A World Safe from Natural Disasters

The Journey of Latin America and the Caribbean

Pan American Health Organization
Pan American Sanitary Bureau, Regional Office of the
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International Decade for Natural Disaster Reduction
Regional Office for Latin America and the Caribbean

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FOREWORD

The 1990s has been declared the International Decade for Natural Disaster Reduction (IDNDR). The mid-point in this International Decade and the World Conference on Natural Disaster Reduction provide a golden opportunity to showcase the progress of Latin America and the Caribbean in reducing the impact of disasters on life and property. It is also an appropriate time to suggest areas in need of additional attention at the national level during the second half of the Decade and beyond.

During the first half of the IDNDR, each country in Latin America and the Caribbean made significant progress in the field of disaster management, or as we call it today, disaster reduction. However, this journey toward a safer Region by no means began in 1990.

The principal purpose of this publication is to remind policy makers and the international community that a modest but sustained investment in disaster reduction in Latin America and the Caribbean has saved, and will continue to save, in a non-dramatic but effective way, a large number of lives and avoid tragedies which would otherwise drain resources for humanitarian assistance. A second purpose is to share the optimism and enthusiasm of disaster professionals at witnessing a slow but steady evolution in the RegionÛfr om the fatalistic acceptance of disasters to the determination to take steps to avoid them whenever possible or minimize their effects through long-term disaster reduction planning.

Natural disasters will continue to impact critical facilities such as hospitals and schools, public infrastructure and housing. However, we can reduce the vulnerability of our communities to these natural hazards, that is, the potential losses can be dramatically diminished, by selecting safer locations and improving design and construction techniques and, most importantly, by ensuring that development decisions impact positively on vulnerability. The technical knowledge necessary to reduce risks from natural disasters has been available for some time.

The most lasting effect of the IDNDR could and should be to establish a disaster prevention Ïcultur eÓin which safety fr om disasters is recognized as a basic requirement of individuals and of society in order to attain a Ïcomplete state of physical and mental well-beingÓor , in other words, health, as defined by the Alma-Ata Conference of 1978.

Carlyle Guerra de Macedo
Director
Pan American Sanitary Bureau

ACKNOWLEDGEMENTS

A myriad of people, initiatives and projects have fashioned the disaster management programs in this Region. No single agency or expert can possibly have an overall view of the multisectoral field of disaster prevention, mitigation, and preparedness. This publication attempts to outline broad trends and highlight the most significant events that have marked the long journey of the countries of Latin America and the Caribbean toward safety from disasters. Unfortunately, most of these significant events have been tragedies that caused loss of life and property—tragedies that were preventable.

This document is the result of a collaborative effort of the staff of the IDNDR Office for Latin America and the Caribbean and the Emergency Preparedness and Disaster Relief Coordination Program of PAHO/WHO. They have been assisted by literally hundreds of officials in the countries, experts, and representatives of agencies who dedicated their time and effort, provided data and documentation, met with consultants and laboriously reviewed the draft circulated at the Inter-American Conference in Cartagena, Colombia, in March, 1994. Every effort has been made to acknowledge specific sources of information. We apologize should any contributor or contribution not be properly recognized.

Again, without the support and cooperation of disaster experts and officials throughout Latin America and the Caribbean, the United Nations system, and bilateral and regional organizations, neither the progress achieved toward disaster reduction in Latin America and the Caribbean during the last 15 years nor, consequently, this book would have been possible.

Claude de Ville de Goyet
Editor-in-Chief

DEDICATION

This book is dedicated to the scientists who lost their lives in the eruption of the Galeras Volcano, one of the seven "Volcanoes of the Decade", in Colombia in 1993, as well as to the nationals in Latin America and the Caribbean who have enthusiastically dedicated their professional lives to promoting disaster prevention and preparedness in their countries.

Disasters

When I arrived in CuracautÃn
it was raining ash
because the volcanoes willed it.

I had to detour to Talca
where they had grown so wide,
those tranquil rivers of Maule,
that I fell asleep on a boat
and went to ValparaÃso.

In ValparaÃso the houses
were falling around me
and I ate breakfast in the wreckage
of my lost library
between a surviving Baudelaire
and a dismantled Cervantes.

. . . I made my bed next to a river
that carried more stones than water,
next to some serene oaks,
far from every city,
next to stones that were singing,
and finally I was able to sleep in peace
in certain terror of a star
that was watching me and winking
with a certain malignant insistence.

But the gentle morning
painted the black night blue
and the enemy stars were swallowed by light
while I sang peacefully
with no catastrophe and no guitar.

Pablo Neruda

Contents

Cover photo:
de Ville de Goyet, PAHO/WHO

NO SHORTCUTS TO DISASTER REDUCTION

Both natural hazards and the disasters they can turn into, are an integral part of the history of the American region. From Mexico to Chile, earthquakes and tsunamis claim hundreds of thousands of victims and cost billions of dollars. In the Caribbean Basin, the hurricane season regulates the lives of millions, overshadowing other risks such as earthquakes and volcanic eruptions which, over the centuries, have also left their mark on these island nations.

Latin America and the Caribbean are regions with histories of frequent and devastating natural disasters, with a population and economic future at risk, and yet with the human resources and institutions necessary to cope and move forward. Universities with centuries-old traditions of academic excellence produce well-trained scientists and researchers, seismologists, meteorologists, engineers, architects, urban planners, economists, and public health physicians. Research and monitoring institutions have spent decades gathering and disseminating seismological and meteorological data. The countries have been and continue to be ideal laboratories in which to study the evolution of disaster management over the last decades and to develop solutions beneficial not only to the Americas but to all countries that share a tendency toward natural catastrophes.

In spite of the economic crisis of the 1980s which seriously affected socioeconomic progress in Latin America and the Caribbean, presently the Region is in a better position than many other regions of the world. However, its vulnerability to natural disasters is an issue that must be resolved. This vulnerability is particularly troubling, considering that rapidly industrializing countries such as Mexico and Brazil have made significant capital investments in infrastructure in highly vulnerable areas, or considering that the Caribbean tourism industry, one of the most developed and modern in the world, is at the mercy of hurricanes each year. This level of development achieved over the years, thanks to an increasingly stable social climate and democratic institutions in most countries, must be protected from natural disasters.

FROM AD HOC RESPONSE TO PREPAREDNESS

4 February 1976, the turning point for Latin America . . . An earthquake measuring 7.5 on the Richter scale strikes Guatemala. In more than one-third of the country, adobe houses with heavy tile roofs, a legacy of the Spanish conquest, collapse in seconds on the sleeping inhabitants. An estimated 23,000 persons are dead or missing. The picturesque allure of the countryside is transformed into a tragic scene that shocks the world. This comes six years

Photo: Waak, PAHO/WHO

Photo facing page:

Few people will question the wisdom of protecting lives and economic investment from the impact of natural hazards. But the countries of Latin America and the Caribbean have learned that there are no shortcuts to disaster reduction—the road is long and winding, but it is worth the challenge.

Today, no single agency can even inventory, much less monitor, the many disaster preparedness initiatives and achievements of the health sector in the Region.

after an earthquake in Peru left more than 60,000 dead.

In September 1979, Hurricane David devastates the economy of Dominica, a small Caribbean island with 90,000 inhabitants. From a global perspective, this may be considered a disaster of modest proportions because of the low number of fatalities; however, the hurricane leaves 80% of the population homeless. Many consider this the turning point for the Caribbean.

In these two instances, the public and private sectors—governmental and international—generously and spontaneously mobilized to assist the victims. But certain shortcomings quickly became obvious: the lack of preparedness and training of key sectors, the weaknesses in existing legislation, and the inadequacy of the national response mechanisms traditionally based on the concept of a military chain-of-command rather than dialogue and coordination in the civilian sector. The days when governments could simply assign responsibility for disaster management to the military and then forget it had passed. The health sector, an early responder in large-scale disasters, was the first to realize that the way to improve its own performance was through civilian planning and training. The era of ad hoc response had been replaced by the era of preparedness.

As is often the case, national resolve materialized first in the form of an internationally crafted resolution. In 1977, the Ministers of Health of the Western Hemisphere instructed the Pan American Health Organization, Regional Office of the World Health Organization (PAHO/WHO), to establish a regional disaster preparedness program to benefit the health sector. Soon, with the financial support of Canada, the United States, and select European countries, this program enabled the countries to improve their readiness. In rapid succession, the program went from a period in which PAHO/WHO masterminded and carried out disaster preparedness activities in the health sector, to a transition phase during which the Organization was associated to some degree with significant events, to the present, in which the countries themselves manage the activities. Today, no single agency can even inventory, much less monitor, the many preparedness initiatives and achievements of the health sector in the Region.

FROM PREPAREDNESS TO PREVENTION

Mexico, 19 September 1985: One of the largest metropolitan areas in the world is hit by a severe earthquake, putting the recently created metropolitan emergency plan to an exacting but successful test. There are conflicting reports, but it is estimated that 10,000 lives are lost in Mexico City. Despite this, the response of the health services is remarkable, thanks to adequately trained personnel, the smooth evacuation of unsafe facilities, and the redistribution of casualty cases across the metropolitan system. However, preparedness alone is not always sufficient, and one striking event sheds light on both its potential and its limitations: the collapse of a modern wing of the Juárez Hospital caused the death of patients as well as doctors and nurses who, ironically, were among the nation's best prepared to respond to mass casualties. Preparedness can alleviate the effects of natural disasters; it can't stop them.

Colombia, 13 November 1985: The Nevado del Ruiz volcano, active for several months, erupts violently. Within an hour, a mudslide triggered by melting snow, gathers rocks and other debris as it makes its way down the slopes of the mountain, burying an estimated 23,000 people. Compounding the national tragedy, a bitter controversy divides scientists and politicians about whether the human losses could have been prevented. The fact that maps of the at-risk areas were available but people were not moved from them illustrates the growing gap between the academic knowledge of natural hazards and how this knowledge is translated into potentially life-saving, but costly, preventive measures.

A NEW FOCUS

These tragedies demonstrated clearly that vertically organized response operations to emergencies had limitations. Soon, both Mexico and Colombia established highly professional public institutions responsible for disaster prevention, mitigation, preparedness, and response. Other countries took similar steps. Costa Rica, a small nation with a constitution that forbids an army, strengthened its emergency commission, adding professionals experienced in urban planning, sociologists, engineers, and architects.

Regionally, PAHO/WHO redirected its disaster program to address the safety of health facilities and to promote comprehensive mitigation policies so that losses, such as those experienced at the site of the Juárez Hospital in Mexico, would not occur again. Similarly, the Department of Regional Development and Environment of the Organization of American States (OAS) included a dynamic component on incorporating risk factors into the socioeconomic development of its member countries. The era of disaster prevention and mitigation had begun in Latin America.

In the Caribbean, despite different risks, a different culture, and a distinct disaster history, the countries nonetheless came to similar conclusions. In the aftermath of Hurricane David (1979), UNDRO, the Office of the UN Disaster Relief Coordinator (now the UN Department of Humanitarian Affairs – DHA), together with the Secretariat of the Caribbean Community (CARICOM), the International Federation of Red Cross and Red Crescent Societies, and PAHO/WHO, with support from bilateral agencies, established the Pan-Caribbean Disaster Preparedness and Prevention Project (PCDPPP). For nine years, this internationally funded project served all the countries of this subregion. A major achievement of PCDPPP was the development of a strategic group of professionals and decision makers who were sensitized to the need for a genuine local commitment to disaster management. Hurricane Gilbert in Jamaica (1988) and Hurricane Hugo in the eastern Caribbean (1989) acted as catalysts for the creation of a bona fide subregional response agency: the Caribbean Disaster Emergency Response Agency (CDERA).

Disaster Mitigation and Prevention and the IDNDR

In decades past, disaster management—or "disaster reduction" as it is now called—was never recognized as a professional activity or a scientific field in its own right. Often, those working in the field were labeled as well-intentioned amateurs. The advent of the

Photo: Gaggero, PAHO/WHO

The natural hazards that threaten the Region are many and varied. Often, the most vulnerable are those with the least economic resources. Hurricane Hugo damaged or destroyed an estimated 80% of the housing on the island of Montserrat in 1989, posing severe financial hardships on much of the population.

International Decade for Natural Disaster Reduction (IDNDR) changed that, providing practitioners at the national level with the international credentials they lacked. Gradually, the Decade has weeded out those practitionersó amateurs and professionalsó who have failed to master new methods and techniques, or who cling to the old ways of equating disaster prevention and mitigation with stockpiling equipment, blankets, and old clothing. The IDNDR's emphasis on engineering and planning sends a strong message that traditional systems geared for relief operations must be replaced with a more development-oriented structure.

This Region's vast experience in dealing with natural hazards has taught it that there are no shortcuts to disaster reduction. Rather, countries must journey along a winding path of sustainable development, a path where progress is made as countries recognize that disaster management is more than a simple logistic exercise. It is a development and planning responsibility, a responsibility calling for multidisciplinary collaboration. In Latin America and the Caribbean, the path from ad hoc response to preparedness and later to prevention and mitigation has been the result of a long maturation process. There are no easy shortcuts on the road from a careless society to a responsible adult nation.

Disaster reduction is too serious a matter to leave to the experts, be they scientists or disaster managers. The most important contribution of the IDNDR in Latin America and the Caribbean has been to accelerate the transition into the new era of integrated disaster reduction and development, where the entire society cooperates in reaching a common objective: building a safer world for all. ◆

AN OVERVIEW OF THE REGION

When a country decides to invest time, energy, and resources to reduce the effects of natural disasters, it must take into account the relationship between the desired outcome and its own capabilities and limitations. The level of economic, political and cultural development of a society determines the type of disaster management it should pursue. This chapter presents an overview of the human and physical environment of the countries of the Region of the Americas where disasters strike frequently and violently. Although Canada and the United States form part of this Region, for the purpose of this publication we are speaking of the developing countries and territories of Latin America and the Caribbean.

Unlike the myriad, distinct societies and economies found in Africa, or throughout Asia or Europe, the majority of people of Latin America share a common language, religion, arts and customs due to strong Spanish and Portuguese influence. Likewise, in the larger Caribbean islands, the Spanish have had extensive impact, but African, British, Dutch, East Indian, and French influences also prevail. Despite a large degree of homogeneity, divisions persist between the descendants of immigrants and the mestizo and indigenous populations, which provide a source of social tension and economic inequality.

THE PEOPLE AND THEIR HISTORY

Desire for wealth brought on conquest and colonization that, beginning in the 15th century, profoundly affected the societies and cultures of the indigenous people. Only a partial picture of the civilizations that flourished in the Americas prior to conquest by the Spanish remains today. However, manifestations of these cultures in the forms of architecture, the arts, engineering, mathematics, and astronomy have survived; many of their achievements are still prototypes of excellence today.

The geographical diversity of the Region contributed to the development of diverse cultures. These people were very familiar with the natural hazards of their world; earthquakes, volcanoes, floods, landslides, and hurricanes affected their lives, and the forces of nature had divine significance (see Box 2.1). The fact that pre-Columbian structures still survive in the South American plateau, the Pacific coast, and the jungles of Central America and Mexico, bears witness to building measures that resisted all types of natural phenomena.

The conquest, begun in 1492, destroyed the native civilizations and social structures and replaced them with a social system similar to that of feudal Europe. Through this system, the colonizers obtained the labor necessary for working the plantations and for

Box 2.1

THOSE WHO WERE SAVED . . . POPULATED THE LAND

The following version of the creation myth of the Mapuche peoples in Chile shows elements common to many such myths: The people are born of a great cataclysmó of a powerful struggle between the natural forces of the sea and the earth. It is based on the features of the earth that define man's surroundingsó tidal waves, earthquakes, and volcanic eruptions. Man and nature, religion, culture and society, life and death, live and inert objects, arise from this same moment of creation:

There in the sea, in its greatest depths
there lived a great snake called ìCai Cai.î
The waters obeyed the orders of this great serpent
and one day they began to cover the land.
There was another equally powerful serpent
who lived in the summit of the mountains.
The serpent ìTen Tenî told the Mapuches
to climb into the hills
when the waters began to rise.
Many Mapuche people did not reach the hills
and were transformed into fish.
The water rose and rose,
and the mountain floated and also rose and rose.
The Mapuches put pots over their heads
for protection from the rain and the sun;
and they said,
ìCai, Cai, Caiî;
and they responded,
ìTen, Ten, Ten.î
They made sacrifices and the water was calmed,
and those who were saved
came down from the mountain and populated
the land.
And so were born the Mapuche people.

Adapted from JosÈ Bengoa, *Historia del Pueblo Mapuche*, 2nd edition, Santiago: Ediciones Sur, 1987.

mining huge amounts of gold and silver.

Settlers from Spain and Portugal arrived in the New World in sizable numbers and by the end of the 16th century had laid the groundwork for the cities that are the capitals today. European rule continued until the slave rebellion that secured Haitian independence from France in 1804. Napoleon's invasion of Spain and Portugal in 1808 lessened the hold of those countries on their colonies. Wars for independence followed, and by the 1830s almost all of the countries of Latin America had been liberated from European rule. However, after gaining independence many countries suffered civil war, dictatorship and militarism: processes that have become commonplace throughout the Region during the 20th century.

