVG records has been awarded an environmental permit for extraction.[91]

- A large number of permit requests are still pending in the Ministry of Environment. The Ministry of Environment has not given a response in over 40 percent of requests for permits to occupy the contract area. Most of the contracts are located in protected areas (ABRAE), which means the Ministry must take the objectives of the protected area into account when evaluating whether to grant environmental permits for mining.

- According to the CVG, there are twenty-five additional small-scale mining areas. Permits have been obtained to occupy land in 40 percent of these areas, and permits are pending for the remainder. Approximately 29 percent of these areas have permits for exploration.[92]

Some mining companies have engaged in exploration without active environmental permits.

Few mining companies are actively engaged in exploration or extraction on their concessions, due to the depressed gold market. However, a review of corporate news releases suggests that:

- Nearly one quarter of foreign companies with holdings in Venezuela appear to have actively explored on their contracts without the required environmental permits.[93]

- Tombstone Explorations announced drilling results in 1997 on its Valle Hondo and Zulo concessions despite the fact that the company has not applied for environmental permits to occupy the territory or to conduct exploration activities.[94]

QUESTION 9 How does mining impact the forests of the Guayana region?

Small-scale mining has negative health and environmental impacts in the Guayana region.

The impact of small-scale mining on the forests of the Guayana region has not been well documented. A few localized studies and the existing literature indicate that:

- In the 1990s, sedimentation in the sub-watersheds of the Caroní River increased by 1.3 to 2 times the amount registered in the 1980s. Areas of active small-scale mining registered the highest rates of sedimentation, with more than three times normal levels.[95] The Caroní River supplies water and electricity not just to the region, but to other parts of the country as well.

- At the levels of production estimated for small-scale miners in the Guayana region, mercury released into the environment is likely to be more than 10 tonnes per year.[96] Mercury exposure can have serious human health impacts (see Box 8).

- Several studies conducted in the lower Caroní River during the early 1990s found that mercury had not yet resulted in contaminating sources of drinking water. However, one analysis found that some fish species in the river were already beginning to demonstrate

signs of contamination,[97] and another study concluded that half the miners living in the lower Caroní River manifested signs of mercury poisoning.[98]

- The extent of deforestation attributed to mining is not known. However, one study estimates that small-scale miners deforest approximately 40,000 hectares per year.[99]

The indirect impacts of mining are likely to be more serious. An analysis of population change in the region suggests that some mining communities become frontier settlements, eventually providing a point of departure for further settlement and migration (see Question 10). The number of small-scale miners appears to have declined in the last few years due to depressed gold prices.[100] This would suggest that impacts may have diminished, although an increase in gold prices and a lack of economic alternatives could reverse this trend.

The Impact of Mercury on the Environment and Human Health **BOX 8**

Small-scale miners wash metallic mercury through sluices. Metallic mercury can be absorbed through the skin, presenting a health risk to miners who handle the material in their sluicing operations. The mercury/gold amalgamation that results from washing is subsequently burned to release the mercury, leaving gold particles behind. Mercury can enter into the environment in two ways: 1) when miners fail to capture mercury as it is washed through the sluice, and 2) when miners burn the mercury amalgam to separate the gold from the mercury. When mercury is oxidized it remains in organisms and can bioaccumulate over time. Oxidation occurs when miners breathe mercury vapors released during the burning process. In a process that is not entirely understood by scientists, metallic mercury can also be transformed into methylmercury when it is released into rivers and streams. This toxic compound is subsequently consumed by aquatic organisms, increasing in concentration as it moves up the food chain.

Mercury poisoning can result in damage to the nervous system, birth defects, or death. Even minimal exposure to methylmercury can have serious consequences, and women and children are particularly at risk. In pregnant women, methylmercury can be transferred through the placenta to the fetus, leading to severe birth defects even in cases where the mother's symptoms are mild.

Source: M. Veiga, "Mercury in Small-scale Gold Mining in Latin America: Facts, Fantasies and Solutions" Paper presented to UNIDO Expert Group Meeting, Vienna: July 1-3, 1997.

Information on the impacts of medium and large-scale mines is not available, but given the characteristics of the Guayana region, there is a significant potential for negative environmental impacts.

No data are available on the impacts of existing large and medium-scale mines in the Guayana region. Obtaining such information would require extensive field work, which was not conducted for this report. However, the Guayana region is characterized by high rainfall (between 1500 and 4000 mm per year), with few dry months throughout the year.[101] Some of the wettest parts of the Guayana region have been allocated for mining. High rainfall carries with it a potential risk that the tailings impoundments typically constructed to store cyanide and other waste from industrial mining processes will overflow, although it may also help to dilute any spills.

Gold mining and ore processing generally include production and use of heavy metals. If improperly managed, waste containing heavy metals can contaminate nearby streams and groundwater.[102] Given the importance of rivers for fish consumption at the local and regional level, mining in the Guayana region must be carefully monitored to ensure that companies comply with strict environmental standards.

Venezuela has an environmental penal code to punish those who contaminate the environment, but there are no standards for mine reclamation and bonds are low.[103] For example, according to its 1999 annual report, Hecla Mining Co. set aside $0.5 million for reclamation and environmental remediation of its La Camorra mine in the Guayana region.[104] It is difficult to evaluate whether this amount is adequate without reviewing the company's reclamation plan. However, mining companies in the United States typically post reclamation bonds totaling between $5 and $50 million, depending on the size of the mine.[105]

Summary and Analysis

Gold and diamond mining is a relatively marginal activity in the Venezuelan economy, and production has been declining due in part to low prices on the international market. However, mining does provide a livelihood for local populations in the Guayana region and it will likely continue to play a role in the regional economy. The challenge is to maintain the benefits of mining for local populations, while ensuring that the region's forest ecosystems remain intact. High levels of rainfall make the task more difficult. Basic issues associated with mining (acid mine drainage, metals management, solid waste management) require well-planned strategies and proper monitoring to prevent large-scale degradation of the region's natural resources.

However, Venezuela may not have adequate administrative and legal conditions to ensure that mining does not damage the forests of the Guayana region. Evidence suggests that small-scale mining has already resulted in significant negative impact to some forests and watersheds, although it is difficult to quantify the extent of the damage across the entire region. Although Venezuela has a penal code to hold companies and individuals accountable for damage to the environment, it is not clear how this law would be applied to companies whose assets are held primarily outside of Venezuela. The apparent absence of adequate reclamation bonds may mean that Venezuelan citizens would bear the brunt of any required clean-up costs if a company were to neglect its environmental responsibilities. Finally, the ability of the government to administer the required level of monitoring and control is questionable, given the state of recordkeeping on mining concessions and corporate partners, and the lack of environmental permits for many concessions and contracts in the region.

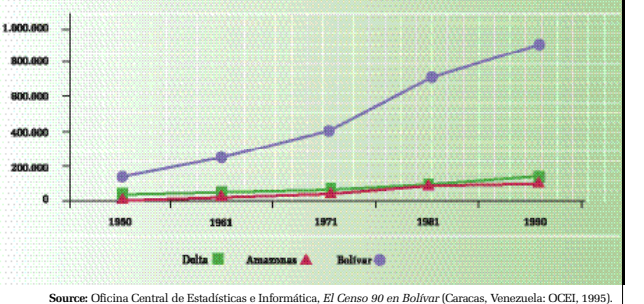
How are settlement patterns changing in the Guayana region? QUESTION 10

Over the last 40 years, the population of the Guayana region has grown steadily, especially in Bolívar State.

In a period of forty years, the population of Bolívar State grew by a factor of seven, from approximately 127 thousand inhabitants in 1950 to 900 thousand inhabitants in 1990 (see Figure 23). In Amazonas and Delta Amacuro States, growth was less dramatic but equally steady. Although part of this growth is attributable to high birth rates, migration from other parts of Venezuela played an important role. During the mid 1980s, Venezuela's development model, which was based on the expansion of an investment in the urban centers in the north of the country, entered into a period of stagnation that drove the country into an economic crisis.[106] The resulting decline of urban development opportunities spurred the migration of city dwellers, particularly the poor, to forested areas of the country. In addition, inhabitants from rural areas and impoverished people from the eastern and southern portions of the country also migrated to the region, increasing the total population of the area. This migration may explain the marked population growth in the forests of the Guayana region.

Although the major urban centers of the region (Puerto Ayacucho, Tucupita, Ciudad Guayana, and Ciudad Bolívar) have grown the most, the number of rural settlements has increased as well. This trend is visible on Map 2, where a high density of populations above 100 inhabitants surrounds urban centers (> 2,500 inhabitants). A key characteristic of the region's urban centers is their dependence on forest resources. Thus growth in urban areas of the Guayana region also implies an increase in area needed for agricultural production and increased demand for forest resources, which often comes at the expense of the surrounding forest.

Population in the Guayana Region by State, 1950-1990 FIGURE 23



Source: Oficina Central de Estadísticas e Informática, *El Censo 90 en Bolívar* (Caracas, Venezuela: OCEI, 1995).

Because basic infrastructure (schools, roads, communications) is concentrated in larger settlements, the number of small settlements surrounding the urban centers has grown over time because smaller settlements depend on these centers to satisfy basic infrastructure needs. Eventually, these small settlements become large enough to justify the development of basic infrastructure and government services. To the degree that population continues to increase in the Guayana region, this cycle will repeat itself, resulting in the establishment of new settlements and the growth of existing ones.

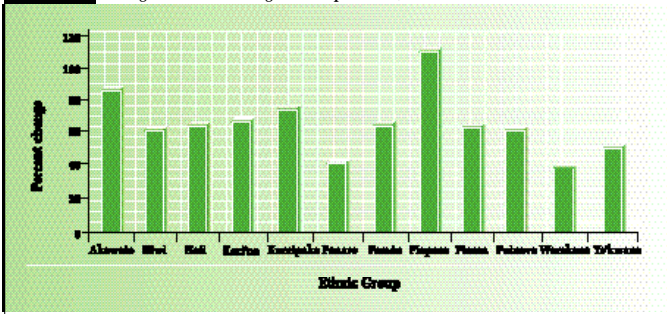
Most indigenous communities grew by more than 60 percent between 1982 and 1992.

Like the general population of the Guayana region, the indigenous population is also growing rapidly (see Figure 24). In some cases, such as the Kurripako, Hiwi, Puinave, and Piapoko ethnic groups, a part of the growth is due to migration from neighboring countries.[107] However, much of the population growth is due to high birth rates and declining mortality rates.

The rapid growth in indigenous populations is accompanied by changes in cultural traditions. Contact between indigenous communities and the Western world has resulted in the incorporation of new values and customs, leading to the development of expectations and needs, which traditional indigenous societies cannot meet. Thus indigenous peoples are becoming more dependent on Western markets for goods and services, and increasingly need monetary resources to satisfy these new desires.[108] This means that indigenous communities are more dependent on larger, non-indigenous settlements for the amenities they provide.

Indigenous communities are becoming more sedentary, eventually increasing in size. This trend results in part from the Venezuelan government's policy of providing basic services (education, health, finances and security) only to larger settlements thus promoting population concentration.

FIGURE 24 **Change in Selected Indigenous Populations, 1982-1992**



Source: Mansutti Rodríguez, A., "Una mirada al futuro de los indígenas en Guayana" *Boletín Antropológico*, 29 (1993): 727.

What is the impact of population change on the forests of the Guayana region? QUESTION 11

Population growth, continued sedentarization, and urbanization associated with intensive use of forest resources constitute a key threat to the integrity of the forests of the Guayana region.

In order to evaluate the impact of settlements on the Guayana region forests, we used field data and the advice of experts to identify areas where economic activities are known to have an effect on forest cover. The resulting map (Map 12) shows the following:

- Non-indigenous agricultural settlements located at the nexus between forest and cleared areas are associated with the highest levels of forest conversion.
- Mining communities that evolve into permanent settlements threaten the forests of the Guayana region by providing a platform for further expansion of non-indigenous settlements.
- The largest population centers have significant impact on the surrounding forest cover. The forests closest to the cities of Upata, Ciudad Guayana, and Puerto Ayacucho have undergone extensive clearing, primarily along roads leading to these cities.

Many small-scale farmers come from other parts of the country, often from places with better soil fertility than in the Guayana region. Thus the agricultural techniques non-indigenous farmers practice may not be suitable to the forest ecosystems of the Guayana region, where soil fertility is limited. Ranching communities located in the Imataca Forest Reserve, especially in the El Dorado-Km88 area, have extensive deforestation.[109]

Colonization along the forest frontier generates pressure to construct new roads and infrastructure. Constructing a road connecting Canaima and La Paragua (or one connecting either El Palmar or Tumeremo to Punto Barima on the Atlantic coast), as some government officials are advocating, would open access to intact forests.

