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**CARIBBEAN REEFS@RISK,
THE WORLD RESOURCES INSTITUTE (WRI)**

Reefs at Risk in the Caribbean

September 2004 Launch

Coral reefs are vital and valuable natural resources that course through the heart of the Caribbean. Teeming with fish and invertebrate life, these ecosystems provide food for millions. Stretching along great lengths of Caribbean coastline, they protect the land from storms' worst ravages. Coral reefs form the foundation of the thriving Caribbean tourism industry, the region's most important economic sector, supplying much of the sand for its beautiful beaches and luring divers and snorkelers from far and wide to come and explore the reefs' colorful and mysterious depths. Unfortunately, these valuable ecosystems are degrading rapidly under the mounting pressure of many human activities.

Purpose and Goal of *Reefs at Risk in the Caribbean*

The *Reefs at Risk in the Caribbean* project was launched to help protect and restore these valuable, threatened ecosystems by providing decision-makers and the public with information and tools to manage coastal habitats more effectively. The project focuses on compiling, integrating, and disseminating critical information on these precious resources for the entire Caribbean region. This information is intended both to raise awareness about the threats to and value of Caribbean reefs and to encourage greater protection and restoration efforts. In this context it contributes to the objectives of the Cartagena Convention, in particular its two protocols on Specially Protected Areas and Wildlife (SPA) and on Land-based Sources and Activities of Marine Pollution (LBS).

Under the framework of the International Coral Reef Action Network (ICRAN) and UNEP's Caribbean Environment Programme, the study was conducted by the World Resources Institute in cooperation with over 20 organizations working in the region, this effort represents a unique, region-wide look at the status of and prognosis for Caribbean coral reefs. The collaborative process of data gathering and analysis has produced the first regionally consistent, detailed mapping of threats to the region's estimated 26,000 square kilometers of coral reefs. The project provides decision-makers and the public with important insights on links between human activities that stress and damage reef organisms and where degradation of reefs could be expected to occur, or may have already occurred. The maps created by the *Reefs at Risk* project will assist regional and national organizations in setting priorities for conservation and natural resource management. The analytical tools and threat indicators will also allow managers to assess, for the first time, the source and scale of threats affecting those many reef areas for which more detailed monitoring information is unavailable.

Methods

Reefs at Risk project collaborators worked to gather and compile data from many sources on Caribbean coral reefs, their condition, the surrounding physical environment, and the social and economic factors associated with human pressure on reef ecosystems. These data were consolidated within a geographic information system (GIS) that includes information on coral reef locations, pressures (i.e., pollution and other observed threats and physical impacts), changes in reef condition, and information on management of reef resources.

Using these data, the project team developed regionally consistent indicators of coral reef condition and threats in four broad categories representing the key stresses to reefs in the Caribbean: coastal development, watershed-based sediment and pollution, marine-based pollution and damage, and overfishing. Substantial input from scientists across the region guided the selection of thresholds for categorizing a given threat level as high, medium, or low. These threat indicators were further calibrated against available data on observed impacts on coral reefs. The four indicators were then combined into a single, integrated index of overall human pressure on Caribbean reefs. This integrated *Reefs at Risk* Threat Index reflects the highest threat level (i.e., low, medium, or high) achieved by any of the four individual threats