As the major maritime link between Spain and her colonies, the Caribbean became the arena for the adventures of buccaneers and for numerous battles as colonial powers vied for territorial and commercial advantage. Partitioning of the region by the British, Danish, Dutch, French, and Spanish continued throughout the 17th and 18th centuries. In the mid-17th century, the colonial economy in the Caribbean, which had been based largely on the export of tobacco and cotton to Europe, shifted to one based on sugar, and labor for the sugar plantations was in turn dependent upon the African slave trade. This ìsugar revolutionî brought about a radical change in the demography, society, and culture of the islands.

Gaining independence in the Caribbean has been a slower process than in the countries of Latin America. The fragmentation of the region by competing European interests and the small size of the islands have favored continued colonialism and dependency. By the mid-1950s, only Cuba, the Dominican Republic, and Haiti were independent. In the 1960s, Barbados, Guyana, Jamaica, and Trinidad and Tobago achieved independence, and other islands did so during the 1970s and early 1980s. At present, several Caribbean islands continue to have either territorial status or be closely associated to countries such as the Netherlands, the United Kingdom, and United States, or to be an integral part of a country, such as the French Departments.

GEOGRAPHY

Latin America and the Caribbean represent a sixth of the earth's land mass, with an extension of 11,263 km from Cape Horn to the southern border of the United States.

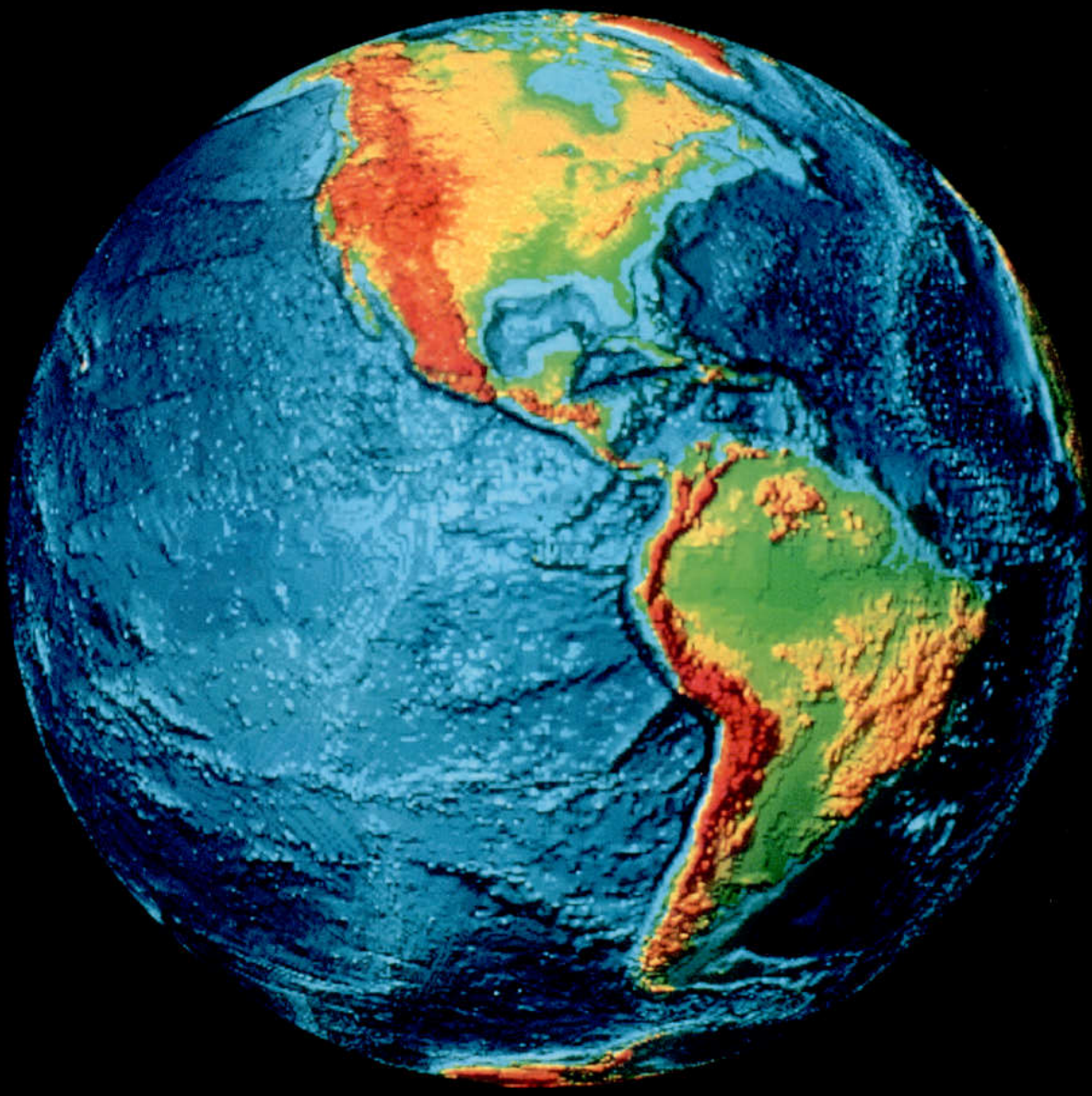
Mountains are the main geographical characteristic of the Region. These mountains are geologically responsible for much of the Region's wealth and many of its disasters. The Andes, Caribbean, and Central American mountains are seated where major tectonic plates interact, a feature that makes the Region highly seismic. To the south, the Andes emerge from Antarctica to form a mountain chain that is second only to the Himalayas in height, rising along the Argentine and Chilean borders to Mount Aconcagua (6,959 m), the highest peak of volcanic origin in the Western Hemisphere. In Bolivia and southern Peru, the Andes branch apart and enclose valleys and high plateaus, the *altiplano*. In Ecuador, there are two distinct ranges separated by basins; three ranges pass through Colombia, the easternmost continuing on to Venezuela.

The mountains of the Caribbean and of Central and South America are geologically young, with a great number of volcanoes. In Ecuador, for example, the central plateau is surrounded by more than two dozen volcanoes. The volcanic soil of this region is responsible for highly productive agriculture.

The location of the Andes near the Pacific coast assures that the longest rivers of South America flow toward the Atlantic and the Caribbean, and that rainfall is concentrated in the eastern lowlands. The Amazon, Orinoco, Paraná, Paraguay, and La Plata Rivers together drain more than 60% of the waters of the continent. The Amazon River Basin is the largest in the world, draining an area of approximately 7,500,000 square km. During rainy periods, severe flooding occurs in the primarily agricultural river areas and in important urban centers.

Coastal plains with warm, moist climates skirt both the Caribbean and the Pacific coast of the Central American Isthmus, and wet, forested lowlands are interrupted by mountainous areas, where some 80% of the population lives. Mexico is formed mainly by a high, arid central plateau enclosed by two mountain ranges.

Latin America contains almost 60% of the tropical forests of the world. But the level of deforestation is also the highest in the developing world: an estimated 1.3% of existing forests are cut each year. At the beginning of the 1990s an estimated 12% of the Amazon rainforest had been cut for timber and mining enterprises, and to increase land available for agriculture and livestock. Deforestation



puts the region's biodiversity at risk, causes soil loss, increases the threat of landslides and silting up of waterways, phenomena that are major concerns for the planners in the Region. Unfortunately, short-term economic gains continue to prevail over long-term environmental considerations.

The Caribbean islands form a broad arc that extends approximately 4,000 km north to south from Florida (U.S.A.) to Venezuela. The size of the islands varies considerably: Cuba, for example, has approximately 111,000 square km and more than 10.5 million inhabitants, while Anguilla has less than 350 square km and less than 9,000 residents. Although the islands have many characteristics in common, geographical diversity exists: from regions with exuberant flora and areas suitable for agriculture, to unproductive volcanic and coral islands.

The isolated upper parts of a chain of submerged volcanic mountains, which form the islands, are characterized by three principal types of topography:

- High and inaccessible mountains (of almost 1,200 m), such as the Blue Mountains in Jamaica, Mount Diablotin in central Dominica, the Soufrière Volcano in Saint Vincent, and the Northern Range in Trinidad, covered by dense forests and crossed by fast rivers;
- High plateaus like those in central Jamaica;
- Sedimentary coastal plains that originate along the slopes of the hills and mountains and form coastlines of sandy beaches.

Some Caribbean islands have neither rivers nor any other natural source of potable water, as is the case in Anguilla, Antigua, Aruba, and Bermuda. Today these islands depend completely on desalinization plants or on collection of rainwater, or as in the case of Nassau, Bahamas, on the importation of over 50% of its drinking water.

CLIMATE

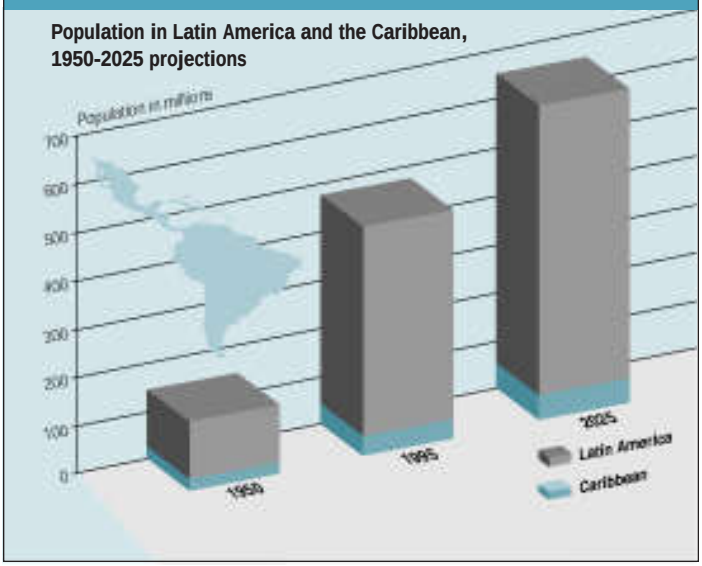
The climates and precipitation in Latin America and the Caribbean vary considerably. The Orinoco basin of Colombia and Venezuela, the Brazilian plateaus, and parts of western Ecuador, contain savannas with well-differentiated wet and dry seasons. On the other hand, broad sectors of Argentina, Chile, Paraguay, and southern Brazil have more temperate climates, with larger fluctuations in temperature. Annual rainfall in the Region varies between an average of 1,000 and 2,000 mm. One of the driest deserts of the world, the Atacama, is on the coast of Chile; Argentina, Bolivia, Brazil, Mexico, and Peru also have expanses of arid land and desert.

The Caribbean islands share a tropical climate with the Atlantic coast of the Central American isthmus. At sea level, the climate is relatively constant but then varies by elevation. Precipitation varies widely, depending on the topography of each island. The mountainous islands receive a great deal of rain, while flat islands of coral origin such as Antigua and Barbuda, Curaçao, and Turks and Caicos Islands are arid.

Map courtesy of U.S. National Oceanic and Atmospheric Administration, National Geophysical Data Center

Figure 2.1

Population in Latin America and the Caribbean, 1950-2025 projections



Figures 2.1, 2.2 based on data from UN Population Division, 1993.

DEMOGRAPHIC TRENDS

Currently Latin America and the Caribbean have a population of 450 million inhabitants; according to UN estimates, by 1995 the population of the Region will reach 482 million, accounting for 61% of the total population of the Western Hemisphere. By the year 2025, the population of Latin America and the Caribbean will reach a projected 650 million (Figure 2.1).

Historically, the world's developing countries have had both high birth and mortality rates, which kept population growth in check. But in the last 40 years, advances in health care, sanitation, and education have contributed to reducing mortality of infants and children, resulting in increased population. While in Latin America the growth rate has dropped from 3% in the 1950s, to 2.1% in 1994, a large proportion of the population is under 15 years of age, and females are just reaching the reproductive age, so the current growth rate is not expected to diminish substantially until the year 2020.

The 10 most populated countries of the Americas, including North Americaó Argentina, Brazil, Canada, Chile, Colombia, Ecuador, Mexico, Peru, Venezuela, and the United Statesó comprise 89% of the Western Hemisphere's total population. With the exception of Argentina, Brazil, and Canada, these countries are in the areas most vulnerable to seismic events in the Region.

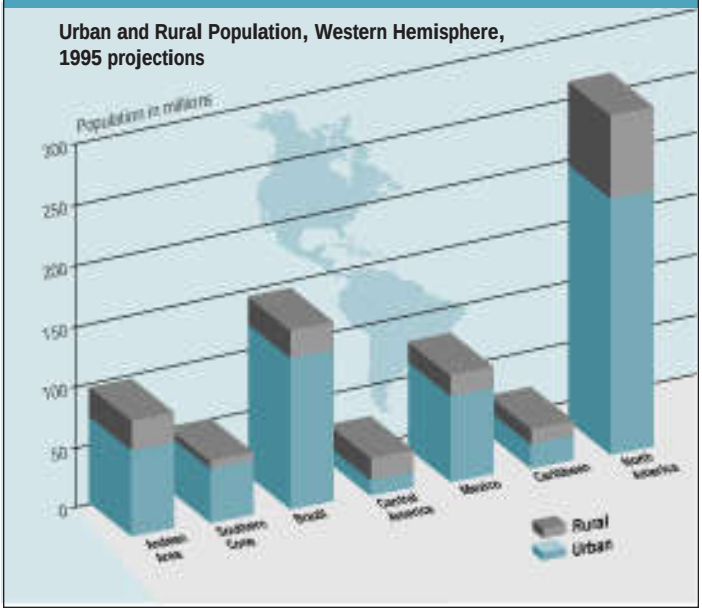
URBANIZATION

Latin America and the Caribbean have undergone an accelerated process of urbanization in the past few decades. With nearly 75% of the population concentrated in cities (see Figure 2.2), this Region has already surpassed the rest of the developing world in levels of urbanization. Fast expanding urban poverty is not only a problem by itself, but it places large numbers of people at risk during natural disasters.

Of particular concern is the continuing

Figure 2.2

Urban and Rural Population, Western Hemisphere, 1995 projections



growth, in number and size, of the so-called megacities (cities with more than 5 million inhabitants). The service infrastructure of these cities is inadequate, and the additional resources needed to keep up with continuing demand are not available. By the year 2000, Mexico City is calculated to be the largest city in the world, with more than 26 million inhabitants; S„o Paulo (Brazil) will have an estimated population of 24 million; Rio de Janeiro (Brazil), 13 million; and Lima (Peru), more than 8 million. Other cities with accelerated growth are SantafÈ de Bogot· (Colombia) and Santiago (Chile).

Figure 2.3

Population Density by Region, 1989

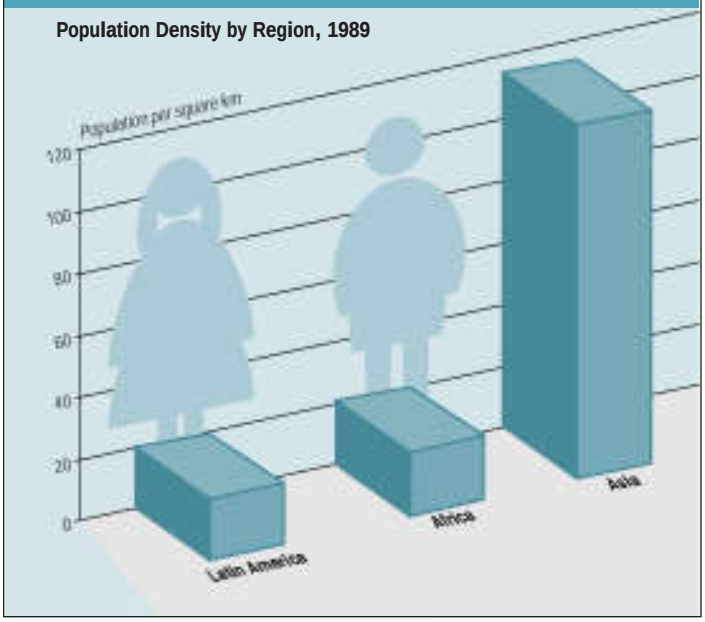


Figure 2.3 adapted from World Resources Institute, 1990.

Urbanization and Poverty

More than half the urban residents in the larger cities in Latin America and the Caribbean live in poverty today, and by the year 2000, it is estimated that 90% of the poor population of this region will live in urban areas. The residents of these peripheral urban areas often have low incomes, limited education, insufficient diets, and live in unsanitary and overcrowded conditions. Safe drinking water, the disposal of solid waste, decent housing, and transportation are particularly lacking in the marginal urban areas. Urban residents are exposed to increased levels of contamination, but the poorest often live on the outskirts of the city where factories are located and environmental protection is at its lowest levels. Poor construction and the unplanned nature of these marginal settlements also expose their dwellers to the effects of natural phenomena such as landslides and flooding. The traditional social structure found in rural areas can be lost in the process of migration, and social instability becomes another risk for those living in urban settlements.

The weight of poverty falls most heavily on certain groups. For example the indigenous population, approximately 30 million in Central and South America, makes up not only a significant portion of the rural poor, but also of the growing poor urban population. Of all groups, they suffer the most from limited access to education, health services, and the possibility of economic mobility.

Among the poor, women are seriously disadvantaged. They frequently support a heavier workload than do men and have lower levels of education and less access to paid employment. Children also suffer disproportionately, and the future quality of their lives is in danger because of deficient levels of nutrition, health care, and education.

Population Density

Population density is one of the factors that determines the severity of a disaster. In general, the relationship between territory and population density is favorable in Latin America (see Figure

Photo: Gaggero/PAHO

With the population of the Region's urban centers growing every day, fast expanding urban poverty is not only a problem in itself, but it places large numbers of people at risk during disasters.