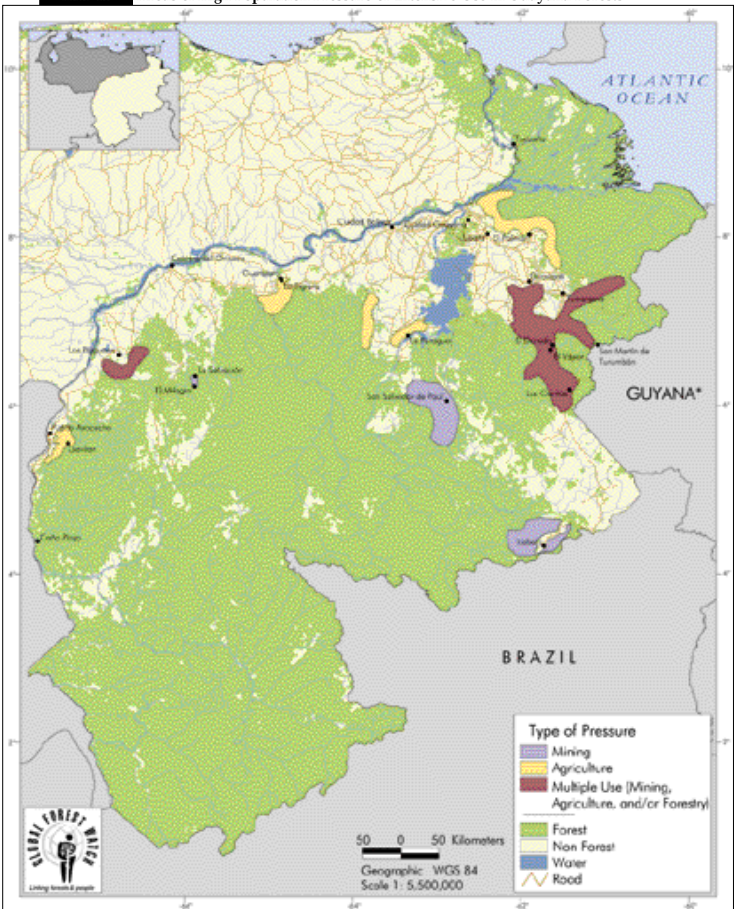
How do forest uses in the Guayana region overlap? QUESTION 12

Conflicts among competing land uses represent serious threats to the integrity of forests in the Guayana region.

Land-use conflicts are often an indicator of pressure on forest ecosystems. Overlaying logging and mining concessions with settlements shows that the eastern part of the Guayana region is at the center of competing interests (see Map 13). Because population pressures are among the key factors driving deforestation in the *llanos* forests of northern Venezuela, the existence of similar pressures in the Guayana region is cause for concern. Potential land-use conflicts include the following:

- *Settlements and concessions*: Overlap between communities and natural resource concessions occurs most noticeably in the Imataca Forest Reserve. Agricultural, mining, and indigenous settlements are located within and around both logging and mining concessions. Without careful planning, concessions could open the Imataca Forest to further deforestation

MAP 12 **Areas of High Population Pressure or Intensive Use in Guayana Forests**



For information on sources and methodology, see Annex 1.
*According to the Geneva Agreement of February 7, 1966, Venezuela claims two-thirds of the territory of Guyana.

by these actors. In addition, because concessions restrict local communities' access to natural resources, some groups may have no other alternative but to move to other relatively intact forests.

• *Small-scale mining and indigenous communities*: The overlap between areas of smallscale mining and indigenous populations is significant –a potential source of conflict between indigenous peoples and non-indigenous small-scale miners.[110]

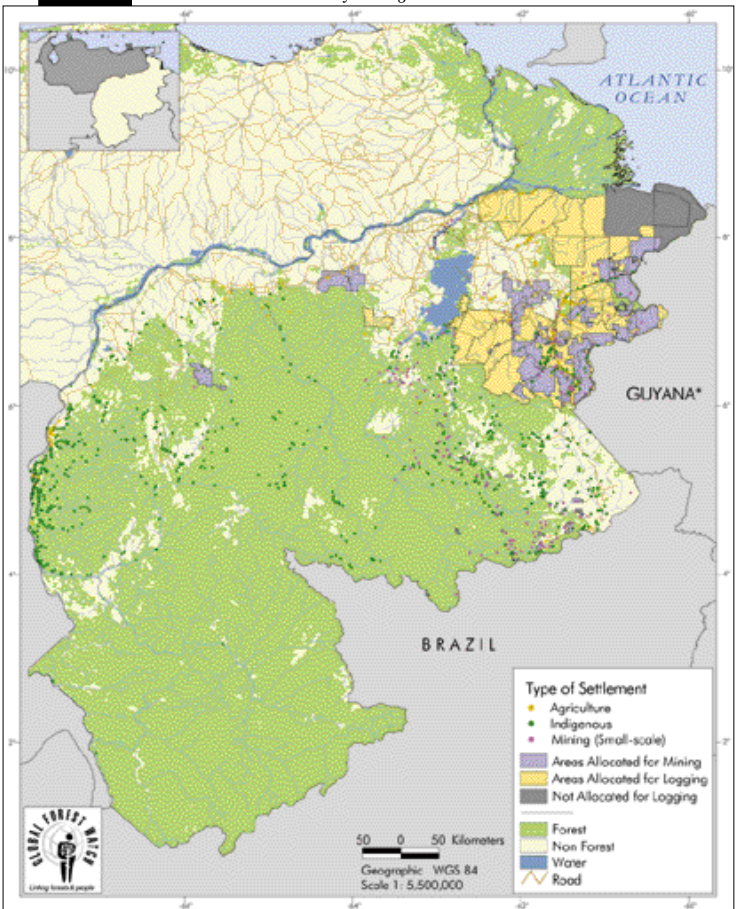
• *Strictly protected areas and indigenous communities*: Indigenous lands overlap with strictly protected areas, although most of these areas were established after indigenous communities had already settled in them. Recent trends observed in indigenous communities (population growth, sedentarization, and increased use of firearms and other new technologies) pose a challenge for preserving the lifestyles of indigenous communities while still maintaining the relative intactness of strictly protected forests.

Summary and Analysis

Although still relatively low, population in the Guayana region has grown exponentially in the 1980s, due primarily to migration from other parts of the country. Even the indigenous population has greatly increased, due mostly to high birth rates and declines in the mortality rate. At the same time, the trend toward sedentarization and growth of indigenous settlements is almost certain to result in a more intensive use of nearby forest resources by these communities.

However, the strongest pressures on the forest ecosystems of the Guayana region come from non-indigenous populations and uses. The continued growth of non-indigenous, natural-resource-dependent settlements around the forest edge is likely to lead to new population centers, increasing the demand for new roads and new infrastructure. Most of the region's forest loss has occurred due to expansion of the economic frontier (e.g., for mining and agriculture). The apparent overlap among indigenous communities, small-scale miners and farmers, and logging and mining concessions is a key indicator of pressure on the Guayana region forests. To the degree that these conflicts remain unresolved, expansion into relatively intact forests will likely accelerate. Because local communities and the regional economy depend strongly on the resources and services provided by these forests, forest loss and degradation would have a lasting impact on the region's populations.

MAP 13 **Land-Use Conflicts in the Guayana Region Forests**



This map presents areas where land-use conflicts may occur because of existing populations and allocations of mining and logging concessions. For sources information, see Annex 1.
*According to the Geneva Agreement of February 7, 1966, Venezuela claims two-thirds of the territory of Guyana.

Conclusions

Global Forest Watch Venezuela focused its initial data collection activities on the Guayana region because it contains Venezuela's largest block of forests. However, portions of northern Venezuela warrant further detailed monitoring, especially in rapidly disappearing remnants of forests in the Andes and coastal ranges. These Andean forests harbor high-value commercial timber species and provide key ecosystem services, such as regulating water flow and quality, and controlling erosion on steep slopes.

The data collected for this report suggest that the forests of the Guayana region offer tremendous opportunity for long-term conservation and sustainable use. These forests are among the most biologically and culturally diverse in Venezuela, and they provide important ecosystem services at a regional and national level. They also represent a significant part of one of the largest blocks of intact tropical forest in the world. However, except for southern Amazonas, most of these forests are at risk from on-going or planned development. Logging and mining could ultimately result in significant forest degradation, given population pressures, competing land uses, and poor management practices.

Furthermore, although the situation is improving, there is a history of low rent capture from ongoing extractive activities. Overall, logging and mining contribute little to the national economy and except for small-scale mining, employ only a small fraction of the local population.

Unfortunately, it is impossible to fully quantify the impacts, costs, and benefits of forest development to date due to:

- inconsistent data upon which recent forest cover estimates are based,
- inconsistent methodologies for estimating forest cover, which makes it impossible to reasonably estimate the degree of deforestation or reforestation over time, and
- the lack of systematic monitoring of development trends over time and space.

The inability to accurately gauge the cumulative impacts of mining, logging, and population growth on the forests of the Guayana region makes it difficult to promote sound conservation and management practices. In some areas, development pressures are so high that scientists may not have time to adequately research the diversity of these ecosystems before the forest is gone.

This report identified several important information gaps, which will need to be filled if the region's policymakers are to make informed decisions about the future of the Guayana region's forests. The most critical data gaps included the following:

- *Accurate and reliable base maps:* Venezuela does not have a cartographic standard, and important basic information is either not publicly available or restricted in geographic scope. Accurate topographic and hydrological maps are especially lacking for the Guayana region and southern Amazonas specifically. Three years ago, the government revived the Cartosur project (an effort led by the official cartographic office to map the Guayana region using radar and satellite imagery), with the objective of providing such important basic information. To date, no maps have been published.

- *Accurate, geo-referenced land-use maps*: Maps of logging and mining concessions, agricultural production, and protected areas need to be standardized and corrected. To date, there is no digital, geo-referenced database of logging and mining concessions for the Guayana region that can be publicly accessed. In addition, there is no geo-referenced map of protected areas at a national scale. Some of this information may be accessed separately through various entities (CVG, Ministry of Energy and Mines, Ministry of Environment), but the quality and reliability of the data are not consistent.

- *An up-to-date vegetation map showing actual forest cover*: Venezuela has not conducted a forest inventory and the most recent, publicly available vegetation map at a national scale represents vegetation circa 1977. Publication of a new vegetation map reflecting forest cover at a national scale should be a high priority.

- *Data on wildlife and the use of non-timber forest products*: Certain parts of the Guayana region have been relatively well researched, while others (especially the Imataca Forest Reserve and Delta Amacuro State) have not. Research on the abundance, use, and economic value of species found in lowland forests is particularly lacking.

- *Data on the impacts of logging on forests of the Guayana region*: The proportion of biomass left in the forest versus the volume transported to sawmills, the area of forest affected by skidder trails and secondary roads, and the regeneration of replanted species are all critical data gaps in knowledge about the effects of logging on forests of the region. These data are important for developing adaptive techniques for forest management.

GFW's aim is to help fill these information gaps. In this report, we have attempted to collect the best available information on the Guayana region's forests to make data available to the public. In the future GFW Venezuela will seek to focus its monitoring activities at a finer scale, providing a more accurate assessment of forest trends in specific parts of the Guayana region so that sound planning and forest management can be implemented before these forests undergo widespread clearing and degradation (see Box 9).

Based on the findings of this report, we identified three critical sub-zones of the Guayana region (see Map below) where more detailed monitoring is necessary in the short-term. These areas are still relatively intact, but they are potentially threatened by a variety of land-uses, including agriculture, logging, and mining.

- *The Imataca Forest*: Much of this forest has already been allocated for logging and mining. However, it remains largely intact, due in part to depressed gold prices on international markets. Logging, mining, indigenous settlements, and small-scale agriculture are all competing land uses, making this a potentially volatile conflict zone.
- *The Northern Sector of the Caura/ Paragua Watershed*: Forests of the Caura watershed are largely unaccessed, except in the northern sector, where agriculture practiced by non-indigenous communities has led to rapid deforestation in recent years. Although not yet under production, this area is also zoned for logging.
- *Northern Amazonas*: The completion of the Ciudad Bolívar-Puerto Ayacucho highway has led to the penetration of forests in this region. Significant tracts of montane, submontane, and lowland forests still remain, but growing population and development pressures could significantly impact forest ecosystems in this portion of Amazonas State.

Global Forest Watch Venezuela aims to continue its monitoring activities at a more detailed scale in these three critical zones, as well as in other zones as these are identified. Our hope is that further monitoring will provide better information about the condition of these forests, as well as more accurate data regarding development activities and other potential pressures on forest ecosystems, so that sound planning and forest management can be implemented before the forests undergo widespread clearing and degradation.

Areas for Future Monitoring in the Guayana Region

Endnotes

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2 The trend towards urbanization is strongly linked to periodic booms in the oil sector. See S. Wunder, "Oil Wealth and the Fate of the Forest: Venezuela," Unpublished CIFOR Draft (Bogor, Indonesia: CIFOR, 2001), pp. 38-39.

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4 Oficina Central de Estadísticas e Informática, *El Censo Indígena de 1992* (Caracas, Venezuela: OCEI, 1993), pp. 28-32.