Key Findings

- **The *Reefs at Risk* Threat Index indicates that nearly two thirds of coral reefs in the Caribbean are threatened by human activities.** Areas with high threat levels include the Eastern Caribbean, most of the Southern Caribbean, Greater Antilles, Florida Keys, Yucatan, and the nearshore portions of the Mesoamerican Barrier Reef in the Southwest Caribbean. In these areas, degradation of coral—including reduced live coral cover, increased algal cover, or reduced species diversity—has already occurred or is likely to occur within the next 5 to 10 years.
- **An estimated third of Caribbean coral reefs are threatened by coastal development.** Coastal development pressures were significant along the coastlines of most of the Lesser and Greater Antilles, the Bay Islands in Honduras, along parts of the Florida Keys, the Yucatan, and the Southern Caribbean.
- **Sediments and runoff of fertilizers and pesticides from agricultural lands threaten about a third of Caribbean coral reefs.** Analysis of more than 3,000 watersheds across the region identified areas at risk from increased delivery of sediments and pollution from agricultural lands. Areas with a large proportion of reefs threatened by watershed-based sediments and pollution were found off Jamaica, Hispaniola, Puerto Rico, the high islands of the Lesser Antilles, Belize, Costa Rica, and Panama.
- **Marine-based pollution and direct damage from ships are widespread, threatening an estimated fifteen percent of coral reefs in the region.** Threat was relatively high in many of the Eastern Caribbean islands, Bermuda, Puerto Rico, Jamaica, Panama, Aruba, and the Netherlands Antilles.
- **Overfishing threatens over 60 percent of Caribbean coral reefs.** Fishing above sustainable levels affects coral reefs by altering the ecological balance of the reef. The threat was rated as high on almost all narrow coastal shelves close to human population centers.
- **Diseases and rising sea temperatures threaten to damage coral reefs across the Caribbean region.** Although not quantitatively assessed in this project, diseases and

warming sea surface temperatures present further, and growing, region-wide threats to Caribbean coral reefs.

- **Ineffective management of protected areas further threatens Caribbean coral reefs.** With the growth of tourism, fisheries, and other development in coral reef areas, marine protected areas (MPAs) are an important tool for safeguarding coral reefs. At present, over 285 MPAs have been declared across the Caribbean, but the level of protection afforded by MPAs varies considerably. Only 6 percent of MPAs were rated as effectively managed, and 13 percent as having partially effective management. An estimated 20 percent of coral reefs are located inside of MPAs, but only 5 percent are located in MPAs rated as effectively managed.
- **The coastal communities and national economies of the Caribbean region are poised to sustain substantial economic losses if current trends in coral reef degradation continue.** Coral reefs provide valuable goods and services to support local and national economies, and degradation of coral reefs can lead to significant economic losses, particularly in the coastal areas of developing countries, through loss of fishing livelihoods, malnutrition due to lack of protein, loss of tourism revenues, and increased coastal erosion. Analysis carried out by the *Reefs at Risk* project indicates that Caribbean coral reefs provide goods and services with an annual net economic value in 2000 estimated at between US\$3.1 billion and US\$4.6 billion from fisheries, dive tourism, and shoreline protection services.
 - Coral reef-associated fisheries in the Caribbean region provide net annual revenues valued at an estimated US\$310 million. *Degradation of the region's coral reefs could reduce these annual revenues by an estimated 30-45%, or US\$95 million to US\$140 million per year by 2015.*
 - Net benefits from dive tourism total an estimated US\$2.1 billion per year in 2000. *By 2015, coral reef degradation could result in reduced net benefits from dive tourism of between US\$110 and 310 million.*
 - Coral reefs protect coastal shorelines by dissipating wave and storm energy. This study estimates that the value of such shoreline protection services provided by Caribbean reefs at between US\$700 million and US\$2.2 billion per year. *Within the next 50 years, coral degradation and death could lead to losses totaling US\$140 million to US\$420 million annually.*

Conclusions and Recommendations

Actions are required across a range of scales—from local to national and international. Such actions include the establishment of better management practices to place fisheries on a more sustainable basis and improve yields, to protect reefs from direct damage, and to integrate the sometimes conflicting approaches to management in the watersheds and adjacent waters around coral reefs. Fundamental to supporting these actions is wider involvement of the public and stakeholders in the management processes, as well as an improved level of understanding of the importance of coral reefs. Better understanding of the economic value of coastal ecosystems, and

of the linkages between human activities and changes in coral reef condition will further support and underpin the necessary changes in management, and will strengthen political and societal support for these changes.

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