2.3). Africa has a density comparable to that of the Americas (an average of 21 inhabitants per square km), but the average is almost six times higher in Asia. However, the numbers in Latin America are national averages and can be misleading. For example, in Argentina and Chile, the density at the country level is not very high (13 and 18 inhabitants per square km, respectively), but 85% of the population is concentrated in urban centers. Among the most populated industrialized countries, Japan has 326 inhabitants per square km, and the Netherlands, 433. Barbados is one of the smaller islands of the Caribbean and has a density in excess of 600 inhabitants per square km; Puerto Rico's density is similar. El Salvador, the most densely populated country in Latin America, has some 257 inhabitants by square km.

Population Migration Between Countries

Population migration for economic reasons from Latin America and the Caribbean toward the United States and Canada is particularly widespread. Temporary or permanent population movements also occur for the same reasons between neighboring countries. Continuous population movement between many Caribbean islands, tied to the harvest of sugar, the tourist industry, and family liaisons is common. The impact of emigration in the countries of the Caribbean is strong. For example, it is estimated that in the mid-1980s, half of the Jamaican citizens lived outside of their country.

A major problem during the 1980s, and still today, has been that of refugees fleeing social violence in their countries. During the peak of political violence, an estimated 7%-10% of Central Americans were either displaced within their own countries or forced to cross borders, often without legal documentation. The recent political crisis in Haiti is a likely catalyst for another wave of undocumented migration.

PRODUCTION

The Region has extensive fertile landó such as that of the Argentine pampasó with abundant and high quality agriculture and livestock. Almost 9% of the fertile land of Latin America is under cultivation, and 28% is in pasture. One-fourth of the work force is in the agricultural sector. Although many farmers only produce at a subsistence level, there is also important commercial production of crops such as sugar, banana, citrus fruits, and grains. The Region has rich mineral deposits,

particularly of copper (Chile and Peru have one-fourth of the world reserve), tin (Bolivia is the highest producer on the continent), iron, silver, and gold. Brazil, Colombia, and Peru have important sources of precious and semi-precious minerals. Finally, the oil reserves of the Region are only surpassed by those of the Middle East.

The natural resources of the Caribbean islands are more limited. The Dominican Republic, Guyana, Haiti, and Jamaica, mine bauxite; Trinidad and Tobago export oil and natural gas. Small deposits of manganese, lead, copper, and zinc are found on most of the islands. Agricultural production is on the decline, but the sugar and banana industries continue to provide employment for most of the work force in Barbados, Cuba, Dominica, the Dominican Republic, Jamaica, Saint Kitts and Nevis, and Saint Lucia.

Light industry contributes to many Caribbean economies, but industrialization has not provided sufficient employment to compensate for the reduction in agricultural production. Tourism is increasingly seen as the classic solution for providing economic diversification and development, particularly in the Lesser Antilles.

Unfortunately, in spite of their enormous potential for development, the economies of Latin America and the Caribbean are fragile, mainly due to their dependency on the export of a limited number of agricultural or mineral products (such as cotton, coffee, sugar, and copper) that are subject to price fluctuations in the international market. How-ever, there have been significant gains toward industrialization in recent decades, especially in Brazil, Chile, Mexico, and Venezuela. The economic liberalization that is beginning to take hold in the Region and that favors market integration through the formation of trading blocks, will lead to the strengthening of the productive sectors of the countries. One example of this process is the North American Free Trade Agreement (NAFTA) signed by Canada, Mexico and the United States.

SOCIOECONOMIC ASPECTS

The World Bank has adopted the gross national product (GNP) as a criterion in classifying the economies of countries and in distinguishing different levels of economic development. Using GNP figures alone, however, can give an erroneous picture of economic conditions in Latin America and the Caribbean, since they conceal the fundamental problem of these countries: the unbalanced distribution of wealth. In certain countries of the Region wealth and political power continue to be shared by the very few and capital is invested abroad rather than in the national economies.

By the end of the 1970s, the economies of most of the countries of the Region had reached a sustained level of growth. But this growth was not always translated into socioeconomic improvement. For example Brazil, the strongest economy of Latin America, doubled its GNP per capita between 1961 and 1979. However, its gains in reducing illiteracy and infant mortality were much less than those achieved by such countries as Chile, Cuba, Jamaica, and Uruguay, which were experiencing slow economic growth. Table 2.1 shows socioeconomic indicators and the “human development index” rankings, prepared by the United Nations Development Program (UNDP) to indicate levels of income, life expectancy,

Table 2.1

Socioeconomic indicators for the countries of Latin America and the Caribbean

	GNP PER CAPITA						
	US$ (1992)	Real growth rate (%) (1985-92)	Life expectancy at birth	Rate of child mortality (1-5 years) x 1000 births (1991)	Mean years of schooling (1990)	Illiteracy rate (%) (1990)	Human development index ranking[a]
Antigua and Barbuda	4,870	1.1	74	23	4.6	4	60
Argentina	6,050	0.5	71	34	8.7	5	46
Bahamas	12,020	-1.2	69	29	6.2	1	32
Barbados	6,530	0.6	75	13	8.9	1	20
Belize	2,210	6.3	68	51	4.6	5	82
Bolivia	680	1.0	60	115	4.0	23	122
Brazil	2,770	-0.7	67	66	3.9	19	70
Chile	2,730	6.1	72	20	7.5	7	36
Colombia	1,290	2.4	69	43	7.1	13	61
Costa Rica	2,000	2.6	75	20	5.7	7	42
Cuba	[b]	[c]	76	14	7.6	6	75
Dominica	2,520	5.1	75	[c]	4.7	3	51
Dominican Republic	1,040	0.3	67	69	4.3	17	97
Ecuador	1,070	0.6	66	64	5.6	14	89
El Salvador	1,170	0.9	64	67	4.1	27	110
Grenada	2,310	4.4	70	36	4.7	4	59
Guatemala	980	0.6	64	81	4.1	45	113
Guyana	330	-5.4	65	65	5.1	4	105
Haiti	370	-2.9	54	134	1.7	47	137
Honduras	580	0.5	65	75	3.9	27	116
Jamaica	1,340	2.9	73	19	5.3	2	69
Mexico	3,470	1.1	70	45	4.7	13	53
Nicaragua	410	-7.8	65	70	4.3	19	111
Panama	2,440	-1.2	73	24	6.7	12	68
Paraguay	1,340	1.0	67	38	4.9	10	90
Peru	950	-4.3	63	82	6.4	15	95
St. Kitts and Nevis	3,990	5.3	70	41	6.0	8	79
Saint Lucia	2,900	5.2	72	22	4.6	16	76
Saint Vincent and the Grenadines	1,990	4.7	71	25	3.9	7	72
Suriname	3,700	-3.2	68	47	4.2	5	65
Trinidad and Tobago	3,940	-3.0	71	29	8.0	4	31
Uruguay	3,340	2.9	73	24	7.8	4	30
Venezuela	2,900	1.1	70	40	6.3	12	50

Sources: The World Bank, 1994; United Nations Development Program, 1993.

[a] United Nations Development Program (UNDP) calculates the human development index (HDI) for 173 countries. The index considers the real purchasing power of the gross national product of each country, life expectancy, literacy levels for adults, and median number of years of schooling. For each indicator, the HDI estimates the degree of relative progress of each country with regard to the minimum and maximum values reached by the set of countries under study. According to UNDP calculations, the countries with an HDI ranking between 1 and 55 have a "high" index of human development; countries between 56 and 111 have a "medium" level of human development; the countries ranked between 112 and 173 have a "low" index.

[b] Figure not available; estimated between US$676-US$2,695.

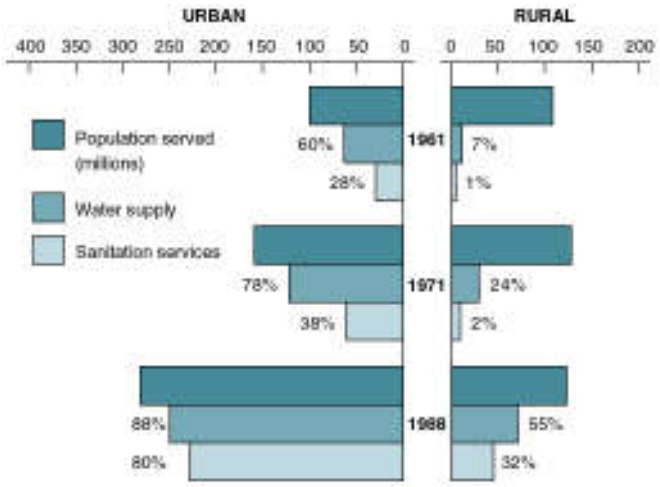
[c] Figure not available.

and education. This index shows that while countries may have similar income levels, they can have very different levels of human development, an indicator of the level of investment being made in the education and health of a population.

During the worldwide recession of the 1980s, most of the countries of the Region underwent crises in their economies and political systems that reduced their share in international markets and in productive investments. The policies of structural adjustment have been applied at an enormous social cost and have heightened social and economic inequality, having the greatest effects on the poorer sectors of the population as well as worsening living conditions of the middle class. An important characteristic of this crisis has been the deterioration of public services, particularly in the health and education sectors, and in the quality of life of the least protected populations.

Figure 2.4

Drinking water and sanitation services in Latin America and the Caribbean, 1961-1988.



Source: PAHO, 1990.

HEALTH, SANITATION, AND EDUCATION

While they continue to have serious health problems, people in Latin America and the Caribbean have the longest life expectancy and lowest child mortality of any developing region in the world. Major advances in reducing child mortality have been made in all regions worldwide; figures have dropped by one-third in developing countries in the last 30 years. But millions of children continue to die from diseases that are preventable with vaccines, or with access to safe drinking water and with adequate nutrition. In Africa, approximately 175 of every 1,000 children die before reaching age five; in Latin America this figure is 60 deaths per 1,000 children; in the English-speaking Caribbean it is less than 30 per 1,000. In the industrialized nations this figure is estimated at 15 deaths per 1,000 children under age five.

The reduction in infant and child mortality in Latin America and the Caribbean is due, for the most part, to achievements in primary health care. While these advances have been striking, there are still many hurdles to overcome. In urban areas there are high concentrations of hospitals and of health personnel, but many of these facilities are outdated and poorly maintained. This is also the case for water and sanitation services, power, and transportation systems which are increasingly overburdened. This deteriorating infrastructure is progressively more vulnerable to the effects of natural disasters.

Data available in 1988 showed that an

Photo: Gaggero, PAHO/WHO

One-fourth of the work force in Latin America is employed in the agriculture sector. However, many of these people barely produce enough to earn at a subsistence level.

average of 88% of the urban population of Latin America and the Caribbean had access to safe drinking water, and 80% were served by sewerage and sanitary installations. In rural areas, these figures were 55% and 32% respectively. Coverage varies considerably from country to country, however, and in the least developed nations, overall access to safe drinking water was below 50%; less than 30% of the population had sanitation services.

While considerable gains have been made in 30 years (see Figure 2.4) maintenance of the water and sanitation services has suffered along with other services as a result of the scarcity of capital to invest in infrastructure. Studies carried out in Peru, for example, have shown that 30% of the rural water supply systems were partially or totally damaged within five years of having been built. The present economic situation and the worsening of the basic services constitute ideal conditions for the spread of cholera in the Region.

Education levels vary widely by country and economic group, but in general, the Region is at the same level as or has surpassed international benchmarks. In the last 30 years, important advances have been made in many countries. For example, Uruguay doubled secondary school enrollments between 1960 and 1986, and in Mexico there was a 12-fold increase in secondary school enrollment in the same period. However, despite rapid growth in education, inequities in income and social mobilityó problems that education should correctó continue to grow. The opportunities to receive an education are still determined largely by social and economic class. Illiteracy is

still above 40% in the poorer countries, and the indigenous population in particular suffers disproportionately in lacking access to education.

While some countries have focused most of their resources in education to eradicate illiteracy, others have given a great deal of importance to improving university education, resulting in a large number of well-trained professionals. Unfortunately though, in many countries, not enough jobs are available for these graduating professionals.

This excess of professionals has been felt particularly in the health sector. To cope with the need for primary care physicians, many governments promoted increased enrollments in medical schools. As a result, Latin America and the Caribbean have the highest physician-to-patient ratio of all developing regions in the world, but the lowest of nurses and midwives per physician. In Mexico, for example, between 1970 and 1980 the enrollment in medical schools increased from 29,000 to 93,000. A study of levels of physician employment in the most important Mexican cities showed that 7% were unemployed, 11% were working at jobs not related to medicine, and 11% had very low paying medical related jobs or were serving very few patients.

THE POLITICAL PROCESS

The democratic process in the Region was strengthened in the 1990s, and most authoritarian political systems were replaced, particularly in Argentina, Brazil, Chile, Paraguay, and Uruguay. The removal of the democratically elected president in Haiti in September 1991, the disbanding of the Peruvian congress in March 1992, and the military insurgencies in Venezuela during the same year, have raised fears that the authoritarian regimes of the past will make a comeback. Caribbean countries have also had their share of political violence, such as the civil unrest in Trinidad in 1990, and during elections in Saint Vincent and the Grenadines and Saint Kitts and Nevis. However, the way in which serious political conflicts were faced in Brazil, Guatemala, and Venezuela, strengthens the hope that future crises will be resolved through the exercise of democratic principles.

The 1980s were violent and turbulent years in Central America, when hundreds of thousands of people died or were displaced because of armed conflicts in El Salvador and Nicaragua, and because of serious civil disturbances in Guatemala. Even though the situation in these countries is still fragile, a certain level of political stability has been attained, and some progress has been made in recovering the economic level that was lost during the decade. The peace accords signed in January 1992 between the government of El Salvador and the Farabundo Martí Front for National Liberation, and the conclusion of the armed conflict in Nicaragua were the results of a long peace process that began in 1983 with the work of the Contadora Group, formed by the governments of Colombia, Mexico, Panama, and Venezuela.

The Process of Subregional Integration

The processes of political and economic integration that have been seen in other regions of the world, particularly in Europe, have encouraged countries of Latin America and the Caribbean to promote subregional organizations that are based on economic cooperation (see

Box 2.2

ORGANIZATIONS PROMOTING SUBREGIONAL INTEGRATION

Amazon Pact. Signed in 1978; member countries: Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, and Venezuela. This treaty provides for cooperation among members in the development of the Amazon Basin, rational use of its resources, and protection of its ecology. Each member has established a national commission to implement joint decisions.

Andean Group (Andean Pact). Founded in 1969; member countries: Bolivia, Colombia, Ecuador, Peru, and Venezuela. It was established to improve the position of the member countries within the Latin American Free Trade Association and to increase the trade and development of the countries. Various complementary agreements exist, including the Hipólito Unánue Agreement, created in December 1971, which promotes, coordinates, and supports efforts to improve health; disaster preparedness is one of its priority programs.

Caribbean Community and Common Market (CARICOM). Founded in 1973; member countries: Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago. Its objectives are economic integration based on a regional common market; cooperation in areas of culture, education, health, labor relations, tourism, and transportation; and coordination of foreign relations and defense policies. In 1991, CARICOM established the Caribbean Disaster Emergency Response Agency (CDERA) in Barbados to coordinate emergency response for disasters occurring in member countries.

Central American Common Market. Founded in 1960; member countries: Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua. It was established to increase industrialization and specialization by liberalizing intraregional trade. The Secretariat of Central American Economic Integration (SIECA) gives technical and administrative support to the organization.

Central American Integration System (SICA). Founded in 1991; member countries: Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama. Its main objectives are, among others, the consolidation of a new model of regional security based on corrective action in the social and economic areas, and the promotion of sustained economic, social, and political development of its Member States.

Central American Parliament (PARLACEN). Founded in 1987; member countries: El Salvador, Guatemala, Honduras, and Nicaragua. A political forum, it aims to surmount the national interests which harm regional and economic integration. Together with SICA, it has played an important role in promoting future legislation with reference to disaster reduction measures.

Latin American Economic System (SELA). Founded in 1975; 27 Latin American member countries. It aims to accelerate intraregional cooperation particularly in the areas of selling primary commodities on the world market and providing a permanent system of consultation and coordination in economic and social matters.

Latin American Integration Association (ALADI). Founded in 1980; member countries: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay, and Venezuela. This organization replaced the Latin American Free Trade Association, established originally to create an area of free trade forming the basis for a Latin American Common Market.

Organization of Eastern Caribbean States (OECS). Founded in 1981; member countries: Antigua and Barbuda, Dominica, Grenada, Montserrat, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines. Because of concern that benefits derived from integration would benefit the larger CARICOM States, these smaller islands created this entity in association with CARICOM. The OECS coordinates development strategies between its members and provides cooperation in economic, foreign policy, and defense matters.

Southern Common Market (MERCOSUR). Founded in 1991; member countries: Argentina, Brazil, Paraguay, and Uruguay. It aims to abolish barriers to trade between Member States, establish a common external tariff, and harmonize economic policies.

Box 2.2). These organizations have had varying degrees of success largely due to the varying fortunes and development of the participating members. Commerce between member countries represents only a small portion of the Region's foreign trade, and the global recession has had repercussions on intraregional trade.