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20 The government deforestation statistics do not take into account an additional 10 states. However, these states are known to have high deforestation rates, making net reforestation unlikely. See J.P. Veillon, "Las deforestaciones en los Llanos Occidentales de Venezuela desde 1950 hasta 1975," in *Conservación de los Bosques Húmedos de Venezuela*. L. Hamilton et al., eds. (Caracas, Venezuela: Sierra Club/Consejo de Bienestar Rural, 1977), p. 100-103; A. Catalán, *El Proceso de Deforestación en Venezuela entre 1975-1988* (Caracas, Venezuela: MARNR, 1989), p. 19-22.

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26 The percent of forests protected depends on whether one excludes the area of overlap between strictly protected areas. See Annex 1 for details.

27 Potential conflicts of use may also occur in the case of overlap between protected zones and forest reserves, if logging results in forest degradation. Although protected zones do not explicitly prohibit logging, forest degradation that could accompany these activities (see Chapter 4, Question 5) would be in conflict with the objectives of a protected zone. For the sake of consistency, we have not included this potential conflict in our analysis of overlapping protected areas, nor is it included in Map 6.

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50 For more details on the administrative requirements of logging concessions, see Miranda et al., *All That Glitters is Not Gold: Balancing Conservation and Development in Venezuela's Frontier Forests* (Washington, DC: WRI, 1998), p. 14.

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Annex 1: Data sources and technical notes

Chapter 1: An Overview of Venezuela's Geography, Economy, and Forest Legislation

Venezuela's Exports, 1997
(Figure 1)

Sector	Percent of Total
Food	2.8
Agricultural Raw Materials	0.2
Fuels	79.5
Ores/ Metals	4.1
Manufactured Goods	13.4

Source: Inter-American Development Bank, *Basic Socio-Economic Data for 21 December 2000* (Washington, DC: IADB, 2001).

Base Data for Maps 1-13

Base layers for Maps 1-13 are from the following sources:

- Political boundary: National Imagery and Mapping Agency, *Vector Map Level 0 (Digital Chart of the World)* 3d ed. (Fairfax, VA: NIMA, 1997) Scale: 1:1,000,000; Fundación Instituto de Ingeniería, Centro de Procesamiento Digital de Imágenes (FII-CPDI), *Political Boundary of Venezuela* (Caracas, Venezuela: FII-CPDI, 2001.
- Rivers: National Imagery and Mapping Imagery, *Vector Map Level 0 (Digital Chart of the World)* 3d ed. (Fairfax, VA: NIMA, 1997).
- Roads: International Travel Maps (ITM), *An International Travel Map: Venezuela* (Vancouver: ITM, 1994). Scale: 1:1,750,000.
- Cities: Birbeck College, University of London, Department of Geography, *World Cities Population Database (WPCD)* (Nairobi: UNEP/GRID, 1991). International Travel Maps (ITM), *An International Travel Map: Venezuela* (Vancouver: ITM, 1994). Scale: 1:1,750,000.

Map 2: Settlements in the Forests of the Guayana Region

Sources:

- Ministerio del Ambiente y de los Recursos Naturales Renovables, *Cartografía en escala 1:100,000 Edición 1-DCN, 1970-1973* (Caracas, Venezuela: MARNR, 1970-1973).
- Ministerio del Ambiente y de los Recursos Naturales Renovables, *Cartografía en escala 1:500,000 Edición 1-DCN* (Caracas, Venezuela: MARNR, 1977).
- Data derived from GFW Venezuela analysis (GPS coordinates for indigenous communities).

Definitions:

- Settlements: An area of permanent residence for a given population. A settlement ranges from a small house in which only one person lives up to a large city.
- Encampment: A settlement with one or more residences in which the inhabitants are workers with a particular company. Generally, encampments are temporary homes for their inhabitants.

Methodology:

- Data on the location of settlements were derived from national census data, GPS coordinates (indigenous communities), and expert opinion.
- GPS coordinates were used for communities located in the Imataca Forest Reserve and along the Caura River. In total, GPS coordinates were provided for 18 Hoti communities, 7 Kari'ña communities, 41 Ye'kwana and Sanema in the Caura River, and 103 indigenous and non-indigenous settlements in Imataca.
- In Amazonas State, only the northern sector close to Puerto Ayacucho was surveyed. Data for the Imataca ` Forest Reserve and the Caura River were collected in the field most recently.
- A team of anthropologists and experts in Puerto Ayacucho collected qualitative information on population pressures near Puerto Ayacucho.
- Data on settlements were entered into a Microsoft Access database, stratified by type of community and uses of the forest (indigenous, agricultural, mining, service, urban center, etc.). Settlements were also stratified by size.

Limitations:

- Where it was not possible to field check information, we have based our data on already published maps and other documented information. Thus errors from other sources may have been repeated.
- Available cartography on settlements is between 10 (Tecmín) and 20 (official cartographic office) years old. This may result in errors, as many of the non-indigenous settlements may have already disappeared or changed names.
- Available maps of forest cover are coarse and it was difficult to identify whether some communities living along the forest frontier are in forests or far from the frontier. The lack of a detailed and accurate rivers and watersheds map made mapping communities difficult.
- The Central Office of Statistics (*Oficina Central de Estadística e Informática –OCEI*) does not provide maps at an appropriate scale or geographic coordinates with the names of population centers.
- There are gaps in the data: We were unable to assemble a team of experts for the forests of Delta Amacuro State. The experts in Amazonas State were unable to dedicate sufficient time to the project due to local political issues. Data on agriculture in Bolívar and Amazonas States are incomplete and in some cases non-existent.
- Some mining communities may have already disappeared, due to the transitory nature of this activity.
- Informants consulted for the Eñapa area were less reliable. In addition, there is a high risk of error in the location of Piaroa communities near Alto Paraguaza, upstream of Salto Maraca, in the Chivapure communities, in the Eñapa communities of Cuchivero, and in the Hoti communities along the same river.
- The Hoti live in semi-nomadic communities and rapidly abandon their settlements. Therefore, these settlements may have changed.

Chapter 2: Forest Cover and Protection

Map 3: Forest Cover

Source: H. Eva and S. Jones, *A forest map of South America* (Ispra, Italy: Tropical Ecosystem Environment Observation by Satellite (TREES), unpublished data). Scale: 1: 1,000,000.

Methodology and Limitations:

The new TREES map is derived from the ATSR-2 sensor (Along Track Scanning Radiometer) onboard the ERS-2 Satellite from 1999-2000. The map represents forest cover in 1996. The data are at 1 km^2 resolution (0.009 degrees) and are received in the 0.55, 0.65, 0.85, 1.6, 11, and 12 microns. The data can be downloaded in near-real-time from the European Space Agency's ESRIN site. The data are automatically remapped to Geographic (Plate Carre) projection using the embedded geolocation points that come with the data. The data are classified using an unsupervised clustering algorithm 'ISODATA'. Classes are then assigned by expert interpretation. TREES classified forest type based on elevation. We have chosen to aggregate lowland, submontane, montane, and mangrove classes

because of errors in topographical base data that underestimate lowland forest cover. Dense forest (lowland, submontane, montane, and mangrove) is defined as forest covering more than 70% within a 1 km^2 pixel area. Fragmented forest is considered to be 40-70% forest cover within a 1 km^2 pixel area. We have clipped TREES data to our boundary layer for Venezuela, and coded the fragmented forest layer to be "non-forest." We chose to exclude fragmented forest from our representation of forest cover because we sought to show closed canopy forest. In addition, the fragmented forest class is less reliable, and can be easily confused with non-forest vegetation by the ERS-2 satellite.

There is a lack of spatially accurate, up-to-date, national land cover data for Venezuela. We have therefore chosen to use TREES data to approximate the forest landcover classes. However, TREES data are meant to show pan-country (or regional) forest cover, and are not designed for national scale analyses. Thus, due to the coarseness of the scale used in the TREES data, we may underestimate forest cover in some areas and overestimate it in other areas. In addition, monitoring of Venezuela's forest cover (especially the Guayana and Andean forests) by satellite data is difficult due to the high cloud cover in this part of the world. Only radar data will be able to continually monitor lowland cloud covered forests. For a detailed analysis of the problems of spatial aggregation of coarse spatial resolution data see: P. Mayaux and E.F. Lambin, "Estimation of tropical forest area from coarse spatial resolution data: a two-step correction function for proportional errors due to spatial aggregation," *Remote Sensing of Environment* 53 (1): 1-16. (1995)

Forest cover and extent

Notes:

Satellite-based estimates

- *DeFries derived from AVHRR 1992/93 satellite imagery*: Data are at a 1 km^2 spatial resolution and were processed under the guidance of the International Geosphere-Biosphere Programme (IGBP). A linear mixture model was applied for various vegetation characteristics (woody, shrubby, deciduous, evergreen). Woody vegetation is defined as mature vegetation greater than 5 meters in height. This category most resembles mature trees. Rather than using a classification scheme, such as that used by TREES, DeFries identifies per centage of tree cover (0-100%). Thus, no minimum thresholds of tree cover were assigned per cell to define forest. DeFries data show areas of partial forest cover, which may not be classified as "forest", but nonetheless provide important goods and services. DeFries et al. used a 60% tree cover cut-off to represent forests. Applying the global dataset to Venezuela reveals that tree cover at a threshold of 60% would place Venezuela's tree cover at approximately 433,000 km^2 in the early 1990s. For a discussion of the DeFries data, see E. Matthews et al., *Pilot Analysis of Global Ecosystems: Forests* (Washington, DC: WRI, 2000), 15.

- *International Geosphere-Biosphere Programme (IGBP):* The IGBP Global Land Cover map is also based on 1992/1993 AVHRR satellite imagery, but classifies forests according to type (evergreen needleleaf and evergreen broadleaf forests; deciduous needleleaf and deciduous broadleaf forests; and mixed forests). According to IGBP, forest cover consists of a minimum of 60% tree cover in any 1 km^2 cell, 10% canopy cover, and tree height over 2 meters. According to this dataset, Venezuela's forest cover in the early 1990s was about 472,000 km^2.

- *Tropical Ecosystem Environment Observation by Satellite project (TREES) derived from AVHRR 1992 satellite imagery*: TREES data are at a 1 km^2 resolution and forest cover is defined as any pixel with at least 70% tree cover. This definition corresponds more closely to closed canopy forest. However, the coarse resolution of the data may not detect small patches of forest. Because TREES uses a classification system for forest cover, changes in forests appear to be more abrupt and may seem more homogeneous than is actually the case. See J.P. Malingreau et al., "AVHRR for Global Tropical Forest Monitoring: the Lessons of the TREES project," *Remote Sensing Reviews* 12 (1995): 29-40. According to this dataset, forest cover in the early 1990s was approximately 463,000 km^2.

• *TREES from ATSR onboard the ERS-2 satellite*: TREES is in the process of publishing new global forest cover data based on the ERS-2 satellite, reflecting 1996 imagery. The same classification system (at least 70% tree cover) used for the AVHRR data applies, but the 1992 and 1996 datasets are not entirely comparable as they come from different satellites. According to the latest available TREES data, Venezuela's forest cover in 1996 was approximately 427,000 km^2. (See details on TREES methodology for the 1996 map under the discussion for Map 3 above).

Inventory-based estimates

• *FAO 1990 baseline data from FRA 2000*: For estimates of Venezuela's forest cover published in FRA 2000, FAO relied primarily on official government data from 1985 to 1995. To arrive at 1990 baseline forest cover, FAO applied a linear extrapolation of these data. FAO defines forests as any area at least 0.5 hectares in size with 10% tree cover. FAO does not distinguish between natural forests and plantations, although the two are vastly different in terms of species composition and diversity, and other factors. It is important to note that the 1990 baseline published in FRA 2000 represents an upward revision of previous estimates for that year, due to changes in methodologies. For a detailed discussion of the limitations of FAO methodology, see E. Matthews, *Understanding the FRA 2000. Forest Briefing* No. 1 (Washington, DC: WRI, 2001). According to the FRA 2000, Venezuela's forest cover in 1990 was approximately 519,000 km^2.

Sources:

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Venezuela's Forest Cover in Thirteen States, 1995

State	1995 (Table 2.2 of *Apéndice*)	Plantation area (ha)	1995 (Table 2.7B of *Apéndice*)
Distrito Federal	88,960.0	800.0	88,960.0
Anzoátegui	885,965.9	248,376.8	1,134,342.7
Aragua	173,697.0	383.0	173,697.0
Bolívar	17,980,854.1	16,553.0	18,242,551.6
Falcón	751,250.0	0	751,250.0
Guárico	1,204,905.6	1,265.0	1,204,905.6
Miranda	421,651.9	1,211.0	421,651.9
Monagas	565,824.1	289,582.5	855,227.6
Nueva Esparta	13,750.0	0	13,750.0
Sucre	361,868.6	287.0	361,868.6
Zulia	1,704,632.0	1,570.0	1,704,632.0
Amazonas	16,362,918.2	0	16,556,407.6
Delta Amacuro	3,077,410.4	316.0	3,322,572.5
TOTAL	**43,593,687.8**	**560,344.3**	**44,831,817.1**

Source: MARNR, *Balance Ambiental de Venezuela, Apéndice 1996* (Caracas, Venezuela: MARNR, 1996), pp. 7, 11, 13.