Integration is relevant in the Region because of the cultural proximity of the countries, and because, in the context of natural disasters, neighboring countries share similar patterns of hazards and vulnerability. The objectives of these organizations have been to promote economic growth while strengthening the political identity of the members; generating financial cooperation; supporting exchanges in technical, scientific, and cultural development; and, in certain instances, by promoting support in disaster reduction between participating countries.

CONCLUSIONS

The serious economic crisis, armed civil conflicts, and the absence of democracy in many countries in the Region during the last decade magnified the endemic problems of poverty and unequal access to wealth and basic services. In such an environment, planners and lawmakers have struggled not to lose ground, and have had more urgent matters on their minds than long-term development plans for, or investment in disaster reduction.

The Inter-American Development Bank (IDB) in its 1993 report presents an encouraging outlook concerning the economies of the Region. According to the IDB, the challenge is now to initiate a ì second generationî of socioeconomic reforms that would combine social equity with long-term growth.

The countries of Latin America and the Caribbean have an enormous economic potential and an excellent and growing capacity of professionals. By focusing human and material resources on socio-economic improvements, countries can reduce the vulnerability of their people to natural disasters and achieve genuine reforms in disaster preparedness. ◆

Photo: Gaggero, PAHO/WHO

WHAT PUTS LATIN AMERICA AND THE CARIBBEAN AT RISK?

Not all violent manifestations of nature—earthquakes, volcanic eruptions, hurricanes, floods—necessarily become disasters. When a disaster does occur, it is not always the exclusive result of the natural hazard itself. What human beings do, or what they fail to do, is a key factor.

Consider the following scenario. A strong earthquake—magnitude 7.8 on the Richter scale—occurs in an unpopulated area. This violent event does not cause the loss of lives nor of infrastructure, and the country does not have to mobilize resources to respond to the situation. As a result, it is not a disaster. But an earthquake of lesser magnitude, for example 5.1 on the Richter scale, can create a disaster of major proportions if it occurs in a densely populated area, or if it causes the collapse of critical facilities such as hospitals or schools, which were not built according to code.

Consequently, the degree of risk to which a country or a population group is exposed when confronted with the effects of a violent natural phenomena depends mainly on two factors: the hazard itself and the vulnerability of the exposed group.

That people have always coexisted with natural hazards is an unchanging fact. What has changed, particularly in the last century, is the impact disasters have when they hit populated areas. In areas where there is no human population, these events for the most part do not become disasters. However, the very same natural hazard—a volcanic eruption or a tropical hurricane—can bring about very different effects depending on the vulnerability of the community.

The vulnerability of a building, a population, or a country is measured by how susceptible to harm or loss it is in the face of a hazard. Thus, the risk factor is calculated by measuring the probable occurrence of a natural hazard of certain intensity against the vulnerability of the exposed elements. For example, a building is at risk during an earthquake when a) the earthquake (hazard) is strong enough to damage or destroy the building, and b) seismic-resistant construction techniques are not used (vulnerability) in the design and construction of the building.

Risk is not an abstract concept; it is concrete and measurable. Many countries and communities have designed maps to illustrate their degree of risk. These maps not only mark the areas with the highest probability of occurrence of an event of certain magnitude, but also point out vulnerable infrastructure in those areas.

A natural disaster is an overwhelming ecological disturbance that exceeds the capacity of the affected community to adjust, and consequently requires external assistance.

Source: PAHO/WHO, 1980.

Photo: Gaggero, PAHO/WHO

Photo facing page:

In the Caribbean, the hurricane season regulates the lives of millions, overshadowing other risks such as earthquakes and volcanic eruptions. Hurricane Gilbert tossed this airplane into the trees at the Kingston Manley Airport in Jamaica.

Table 3.1

Selected natural disasters in Latin America and the Caribbean, 1970-1993

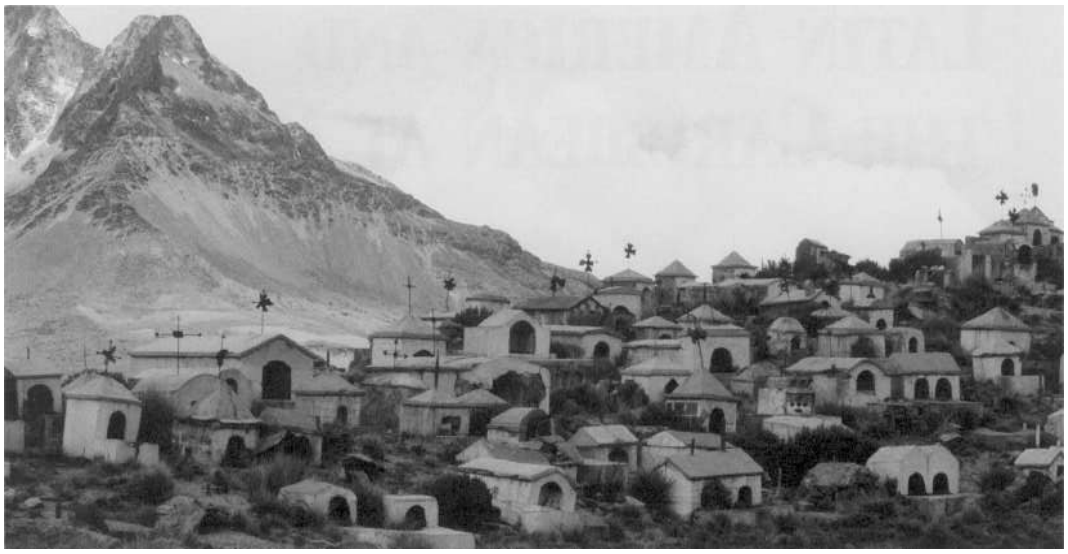


Photo: Waak, PAHO/WHO

Year	Country	Type of disaster	No. of deaths reported	Estimated no. of affected people
1970	Peru	Earthquake	67,000	3,139,000
1972	Nicaragua	Earthquake	10,000	400,000
1974	Honduras	Hurricane (Fifi)	7,000	15,000
1976	Guatemala	Earthquake	23,000	1,200,000
1979	Dominica	Hurricane (David)	38	81,000
1979	Dominican Republic	Hurricane (Frederick)	1,400	1,200,000
1980	Haiti	Hurricane (Allen)	220	330,000
1982	Mexico	Volcanic Eruption	1,770	60,000
1985	Chile	Earthquake	180	1,000,000
1985	Mexico	Earthquake	10,000	60,000
1985	Colombia	Volcanic Eruption	23,000	200,000
1986	El Salvador	Earthquake	1,100	500,000
1987	Ecuador	Earthquake	300	150,000
1987	Dominican Republic	Hurricane (Emily)	3	50,000
1988	Brazil	Flood	355	108,000
1988	Jamaica	Hurricane (Gilbert)	45	500,000
1988	Mexico	Hurricane (Gilbert)	225	200,000
1988	Nicaragua	Hurricane (Joan)	116	185,000
1989	Antigua, Guadeloupe, Montserrat, Puerto Rico, St. Kitts and Nevis, U.S.A., U.S. Virgin Islands	Hurricane (Hugo)	56	220,000
1990	Peru	Earthquake	21	130,000
1991	Costa Rica	Earthquake	51	19,700
1992	Nicaragua	Tsunami	116	13,500
1993	Honduras	Tropical Storm (Gert)	103	11,000

Source: PAHO/WHO; OFDA/USAID; DHA/Geneva; *Atlas Nacional de Riesgos de MÈxico.*

NATURAL HAZARDS IN LATIN AMERICA AND THE CARIBBEAN

Natural hazards of all types exist in Latin America and the Caribbean. The most common are classified by their origin: geological, such as earthquakes, tsunamis, volcanoes, and landslides; or hydrometeorological, such as hurricanes, tropical storms, floods, landslides, and drought. Selected natural disasters in Latin America and the Caribbean are listed in Table 3.1.

GEOLOGICAL HAZARDS

Earthquakes

During the last 100 years, earthquakes of great magnitude and intensity have rocked many countries in the Americas. Earthquake magnitude, first defined by Charles Richter, is a measure of the strength of an earthquake as calculated from records of the event made on a calibrated seismograph. The Richter scale is used to describe an earthquake's magnitude. In contrast, earthquake intensity is a measure of the effects of an earthquake on structures and the earth's surface at a specific site. Among the many existing scales, the Modified Mercalli Intensity Scale of 12 degrees, symbolized as MM, is frequently used.

Most earthquakes in the Region have been caused by the interaction of active tectonic plates (see Figure 3.1). The Cocos plate, for example, subducts or dives beneath the lighter American plate. On 19 September 1985, the Cocos plate snapped at a depth of 20 km, and seismic waves devastated Mexico City more than 350 km away. This sort of activity, the subduction and collision between the continental and the Cocos, Nazca, and Caribbean plates, is responsible for the extensive seismicity along the Pacific coast of Central and South America and in the Caribbean Basin. The earthquake that hit northern Peru on 31 May 1970 killed an estimated 67,000 people. Entire villages, such as Yungay and Ranrahirca, were buried in the avalanches and mudslides that were triggered by the tremor. An estimated half million people were left homeless.

In Central America, the Cocos and overriding Caribbean plates are broken into distinct segments which are characterized on the earth's surface by structural depressions full of volcanic and alluvial sediments. The richness of this soil has attracted dense human settlements to spring up, precisely in those places most prone to seismic activity.

In 1972 most of Managua, the capital of Nicaragua, was destroyed by a 6.2-magnitude earthquake, leaving 10,000 dead. In 1976, 23,000 people perished in an earthquake in Guatemala; nearly 90% of the buildings in the central part of the country's high mountains were destroyed or seriously damaged. The collapse of unstable slopes, where thousands of people of limited resources lived, caused most of the deaths in Guatemala City. In March 1985 an earthquake took place in central Chile which measured 7.8 on the Richter scale with its epicenter on the coast near Alzarrobo. This event affected an area where 50% of Chile's urban population is concentrated; 180 lives were lost; 2,575 people were injured; and nearly 84,000 homes were totally destroyed. In El Salvador in 1986, a 20-square-block area in downtown San Salvador was completely destroyed, claiming more than 1,000 lives.

Photo facing page: Cemetery at Milluni tin mine, Bolivia.

Tsunamis

Tsunamis are caused by earthquakes, volcanic activity, and landslides on the sea floor which generate enormous waves. Because of the length, depth, and velocity of these waves they are difficult to detect and monitor.

About 80% of tsunamis occur in the Pacific Ocean, but there have been significant events in the Caribbean too. In 1692, 3,000 people were killed by an earthquake and tsunami at Port Royal, Jamaica. As the result of an earthquake off the Virgin Islands in 1867 and the 1918 Puerto Rico earthquake, tsunamis did extensive damage. Tsunamis present a real threat to islands that make a substantial living from tourism along their shores and for countries like Guyana and Suriname that are below sea level. One of the most serious tsunamis in recent history was one set off by the 1960 earthquake in Chile. It not only obliterated fishing villages in Chile, but caused the deaths of hundreds in Hawaii, Japan, and the Philippines. In 1992 a 7.2 magnitude earthquake off the western coast of Nicaragua generated waves over 10 m high that left 116 dead and over 40,000 homeless (see Box 3.1).

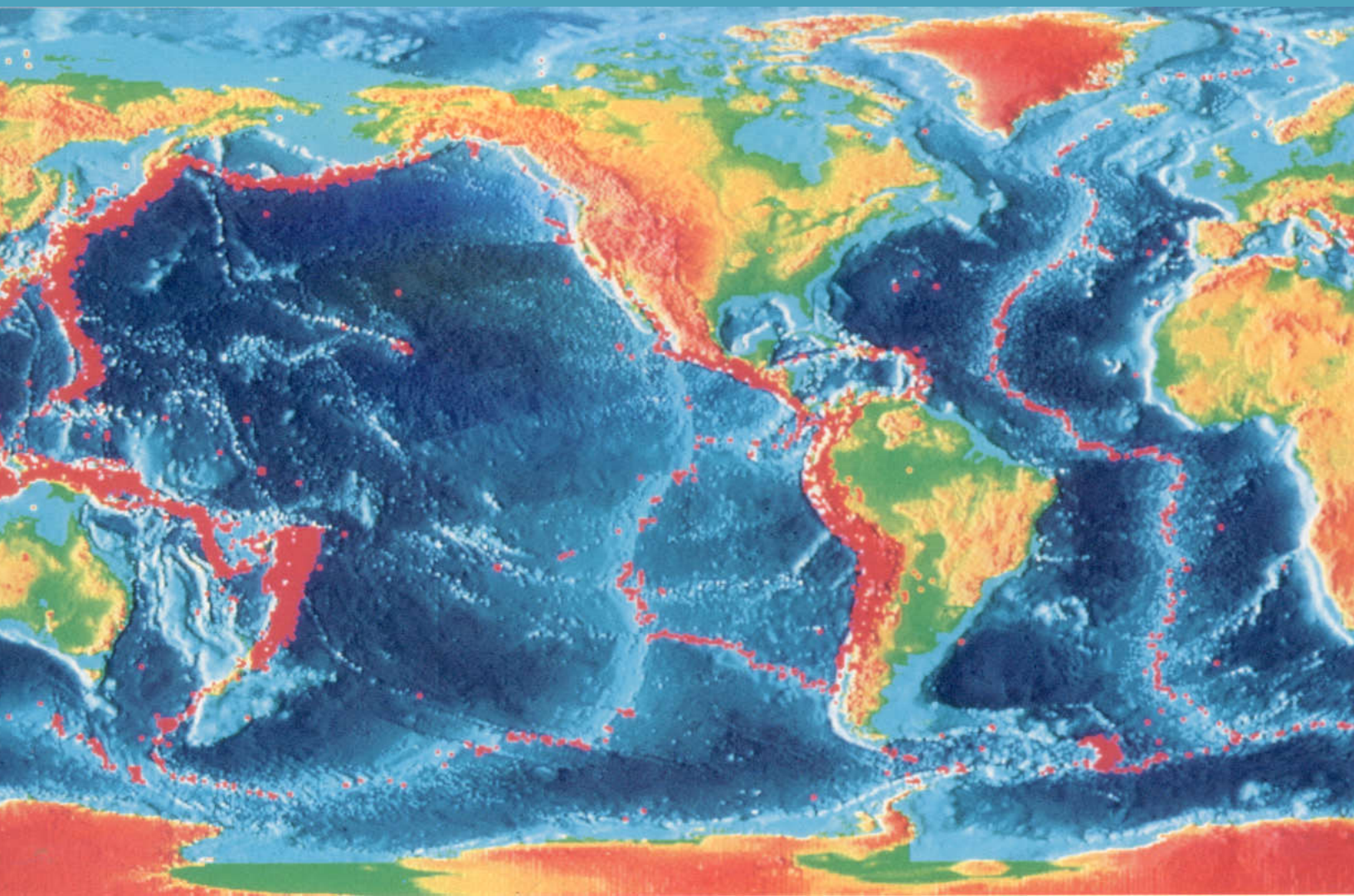
Volcanoes

For centuries, those who have inhabited the Americas have been well aware of the hazards posed by volcanoes. Guatemala, for example, is known as the country of lakes and volcanoes, but this nickname could be applied to other

Figure 3.1. Map showing epicenters of earthquakes, magnitude ≥ 5 since 1980.

Map courtesy of NOAA, U.S. Geophysical Data Center.

Figure 3.1



Box 3.1

WHEN THE EARTH MOVES UNDER THE SEA

A Double Hazard in Chile. In May 1960 Chile was ravaged by a triple catastrophe—two earthquakes and a tidal wave—that affected 13 of the country's 25 provinces, leaving a profound mark on the population and causing severe deterioration in the economy. In just a few minutes, hundreds of lives were lost, dwellings were demolished, gas and water pipes broken, communications interrupted, industries destroyed, livestock lost, agriculture ruined, and roads and railroads left impassable. In several areas the topography was changed: part of the coastline sank into the sea, new islands appeared and others were demolished by the tidal wave. Three landslides covered the natural dam of Lake Riñihue, causing an avalanche that almost demolished the small towns that lay along the banks of the San Pedro River and the low lying areas of Valdivia. Chilean engineers carried out the nation's largest emergency engineering task; in two months they opened an evacuation channel from the lake, thus avoiding the destruction of a rich agricultural, livestock, and industrial area, with a population of approximately 100,000.

Source: R. Urrutia and C. Lazcano, 1993.

Tumaco, Colombia. In 1979, a tsunami ravaged the Pacific coast of Colombia, destroying 80% of the important maritime and fishing port of Tumaco. The vulnerability of this area was well-known; in 1906 this city had been totally destroyed by one of the strongest tsunamis of the century. The damages were extensive because a large part of the urban area was built at sea level on loose saturated sands, which produced the phenomenon known as soil liquefaction.

Source: DHA, Geneva.

Callao, Peru. In October 1966 a magnitude 6.3 earthquake occurred off the coast of central Peru. A tsunami followed, hitting the port city of Callao in mid-afternoon, with waves that reached a height of 3.4 meters. Callao had already been destroyed once, in 1746, by an earthquake believed to have registered 8.5 on the Richter scale, that was also followed by a tidal wave that decimated the population; only 200 of the 5,000 inhabitants survived. At that time, the sea penetrated 1.5 km inland, dragging with it several ships that were anchored in the port. Eighty percent of the buildings in the neighboring city of Lima, capital of Peru, were damaged.