Notes:

- In 1996 the Venezuelan government published forest cover estimates for 1995, based on an unpublished vegetation map (*Balance Ambiental de Venezuela, Apéndice*). In addition to providing forest cover estimates for all 23 states and territories, the *Apéndice* also includes a deforestation analysis for 13 states (see table below).
- The *Apéndice* reports internally inconsistent forest cover figures for several of the states listed. In one table of the *Apéndice*, 1995 forest cover estimates for 5 of 13 states are listed higher than in another table in the same chapter. The increase in forest cover for two of these states (Monagas and Anzoátegui) can be attributed to the inclusion of plantation area in one of the tables. However, for the remaining three (Bolívar, Amazonas, and Delta Amacuro), plantation area alone is not enough to explain the discrepancy in estimates.

Venezuela's Deforestation in Thirteen States, 1982-1995

State	1982	1995	Area deforested	% total loss/gain	Annual deforestation (ha)	% Annual deforestation
Distrito Federal	97,966.0	88,960.0	(9,006.0)	-9.2	(692.8)	-0.7
Amazonas	16,612,558.0	16,556,407.6	(56,150.4)	-0.3	(4,319.3)	0.0
Anzoátegui	983,023.0	1,134,342.7	151,319.7	15.4	11,640.0	1.2
Aragua	262,478.0	173,697.0	(88,781.0)	-33.8	(6,829.3)	-2.6
Bolívar	18,709,134.0	18,242,551.6	(466,582.4)	-2.5	(35,891.0)	-0.2
Delta Amacuro	3,360,195.0	3,322,572.5	(37,622.5)	-1.1	(2,894.0)	-0.1
Falcón	970,210.0	751,250.0	(218,960.0)	-22.6	(16,843.1)	-1.7
Guárico	1,435,140.0	1,204,905.6	(230,234.4)	-16.0	(17,710.3)	-1.2
Miranda	504,257.0	421,651.9	(82,605.1)	-16.4	(6,354.2)	-1.3
Monagas	750,154.0	855,227.6	105,073.6	14.0	8,082.6	1.1
Nueva Esparta	13,750.0	13,750.0	-	0.0	-	0.0
Sucre	578,559.0	361,868.6	(216,690.4)	-37.5	(16,668.5)	-2.9
Zulia	3,949,197.0	1,704,632.0	(2,244,565.0)	-56.8	(172,658.9)	-4.4
Total	**48,226,621.0**	**44,831,817.1**	**(3,394,803.9)**	**-12.8**	**(261,138.8)**	**-1.0**

Source: Original 1982 and 1995 forest cover numbers from MARNR, *Balance Ambiental de Venezuela, Apéndice 1996* (Caracas, Venezuela: MARNR, 1996); calculations for all other columns are based on formulas entered into a Microsoft Excel Spreadsheet.

Notes:

- The *Apéndice* reports an average annual deforestation rate of 0.54% between 1982 and 1995 for 13 of 23 states (see Table 2.7B, page 13). However, these estimates appear to have been incorrectly calculated. The above table reflects the 1982 and 1995 forest cover estimates as reported in the *Apéndice*, with the derived forest change estimates calculated automatically using Microsoft Excel. Our calculations revealed that the annual deforestation rate in these 13 states would appear to about 1%.
- For the purposes of this table, we have assumed that the numbers for Anzoátegui, Monagas, Bolívar, Amazonas, and Delta Amacuro are correct in table 2.7B of the *Apéndice* rather than the 1995 forest cover numbers provided in table 2.2 of the same document.

Maps 4-6, Figures 2-4

Venezuela's Forest Types (Figure 2)

Forest Type (by Elevation)	%
Lowland	60.2
Submontane	28
Montane	10.4
Mangrove	1.1
Tepui	0.3

Note:

• Elevational cut-offs are as follows: Lowland = <500 meters; Submontane = 500-1,500 meters; Montane = >1,500 meters; Mangrove = <100 meters; Tepui = >1,500 meters.

Degree of Protection of Venezuela's Forests (Figure 3)

Ecosystem type	Total Area of Forests (sq. km)	Total Area Strictly Protected* (sq. km)	Area of National Parks (sq. km)	% Strictly Protected*	% Not Protected
Lowland forests	229,469.4	44,894.5	22,417.3	19.6	80.4
Submontane forests	106,861.4	59,660.3	30,108.9	55.8	44.2
Montane forests	39,677.3	32,593.8	20,860.6	82.1	17.9

*Does not exclude overlap between strictly protected categories or uncertainty regarding protected area boundaries

Note:

• Due to overlap in strictly protected areas and the uncertainty regarding the boundaries of natural monuments, it is difficult to estimate the amount of forests that are legally protected for conservation purposes. For this reason, we have chosen to estimate a range of forests, which might be considered protected. The low end of the range (17%) includes only national parks, to account for the uncertainty that occurs when considering the boundaries of natural monuments. The high end of the range (32%) includes all area classified as strictly protected (IUCN categories I-IV; that is, national parks, natural monuments, and wildlife refuges), including the overlap within these categories.

Degree of Forest Protection, Guayana Region (Figure 4)

Ecosystem type	Total Area (sq. km)	Strictly Protected (sq. km)	% Strictly Protected	Extractive Use (sq. km)	% Extractive Use	Overlap (sq. km)	% Overlap
Lowland forests	210,953.1	39,761.0	18.8	121,375.0	57.5	13,324.1	6.3
Submontane forests	98,922.2	55,127.7	55.7	55,283.6	55.9	19,924.7	20.1
Montane forests	37,218.2	29,971.8	80.5	15,135.1	40.7	8,678.9	23.3

Notes:

• The area of overlap between national parks and the Orinoco-Casiquiare Biosphere Reserve was not counted as overlap because Venezuelan legislation clearly states that the national parks override areas of overlap in the

biosphere (that is, the national parks are meant to be the core of the reserve and, as such, remain protected for conservation purposes).

• Overlap includes all areas where strictly protected areas overlap with areas designated for extractive (or natural resource) uses.

Sources:

• MARNR, *Mapa de Áreas Bajo Régimen de Administración Especial*, Photocopy (Caracas, Venezuela: Dirección General Sectorial de Planificación y Ordenación del Ambiente, 1983 with updated boundaries in 1999, unpublished draft). Scale: 1:1,000,000.

• MARNR, *Mapa de Áreas Bajo Régimen de Administración Especial*, Photocopy (Caracas, Venezuela: Dirección General Sectorial de Planificación y Ordenación del Ambiente, 1998, printed). Scale: 1:2,000,000.

• H. Eva and S. Jones, *A forest map of South America* (Ispra, Italy: Tropical Ecosystem Environment Observation by Satellite (TREES), unpublished data). Scale: 1: 1,000,000.

• O. Huber and C. Alarcón, *Mapa de Vegetación de Venezuela* (Caracas, Venezuela: MARNR/ The Nature Conservancy, 1988). Scale: 1:2,000,000.

• O. Huber, *Venezuelan Guayana Vegetation Map* (Caracas, Venezuela: CVG Edelca/Missouri Botanical Gardens, 1995). Scale: 1:2,000,000.

Methodology:

• Huber's *Venezuelan Guayana Vegetation Map* was digitized and added to the digital version of the *Mapa de Vegetación de Venezuela* (area north of the Orinoco) to obtain an ecosystem layer. The Guayana map is an update to the original work published for the whole of Venezuela.

• To obtain forest ecosystems, we combined data from TREES and Huber's maps of potential vegetation types. TREES data were resampled to the scale of Huber's maps, 1:2,000,000 resolution. TREES classes were then aggregated into forest and non-forest, the latter including fragmented forest. Each TREES forest pixel was then coded according to ecosystem type from Huber's data, to produce a dataset on forest type. This layer was used to estimate forest cover by ecosystem type. In addition, the layer was used with the protected areas dataset to estimate percentage of protection for each forest type –lowland, submontane, and montane.

Additional methodology for Maps 4-6:

• The MARNR *Mapa de Áreas Bajo Régimen de Administración Especial* 1983 (with updated boundaries in 1999) paper map was digitized, corrected with the MARNR 1998 published map, and checked by protected areas experts in Venezuela.

• Protected areas were divided in two categories: strictly protected (corresponds to IUCN categories I to IV) and those designated for resource use (IUCN categories V and VI). Although IUCN lists Wildlife Reserves as category IV, we chose to categorize these protected areas as "designated for resource use," since the primary objective of this category according to Venezuelan law is for wildlife use. Wildlife Reserves encompass less than 20,000 hectares.

• Forest lots (*lotes boscosos*) are not part of the protected area (ABRAE) system. However, because these areas are also designated for extractive use (logging), we have chosen to include them in Map 5.

Limitations

• The TREES/Huber overlay resulted in a coarser version of the regional scale TREES map. While experts agreed that the representation of forest ecosystems was more accurate under this scenario, the forest cover area is slightly underestimated. For this reason, the analysis is appropriate for determining percentages of ecosystems that are protected, but not for representing total forest cover. We have chosen to maintain the TREES layer in its original format as a more accurate representation of Venezuela's forest cover.

• Venezuela lacks a digital, georeferenced, national scale protected areas map that has been reviewed by the official cartographic office (known as the *Instituto Geográfico de Venezuela "Simón Bolívar"*). For this reason, Maps 4 and 5 are based on schematic maps created by the Ministry of Environment.

• There are differences between the estimated area of ABRAE according to Maps 4 and 5 and the area listed by the Ministry of Environment. These differences could be due to the quality of the base maps that were digitized, as well as to the fact that the Ministry calculates the area of protected areas using manual methods (see below). For this reason, the Ministry's numbers are approximate and expressed in rounded numbers.

• The protected areas base map that GFW digitized was a photocopy of a draft map, which was never published. The draft map was created manually, without use of an accurate digital elevation model. This means that the boundaries of the protected areas are not exact. In addition, the base map does not show overlapping boundaries in protected areas, making it difficult to estimate both the actual area of protected areas and the overlap between them.

• We were unable to estimate forest cover designated for resource use in the area north of the Orinoco River, due to the magnitude of overlap between protected areas.

Management Objectives of National Protected Areas

ABRAE categories

A. Natural Monuments
B. National Parks
C. Wildlife Refuges
D. Wildlife Reserves
E. Protected Zones
F. National Hydrological Reserves
G. Biosphere Reserves
H. Forest Reserves
I. Forest Areas Under Protection
J. Forest Lots (although these are not part of the ABRAE system, they are designated for logging)

Management Objective										
ABRAE	A	B	C	D	E	F	G	H	I	J
IUCN Category	III	II	IV	V	V	IV	VI	VI	VI	VI
Protection of ecosystems and species	1	1	2	3	1	1	1	2	2	2
Scientific research and education	2	1	1	1	2	2	2	1	1	2
Protection of geographic and scenic values	1	1	2	3	2	3	2	3	3	NA
Protection of fauna and habitat	2	2	1	2	2	2	2	3	3	2
Sustainable use of wildlife	NA	3	3	1	3	NA	2	3	3	3
Forestry	NA	NA	NA	NA	NA	NA	3	1	1	1
Watershed protection and administration of water	3	2	3	3	1	1	2	3	3	NA
Administration of water resources	NA	NA	NA	NA	3	1	3	3	NA	NA
Conservation of cultural landscape	3	3	NA	3	3	3	1	NA	NA	NA
Recreation and tourism	3	2	3	2	2	2	2	3	3	NA

Key
1= Primary objective
2= Secondary objective
3= Potentially applicable objective
NA= Not applicable

Sources: M. Bevilacqua, "Áreas Bajo Régimen de Administración," in M. Aguilera et al. (eds.), *Biodiversidad en Venezuela* (Caracas, Venezuela: CONICIT/Fundación Polar, in press); MARNR, "Plan del Sistema Nacional de Áreas Protegidas," 1ra. Etapa: Marco Conceptual, Serie de Informes Técnicos (Caracas, Venezuela: DGSPOA/IT/213, Ministerio del Ambiente y de los Recursos Naturales Renovables, 1985).