Source: Instituto Nacional de Defensa Civil, Peru, 1994.

countries in Central America, the Caribbean, and South America as well. As far back as colonial times, El Salvador's Izalco volcano was called the "Lighthouse of the Pacific." Yet although there are numerous active volcanoes in the Region, destructive volcanic eruptions have been less frequent than other types of natural disasters in this century.

In 1902, three major volcanoes erupted with great force in the Caribbean and in Central America. The tragedy began with the explosion of Mount Pelée in Martinique that discharged a dense emulsion of incandescent lava and boiling gases that ran downhill to the port of St. Pierre. Thirty thousand persons were suffocated. Twenty-four hours later, the Soufrière volcano on the neighboring island of Saint Vincent, 150 km away, erupted in a similar manner, causing the death of 1,500 people. Later that same year, the Santa María (Santiaguito) volcano in Guatemala, took the lives of 6,000 people. Three quarters of a century later, in 1979, the Soufrière exploded again, causing extensive damage and making communication impossible

Box 3.2

THE SNOW-CAPPED ANDES INSPIRE RESPECT. . . AND FEAR

Photo: Vizcarra, PAHO/WHO

After almost 150 years of inactivity, the Nevado del Ruiz volcano, located 120 km northwest of SantafÈ de Bogot· , Colombia, erupted violently on 13 November 1985. The intense heat and the seismic activity that accompanied the eruption melted only a small portion of volcano's icecap, but this was enough to send a devastating current of mud, rocks, and ashes down the riverbeds that descended its slopes, burying almost completely the city of Armero at its base.

After several days of intense search and rescue efforts, hindered because the only access to the disaster site was by air, the death toll reached 23,000. The disaster affected a 1,000 square km area in what was one of the country's most important agricultural areas. Other affected cities included Chinchin· , where 2,000 persons perished; Mariquita, where it was necessary to evacuate 20,000 people, and Guayabal. Thousands of homes, roads, and bridges were destroyed.

These mud flows, originating from volcanic eruptions, are known as lahars, and their descent can reach speeds of 100 km per hour. They occur frequently and equal or surpass the strength of incandescent avalanches, the principal cause of volcanic destruction.

In January 1986, the volcano began again to spew toxic gasses on the affected area. Forty thousand people in a 50 km radius around the volcano had to be evacuated.

Source: PAHO/WHO; Colombian Government reports.

between the northern and southern parts of the island of Saint Vincent.

In March 1982, the Chichonal volcano in the state of Chiapas in southeast Mexico came to life with a tremendous explosion that launched a column of ash and gases 15 km high. Several days later, there was an even more violent eruption. Pyroclastic flows demolished the village of Francisco LeÛn and other nearby towns, damming up rivers and streams and forming lakes of boiling water. When one of these natural reservoirs opened, the banks of the Magdalena, Syula, and Grijalva rivers overflowed. An estimated 1,770 lives were lost as a result of this eruption.

After a prolonged period of inactivity, an exceptionally violent explosion of Costa Rica's Arenal volcano in 1968 launched rocks upon a nearby village, claiming 64 lives. Between 1963 and 1965 the Iraz˙ volcano, southeast of the capital of San JosÈ, discharged such a large quantity of ash that the coffee crop and the country's economy in general were seriously affected.

Presently six volcanoes in Nicaraguaó ConcepciÛn (Ometepe), Santiago, Momotombo, Pylas, Cerro Negro, and Telicaó are in varying states of activity, from the emission of gases to the explosion of ash accompanied by lava flows. The eruption of the Cerro Negro

volcano in 1992 spewed ash over a 200 km radius.

In South America, most of the volcanoes that erupted in past centuries were too far removed from densely populated areas to cause much havoc. However, the eruptions of Cotopaxi (Ecuador) in 1877 and Villarica (Chile) in 1936 melted large volumes of ice and snow that caused avalanches affecting vast urban and agricultural areas. The case of the Nevado del Ruiz volcano in Colombia was similar (see Box 3.2). The eruption of the Mt. Hudson volcano in southern Chile in 1991 affected some 62,000 people and caused serious damage to livestock and agriculture in Chile and Argentina.

HYDROMETEOROLOGICAL HAZARDS

Hurricanes

Annually some 80 cyclonesÛor hurricanes as they have come to be known in the Western Hemisphere from the indigenous term ÏHura Kan,Óor Ïwinds of the GodsÓÛtor m over warm tropical waters during the summer months. Each year it is estimated that some 20,000 people lose their lives to tropical storms worldwide; the material

Figure 3.2

Map adapted from OAS, 1991.

Simpson/Saffir Scale

CATEGORY	1	2	3	4	5
Wind speed (Km/hour) and damages	119 -151 Minimum	152 -176 Moderate	177 - 209 Strong	210 - 248 Severe	>248 Catastrophic

Between 1990 and 1992, approximately two million people in Bolivia were seriously affected by both heavy flooding and drought.

losses can surpass billions of dollars. The Simpson/Saffir Scale is used to categorize hurricanes (see Figure 3.2).

According to the OAS, between 1960 and 1989 hurricanes claimed 28,000 victims, altered the lives of another 6 million, and destroyed property valued at close to US$16 billion in the Caribbean Basin alone, without counting losses caused by those storms in Latin America, the United States, and its possessions.

More than 4,000 tropical storms have occurred in the last 500 years in the Caribbean, half of which have been become hurricanes. The most devastating of all happened in October 1780, striking practically every island in the Caribbean, beginning with Tobago, continuing through the Leeward Islands, and across Hispaniola. Almost 20,000 people perished.

An average of 10 hurricanes threaten the West Indies and the east coast of Central America and Mexico between June and November every year. In 1988 Hurricane Gilbert dealt a devastating blow to the Caribbean, leaving hundreds of thousands of people without shelter in Jamaica before cutting across the Yucatán peninsula and ravaging the Mexican city of Monterrey (see Box 3.3). Barely two months later, after striking the Caribbean coasts of Venezuela and Colombia, Hurricane Joan left a trail of destruction from coast to coast in Nicaragua and other Central American countries. The next year, Hurricane Hugo ravaged the Leeward Islands, causing serious damages in Antigua, Guadeloupe, Montserrat, Saint Kitts and Nevis, Puerto Rico and the U.S. Virgin Islands. The storm ended by slamming into the eastern coast of the United States, heavily damaging the city of Charleston, South Carolina.

In August 1992 Hurricane Andrew tore across Eleuthera and other islands in Bahamas before delivering its most forceful blow on the Atlantic and Gulf of Mexico coasts of the U.S., devastating southern Florida and, to a lesser degree, Louisiana. Property damages in the United States were estimated at US$30 billion.

Floods

Floods are, perhaps, the most frequent and among the most ruinous type of natural disaster; however, they almost never receive the same immediate attention, for example, that an earthquake or a hurricane does. Almost every country in Latin America and the Caribbean is affected by the problem of floods.

During sudden-onset natural disasters, the different stages—impact, emergency response, and rehabilitation / reconstruction—are clearly delineated. However, with slow-onset floods, the boundaries are less clear. Months can pass before the authorities realize that an emergency exists. The isolation period may be prolonged and rehabilitation or reconstruction may overlap with the next flood.

The phenomenon known as *El Niño* has caused cycles of heavy rains and drought in many parts of the world. The effects of *El Niño* in 1982-83 in South America were among the most devastating (see Box 3.4).

The principal river cities of Paraguay were affected during the winter periods of 1982, 1983, and 1987, and more than 3,000 families had to be relocated. Because of its topography, large areas of Argentina and Uruguay also experience periodic flooding.

Between 1990 and 1992,

Box 3.3

A HIGH-RISK SEASON: HURRICANE GILBERT

At 5:00 a.m. on 9 September 1988, Jamaica's National Meteorological Service issued its first hurricane alert. Two days later, the alert had become a warning. But a majority of Jamaica's population had never experienced the direct consequences of a hurricane, and were exceedingly conservative in heeding the warning. There would be time enough in the morning to make preparations, they thought.

That was not to be the case. Only three hours of daylight remained on the afternoon the warning was issued, and during the night wind speeds accelerated. Hurricane Gilbert, a storm of colossal proportions, made landfall on the eastern end of Jamaica on September 12 at 10:00 a.m. During its trek across the island from east to west, it gathered speed and turned into a Category 5 hurricaneó the most severe.

Jamaica's last experience with a hurricane was Hurricane Charlie in 1951. Hurricane Gilbert differed from Charlie in several respects. Unlike Charlie, Gilbert's eight-hour rampage crossed the entire length of the island. Gilbert was also the largest cyclonic system ever observed in the western hemisphere, and one of the wettest, although fortunately for Jamaica, most of the precipitation fell on the sea.

Photo: Gaggero, PAHO/WHO

Princess Margaret Hospital in Jamaica was one of the hospitals damaged by Hurricane Gilbert.

The impact of Hurricane Gilbert was devastating for all sectors of the society and the economy. Damage was estimated at US$4 billion, with the damage to agriculture accounting for over 40% of this total. Ninety-five percent of all health facilities suffered damage. Of the 25 public hospitals only two escaped with minimal damages. Two were destroyed and eleven suffered severe damage. There are 377 Health Centers in the island and 55% of these were severely damaged. The cost of emergency repairs was estimated at US$13 million with roughly 55% of this representing the cost of repairs to secondary care facilities.

The National Water Commission managed the storage and distribution of domestic water. The hurricane damaged over 50% of these facilities to a degree which varied from minor to complete destruction. Pipelines, storage tanks, pump and chlorinator houses were all affected. There were instances in which rivers changed their courses, threatening supplies and facilities.

The response from the international community was immediate and large quantities of supplies flooded the country. Daily meetings were held to coordinate donor response and the needs of the country. This achieved some measure of success. However, it was felt that prearranged needs lists would have speeded up the process of acquiring necessary supplies. Moreover, the major part of the relief effort centered around the transportation of goods. The cost of mobilizing distribution was, at times, greater than the value of the goods. A great deal of time was also spent in clearing, documenting and sorting the donations.

Source: PAHO/WHO.

Box 3.4

EL NIÑO

In June 1982, scientists again began to observe a series of atmospheric and oceanic changes in the region of the equatorial Pacific, which were related to the phenomenon known as *El Niño.* This phenomenon causes floods and droughts at irregular intervals of between 3 and 16 years along the western coast of South America, as well as in many other areas of the world. This 1982 occurrence of *El Niño* caused widespread drought in western Bolivia, southern Peru, northeastern Brazil, Costa Rica, southern Mexico, Indonesia, the Philippines, Australia, New Guinea, parts of Africa, southern India, and southern China. It also caused floods in Ecuador, Peru, eastern Bolivia, southern Brazil, northern Argentina, eastern Paraguay, and the Polynesian islands.

In the housing sector in Peru, the urban slums in Lima were the most affected by this phenomenon. In total, 62,771 dwellings were partially damaged or destroyed by flooding. The transportation and drinking water and sewerage infrastructure were practically destroyed. The floods ruptured water and sewerage networks, causing severe shortages of services to most of Peru's coastal population, including the city of Piura, where 16,750 meters of pipe were destroyed.

The consequences of *El Niño* along the coast of Ecuador caused the country's marine reserves to virtually disappear, severely damaging the fishing industry. In addition, heavy rainfall in these coastal areas reached into the mountains in some parts, causing rivers to overflow.

Source: PAHO/WHO.

approximately two million people in Bolivia were seriously affected by both heavy flooding and drought. The floods at the beginning of 1992 in the northeast part of the country affected more than 40,000 people in 160 communities. Agricultural and livestock losses were estimated at more than US$16.6 million. The deterioration in the standard of living and the interruption of basic public health services placed the affected population at risk for outbreaks of communicable diseases.

Cuba, the Dominican Republic, Jamaica and Trinidad and Tobago are also subject to frequent flooding which impacts on the transportation sector, for example, destroying large numbers of bridges and roads. But the Caribbean is also prone to flash floods which cannot be predicted by the national meteorological offices. A number of these flash floods are the result of other hazards such as hurricanes or landslides.

The serious flooding in the Atlantic region of northern Nicaragua in May and June 1990 affected more than 100,000 people. The indigenous communities of Miskitos and Sumos, located along the Prinzapolka, Bambana, and Coco Rivers were the most affected, together with settlements in the coastal areas. The condition of the land made cultivation impossible, resulting in food shortages, which in turn, made the population more susceptible to endemic diseases in the region.

A flood's major effects on health are in four main areas: communicable diseases, environmental sanitation, food and nutrition, and vectors. As a rule, dramatic, well-defined outbreaks of diseases generally do not occur in the immediate aftermath of a flood. Instead, a slower, widespread deterioration of general health conditions takes place,

which all too often becomes part of the chronic lowering of the affected community's health status.

In areas that are continually exposed to floods, a "disaster culture" has developed over time. The people of these regions have adapted to both the frequency and difference in intensity by constructing their houses on stilts and elevating the floors with wooden boards as the flood waters rise. It is not uncommon, when water levels have reached a high point, to observe a boat tied to a window, which has become the door!

Drought

Drought is a phenomenon that has affected large areas of the Western Hemisphere, but perhaps the case whose causes and effects have been most studied is that of Brazil. Since the 1940s, an increase in the population, the large scale destruction of natural resources, and growing desertification have caused this country to suffer increasingly severe droughts. These periodic droughts destabilize the primitive economy of the region, deplete the natural resources, burn the grasses, decimate livestock, and demolish crops, converting the *sertão* into a desert landscape whose inhabitants, deprived of reserves, die from lack of food and water. Many migrate to the large cities, where they add to the growing number who inhabit the *favelas*, or slums circling the cities.

The effects of drought, always disastrous, grow in proportion to the extent of the territory affected. If the affected area is not very large, neighboring regions that are not affected can offer aid. According to the Brazilian author Luis Augusto da Silva Vieira, in his account of drought in northeast Brazil in the first half of this century, the crises occur in irregular patterns: partial drought usually occurs every 4 to 5 years, normal drought, every 10 to 11 years, and exceptionally severe cases are seen every 50 years. The great drought of the 1980s verified this, since the two previous large-scale droughts had occurred in 1877 and 1932.

Landslides

The impact of landslides depends on the specific nature of the event and its origins. For example, landslide failures of hillsides or mountain slopes obviously constitute a hazard to human beings and property, but in general cause damage in only a limited geographic area. By contrast, volcanic-triggered slides, avalanches, mudflows and lateral blasts can affect larger areas and can cause greater life and property loss. The large majority of landslides are caused or intensified by geologic and hydrometeorologic factors. The case of Armero, Colombia, in 1985, demonstrated one of the most destructive consequences of a volcanic eruption: volcanic mudflows descended from the summit of Nevado del Ruiz at great speeds following the paths of several rivers in the area.

However, the most severe landslides are those caused by the gradual displacement of large areas of the earth's surface, since their effect on buildings and other infrastructure is slow but dangerous. This type of landslide is triggered by extreme hydrometeorological conditions or by earthquake shaking.

Road and highway construction can cause slope failures: limited budgets often dictate where and at what angle a slope is cut rather than what is most stable. When severe rains occur, the roads collapse,

Box 3.5

LANDSLIDES

Photo: Vizcarra, PAHO/WHO

MedellÌn, Colombia. In September 1987 a major landslide estimated to contain 20,000 cubic meters of earth descended on the neighborhood of Villatina in the city of MedellÌn, Colombia. An uncovered open channel, located in the upper part of the neighborhood, which had deteriorated because of a lack of maintenance, overflowed and added to the mass, destroying 100 dwellings, killing 207, leaving 300 missing, and nearly 2,000 affected. The Villatina neighborhood was located in an appropriate area for urbanization, given the topographical conditions and was not thought to be susceptible to such hazards.

Source: Bustamante, 1987.

Rio de Janeiro, Brazil. In February 1988 a strong cold Arctic air mass passed over southern Brazil, triggering torrential rains in the state of Rio de Janeiro and depositing 279 cubic millimeters of rain on the city of Rio de Janeiro and neighboring areas. The rains caused rivers to overflow and flooded the poorer neighborhoods that surround the city, destroying hospitals and dwellings and leaving 289 dead, 734 injured, and 18,560 affected. The drinking water services, sewerage, electric energy and telephones were interrupted for several days. The direct cause of the landslides was the rainwater that saturated the steep slopes of unstable soil and insufficient drainage for the large volume of water.

Source: UNDP; PAHO/WHO.

La Josefina, Cuenca-Ecuador. In March 1993 a landslide containing 20 million cubic meters of earth blocked the Paute River with a dam of rubble and dirt 100 meters high and one kilometer long, causing a reservoir of 200 million cubic meters of water to form upstream from the blockage. Warning had been given about this hazard, but measures needed to avoid the disaster had not been taken. It occurred because of heavy rainfall at the site of a previous landslide, and was brought on as well by inadequate road construction.

Following the landslide, a channel was constructed to drain water from behind the blockage, thereby reducing the flooded area upstream. But 26 days after the original landslide, the drainage channel itself collapsed, and due to the erosion brought on by continual rains, the dam failed one week later. This failure resulted in flash floods damaging an area that extended 100 km below the dam. Although inhabitants in the floodplain had been evacuated, a total of 35 people lost their lives, and economic losses were estimated at US$140 million.

The flooding and impending dam collapse threatened the Paute Hydraulic Project, located 50 km downstream, which provides 65% of Ecuador's power. The dam failure was simulated so that contingency plans could be prepared for that occurrence.

Source: Zevallos, 1994.

Photo facing page:

Housing destroyed by landslide in Rio de Janeiro, 1988.

not only claiming lives and interrupting important lines of communication but also placing severe demands on the limited institutional resources available to rebuild them.

Human activity, particularly deforestation of watersheds, pollution, and other impacts can result in landslides with extreme economic and social impacts. A landslide dam on the Paute River in Ecuador flooded most of the fertile land upriver of the slide. Population centers downriver were threatened by the catastrophic failure of the landslide dam (see Box 3.5).

Landslides caused by strong rains and flooding have had devastating effects in the Region, particularly in deforested areas and in areas where housing has been constructed on unstable soils. One tragic failure occurred in the Bolivian goldmining camp of Llipi, north of the capital city, La Paz. Torrential rains on 8 December 1992 caused a landslide that buried the entire village; 49 people were killed. Deforestation contributed significantly to the disaster; tunnels used for mining collapsed. A similar landslide occurred in Ecuador in May 1993, in the goldmining region of Nambija, claiming 140 lives.

In early August 1993, Tropical Storm Bret raced through the eastern Caribbean, causing severe structural damage in Trinidad and Tobago before striking Caracas, Venezuela, with full intensity. The storm's rains and winds triggered landslides in poor neighborhoods located in the outskirts of the capital and in the States of Miranda and Aragua. At least 100 people died, 400 were injured, and approximately 5,000 were left homeless.

VULNERABILITY

A close relation exists between vulnerability to disasters and socioeconomic development. For example, the accelerated rate of urbanization in Latin America contributes to its vulnerability, and also leads to environmental degradation and to poverty, which in turn lead to the use of inadequate construction techniques. Other factors such as population growth and low levels of education are related closely to the problem of vulnerability.

The Accelerated Rate of Urbanization

Most developing countries worldwide have witnessed a rapid rate of growth in their urban population, while in developed countries, it has declined. This growth is not only due to birth rates, but to the trend to migrate from rural to urban areas, especially among population groups of limited resources that look to the cities for better access to services and greater sources of income. The result is often the creation of perilously situated settlements on the fringes of large urban areas.

Poverty

Natural disasters in Latin America and the Caribbean have invariably shown that those with little income and a poor quality of housing suffer disproportionately when disaster strikes. The poor, with lower levels of education, often live in improvised settlements in highly vulnerable locations, such as the slums on the landslide-prone hills of Rio de Janeiro, the slopes of volcanoes, or riverbanks. During periods of drought, the most affected are those who cannot acquire food. Most often, hunger results

Natural disasters in Latin America and the Caribbean have invariably shown that those with little income and poor quality housing suffer disproportionately when disaster strikes.

from a lack of money to purchase food rather than from the lack of food itself. Poverty is also the greatest cause of both internal and international migration, which poses serious challenges in terms of immediate assistance, as well as in long-term development efforts.

A study by UNDRO (1988) estimated that 95% of the deaths caused by disasters occurred among 66% of the population of the world's poorer countries. In Japan, for example, an average of 63 persons die each year because of natural disasters. In Peru, a country with a similar incidence of disasters, the toll is 2,900.

Latin America and the Caribbean share a problem common to many parts of the world: not only do the poor receive a disproportionate share of the impact of the disaster itself, but they also are at a disadvantage during the rehabilitation and reconstruction phases. Prior to a disaster, this group depends on their limited income, often generated at home, for their daily survival. A disaster not only robs them of their source of income, but they cannot absorb the additional expense of purchasing materials for reconstruction. This accelerates the poverty cycle, which, in turn, heightens vulnerability to disasters.

Vulnerability of Constructions

The type of construction, as well as population density in the areas of greatest hazard, increase vulnerability. It is estimated that almost 90% of the victims of earthquakes are injured by the collapse of buildings, as was the case in Nicaragua in 1972 and in Guatemala in 1976. A similar situation occured in Dominica in 1979 and Montserrat in 1989, where an estimated 90% of the housing that collapsed was due to non-compliance with hurricane or wind-resistant codes.

Most old constructions in Latin America, both housing and institutions, are made of adobe and unreinforced masonry. Adobe houses do not resist earthquakes in the same way as wood structures, which are lighter and more flexible. The weight of the clay tile roofs of many of these structures also contributes to their instability, as was the case in the earthquake of Guatemala, where many died as a result of collapsed buildings.

To a great extent in the Region, the infrastructure of basic services such as water and energy is old, and many countries lack the resources to maintain it properly. Weak infrastructure poses a great obstacle to providing uninterrupted services. In times of disaster, hospitals and educational facilities, which over decades have undergone structural modifications without taking into account safety considerations, put already vulnerable groups—children, the sick, and the poor—at greater risk.

Environmental Factors

The environment surrounding human settlements contributes to disasters. In some cases, these surroundings cannot be modified and people must learn to adapt to avoid the serious consequences inherent to the location. For example, soil type is a determining factor as to why earthquakes cause more damage in some places than in others. The earthquake of 1985 in Mexico had its epicenter off the coast of the state of Guerrero, 350 km to the southwest of Mexico City. The coastal city closest to the epicenter, Acapulco, suffered only minor damages, but the capital was devastated. Mexico City was constructed on the site of the ancient

Box 3.6

THE 1985 EARTHQUAKE IN MEXICO

An earthquake of extraordinary magnitude, 8.1 on the Richter scale, caused extensive damage in a densely populated area of downtown Mexico City on 19 September 1985. The earthquake and its aftershocks caused the deaths of more than 10,000 persons; tens of thousands were injured and left homeless.

Approximately 33,600 dwellings were destroyed and 65,000 more suffered considerable damage. The health sector facilities were especially hard hit, with many hospitals and clinics destroyed. Nearly one fifth of the schools in the city were destroyed or seriously damaged. Also seriously damaged or destroyed were the water, electrical, and telecommunications systems in the central city.

Photo: Vizcarra, PAHO/WHO

Search and rescue teams work to free those trapped when Hospital Ju· rez collapsed in Mexico's 1985 earthquake. At this site alone, 561 personsó medical and administrative staff, patients, and visitorsó lost their lives.

The direct losses were estimated at $US3.8 billion. These losses included the urban infrastructure, public service facilities and their equipment, housing, heath and educational facilities, communications, small industry and businesses. The indirect losses were estimated at $US544 million and included the decrease of income and the increase in costs to small industry and business, communications, tourism, and the personal services sector. The total losses caused by the earthquake amounted to $US4.4 billion, making this natural disaster one of the most damaging in recent years in the Region.

More serious than the absolute losses is the effect which the rehabilitation and reconstruction had on the macro economics of Mexico. The effects are especially significant considering that the total losses represented only 2.7% of the GDP of Mexico. However, the disaster occurred at a time when the government was applying a policy of austerity in public expenditures; thus, banks had limited assets to meet the increased demand for credit and more external restrictions were foreseen.
In the five years following the earthquake, the negative effect in the balance of payments reached US$ 8.6 billion in spite of considerable income from insurance and foreign donations. The fiscal deficit increased approximately $US1.9 billion due to the expenses of rehabilitation and reconstruction.

The demands of the reconstruction required the Mexican authorities to revise their economic policy to accommodate greater needs for public funding, credits, and imports. The priorities for public expenditures were reoriented to reconstruction projects leaving many of the pre-disaster problems of the city unattended.

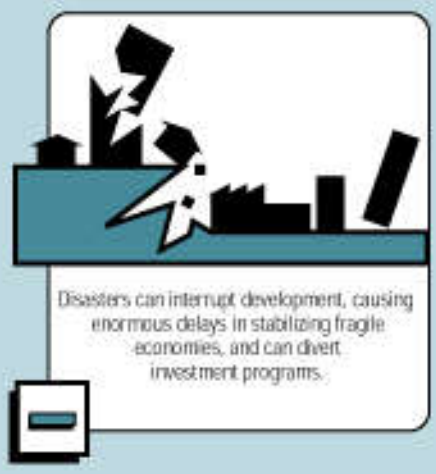
Source: Jovel, ECLAC, 1985. Reprinted from *Disasters and Development,* UNDP/UNDRO, 1991.

Box 3.7

NATURAL DISASTERS AND DEVELOPMENT OFFER BOTH OPPORTUNITIES AND OBSTACLES

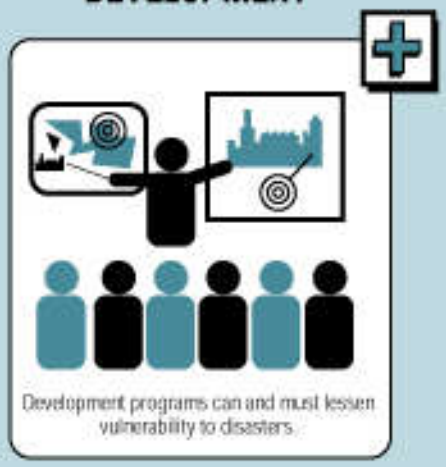
DISASTERS

Disasters can provide unique windows of opportunity in development. In the wake of the 1986 earthquake in El Salvador, the health sector took advantage of the severe damage to the large Children's Hospital to restructure and decentralize services so that the nation would not be dependent on the services of one ìmegahospital.î

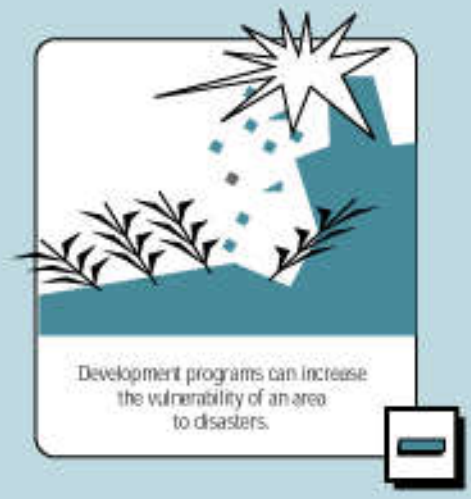


The El Salvador earthquake also had extreme social and developmental consequences: scarcity of housing, high unemployment (26-35%), and a reduced capacity in public health facilities. Hurricane Joan, which ravaged the Atlantic coast of Nicaragua in 1988, also had serious effects on an already failing economy during a difficult political and economic period.

DEVELOPMENT



Housing or infrastructure projects built in accordance with construction safety codes are less vulnerable because they have been designed to better withstand disaster impact. Research into construction of adobe dwellings in Peru, for example, aims to improve the performance of old and new dwellings in future seismic events.



Activities related to development projectsósuch as quarrying for construction materials or indiscriminate clearing of forests for agricultural purposesócan degrade soil conditions, thereby increasing the risk of disasters. Other proj-ects designed as income-generating opportunities can accelerate urban growth and force low-income workers to seek housing in marginal, hazard-prone areas.

Source: PAHO/WHO; IDNDR Regional Office.

Aztec capital of Tenochitlán. Over the centuries, the lake which surrounded the Aztec capital as a moat had shrunk, leaving deep layers of clay, sand, and gravel beneath the surface. Unlike solid rock, Mexico City's soil transmitted seismic waves as rocking motions, similar to ocean swells, which many edifices could not withstand (see Box 3.6).

In other cases, man's attempts to modify his surroundings contribute to disaster situations. Deforestation, environmental degradation, and the irrational use of land create precarious conditions that multiply the effects of disasters. For example, deforestation leads to water runoff which contributes to flooding and landslides; the destruction of mangroves reduces the ability of coastal regions to resist tropical winds and high waves.

The use of advanced technology in commercial agricultural production can be harmful. When machines are used to farm fertile areas of a country, the rural labor force loses its source of employment and has no recourse but to move to more marginal areas.

Drought conditions often are exacerbated by inadequate growing patterns, excess of pasture lands, indiscriminate exploitation of natural resources, deforestation, or inappropriate land conservation techniques. Deforestation in Haiti, due partially to the exportation of fine woods, and to the lack of fuel, contributed to drought conditions in this country. In Latin America, approximately one fifth of the territory is threatened by desertification, which can leave in its wake social unrest, conflicts, and mass migrations, in addition to hunger and disease.

THE RELATIONSHIP BETWEEN DISASTER AND DEVELOPMENT

Nations increase their capacities and decrease their vulnerabilities through development. Development planning is used by governments to draft plans to guide economic and social development. The concept of sustainable development is widely recognized by international agencies and by governments, although its definition is not universally agreed upon. Sustainable development is the outcome of comprehensive planning that incorporates considerations of disaster risk (reducing hazards and vulnerability) as well as strategies designed to protect the environment and to improve economic growth, levels of education, and living conditions of the entire population (see Box 3.7).

Economic losses caused by a disaster of great magnitude often exceed the annual gross income of a country. It is not surprising then that these events can paralyze the affected countries and cause social and political disturbances. The World Bank has estimated that in developing countries, the economic losses due to disasters, as percentages of the gross domestic product (GDP), are 20 times higher than in industrialized countries.

According to the Economic Commission for Latin America and the Caribbean (ECLAC), disasters have three types of economic repercussions: direct effects on property; indirect effects caused by losses in economic production and services; and secondary effects that are manifested after the disaster in a reduced national revenue, increased inflation, problems of foreign trade, increased public spending, the resulting fiscal deficit, and reduced monetary

Table 3.2

ECONOMIC LOSSES CAUSED BY NATURAL DISASTERS IN LATIN AMERICA AND THE CARIBBEAN

(in millions of 1987 US dollars)[a]

Photo: UN, IFRC

LOSSES & EFFECTS	EARTHQUAKES		HURRICANES	FLOODS/ DROUGHTS
	Mexico City 1985[b]	Ecuador 1987[c]	David & Frederick 1979[d]	El NiÒo 1982-1983[e]
Total losses	**4,337**	**1,001**	**1,057**	**3,970**
Direct losses	3,793	186	842	1,311
Capital stock	3,777	184	506	1,060
Inventories	16	2	230	251
Production	0	0	106	0
Indirect losses	544	815	215	2,659
Production	154	704	185	1,284
Services	390	111	30	1,375
Secondary effects				
Public sector finances	1,899	397	303	. . [g]
Increased expenditures	2,025	55	264	. . [g]
Decrease in revenues	(126)[f]	342	39	. . [g]
External sector	8,579	781	464	621
Reduction of exports	1,650	635	167	547
Increase in imports	9,075	155	296	74
Disaster-related income	(2,146)[f]	(9)[f]	ñ	ñ

a All figures adjusted for inflation through 1987 to enhance comparability.
b Secondary effects estimated for 1986 to 1987, and projected thereafter through 1990.
c Includes damages caused by ensuing floods and mudflows which represent a very high percentage of the total.
d Damages refer to the Dominican Republic only, even though other countries were affected as well.
e Damages refer to Bolivia, Ecuador and Peru, although other countries were affected as well.
f Figures in parentheses refer to income gained from insurance and foreign donations.
g Produced significant increases in the fiscal deficit; exact figures are not available.

Source: Jovel, 1989. Reprinted from *Disasters and Development*, UNDP/UNDRO, 1991.

reserves.

Table 3.2 presents estimated economic losses caused by selected natural disasters in Latin America and the Caribbean. Although these losses are not devastating for industrialized countries with strong economies, they have serious and lasting effects on the susceptible economies of developing countries. For example, drought and floods in Bolivia, Ecuador, and Peru associated with *El NiÒo* reduced the per capita income by 10% and elevated some retail food prices by 50%. Although the direct losses caused by the Mexico earthquake were equivalent to only 2.7% of the GDP, the expenditures for reconstruction and rehabilitation of basic services wreaked havoc on the economy, at a time when Mexico was operating under a policy of fiscal austerity.

RISK IN LATIN AMERICA AND THE CARIBBEAN

While risk is concrete and measurable, it is also relative and depends on how communities view it. People constantly attempt to diminish their vulnerability to hazards, while at the same time maintaining a balance between the risk and the benefits attached to them. For example, living near a volcano presents the threat of an eruption, but provides the advantage of fertile lands for agriculture.

Calculating to make risks measurable makes them seem controllable. But it is one thing for planners to calculate risks and another for people to accept the calculations, want to act on them, and then have the means to do so. Many families who live in areas prone to the periodic flooding of rivers rebuild their dwellings on the same sites while awaiting the food, clothing, and building materials from agencies in charge of the emergency response. Planners view this risk of living on the river bank as unacceptable; for them, the ideal solution is to relocate these people. But the people themselves are attached to familiar areas, may be more afraid of unknown hazards than familiar ones, and may insist on staying.

In Latin America and the Caribbean, important relationships exist between natural hazards, the particular vulnerability of each community or population group, and the risks each faces of suffering the effects of disaster. To convince people that they should take steps to become less vulnerable, and then give them a way to overcome the risk, is the vision of all who work in the field of disaster reduction. ◆

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BOMBERO
HONDURAS
REACCION

THE WAKE-UP CALL: FROM IMPROVISATION TO RESPONSE PLANNING

Photo: Gaggero, PAHO/WHO

Photo: Vizcarra, PAHO/WHO

Photo facing page:

The force of the 1985 earthquake in Mexico ruptured gas lines; the ensuing fires were an additional cause of damage to buildings.

During the past five centuries, dating back to the earliest recorded accounts, nature has struck the Americas with fury in one of many formsó an earthquake, a volcano, a hurricaneó and has left in its wake destruction, which rapidly subsides and is subsequently forgotten, even by those who suffer its consequences. It was common to believe that natural disasters were simply tható acts of natureó and as such, were unpredictable and uncontrollable, merely events to be endured. To plan for disasters that may never happen was thought to be folly. Inevitably though, nature's wrath did return, bringing with it devastation. The visits seemed random but were actually routineó regular enough to warrant preparing for them. To convince people that planning could counteract many of the effects of nature was to win half the battle.