Area of Forests in Venezuela by Category of Protected Area

Category	Ecosystem							Total
	Nonforest	Lowland	Submontane	Montane	Mangrove	Tepui	Water	
AB	19,686.3	2,680.7	3.4	0	104.5	0	37.1	**22,512.0**
LB	1,285.6	7,527.0	2,255.1	0	0	0	71.2	**11,138.9**
MN	9,039.8	22,477.1	29,551,4	11,733.3	0	231.5	13.5	**73,046.6**
PN	47,554.6	22,417.3	30,108.9	20,860.6	909.0	541.7	414.5	**122,806.6**
RB	3,216.0	38,855.2	30,967.2	12,078.6	786.2	351.4	155.2	**86,409.8**
REFA	695.1	135.2	0	0	0	0	3.4	**833.7**
RFR	11,586.0	71,531.4	30,810.5	5,406.0	1,351.8	119.2	792.4	**121,597.3**
RFS	851.4	0	0	0	3.4	0	47.0	**901.8**
RNH	18,046.3	1,217.0	438.0	0	0	0	3.4	**19,789.9**
ZP	43,656.6	27,740.5	19,855.1	9,871.9	0	0	721.7	**101,845.8**
Total	**155,617.7**	**194,581.6**	**143,989.6**	**60,035.5**	**3,155.0**	**1,243.8**	**2,259.3**	**560,882.5**

AB= Forest Areas Under Protection
LB= Forest Lots
MN= Natural Monuments
PN= National Parks
RB= Biosphere Reserve
REFA= Wildlife Reserve
RFR= Forest Reserve
RFS= Wildlife Refuge
RNH= National Hydraulic Reserve
ZP= Protected Zone

Chapter 3: Non-Extractive Value of Forests of the Guayana region

Biodiversity

Table 4: Venezuela's Global Rank in Terms of Biodiversity

Notes:

- *Number of species per 10,000 km²*: This allows comparisons of number of species among countries of varying sizes by predicting the number of species that would occur in a uniform area. The species-area curve consists of the following formula: $S=cA^z$, where S=number of species, A=area, and *c* and *z* are constants. For more details, see World Resources Institute, *World Resources, 2000-2001* (Washington, DC: WRI, 2001), pp. 317-318.
- Statistics for total number and number of endemic mammals were updated from J. Ochoa G. and M. Aguilera, "Mamíferos," in M. Aguilera et al. (eds.) *Biodiversidad en Venezuela* (Caracas, Venezuela: CONICIT/Fundación Polar, in press), and ranked according to data tables in WRI, 2001.

Figures 5-6, Map 7

Wildlife Species Richness in the Guayana Region (Figure 5)

Group	Guayana Region	Not in Guayana
Mammals	244	91
Birds	855	512
Amphibians	128	147
Reptiles	98	194

Wildlife Restricted to Forests of the Guayana Region (Figure 6)

Group	Restricted	Not restricted
Mammals	188	56
Birds	337	518
Amphibians	76	52
Reptiles	45	53

Map 7: Threatened and Endemic Species by Sub-Region of Guayana

Threatened Species by Sub-region

Group	Northern Amazonas	Southern Amazonas	Caroní Sub-Region	Caura Sub-Region	Imataca-Orinoco Delta
Mammals	15	14	14	15	2
Birds	7	7	7	7	2
Reptiles & Amphibians	5	5	2	5	5

Known Endemic Species by Sub-region

Group	Northern Amazonas	Southern Amazonas	Caroní Sub-Region	Caura Sub-Region	Imataca-Orinoco Delta
Mammals	2	3	5	4	2
Birds	9	8	11	8	1
Reptiles & Amphibians	16	7	25	8	0

Sources: unpublished zoological collections, comprised of the following:

- Colección de Vertebrados de la Universidad de los Andes (CVULA), Mérida
- Museo de Historia Natural de Guanare (MHNG), Guanare
- Museo de la Estación Biológica de Rancho Grande (EBRG), Maracay
- Museo del Instituto de Zoología Agrícola de la Universidad Central de Venezuela (MIZA), Maracay
- Museo de Biología de la Universidad Central de Venezuela (MBUCV), Caracas
- Colección de Vertebrados de la Universidad Simón Bolívar (CVUSB)
- Museo de Ciencias Naturales de la Universidad Simón Bolívar (MCNUSB), Caracas
- Museo de Ciencias Naturales de Caracas (MCN), Caracas
- Museo de Historia Natural La Salle (MHNLS), Caracas
- American Museum of Natural History (AMNH), New York
- United States National Museum of Natural History (USNM), Washington

Scientists specializing in each of the wildlife groups:

Mammals: José Ochoa G. (ACOANA), Javier Sánchez (MARN), and Francisco Bisbal (MARN)
Birds: Miguel Lentino (Colección Ornitológica William H. Phelps)
Herpetofauna (reptiles and amphibians): Enrique La Marca (Universidad de Los Andes, Geography School), Jesús Manzanilla (Universidad Central de Venezuela), Celsa Señaris (Museo Natural de Historia La Salle)

Map Sources:

• GFW Venezuela analysis (see below)

Methodology:

The data for this section are based on a review and analysis of wildlife inventories conducted in forest ecosystems of the Guayana region. Within this region, five sub-regions were identified, based on biogeographic and environmental criteria. These sub-regions, which are represented on Map 5 include: Southern Amazonas State, Northern Amazonas State, Caura River Sub-region, Caroní River Sub-region, and Imataca-Orinoco Delta.

The representation of species in forest ecosystems was evaluated for each wildlife group, taking into account known species richness in all of Venezuela and in the Guayana region. As a complement to this analysis, the proportion of species restricted to forest ecosystems was quantified for each taxonomic group. In addition, the number of components with priority for conservation was estimated, taking into account the presence of endemic species or other restrictions in their distribution. For the purposes of this study, endemic species are those with distributional patterns restricted to Venezuela. The potential for threat was estimated using the following criteria:

• Increased level of local hunting
• Growing loss of habitat
• Low demographic potential
• High degree of sensitivity to changes in the primary condition of ecosystems.

Limitations:

• The data are limited to existing zoological inventories. As such, the indicators do not represent a complete catalogue of wildlife species inhabiting forests in the Guayana region or in Venezuela.

Non-Timber Forest Products

Figures 7-9
Proportions of Plants and Animals Used by Indigenous and Non-Indigenous Communities (Figure 7)

Use	Flora (No. of Species)	Fauna (No. of Species)
Food	186	87
Medicine	175	39
Construction	21	0
Handicrafts	34	25
Other	100	28
TOTAL	**516**	**179**

Source: GFW Venezuela. Database of bibliographic references on non-timber forest product use in the Guayana region, 2001.

Threatened Animals Used by Indigenous Groups, by Type of Use (Figure 8)

Use	Not Threatened (No. of species)	Threatened (No. of species)
Food	74	13
Medicine	29	10
Handicrafts	17	8
Other	21	7

Sources: GFW Venezuela. Database of bibliographic references on non-timber forest product use in the Guayana region, 2001; J.P. Rodríguez and F. Rojas-Suárez, *Libro Rojo de la Fauna Venezolana* 2d ed. (Caracas, Venezuela: Provita, Fundación Polar, 1999).

Threatened Plants Used by Indigenous Groups, by Type of Use (Figure 9)

Use	Not Threatened (No. of species)	Threatened (No. of species)
Food	147	39
Medicine	142	33
Construction	8	13
Handicrafts	25	9
Other	76	24

Sources: GFW Venezuela. Database of bibliographic references on non-timber forest product use in the Guayana region, 2001; S. Llamozas et al., *Libro Rojo de la Flora Venezolana* (Caracas, Venezuela: Fundación Instituto Botánico de Venezuela. Provita, Fundación Polar, in press).

Methodology:

- Data represent a literature review of published and unpublished scientific research conducted over the last 30 years on the use of wild, non-cultivated species used as non-timber forest products in the Guayana region. Over 150 published references were reviewed, of which 103 were incorporated into the database. The data base also includes an additional 38 secondary references which were not reviewed, due to difficulties in accessing these publications.
- Data from each publication were collected and organized in a Microsoft Access database which includes the following: reference number, origin of the publication and characteristics of the research project, thematic content of the publication, and description of non-timber forest product use.
- Interviews with ecology, anthropology, pharmaceutical and resource conservation experts complemented the information in the database.
- Plant and animal species with reported uses in the literature were integrated into the database in a standardized format, to avoid duplication of information. The database does not include species identified at the taxonomic level of family nor those identified solely by local common names.
- Sixty-seven percent of the literature reviewed was published in professional journals that are widely distributed, while the remainder consisted of technical reports and special studies that are less accessible.
- Threatened species were defined according to criteria established in the Venezuelan red books of species (*Libro Rojo de la Fauna Venezolana* and *Libro Rojo de la Flora Venezolana*). These criteria include the following:
    - Critically threatened: Extremely high threat of extinction from the wild in the immediate future
    - Threatened: Very high risk of extinction from the wild in the near future
    - Vulnerable: Not highly or critically threatened, but at high risk of extinction from the wild in the near future.

Further details on definitions of threat may be obtained from J.P. Rodríguez and F. Rojas-Suárez, *Libro Rojo de la Fauna Venezolana*. 2d ed. (Caracas, Venezuela: Provita, Fundación Polar, 1999), pp. 455-458.

Limitations:

- The data do not include the use of species found in aquatic ecosystems.
- Not all of the bibliographic references included information on the forest ecosystem associated with each non-timber forest product.
- A discussion on the use of non-timber forest products is often not the primary objective of many publications. Not all studies are easily accessible, particularly those anthropological studies focusing on indigenous communities. Thus some references with important information may have been left out of the database.
- The majority of studies were restricted to areas surrounding local communities and very few studies provided information at the statewide level. None of the studies presented integrated information across the Guayana region.
- The majority of studies have been conducted in the southern part of the Guayana region: 69% of the references reviewed included information on the use of non-timber forest products in Amazonas State, while only 15% of the studies encompassed data on non-timber forest product use in Delta Amacuro State.
- Floristic inventories in some parts of the Guayana region are incomplete. Many expeditions have focused on the tepuyes, while collection of botanical material in high diversity lowland forests has been carried out only sporadically.
- Knowledge about fauna of the Guayana region is based primarily on basic qualitative inventories, which were conducted in easily accessible areas near rivers. Some information is also available from studies conducted on tepuyes or isolated mountain ranges. There is no available information regarding the abundance of wildlife populations.
- Data on unpublished research projects are incomplete and difficult to access. Research project teams are reluctant to distribute information while data collection is on-going.
- Data on medicinal and religious uses of non-timber forest species are only available at a qualitative level, given that intellectual property rights have not been established with respect to the use of these species.
- Studies on the distribution, abundance and status of fauna and flora populations in the Guayana region are lacking, especially with respect to those species used by local communities. In addition, few studies document the impact of human activities on wildlife in the Guayana region. This limits the potential for evaluating the impact of extraction on these species.
- Only a few recent studies quantify the dependency of local communities on flora and fauna in the Guayana region.
- Very little data exist on the trade of wildlife for pets.
- There are no data regarding the economic value of Venezuela's biodiversity, and particularly that of non-timber forest resources.

Imports, Exports, and National Production of Roundwood, 1993-1998 (Figure 10)

Year	National Production (m^3)	Imports (m^3)	Exports (m^3)
1993	1,161,061.5	79,817.2	29,379.7
1994	981,668.6	33,816.9	9,285.7
1995	1,087,926.1	39,125	8,071.9
1996	1,440,306.3	2,866	1,790.7
1997	1,618,075	8,301	4,550
1998*	1,027,177.9	12,993.8	4,523.7
AVERAGE	**1,219,369.2**	**29,486.65**	**9,600.283**

*Estimate
Source: MARNR, *Boletín Estadístico Forestal*, No.2 (Caracas, Venezuela: Ministerio del Ambiente y de los Recursos Naturales Renovables, 1999, p. 67).

Pulp and Paper Imports, 1990-1999 (Figure 11)

Year	Pulp/Paper Imports ('000 metric tonnes)
1990	1,680.1
1991	1,918.3
1992	3,177.1
1993	2,144.0
1994	1,993.4
1995	2,343.8
1996	1,544.1
1997	1,928.7
1998	1,710.0
1999	1,677.4

Source: FAO, "Pulp and Paper Imports: Forestry Statistics, 2000." Online at: http://www.fao.org/forestry/include/frames/ (July 6, 2001).

Industrial Wood Production, 1980-1999 (Figure 12)

Year	Industrial Wood Production ('000 m^3)
1980	762
1981	794
1982	486
1983	490
1984	490
1985	638
1986	703
1987	703
1988	661
1989	643
1990	698
1991	737
1992	1,148
1993	804
1994	770
1995	755
1996	775
1997	520
1998	530
1999	443

Note: Industrial wood production is represented as an aggregate of industrial wood, sawnwood, plywood, and veneer sheet production. All units are in roundwood equivalents, where industrial wood=1, sawnwood=1.82, plywood=2.3, and veneer sheet=1.9. See S. Wunder, *Oil Wealth and the Fate of the Forest: Venezuela* Unpublished draft (Bogor, Indonesia: CIFOR, 2001), p. 21.
Source: FAO, "FAOSTAT, 2000." Online at: http://www.fao.org/forestry/include/frames/ (July 6, 2001).

Wood Production by Source, 1993-1998 (in cubic meters) (Figure 13)

Source	1993	1994	1995	1996	1997	1998**
Cutting Licenses	565,541.3	443,875.0	393,073.9	394,287.2	366,910.4	238,124.9
Concessions	365,838.2	298,253.8	280,301.4	430,824.9	385,523.0	406,267.0
Plantations*	154,149.0	160,765.0	415,257.0	616,241.0	580,967.5	382,786.0

*Caribbean pine plantations
**Official estimate

Source: MARNR, *Boletín Estadístico Forestal*, Nº 2 (Caracas, Venezuela: MARNR, 1999).