The reality of the Americas until the early 1970s was this: When disaster did strike, relief was provided with a great deal of generosity and solidarity, but in an improvised and uncoordinated way. Sectors providing relief competed rather than cooperated with each other. The lack of coordination led to an international response that was neither technically appropriate nor culturally sensitive.

With each passing year, as the size of the at-risk population grew and its dependency on essential services such as water, electricity, communications, roads, and airports increased, disaster response, which included immediate relief, rehabilitation, and reconstruction operations, became more commonplace and more complex.

During the last 25 years, the large-scale disasters experienced by the countries of Latin America and the Caribbean forced them to recognize the need to better organize their response and to deal with the usual problems that accompanied disasters: rescuing the survivors; treating the injured; putting out fires; controlling leaks of hazardous materials; providing shelter, water, and food to the affected population; evacuating people to safer places; reestablishing communications; maintaining security and public order; and identifying and disposing of bodies.

Several of these disasters brought to light what was wrong with a response that was organized in an ad hoc fashion. For example, when the exclusive authority for disaster response was assigned to agencies responsible for internal and external security, without the full participation of the rest of the nation, a period of chaos often ensued. Overemphasis on ì law and orderî was often the antithesis of coordinated action and effective management. At the same time, the survivors were overwhelmed by the sometimes counterproductive rush of

local, national, and international agencies whose goodwill often exceeded their mandate to provide assistance.

The response phase to disaster is complex, because in addition to the number of organizations that are involved, the greatest problems lie in making decisions under uncertain circumstances. Matters become even more complicated when agencies, unsure of their roles even in normal times, undertake operations that interrupt rather than coordinate the efforts of all the groups involved.

THE EVOLUTION OF NATIONAL RESPONSE ORGANIZATIONS

The official response to disaster in Latin America and the Caribbean has steadily improved. Early on, emergency response was dominated by a country's armed forces, national Red Cross or in the case of English-speaking territories in the Caribbean, by the governor. Today's response involves civil defense or disaster response agencies, usually functioning under the Ministries of Defense or Interior. These agencies organize and coordinate the country's disaster response as well as maintain public order and national security.

Despite improvement in emergency situations, between 1970 and 1985 many civil defense systems had a tendency—understandable under military regimes—to confuse "coordination" with "command." This confusion provoked conflicts regarding their role and led to an ineffective use of health sector and other public sector resources. Governmental and nongovernmental institutions vied to play a leading role and thus gain national and international recognition.

One of the success stories in terms of a government response took place in the Huaylas Canyon disaster in Peru in 1970, during which the civil defense demonstrated their effectiveness, delegating "first responder" responsibilities to the Armed Forces in this remote and inaccessible area of the country. Medical personnel, paramedics, and drugs were on the ground four days after the earthquake, when a Hercules plane belonging to the Peruvian Air Force circled the area and dropped by parachute 50 soldiers, 4 doctors, and 7 nurses on the area—the only health personnel trained in parachuting in the country.

During the 1980s, civil defense organizations began to include disaster preparedness for the public in their activities. As they engaged in preparing plans and programs to manage disasters, they became more capable and equipped to train personnel in many sectors and expand their organization from the local to the regional levels.

Toward the mid-1980s, national-level agencies and organizations with a role in responding to disasters joined together, and with the technical support of international organizations (including PAHO/WHO, UNDRO, the Office of U.S. Foreign Disaster Assistance [OFDA/USAID], UNESCO, and others), identified priority areas in order to avoid duplication of activities. In most cases, the civil defense institutions recognized the need for the public to participate more actively and become better prepared to face disasters.

During the 1980s, civil defense organizations began to include disaster preparedness for the public in their activities.

Box 4.1

HUAYLAS CANYON: THE WAKE-UP CALL

The 1970s began for the Region with a devastating earthquake in the Huaylas Canyon in Peru. The quake, which occurred on 31 May 1970 and measured 7.5 on the Richter scale, had its epicenter on the coast near the towns of Chimbote and Huarmey. The cities of Huaraz, Caraz, and Aija in Huaylas Canyon were destroyed, and other important coastal cities such as Trujillo and Chimbote also suffered significant damage.

The ruin did not stop there. The huge quake dislodged the northern wall of the snow-capped Huascar· n mountain, triggering a mudslide that dragged along with it 80 million tons of snow, rocks, and mud as it descended upon the town of Yungay.

Survivors from the affected area worked to rescue the injured and bury the dead in the very first hours after the quake, as roads in this remote area were destroyed and assistance could not arrive from Lima and other coastal cities.

Less than two hours after the quake, the Huaraz Regional Hospital, with a normal capacity of 150 patients, had already received 670 seriously injured patients with multiple trauma injuries and serious fractures. The lack of adequate prior planning challenged the imagination and creativity of the local health authorities in dealing with a problem of this magnitude, given the scarcity of medical personnel. They elected to perform triage, a new concept for these medical professionals.

Because the city remained without electricity and the hospital's electric plant was not operating, all surgical and emergency interventions were performed by candlelight, the candles donated by nearby convents and churches. Local authorities also solved the problem of an interrupted supply of drinking water by deciding that individuals who arrived at the hospital asking about family members would only be provided information if they brought with them a bucket of water from the river, a spring, or some filtered source, to be deposited in large cylinders set up for this purpose throughout the hospital. When the hospital's stock of medicines ran out, local police appropriated all medicines found in the rubble of the destroyed pharmacies in Huaraz.

The disaster in the Huaylas Canyon of Peru was the wake-up call for the Region. Although it gave the international community a great deal to think about, it did not lead to any decisive action.

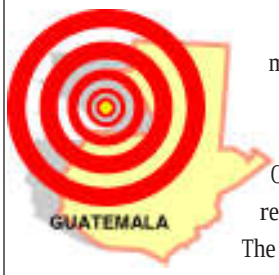
Deaths: 67,000 ◆ Injuries: 150,000 ◆ Affected: more than 3 million

PROBLEMS	SOLUTIONS	COMPLICATIONS
Rescue of survivors and recovery of bodies	Local personnel	Lack of personnel and equipment for removing debris
Treating the injured	Triage	Lack of medical personnel and paramedics
Lack of electricity	Candles	Insufficient candles
Interrupted drinking water supply	Water provided by family members	Water not potable
Lack of medicines	Appropriated from local pharmacies	Stocks were quickly exhausted
Housing for survivors	Return to the rubble and set up temporary housing	Tents not appropriate for the climate
Distribution of food	Community organization by sector and camp	Dissatisfaction in donor community because they could not deliver food aid directly
International relief missions were not self-sufficient	Depended on items meant for victims or depended on victims themselves	Depleted the donated goods and became a burden for the survivors
Relief missions were unfamiliar with language	Interpreters	Difficulty in communicating with survivors placed limitations on providing opportune and appropriate aid

Source: CRYRZA, 1971.

Box 4.2

GUATEMALA EARTHQUAKE: THE MAGNITUDE OF THE AFFECTED AREA PRESENTS A CHALLENGE



In the early pre-dawn hours of 4 February 1976, Guatemala was rocked by an earthquake measuring 7.5 on the Richter scale. Once again, needs during the first critical days following the disaster were spontaneously met by the very survivors and by the national authorities, with their own resources. Because in this situation it was easy for people from neighboring countries in Central America and Mexico to reach Guatemala during the search and rescue phase, the country received support in first aid.

The damages caused by the earthquake awakened a spontaneous national reaction, worthy of commendation, and the large amount of international relief undoubtedly served the country in its short-term recovery efforts.

The National Emergency Committee (CONE), created in 1969, worked with dedication, although the lack of preparedness on the part of many sectors and the absence of experience in intersectoral planning caused the response to be more improvised than coordinated. CONE?s contingency plans did not allow for meaningful participation of the civilian sector and were not designed for an emergency of this magnitude.

This disaster served as a second warning for the international community, but in this case, the health sector at the regional level did respond adequately.

Deaths: 23,000 ◆ Injuries: 77,000 ◆ Affected: 3.7 million

PROBLEMS	SOLUTIONS	COMPLICATIONS
Destruction of health infrastructure	Care provided in improvised hospitals	Insufficient human resources and equipment
Problems of organization in the governmental response to the disaster	Direct command by the President and the Armed Forces	Dissatisfaction among population
Excessive amounts of unsolicited international aid	Multiple points of distribution	Perishable food spoiled and clothing inappropriate for the climate was wasted
Inappropriate temporary housing (ïigloosÓ)	Survivors stayed in the ruins of their homes or used tents	ÏIgloosÓ were not used and thus wasted

Source: PAHO/WHO.

THE EVOLUTION OF INTERNATIONAL ASSISTANCE

Thanks to the rapid growth of communications technology, today news of major disasters today spreads worldwide in a matter of minutes. One cannot underestimate the effectÛfor good and for badÛthis speed has had on international response. Quick communication about disasters permits organizations to act immediately to offer relief. But this same quick communication is often incomplete and can encourage inappropriate actions based on erroneous information.

The earthquakes of Peru (1970) and Guatemala (1976) in Latin America, and Hurricane David (1979) in Dominica were the turning points in transforming the response of the countries of the RegionÛfr om improvised to better preparedÛjust as the 1970 cyclone in Ban-gladesh (in which 250,000 people died) and the earthquake in Nicaragua (1972) served to trigger similar changes

Box 4.3

HURRICANE DAVID, DOMINICA: DIFFERENT PROBLEMS IN SMALLER COUNTRIES

Photo: de Ville de Goyet, PAHO/WHO

On 29 August 1979 Hurricane David, considered one of the worst storms of this century with winds that surpassed 250 km per hour, lashed the island of Dominica in the Caribbean. As a result, 38 people died and more than 3,000 were injured, even though the regional media had alerted the population. Dominica was practically destroyed: the roads, all means of communications, the island's energy, and drinking water supply were interrupted; most dwellings were left without roofs; and agriculture and livestock were seriously affected.

Because the government's normal administrative services were critically affected, a Relief Committee was formed. The local response, although improvised, was excellent. Hurricane David sounded the first alarm bell for the countries of the Caribbean, which prior to this, had not paid a great deal of attention to the consequences of the earthquakes in neighboring Latin America. Smaller countries, and especially islands, learned from Hurricane David that they should resort first to neighboring countries for assistance. They also recognized that an inter-Caribbean mechanism for responding to disasters was necessary. The very positive result of this disaster was the creation of the Pan-Caribbean Disaster Preparedness and Prevention Project (PCDPPP).

Deaths: 38 ◆ Injuries: 3,000 ◆ Affected: 81,000

PROBLEMS	SOLUTIONS	COMPLICATIONS
Transportation routes interrupted	Assistance from neighboring islands	Economic losses
Communications and electric energy interrupted	Emergency power plants	Food spoiled and vaccines ruined
Failures in distribution of drinking water	Population instructed to boil water	Increase in gastrointestinal illnesses
Roofs blown off houses	Temporary housing and tents	Increase in respiratory illnesses
Difficulties in providing medical care	National and international health brigades	Increase in overall rate of morbidity

Source: U. Reid, 1980.

at the international level (see boxes 4.1-4.4).

The Earthquake in Nicaragua

Two years after the tragedy in Peru's Huaylas Canyon, shortly before Christmas of 1972, an earthquake shattered Nicaragua. The international community reacted with great solidarity and assistance came quickly and spontaneously, especially from neighboring countries.

However, the response was difficult for Nicaragua; the civil agencies, suffering serious losses, were late in getting organized. When they did, the response was uncoordinated. As more information on the effects of the earthquake became known, other countries began to send all types of assistance, most of which had not been requested. This inundation of supplies created serious problems in terms of classification, storage, transportation, and distribution. Most of the well-known anecdotes on inappropriate international assistance come from the experience of this earthquake: winter clothing sent to a tropical country, perishable foods unfamiliar to the local population, transport of the injured outside the country without documenting the cases, the construction of insulated "igloos" in a warm climate, to name a few.

At the same time, the emergency situation itself helped to break down barriers, and many positive examples of international solidarity occurred. An example of humanitarian concerns prevailing over political differences was the mobile hospital erected in Managua by the government of Cuba, even though the two governments did not maintain diplomatic relations.

The earthquake in Nicaragua showed the international community the problems of an inappropriate natural disaster response, but knowing the problems didn't automatically produce solutions. In 1976, when another major earthquake struck Guatemala, patterns of international assistance had changed little, and many of the same errors made in Nicaragua were repeated. Improvisation and an absence of planning for the response resulted in wasted external aid.

Regional organizations, PAHO/WHO in particular, saw that they faced a double challenge: (1) to offer technical cooperation in disaster preparedness for the countries of this Region and (2) to coordinate health assistance (within the framework established by UNDRO, mandated by a resolution adopted by the U.N. General Assembly after the cyclone in Bangladesh). As a result of the 1976 Guatemala earthquake, the Ministers of Health of PAHO's Member Countries requested that the Director create the Emergency Preparedness and Disaster Relief Coordination Program (Resolution X, Directing Council XXIV). The health sector in Latin America and the Caribbean thereby set the example of integrating public services with the civil sector in disaster preparedness at the regional level.

However, creating regional mechanisms for coordinating international response and establishing national preparedness programs alone do not guarantee reform in international assistance; international organizations have their own dynamics which are not always relevant to the needs of victims of disasters. Any large-scale disaster will show what still happens, in spite of a country's readiness, when international aid does not respond to specific needs.

The Earthquake in Mexico

In September 1985 Mexico suffered a

Any large-scale disaster will show what still happens, in spite of a country's readiness, when international aid does not respond to specific needs.

Box 4.4

EARTHQUAKE, NICARAGUA, DECEMBER 1972

Dead: 10,000 ◆ Injuries: 20,000 ◆ Affected: 400,000

PROBLEMS	SOLUTIONS	COMPLICATIONS
Destruction of health infrastructure	Care provided in improvised hospitals	Insufficient human resources and equipment
Problems of organization in the governmental response to the disaster	Direct command by the President and the Armed Forces	Dissatisfaction among the population
Deficiencies in classifying injuries	Evacuation to neighboring countries	Repatriation of the injured and flaws in record keeping
Excessive amounts of unsolicited international aid	Multiple points of distribution	Perishable food spoiled and clothing inappropriate for the climate was wasted
Reconstruction with insulated materials (iigloosî)	Survivors stayed in the ruins of their homes or used tents	This inappropriate type of housing was not used and thus wasted
Incineration of unidentified bodies		Good forensic records were not kept

EARTHQUAKE, MEXICO, SEPTEMBER 1985

Dead: 10,000 ◆ Injuries: 30,000 ◆ Affected: 60,000

PROBLEMS	SOLUTIONS	COMPLICATIONS
Destruction of health infrastructure	Transfer to other hospitals	Families had difficulty locating patients
Problems of organization in the governmental response to the disaster	Direct command by the President and the Armed Forces	Dissatisfaction among the population
Excessive amounts of unsolicited international aid	Multiple points of distribution	Duplication of donations and difficulties in delivering to needy population
Distribution of drinking water deficient	Distribution by water tank trucks and repair to broken mains	Increase in gastrointestinal illnesses
Final disposition of bodies	Maintaining cadavers in dry ice until identified	Decomposition of bodies and dissatisfaction among family members
Collapse of housing structures	Use of own resources and international aid	Insufficient human resources and machinery to remove debris

Source: PAHO/WHO.

catastrophic earthquake measuring 8.1 on the Richter scale. Hardest hit was the capital, Mexico City. There, in spite of having effective national plans in place and trained people to carry them out, international aid was disruptive and hampered rather than helped the national response.

Almost 12 years after the earthquake in Managua, and 9 years after the one in Guatemala, the Mexican government was prepared and provided an organized approach to the disaster. Immediately, hundreds of rescue and relief brigades mobilized, both official and spontaneous, and fanned out to the various points of destruction. At the institutional level, triage and emergency care teams were organized to cope with the situation. Although Mexico had a National Emergency Plan under the direction of the Armed Forces, the President of the Republic established two emergency commissions at the national and city levels.

International assistance was offered only hours after the disaster struck. Nevertheless, despite official requests for specific needs—specialized search and rescue teams for trapped victims; equipment and supplies for second and third level hospitals, particularly for operating rooms, recovery rooms, and intensive care units; refrigeration devices—more than two-thirds of the donated shipments consisted of unsolicited drugs, food, used clothing, blankets, and other low priority items. The international community realized that a strategic plan was needed to avoid these costly mistakes.

NEW IDEAS FOR ANSWERING AN OLD CALL

As a result of experiences in Latin America and the Caribbean in responding to disasters as well as in managing the associated flood of international assistance, a high-level meeting was held in 1986 in San José, Costa Rica, to set guidelines for the donor community on what constitutes effective international health relief assistance and how to provide it (see chapter 5).

Box 4.5

VENEZUELA: INTEGRATED EMERGENCY RESPONSE

Venezuela's Integrated Emergency Response System, an initiative of the country's Ministry of Health and Social Assistance, brings together a number of the country's important public services through a single emergency telephone communication system. The system is activated by dialing 171. The objective of the system is to coordinate and improve the response to emergencies of these agencies: the national telephone company, the Ministry of Health, the Fire Department of Caracas and Sucre, the metropolitan police, the municipal governments of Caracas and Sucre, and the Venezuelan Institute of Social Security.