List of the most important timber species harvested in the Guayana region, in descending order according to their level of production in 1997

Scientific name	Common name	Bs./cubic meter	US$/cubic meter*
Erisma uncinatum	Mureillo	67,270	119.06
Hymenaea courbaril	Algarrobo	86,934	153.87
Manilkara bidentata	Purguo	60,312	106.75
Peltogyne spp.	Zapatero	72,659	128.60
Ceiba pentandra	Ceiba	56,017	99.15
Catostemma commune	Baramán	50,578	89.52
Tabebuia serratifolia	Puy	87,753	155.32
Parkia nitida	Caro caro	54,110	95.77
Mora exelsa	Mora	71,312	126.22
Carapa guianensis	Carapa	60,435	106.96
Simaruba amara	Cedro Blanco	61,278	108.46
Pouteria spp.	Capure	60,169	106.49
Andira spp.	Pilón	64,407	113.99
Copaifera officinalis	Aceite	59,762	05.77
Brosimun spp.	Charo	48,273	85.44
Pterocarpus vernalis	Drago	46,113	81.62

*Exchange rate= Bs. 565/ US$1

Sources:

MARNR. *Estadísticas Forestales año 1997*. Serie No. 5 (Caracas, Venezuela: MARNR, Dirección General Sectorial del Recurso Forestal, 1999).

Mennega, E.A., W.C.M. Tammens-de Rooij, and M.J. Jansen-Jacobs, eds. *Check-list of woody plants of Guyana: based on D.B. Fanshawe's check-list of the indigenous woody plants of British Guiana*. (Wageningen, The Netherlands, 1988).

Rollet, B. *Inventario forestal de la Guayana Venezolana. Estudio de preinversión para el desarrollo forestal*, informe 3 (Caracas, Venezuela: MAC, FAO, 1967).

Rollet, B. "Etudes quantitatives d' une forèt dense humide sempervirente de plaine de la Guyane Vénézuelienne." Doctoral dissertation. (Toulouse, France: Faculté de Sciences, 1969).

Steyermark, J., P. Berry, K. Yatskievych, and B. Holst, eds. *Flora of the Venezuelan Guayana*. Vol. 1-5. St. Louis: Missouri Botanical Garden Press, 1995-1999.

Sanoja, E., personal communication, May 7, 2001.

Note: There are many inconsistencies with regards to the common names identified with each species. This is related to the lack of an updated list of wood species for the Imataca Forest Reserve and the San Pedro forest lot. The latest list of species is dated from 1969 (Rollet, 1969, FAO), despite the fact that concessionaires compile dendrologic studies in the process of developing management plans. However, this information has not been compiled and updated. A comprehensive botanical species list of the Imataca forest is currently under way at the *Herbario MER* of the Faculty of Forest Sciences, Universidad de los Andes, Mérida.

Table 7: Logging Fees Applied to the Guayana Region

Notes:

- We calculated logging fees for 1997 and 1999 based on log production and prices at the mill gate, by wood species harvested in the Guayana region in 1997. Statistics for prices and production by wood species are not available for 1999. To account for an increase in price between 1997 and 1999, we assumed an increase of 50% (R. Silva, personal communication, July 12, 2001). Between 1997 and 1999, Venezuela's non-coniferous, industrial roundwood production decreased by 9% (FAO, "FAOSTAT, 2001." Online at: http://www.fao.org/forestry (July 13, 2001). Since Bolívar State accounts for much of the country's non-coniferous, industrial roundwood production, we assumed a 9% decrease in production for 1999.
- Prices have been weighted to production per cubic meter for each wood species harvested (see below).

Total Weighted Price and Roundwood Production, Guayana Region

Year	Roundwood Production (m^3)	Weighted price/ m^3	Technical service fee, Bs./ m^3 (1999)
1997	221,818	59,172	697
1999	199,294	89,899	9,292

Source: MARNR, *Estadísticas Forestales*, Año 1997, Serie No. 5 (Caracas, Venezuela: MARNR, 1999).

Logging Fees as a Proportion of Production Value in the Guayana Region and Other Tropical Countries (Figure 14)

Country/Region	% production value
Guayana region (1997)	3
Guayana region (post 1999)	12
Gabon	15
Cameroon	18

Sources: J.G. Collomb et al., *A First Look at Logging in Gabon* (Washington, DC: WRI, 2000); J.G. Collomb et al., *An Overview of Logging in Cameroon* (Washington, DC: WRI, 2000).

Notes:

- Production value for Gabon and Cameroon is free-on-board cubic meters.
- Volumes for the Guayana region are expressed in official cubic meters.
- Value of production per cubic meter has been weighted to production of the most important species in the Guayana region.

Figures 15-17, Maps 8-10

Summary of Production by Concessionaire (Management Plan Estimates versus Actual Cuts)

Concession Owner	Management Plan			
	Estimated average harvest area (ha/year)	Estimated average yearly volume		No. annual cuts (with research parcels)
		Total (m^3/year)	ha (m^3/ha/year)	
COFORGUA	3,654	23,063	6.3	–
INPROFORCA	5,346	71,849	13.4	–
Aserradero Hnos. Hernández	3,808	30,614	8.0	7
MADERORCA	3,850	22,432	5.8	5
CODEFORSA	3,256	60,017	18.4	8
COMAFOR	3,850	44,427.5	11.5	5
INTECMACA	4,325	83,941	19.4	7
CVG- Imataca	3,860	38,600	10.0	5
SOMAGUA	3,625	30,000	8.3	4
Total Imataca Forest Reserve			**11.2**	
Matamoros	4,700	51,105	10.9	13
El Manteco	5,085	63,712	12.5	13
Yocoima	4,180	35,510	8.5	15
Maderas Nuria I	4,032	33,120	8.2	8
Maderas Bosco	3,298.5	39,455.5	12.0	4
Total Forest lots			**10.4**	
PRIVATE LOTS AND SPECIAL DECREE				
Caño Blanco				10
Fundo Botijón	612	2,393	3.9	1
CVG-Guri	2,711	21,254	7.8	3
Total private lots and special decree			**5.9**	
Grand Total			**9.2**	

Notes:

- - = no data or no extraction.
- ** = no data on research parcels.
- * = does not include 1999.
- IC = incomplete data.
- CVG-Imataca, Coforgua, Inproforca, Intecmaca and Somagua are currently inactive.
- Estimates of number of trees/ha in Intecmaca from Ochoa (1997).
- The database is incomplete for some columns. For some years it was not possible to obtain data for the number of trees cut nor the volume harvested in some concessions. For this reason, the averages for the trees/ha/year and volume/ha/year harvested were estimated using only the available data. Thus several parameters in this table cannot be used to calculate other derived parameters.
- All volume is expressed in official cubic meters.

Annual Cutting Plans (Executed)

Area	Harvested trees		Volume	
Total harvested (ha)	Total	ha/year	Total (m^3)	ha (m^3/ha/year)
–	–	–	–	–
–	–	–	–	–
21,097 (16,403*)	41,022*	2.5	125,633*	7.5
14,689 (12,689**)	35,291**	3.2	44,557**	4.0
21,407	82,937	3.8	129,930	6.1
15,550	29,574**	–	71,379**	5.3
22,313	34,694 IC	2.3	148,774	6.9
11,476	12,181 IC	–	34,438 IC	5.8
6,117	21,997**	–	67,050	6.3
123,556	**257,697**	**3.0**	**621,762**	**6.1**
53,455	45,458**	–	182,006*	4.1
53,455 IC	31,374 IC	1.6	60,565 IC	3.1
52,159	73,429**	1.6	186,388**	4.6
28,868	69,719	–	152,003 IC	7.9
10,407	38,491**	–	39,536 IC	8.1
198,345	**258,471**	**1.7**	**620,499**	4.8
21,981	16,637 IC	2.4	129,229 IC	6.4
1,412	–	–	4,448 IC	–
5,495	4,833 IC	–	7,538	1.7
28,888	**21,470**	**–**	**141,215**	**–**
350,789	**537,638**	**2.5**	**1,383,476**	**5.3**

Status of Concessions in the Guayana Region

Concession Owner	Status	AREA (HA)	
		According to Management Plan (MP)	According to MARN
			Imataca Forest
COFORGUA	In review	130,000	130,000
INPROFORCA	Inactive	182,791	130,000
Hermanos Hernández	Active	125,000	125,000
CVG-Sierra Imataca Decreto 367	Inactive	236,094	236,000
CODEFORSA	Active	122,400	134,000
SOMAGUA	Inactive, under investigation	160,900	162,000
INTECMACA	Inactive, under investigation	180,100	180,000
MADERORCA	Active, under investigation	125,100	130,000
COMAFOR	Active	129,335	125,000
Fundación La Salle	In review	130,000	130,000
UNEG	In review	59,400	–
			San Pedro, El Dorado Tumeremo and
Aserradero El Manteco	Active	180,000	195,000
Aserradero Matamoros	Active	195,000	180,000
Aserradero Yocoima	Active	193,000	193,000
Elaboración de madera Bosco C.A.	Inactive	78,882	–
Maderas Nuria I C.A.	Active	171,720	–
			Private lots and
Caño Blanco	Active	29,228	–
Fundo Botijón	Inactive, under investigation	7,000	18,735*
CVG-Bosque Guri-El Frío (Decreto 1141)	Inactive	75,652	–
TOTAL		**2,511,602**	**2,068,735**

*Original area of Flamerich lot

Notes:

- 8.49% of the CVG-Bosque Guri-El Frío concessions is in a "special zone" (logging is prohibited).
- UNEG and Fundación La Salle are applying for experimental, research plots to conduct research on silvicultural techniques.

Acronyms:

MP: Management Plan
COFORGUA: Corporación Forestal Guayana
INPROFORCA: Industrializadora de productos forestales C.A.

	Management Area (ha)	Contract Years	No. of Compartments	Sawmill
Reserve				
	95,000	MP not yet approved	26	Yes
	137,926	25	25	Yes
	95,200	25	25	Yes
	115,800	30	30	Yes
	94,440	30	30	Yes
	76,044.25	–	22	Yes
	177,000	40	40	No
	107,009	25	25	Yes
	115,500	30	30	Yes
	102,684	30 MP not yet approved	30	No
	–	MP not yet approved	–	No
Altiplanicie de Nuria Forest Lots				
	139,400	30	30	Yes
	14,000	30	30	Yes
	136,800	30	30	Yes
	65,969	20	20	Yes
	128,904	30	30	No
Special Decree				
	29,228	20	20	No
	3,060.17	5	5	No
	54,220	20	20	No
	1,688,184.42			7/19 No

CODEFORSA: Corporación de Desarrollo Forestal
SOMAGUA: Sociedad Maderera de Guayana
INTECMACA: Industria Técnica de Maderas
MADERORCA: Maderas del Orinoco
COMAFOR: Consorcio Maderero Forestal
UNEG: Universidad Nacional Experimental de Guayana

Sawmill Capacity versus Production (Figure 17)

City or Region	Company Name	Roundwood entering mill (m^3/year)	Maximum Installed Capacity (m^3)	Average Annual Volume of Sawnwood (m^3/year)
	Aserradero El Cristo	24,000	11,000	8,800
	Aser. Angostura 2000	3,000	3,120	2,400
	Aser. San Miguel C.A.	3,000	7,200	3,600
	Aser. Orinoco Industrial S.A.	8,000	7,200	3,000
Ciudad Bolívar		**38,000**	**28,520**	**17,800**
	Promaca	5,000	8,820	1,800
	Aserradero Sta. María	1,500	12,000	1,800
	Aserradero Imataca C.A.	2,160	8,225	2,350
	MADERORCA. Maderas Orin.	5,000	12,000	7,200
	E.W.E.	1,728	2,160	1,680
Ciudad Guayana		**15,388**	**43,205**	**14,380**
	Elaboración de Maderas Bosco C.A.	20,000	8,000	1,470
	Maderas T.B.C.A. (Todisco Buck)	800	2,880	1,680
	Aserradero Tumorronay	400	4,800	2,400
	Maderas Gredo C.A.	2,000	4,800	2,400
	Aserradero COVEMAT	6,000	7,200	3,600
	Guayana Wood Company	2,400	5,000	2,100
Guasipati and Tumeremo		**31,600**	**32,680**	**13,650**
	Asseraderos Hnos. Hernández	1,300 5,	280	5,040
	DIMASURCA (Distrib. de Maderas del Sur)	2,000	2,000	4,800
	Aserradero Adriático C.A.		2,640	2,160
	Aserradero Yocoima	18,000	25,000	22,000
	Aserradero Matamoros	15,000	15,000	3,750
	Santa Rosa	7,000	8,400	2,400
	Maderas Industriales	3,228	9,400	3,525
Upata		**46,528**	**67,720**	**43,675**
El Manteco	Aserradero El Manteco C.A.	**12,000**	**20,000**	**4,000**
Tucupita	Aserradero Santa Inés	**1,000**	**2,000**	**1,500**
TOTAL		**144,516**	**194,125**	**95,455**

Table Sources:

- Concession management plans (*Planes de ordenación y manejo forestal*)
- Concession contracts
- Concession annual cutting plans
- Annual cutting reports
- Authorization communications
- Site visits to a select number of concessions (Hermanos Hernández sawmill, Yocoima sawmill)
- Interviews with official company representatives and with the Ministry of Environment, as well as with forestry experts
- Questionnaire of sawmill operators, filled out with the help of the director of each sawmill

Sources for Maps 8-10:

- MARNR/SEFORVEN, *Unidades de Manejo de la Reserva Forestal Imataca y Lote Boscoso San Pedro* (Caracas, Venezuela: MARNR, 1987). Scale: 1:500,000.
- Comisión Estatal de Ordenación del Territorio del Estado Bolívar, *Áreas destinadas a producción forestal permanente*, based on national cartography and SEFORVEN, 2000.
- Comisión Estatal de Ordenación del Territorio del Estado Bolívar, *Propuesta Asignación de Uso del Estado Bolívar* (Ciudad Bolívar, Venezuela: IAMOT, 1999).

Technical Notes:

- All production volumes are expressed in official cubic meters, derived through a formula established by the Ministry of Environment:

  V-MARN=0.605 * D^2 * L, where

  V-MARN=the volume in m^3; 0.605=conversion constant; D=cutting diameter at breast height in meters; L=commercial height in meters.

- To estimate roundwood volume, ministry officials multiply V-MARN by a co-efficient of 0.55.
- In addition, in some annual cutting plans, the roundwood volume is estimated through the Paragua formula for standing timber, the result of which is a lower volume than that obtained using the MARN roundwood formula.
- Compartments are the operational unit of cutting plans. In general, a concession is divided in compartments of varying sizes, depending on the number of years of the contract.
- Harvesting in one compartment can begin during one annual cutting cycle and end 1-3 years later. For this reason, volumes extracted from one compartment do not always correspond to the calendar year indicated in the cutting plan, resulting in confusion in annual production records.
- Actual volume cut and number of trees harvested are most likely an underestimate, due to the lack of data for some years and concessions. Total production is likely to be higher than that reflected in the above tables.

Methodology:

- Management plans, annual cutting plans, and other company documents were reviewed to compile data reflected in the above tables. The list of reviewed documents includes 122 titles.
- Data on sawmills were compiled from interviews with official company representatives for each sawmill and with the Ministry of Environment and forestry experts.
- Logging concessions maps were derived from the original decree allocating each concession.
- The boundaries of the Imataca Forest Reserve and surrounding forest lots were adjusted according to expert opinion to fit the boundaries of the logging concessions.

Limitations:

- There is no standard cartographic base map that can be used to accurately locate concession boundaries. The most recent base map is from 1987 and contains various errors.
- Many concessions have been established without defining geographic coordinates. In these cases, concession boundaries are identified by incidental, non-geographic points (e.g. a road or a house). Concession boundaries are approximate.
- Our base layer for rivers was coarser than our data for logging concessions. We adjusted concession boundaries to fit rivers and the international border of Venezuela, which resulted in changes in the area of some concessions, the Imataca Forest Reserve, and the forest lots. For this reason, the area of some forest lots and the Imataca Forest Reserve may vary from official statistics. At the most, our statistics vary by 10% from official figures.
- The database produced for this study does not include reliable data regarding the final destination of sawmill products or roundwood due to our inability to collect these data.
- The criteria used by the Ministry of Environment to define volume and number of trees to be cut each year are not clearly defined. It appears that one criterium for harvesting is the number of parent trees.
- There are no reliable data on the area of forest or the number of trees affected by skidding trails. Likewise there are no data on the area of forest cut to establish log yards.
- Mitigation of environmental impacts from logging is not well incorporated in management and cutting plans. For example, there is no information on the effects of logging on the biodiversity of the surrounding ecosystem incorporated in either the management or cutting plans.

Venezuela's Gold and Diamond Production Compared to Other Major Producers, 1999 (Figure 19)

Country	Gold (kg)
Australia	302,580
Brazil	40,900
Canada	158,275
China	170,000
United States	341,000
Guyana	13,500
Venezuela	5,946

Country	Diamonds ('000 carats)
Botswana	20,000
Brazil	900
D.R. Congo	18,000
Russia	23,000
South Africa	10,000
Venezuela	95

Sources: US Geological Survey, *US Geological Survey Minerals Yearbook* (Washington, DC: USGS, 1999); MEM, Dirección de Planificación y Economía Minera, *Anuario Estadístico Minero* (MEM: Caracas, Venezuela, 1999).

Price of Gold, 1975-2000 (Figure 20)

Year	Average $/oz.
1975	515.3
1976	378.2
1977	420.6
1978	509.6
1979	728.7
1980	1281.9
1981	871.5
1982	684.8
1983	733.5
1984	596.7
1985	507.5
1986	578.0
1987	675.7
1988	636.1
1989	529.2
1990	507.0
1991	457.7
1992	422.1
1993	429.0
1994	446.0
1995	433.8
1996	425.9
1997	355.0
1998	310.5
1999	288.4
2000	279.0

Note: Prices were adjusted for average inflation (indexed to 2000 U.S. dollars).
Sources: The Gold Institute, Online at: http://www.kitco.com/charts/historicalgold.html; World Gold Council, "Gold Demand Up 11% in Q4 2000," *Gold Demand Trends* 34, Feb. 2001, Online at: http://www.gold.org/Gedt/Gdt34/Gdt34.pdf (June 28, 2001); Inflation data from International Monetary Fund, "World Economic Outlook Database," May 2001. Online at http://www.imf.org/external/pubs/ft/weo/2001/01/data/index.htm (July 10, 2001).

Venezuelan Gold and Diamond Production, 1989-1999 (Figure 21)

Year	Gold (kg)	Diamonds ('000 carats)
1989	5,113	213
1990	6,334	337
1991	4,220	214
1992	8,547	478
1993	8,985	411
1994	10,094	583
1995	7,259	296
1996	x,xxx	172
1997	22,322	248
1998	6,740	97
1999	5,946	95

Source: MEM, Dirección General de Planificación y Economía Minera, *Anuario Estadístico Minero* (Caracas, Venezuela: MEM, 1999).

Question 6: The value of gold and diamond mining for the Venezuelan economy.

- According to the SENIAT, mining companies paid 535 million bolívares in taxes and the state-run CVG-Minerven paid 1,878 million bolívares between 1993-1997.
Source: C. Rodner, "Réquiem para un bosque," *Debates IESA* 3, No. 4 (April-July 1998).

- The average exchange rate for this period was Bs. 263.96/US$1
Source: Banco Central de Venezuela, "Tipo de Cambio de Referencia (Bs./US$)." Online at: *www.bcv.org.ve/cuadros/2/253.htm* (July 19, 2001).

- Total production of gold for the same period was 60,379 kg.
Sources*:* US Geological Survey, *US Geological Survey Minerals Yearbook, 1999* (Washington, DC: USGS, 2000); US Geological Survey, *US Geological Survey Minerals Yearbook, 1997-98* (Washington, DC: USGS, 1999).

- Average price of gold for the same time period was $369.40 (Note that this is in real value, rather than inflation-adjusted dollars.)
Source: World Gold Council, "Gold Demand Up 11% in Q4 2000," *Gold Demand Trends,* 34, February 2001. Online at: http://www.gold.org/Gedt/Gdt34/Gdt34.pdf (June 28, 2001).

Mining Concession and Contract Ownership (Figure 22)

Category	Area (ha)	% of total
Government	731,455.5	39
Foreign held	455,022.5	24
Small-scale (national)	414,019.0	22
Unknown	264,948.7	14
Rescinded	13,322.0	1
TOTAL	**1,878,767.7**	**100**

Source: GFW Venezuela, 2001 (see below for details).

Sources:

- "Empresas con contratos rescindidos," *El Universal* (Caracas, Venezuela, November 27, 1997).
- Corporación Venezolana de Guayana, Vicepresidencia Corporativa de Minería, *Situación Actual de la Permisología Ambiental de los Contratos Vigentes de Pequeña, Mediana y Gran Minería en Áreas Asignadas a la CVG,* Report to Ministry of Environment (Ciudad Bolívar: CVG, 1999).
- CVG-Tecmín, *Estado Actual de los Contratos Vigentes de Mediana Minería, firmados por CVG con Terceros Actualizados a Julio del Año 1996* (Ciudad Guayana, Estado Bolívar: CVG-Tecmín, September 1999).
- *Gacetas Oficiales* (Official Gazettes) for mining concessions granted by the MEM.
- Internet search of multinational mining companies with holdings in the Guayana region.
- Small-scale mining communities: GFW Venezuela, Database on Communities and Settlements, 2001.

Methodology (Figure 23, Table 11, Map 11):

- Data on mining concessions granted by the Ministry of Mines were obtained from the official gazettes in which concession boundaries are published. Geographic coordinates were extracted for each concession boundary.
- Data on contracts granted by the CVG were obtained from a hardcopy database purchased from CVG-Tecmin. The database included: name of contract, area of concession, name of contracting company, legal representative, location, objective of contract, date of request and signature of contract, duration, UTM coordinates.
- An additional CVG database was acquired that includes environmental permits by contract. No equivalent database was available for concessions allocated by the MEM.
- These datasets were integrated into a Microsoft Excel digital file, which includes area of each concession/contract, company name, year granted, and environmental permits.
- To link concessions and contracts to multinational mining companies, we conducted an Internet search using mining industry and stock market databases (e.g. www.infomine.com, www.freeedgar.com, www.sedar.com). We also conducted a general Internet search by company.
- Additional information on each company was obtained primarily through reviewing corporate filings to the Securities and Exchange Commission, the Canadian Securities Administrators, and from corporate annual reports and news releases available from Internet websites.
- To verify ownership, we sent letters of clarification to each of the foreign companies found to have holdings in the Guayana region. Of the 28 companies originally identified, we received 5 responses. We were unable to locate addresses for 3 companies. Two companies responded that they no longer held interests in the Guayana region.
- Map 11 ("Mining in the Guayana Region") is the result of plotting geographic coordinates listed in government databases. The CVG-Tecmín database was used to identify mining contracts, and coordinates found in official gazettes were used to determine mining concessions granted by MEM. In both cases, some concessions and contracts were incorrectly plotted due to either errors in geographic coordinates, or the order in which the coordinates were listed. Unfortunately, we were unable to correct these errors due to mechanical difficulties, which resulted in the separation of the attribute data from the coordinates. We have chosen to show mining concessions and contracts as general polygons where a group of concessions or contracts has been awarded. Small-scale mining points are approximate locations of mining communities. As such, they represent a proxy for where small-scale miners can be found.

Limitations:

- There is no official government database listing mining concessions. The Ministry of Energy and Mines is developing a digital database of mining companies with concessions and contracts in the Guayana region, but once complete these data will not be publicly available.
- For concessions allocated by the MEM, geographic coordinates are not provided consistently. In some cases, the decree identifies concession boundaries according to rivers, roads, or other objects (trees and houses), making the accurate representation of concession boundaries dependent on the accuracy of base maps. Map 11 should only be used as a rough representational tool for identifying some areas where mining rights have been allocated.
- The data obtained from the CVG included numerous errors, such as incorrect geographic coordinates, improper order of coordinates, and text indications instead of numerical coordinates. This is likely a result of errors in data entry, as well as a failure to consistently provide geographic coordinates.
- Concession/contract area and accompanying statistics related to the area of the Guayana region under concession have been aggregated from the CVG-Tecmín and MEM records. Thus they should be

considered approximate, as more accurate numbers would require an accurate map of concessions and contracts.

• Contracts listed in the CVG report on environmental permits are systematically linked to the wrong companies. Cross-checking contract ownership with data obtained from corporate sources indicates that the CVG-Tecmín database of ownership is more reliable. For this reason the CVG report to the Ministry of Environment was used only for identifying compliance with environmental permits, and not for identifying ownership.

• The data include numerous gaps. For example, small-scale mining contracts allocated by the CVG are only presented in an aggregated manner in the CVG report to the Ministry of Environment regarding environmental permits. The CVG Tecmín ownership database did not include specific information (including geographic coordinates) for all small-scale mining contracts.

• The percentage of land allocated for small-scale mining in Figure 22 was derived from adding the area listed in the CVG report to the Ministry of Environment to the database obtained from CVG-Tecmín. Concessions allocated by the MEM to associations and cooperatives were also added to the small-scale mining database.

• There appears to be some duplication of concessions in the CVG-Tecmín registry. This is likely to be the result of modifications in legislation, which resulted in the CVG further sub-dividing some mining contracts. Although the exact area affected by duplicated contracts is not known, it is likely to be less than 50,000 hectares.

Population in the Guayana Region by State, 1950-1990 (Figure 23)

Year	Bolívar	Amazonas	Delta Amacuro
1950	127,436	10,582	33,648
1961	213,543	11,757	33,979
1971	391,665	21,696	48,139
1981	668,340	45,667	56,720
1990	900,310	55,717	84,564

Source: Oficina Central de Estadísticas e Informática, *El Censo 90 en Bolívar* (Caracas, Venezuela: OCEI, 1995).

Change in Selected Indigenous Populations, 1982-1992 (Figure 24)

Group	1982	1992	% change	Data code
Akawaio	491	911	85.5	3
Arahuaco	78	248	217.9	1
Arutani	9	45	400	1
Baniva	1,167	1,192	2.1	1
Bare	1,265	1,226	-3.1	1
Hiwi	7,256	11,608	60	3
Hoti	398	643	61.6	3
Kari'ña	6,849	11,141	62.7	3
Kurripako	1,623	2,816	73.5	3
Mapoyo	76	178	134.2	1
Panare	2,379	3,314	39.3	3
Pemón	11,464	19,129	66.9	3
Piapoco	640	1,333	108.3	3
Piaroa	7,030	11,539	64.1	3
Puinave	491	774	57.6	3
Sape	9	28	211.1	1
Warao	19,573	24,005	22.6	2
Warekena	316	428	35.4	3
Yabarena	155	319	105.8	1
Yanomami	12,082	15,012	24.3	2
Ye'kwana	3,038	4,472	47.2	3
Yeral	Not counted	775	NA	NA

Data codes: 1=Groups that were better counted in 1992 than in 1982; 2= Groups that presented problems in the 1992 census count; 3= Groups that do not reflect any problems in the 1982 or 1992 censuses

Note: There are no census numbers for the Yeral in 1982 as this group was not counted as a separate group until 1992.
Source: Mansutti Rodríguez, A. "Una mirada al futuro de los indígenas en Guayana." *Boletín Antropológico* 29 (1993): 7-27.

Map 12: Areas of High Population Pressure or Intensive Use in Guayana Forests

Sources:

- GFW Venezuela analysis (GPS coordinates for indigenous communities and expert consultation).
- Mansutti Rodríguez, A. et al. *Diagnóstico de los Conflictos Socio-ambientales en Imataca: Líneas Estratégicas de un Programa para el Resguardo y la Consolidación de los Asentamientos Humanos ubicados en la Reserva Forestal Imataca (RFI)*, Final Report to the World Bank (Ciudad Bolívar, Venezuela: CIAG/UNEG, 1997).

Methodology:

- Based on the above-cited report to the World Bank, and expert opinion, polygons were delineated around settlements known to have an impact on forests.

Limitations

- This map is purely representational and is meant to roughly identify areas where human-based activities (such as agriculture, small-scale mining, and ranching) are probably having an impact on forest cover. Field visits and finer scale monitoring are required to further identify the nature and extent of these impacts.

Map 13: Land-use Conflicts in the Guayana Region Forests

- Data for Map 13 derived from GFW Venezuela analysis (GPS coordinates for indigenous communities, logging concessions, mining concessions, expert consultation). See descriptions for Map 2, Map 8, and Map 11 for details.

Annex 2: The GFW Review Process

Global Forest Watch Venezuela is a national network that has sought to include many individuals involved in forest issues. The process leading to this report lasted over two years and included several technical workshops to define the scope of the project, identify indicators, and present preliminary results of data collection efforts. Many individuals representing government, nongovernmental organizations, universities, local community groups, and the private sector participated in various stages of the process (see Table A-2).

Review Process

This report underwent an external review process lasting approximately five weeks. Twenty-two copies of the draft manuscript were sent to external reviewers in Venezuela and elsewhere. Fifteen sets of comments were returned and incorporated into the final draft. The external reviewers included experts in all of the themes addressed by the report. Individuals who were sent a copy of the manuscript included (an asterisk denotes reviewers who were unable to review the report): Horacio Biord,* Hernán Castellanos, Abigail Castillo, Américo Catalán, Julio César Centeno,* Pedro Delfín, María del Carmen Díaz Gestoso,* Hugh Eva, Otto Huber, Anibal La Riva,* Armando John Madero,* Juhani Ojasti, Abel Perozo,* Miguel Plonzcak, Jim Roberston, James Ross-Jones, Javier Sánchez, Euro Segovia, Ivette Torres, Compton Tucker,* Sven Wunder, and Stanford Zent.

These individuals represented the following institutions: Universidad Católica "Andrés Bello",* Universidad Experimental de Guayana, Dirección General Sectorial de POA (MARN), Dirección del Recurso Forestal (MARN), Universidad de los Andes/ Tropenbos,* TREES project, Instituto Venezolano de Investigaciones Científicas, Universidad del Oriente,* Corporación Venezolana de Guayana,* Universidad de los Andes, Placer Dome International, Sociedad Conservacionista Audubon de Venezuela, Museo de la Estación Biológica de Rancho Grande, United States Geological Survey, University of Maryland,* and the Center for International Forestry Research. However, comments reflected personal opinions rather than institutional endorsements. In addition, several WRI staff provided valuable input: Jean-Gael Collomb, Jaime Echeverría, Nels Johnson, Lars Laestadius, Carmen Revenga, and Ralph Ridder.

Major Review Comments and How They Were Addressed

Most of the comments received involved suggestions for improving the overall structure and flow of the report; some reviewers suggested ways to improve clarity of the maps. Listed here is a summary of the major comments received and how they were addressed:

- *Many reviewers (especially those less familiar with Venezuela) felt the draft was too dense and difficult to read.*

To make the report more accessible to audiences outside of Venezuela, we re-organized and simplified the structure of the report, bolstering the introductory chapter to provide clear background explanations for those unfamil-

iar with forest issues in Venezuela and the Guayana region. We added a glossary in the beginning to explain terms and our use of specific phrases. In addition, we improved the flow of the text by eliminating unnecessary details, converting many of the bullets into paragraphs, and adding summary paragraphs in the beginning of each chapter that provide the results of our analysis.

• *Several reviewers felt that the draft lacked adequate analysis and compelling conclusions. Two reviewers cited the lack of recommendations.*

We added analytical paragraphs in the executive summary; at the end of the logging, mining, and populations sections; and strengthened the conclusions to include not only details of GFW Venezuela's future monitoring efforts, but also to provide a synthesis of key data gaps that decision makers will need to better monitor forests. We also added a paragraph summarizing the major findings of the report. Global Forest Watch's mandate is to provide up-to-date, high-quality data. Thus we do not engage in policy analysis nor do we provide recommendations in our products. It is our hope that other organizations will use the data presented in this report to make decisions, develop policies, and present recommendations.

• *Some reviewers felt that we did not sufficiently acknowledge the impacts of agricultural clearing, ranching, and forest fires on forest cover.*

Due to limited resources, we were unable to include new data on these activities, but we added existing information from the literature and from government statistics to emphasize the direct role these activities play in Venezuela's deforestation. In addition, we revised Box 7 ("The Role of Logging in Deforestation in the *Llanos*") to acknowledge the primary role of agriculture in forest conversion in the *llanos* region. We also added language in the introductory sections citing agriculture as a primary cause of deforestation.

• *Some data were deemed outdated or incorrect.*

We updated data in several sections, including logging fees, mining production statistics and details of regulations, and forest cover statistics. Most of this was as a result of new data provided by our reviewers. We also corrected erroneous statements and contradictions in data.

• *Some reviewers had trouble understanding the figure in Box 5 ("The Relationship Between Forest Cover and Wildlife") and one reviewer felt the information provided was too simplistic.*

We added references to other research that demonstrate the impact of logging on biodiversity, provided more relevant details on the types of impacts especially on bird and bat species, and included a more clear explanation of the figure within the box. We also modified the figure slightly so the differences between the lines would be more apparent.

• *A couple of reviewers felt that Figure 2 should represent forest cover by elevational criteria or by physiological classes, but not both.*

We chose to use elevational criteria, as that fits more closely our analysis of the distribution of forests under protected status. To represent elevational classes, we used a combination of O. Huber's 1988 Vegetation Map for Venezuela and the TREES satellite data for 1996 (see Annex 1 for details). In addition to maintaining the consistency of analysis with the protected areas section, the O. Huber map is deemed to be of high quality for representing vegetation classes.

• *We were criticized for our use of the TREES data as a base forest cover layer for Venezuela, due to the fact that these data are relatively coarse and do not adequately represent small forest patches.*

While we agree in principal with this criticism (see our discussion of the limitations of this dataset in Annex 1), we felt that this was the most appropriate source to use. Despite the limitations of satellite imagery, this is the only map of forest cover that is relatively recent. The only other publicly available maps of Venezuela's forest cover represented forest cover from the late 1970s. Furthermore, our intent in this first publication was to document the extent of forest cover at a coarse scale, with a particular emphasis in the Guayana region, an area of primarily closed canopy forests. For these reasons, we deemed the TREES data to be sufficient for our objectives. Future fine-scale monitoring efforts will require the use of more detailed forest cover maps.

Table A-2: Participants in Workshops Held by GFW Venezuela

Name	Institution
Scoping Workshop: November 17, 1998	
Carolina Ramírez	Ministerio del Ambiente y de los Recursos Naturales Renovables-Seforven
Julio César Centeno	Universidad de los Andes-Tropenbos
Anna Ponte	AVVA Frontera Gran Sabana
Astur De Martino	Universidad Nacional Experimental de Guayana
Mary Prado	Conicit
Paula del Giorgio	EcoNatura
Otto Huber	Fundación Instituto Jardín Botánico
Carmen Meneses	Ministerio del Ambiente y de los Recursos Naturales Renovables
Minu Parahoe	CELOS (Suriname)
James Ross-Jones	Audubon de Venezuela
Zoyla Martínez	Fundación para la Defensa de la Naturaleza
Francisco Guerra	Centro de Procesamiento Digital de Imágenes
Armando Hernández	Fundación Polar
Carolina Bertsch	Provita
Willem Ferwerda	Netherlands Committee for IUCN
Julio Delgado	Ministerio del Ambiente y de los Recursos Naturales Renovables (Vegetation Department)
Milagro Agudo	Ministerio del Ambiente y de los Recursos Naturales Renovables
Hugo Arnal	The Nature Conservancy
Fernando Delgado	Centro Interamericano de Desarrollo e Investigación Ambiental y Territorial.
Nalua Silva	Universidad Nacional Experimental de Guayana
José Poyo	Consejo Nacional Indígena Venezolano
Workshop to Define Criteria and Indicators, State of the Forest Report: November, 18-19, 1999	
Armando Hernández	Fundación Polar
Álvaro Atilano	Comisión Especial para la Reserva Forestal Imataca-Ministerio del Ambiente y de los Recursos Naturales Renovables
Edgar Quintero	Ministerio del Ambiente y de los Recursos Naturales Renovables-Dirección General Sectorial del Recurso Forestal
Elba Quintero	Ministerio del Ambiente y de los Recursos Naturales Renovables-Dirección General Sectorial del Recurso Forestal
Eric van Praag	Observatorio Mundial de Bosques-Venezuela
Franklin Rojas	Provita

Gydris Adrián	Comisión Especial para la Reserva Forestal Imataca-Ministerio del Ambiente y de los Recursos Naturales Renovables
María Bastidas	Centro de Procesamiento Digital de Imágenes
Nalua Silva	Universidad Nacional Experimental de Guayana
Rafael Leal	AVVA Frontera Gran Sabana
Zoila Martínez	Fundación para la Defensa de la Naturaleza
Zonia Rivas	Ministerio del Ambiente y de los Recursos Naturales Renovables–Dirección General Sectorial de Planificación y Ordenamiento Ambiental
Data Review Workshop: October 31, 2000	
Américo Catalán	Ministerio del Ambiente y de los Recursos Naturales -Dirección General de los Recursos Forestales
Armando Hernández	Fundación Polar
Carolina Iglesias	Ministerio del Ambiente y de los Recursos Naturales-Cartosur
Edgard Yerena	Fundación para la Defensa de la Naturaleza
Freddy Serrano	Ministerio del Ambiente y de los Recursos Naturales
Julio Delgado	Ministerio del Ambiente y de los Recursos Naturales
Otto Huber	Universidad Simón Bolívar
Euro Segovia	Ministerio del Ambiente y de los Recursos Naturales-Dirección-General de los Recursos Forestales
Alfredo Arteaga	Ministerio del Ambiente y de los Recursos Naturales
Eric van Praag	Observatorio Mundial de Bosques-Venezuela
James Ross-Jones	Audubon de Venezuela
Julia Miguel	Instituto Geográfico de Venezuela "Simón Bolívar"
Tahis Tejeras	Instituto Geográfico de Venezuela "Simón Bolívar"
Zoyla Martínez	Fundación para la Defensa de la Naturaleza

Note: List does not include authors of this report.

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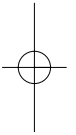


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