The system was originally designed to respond to medical emergencies caused by fires, explosions, landslides, hazardous materials incidents, traffic accidents or collapsed structures in five of the nation's municipalities. Following an evaluation of the performance of the institutions involved during the first phase, a decision will be taken to expand the system to meet growing needs by including the participation of other institutions such as the Ground Transportation Authority, the National Guard and the Electric Company of Caracas.

Source: Ministry of Health, Venezuela.

Photo: Vizcarra, PAHO/WHO

Due to the widespread devastation caused by the eruption of the Nevado del Ruiz volcano in Colombia, the injured had to be airlifted to hospitals in neighboring cities.

The approach to requesting international assistance was improved notably beginning in 1988, when personnel from the Ministries of Foreign Affairs began participating in regional preparedness activities. They focused on the role of diplomatic and consular missions in both donor and recipient countries during the response phase of disasters. The improvement was seen following the 1991 earthquake in Peru. The coordinated response of Chile and Peru provided a successful example of disaster planning. Chile waited to receive an official list of needs, and when it arrived, provided assistance within 72 hours of the disaster. This operation was directed by the chanceries of both countries, using their military transport and their respective civil defense agencies (ONEMI in Chile, and the Peruvian Civil Defense). Both Ministries of Health coordinated the technical operations.

CONCLUSIONS

The response to disasters, both by the nations affected and from the international community, has gradually improved in Latin America and the Caribbean in the last 30 years (see Box 4.5). The relief phase is no longer spontaneous, disorganized, or uncoordinated; response is now based on advance plans that have been tested and validated. The active participation of governmental organizations and international agencies means that international assistance is no longer as necessary in the immediate response phase but can be better utilized in the rehabilitation and reconstruction stages. This transition, accomplished in a relatively short period of time, is a result of the institutionalization of disaster preparedness programs, initially in the Ministries of Health, and later in other governmental offices. Today, disaster preparedness programs are being carried out in the entire Region. ◆

The relief phase is no longer spontaneous, disorganized, or uncoordinated; response is based on advance plans that have been tested and validated.


freeway
O MAIS BARATO DO RIO
freeway

DISASTER PREPAREDNESS TAKES CENTER STAGE

Societies, much the same as human beings, learn through mistakes and experiences. The countries of Latin America and the Caribbean, after the natural disasters they experienced during the 1970s, were convinced that the key to coordinated response lay in evolving from improvisation to systematized disaster preparedness. This need, which became evident after such catastrophes as the earthquakes in Peru (1970), Nicaragua (1972), and Guatemala (1976), and Hurricanes David and Frederick (1979), gave impetus to an enormous number of preparedness activities in the countries of the Region during the 1980s.

THE CENTRALIZED PHASE: STRENGTHENING RELIEF AGENCIES

In the earlier days of disaster response, this field was considered the domain of professionals and experts dedicated exclusively to this task. Specialized relief agencies organized simulations, trained their own personnel, and set up warehouses for the storage of relief material such as tents, blankets, and medicines. But frequently they carried out their activities in total isolation from each other, from other sectors, and from the population at large. This isolation hindered them from developing a vision of their role in disaster preparedness. Consequently, as late as the second half of the 1970s, health and water authorities could not find a rationale for including the topic of disaster preparedness in their activities. A typical reaction was, "Disasters? That's the responsibility of the military (or the civil defense, or the Red Cross) . . . . We have nothing to do with that." The earthquake in Guatemala was one of the experiences that most dramatically underscored the gulf, in normal times and in times of emergency, between the relief assistance experts and the institutions supplying health and water services. Each needed to understand its particular role in disaster preparedness and to expand its services from central urban areas to provincial and rural ones.

Most national civil defense systems expanded their organizations by setting up local civil defense committees. However, the dictates from a central bureaucracy on which they depended reflected their principal concerns: the maintenance of public order and safety in case of emergency. Although local committees gave the pretense of community participation, in practice they preserved their hierarchic centralized mode, thus preventing the participation of the principal protagonists, the members of the community at risk.

Photo: Gaggero, PAHO/WHO

Photo facing page:

Providing relief to a disaster-stricken community can, at times, lead to chaos and cause a "second" disaster. Following flooding and landslides in Brazil in 1988, food aid is distributed.

DISASTER PREPAREDNESS

Disaster preparedness includes all activities that are carried out prior to advance notice of a catastrophe to facilitate rescue, relief, and rehabilitation and to use the available resources in the best possible fashion—first at the local level; if these are insufficient, at the national level; and finally at the international level.

Source: PAHO/WHO.

Box 5.1

MEDICAL CARE AT THE DISASTER SITEó A VITAL LINK IN HEALTH SECTOR DISASTER PREPAREDNESS

Photo: Gaggero, PAHO/WHO

Prehospital medical care plays a vital role in responding to major emergencies. Treating massive numbers of victims in a disaster requires a well-coordinated interagency approach involving health personnel, search and rescue teams, first aid workers, fire fighters, police, and security forces. Without a central coordinating body that maintains communication between rescue and relief efforts, chaos results.

Timely medical treatment at the site of a disaster requires triage and tagging techniques to categorize and classify victims. To perform this work effectively, well-coordinated personnel (pre-hospital, hospital, and medical personnel; paramedical personnel; and other health care workers) trained in the management of mass victims is needed.

While initial efforts at developing these networks of personnel have been made in certain large cities, they have not been developed in most countries of the Region, due to the scarcity of people trained in prehospital treatment. Most prehospital treatment is performed by volunteers affiliated with the Red Cross or by medical staff or assistants sent from hospitals close to the site of a disaster. Strategic efforts aimed at strengthening prehospital treatment should constitute an important element of metropolitan disaster preparedness and response plans.

Source: PAHO/WHO.

THE DECENTRALIZED PHASE: PREPAREDNESS OF PUBLIC SECTORS AND THE COMMUNITY

In addition to planning by relief agencies, disaster preparedness requires the organization and participation of a country's institutions and the training of its human resources. Emergency preparedness must not be organized solely at the central level, but also with the participation of numerous other sectors: establishments such as schools, hospitals, blood banks, and airports also need plans (see Box 5.1). The success of these efforts has varied from country to country depending, to a great extent, on the amount of authority the coordinating agency responsible for emergencies has, and the harmonious relationship between the country's civilian and military sectors.

PREPAREDNESS AS A MULTISECTORAL TASK

Those countries in Latin America and the Caribbean that have improved their disaster preparedness demonstrate two prerequisites for success: strong political support for national disaster agencies and solid coordination between sectors.

From the outset, the health sector in Latin America and the Caribbean created awareness and assumed leadership to coordinate all members of society in developing preparedness policies that met their needs. Starting in 1977, with the support of PAHO/WHO, countries in the Region initiated a process that still continues; they set up disaster preparedness units in most Ministries of Health and designated focal points in each. This experience yielded an

Photo above: Training for pre-hospital treatment is accomplished through a simulation exercise in Peru.

unprecedented technical and qualitative change in the Region. In a few years' time, the health sector's response capacity was changed so that it included other disaster preparedness organizations, governmental institutions, and national and international NGOs in its training, planning, and organizing.

The visible results of this process encouraged the countries to develop and improve their emergency plans and to exchange information and experiences. Subregional and regional meetings promoted by the health sector provided a timely forum. These meetings have led to the establishment of many important disaster preparedness policies. One of the most notable is a regional policy on international disaster assistance (see Box 5.2). This policy was further strengthened by including the Ministries of Foreign Affairs in national preparedness plans. When disaster strikes, this sector, through its diplomatic and consular offices, plays an important role by encouraging donations and providing information on the kinds of donations needed from abroad. Cooperation between the health and foreign affairs sectors has yielded common criteria for managing and coordinating international assistance, thereby reducing the potential for conflicting requests. As a final outcome, several Ministries of Foreign Affairs have

Box 5.2

LATIN AMERICA AND THE CARIBBEAN SET REGIONAL POLICY ON INTERNATIONAL HEALTH RELIEF ASSISTANCE

The balance between the need for immediate international aid on the one hand, and the appropriateness of the donations on the other, is a delicate one. In disaster after disaster, stories abound of containers of useless supplies, spoiled food, or medical supplies bearing instructions in foreign languages. All of this competes for space and the immediate attention of the country's disaster managers.

The earthquake in Mexico in September 1985 was still in the headlines when, barely two months later, the volcanic eruption of the Nevado del Ruiz took place in Colombia. After these traumatic disasters, high-level representatives of the governments of the Americas met in San José, Costa Rica, in March 1986 to make international health relief more compatible with the needs of affected communities. The recommendations made at this meeting—approved unanimously by the participants—became the formal regional policy of PAHO after ratification by the Ministers of Health of Latin America and the Caribbean at the XXXII Meeting of PAHO's Directing Council in 1987.

This policy, to which all the countries in the Region have pledged to adhere, stipulates that:

- Donors will consult with the health authorities or with the appropriate agencies of an affected country before providing assistance;
- The affected countries will assess health needs quickly and communicate the needs to donors as soon as possible;
- Inasmuch as many countries in the Region are both recipients and donors of international relief assistance, all will establish policies regarding the acceptance of unrequested or inappropriate supplies.

Source: PAHO/WHO.

Box 5.3

LEGISLATION ON DISASTER MANAGEMENT IN THE ANDEAN COUNTRIES

Legislation on disaster management in the Andean countries of South America goes back to the 1930s and 1940s, when responsibility for handling accidents, calamities, and epidemics was assigned to specialized relief organizations such as the Red Cross in Colombia, or the National Relief Board in Venezuela.

Starting in the 1960s, civil defense systems were established in Colombia (1965), Venezuela (1971), Peru (1972), Chile (1974), and Ecuador (1983). In the late 1980s new elements began to be integrated into the existing disaster management programs to regulate and coordinate the participation of the health sector with other sectors. In Colombia, for example, legislation established the National System for Disaster Prevention and Response to define the responsibilities of all public, private, and community organizations. In 1989 regulations for the National Health Committee for Emergencies (CONASE) were promulgated in Ecuador; and in 1992, the Advisory Council of the National Civil Defense System was set up in Peru.

The legislative framework for regulating disaster management is responsive to changing needs that have emerged in the countries. For example, as a result of the Nevado del Ruiz tragedy in Colombia, emergency funds were set up to provide credits to disaster victims, and grant tax exemptions for the importation of machinery and equipment. In Ecuador, the National Office for Fire Protection was organized by the Ministry of Social Welfare to guarantee enforcement of related legislation. In 1989 the Drought Emergency Program was organized in Peru to manage external funds obtained by the government through technical cooperation assistance. Another example of legislation includes the Permanent Presidential Commission, established by Venezuela in 1990 to develop contingency plans for flood control on the eastern coast of Lake Maracaibo.

Source: PAHO/WHO.

designated focal points responsible for disaster preparedness activities, thus ensuring their continuity. Chile, Colombia, Ecuador, Jamaica, and Panama, among others, have also published and distributed guidelines and procedures for their diplomatic and consular missions.

LEGAL EVOLUTION OF DISASTER PREPAREDNESS

A problem today in many Ministries and State institutions active in disaster preparedness is that they have neither legal status nor a fixed budget, although from time to time additional resources are mobilized on an ad hoc basis (see Box 5.3). The situation in the health sector illustrates this problem. Although all the countries in the Region have established a health sector disaster preparedness program, fewer than half the programs in Latin America have legal backing with specific resources earmarked for this purpose in their national budgets. The laws that do exist are often incomplete; without high-level political support, the authority delegated to the disaster preparedness unit is weakened.

Until the 1980s, laws existed to support almost exclusively the activities of the civil defense agencies. Subsequently, more comprehensive laws were adopted at the national level that extended to the public and private sectors. These laws led to the creation, for example, of the Comisión Nacional de Emergencias (National Emergency Commission–CNE) in Costa Rica, the Sistema Nacional para la Prevención y Atención a los Desastres

(National System for Disaster Prevention and Responseñ SNPAD) in Colombia, the Disaster Preparedness Offices in Barbados (CERO), and the National Emergency Management Agency (NEMA) in Trinidad and Tobago which have separate funding, and special authority during officially declared emergency situations. The Jamaica legislature recently empowered the Office of Disaster Preparedness and Emergency Mangement (ODPEM)to raise its own funds and to mobilize national resources toward preparedness.

These national trends reflect the strengthening of democratic institutions. They also ensure the participation of the public and private sectors, together with the security forces, in their respective areas of responsibility and expertise. However, laws also have their limitations, since they cannot absolutely provide for every eventuality. They may even limit the authorities' ability to respond in a flexible manner to the events, and force them to step outside the legal framework to approve actions on an ad hoc basis. For this reason, countries must strike a balance between the flexibility needed for responding to disasters and the legal basis that supports them.

COMMUNITY ORGANIZATION

In the 1980s, at the same time that the Region's nations were strengthening their institutions, local communities were becoming increasingly involved in disaster preparedness activities. Assistance, whether national or international, often arrives hours or days after the catastrophe, too late to make a difference in saving lives. The local population is in the best position to understand its own environment and culture and consequently is able to provide not only a quicker, but a more adequate response to disasters. Box 5.4 describes projects in El Salvador and Peru that communities undertook to deal with disaster situations and reduce their vulnerability. These projects also served to solve day-to-day problems of development, thereby benefiting community organization. Similar projects were undertaken in marginal neighborhoods of Santo Domingo in the Dominican Republic.

In the 1980s in Central America some 2 million people in Guatemala, El Salvador, and Nicaragua fled their homes as a result of civil strife. In 1990, Belize, Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua initiated PRODERE (Programa de Desarrollo Regional), a development program for displaced, refugee, and repatriated persons in Central America. This program, supported by the Government of Italy, involved the participation of almost all UN organizations under the coordination of UNDP and several NGOs.

PRODERE offers vulnerability analysis in the face of natural, chemical, and environmental hazards, including the prevention and management of disasters. It also demonstrates the interrelationship between rehabilitation after a disaster or in a ì complexî emergency (one brought on by civil strife), sustainable community development and preparedness for natural disasters.

Preparedness experiences in small communities in Latin America and the Caribbean demonstrate that to be motivated to prepare for disasters, people must be convinced that reducing their vulnerability contributes to the overall development of the community, since disasters only worsen the day-to-day

Photo: Gaggero, PAHO/WHO

The local population is in the best position to understand its own environment and culture and consequently is able to provide not only a quicker, but a more adequate response to disasters.

Box 5.4

STRENGTHENING COMMUNITY AWARENESS AND PARTICIPATION

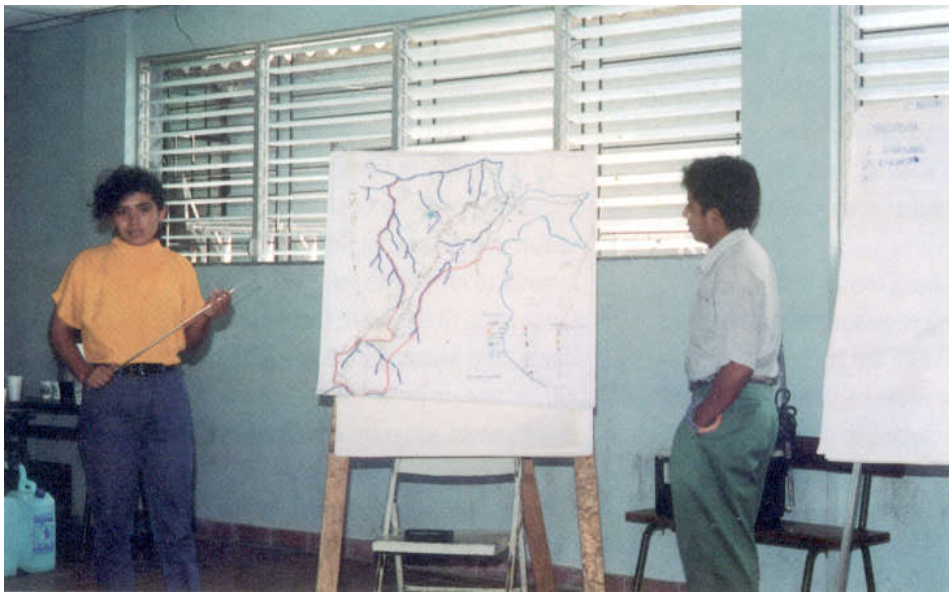


Photo: Ferrer

Neighbors identify and map potential hazards in their community in El Salvador.

Risk Maps in El Salvador and Colombia. As a consequence of the El Salvador earthquake in 1986 which destroyed poor neighborhoods in San Salvador and left thousands of people dead, injured, or homeless, several agencies, such as the Ministries of Health and Education (with the support of the Italian Cooperation and PAHO/WHO), were assigned the task of developing a community infrastructure for better organization in future disasters.

Community participation involved creating ì risk and resource mapsî to identify hazards in neighborhoods and resources available in the event of a disaster. Through this process, participants learned about natural hazards and assumed responsibility for organizing prior to a disaster, responding in an emergency, and taking part in rehabilitation and reconstruction.

This process was tested in a pilot rehabilitation and reconstruction project following the Nevado del Ruiz volcanic disaster in Colombia. The project demonstrated that the organization and implementation of local emergency plans could be strengthened when they are included in sustainable local health services.

Source: PAHO/WHO.

Community Preparedness in the Andean Highlands. In the early 1980s, the area surrounding Lake Titicaca along the border between Peru and Bolivia underwent an unprecedented drought caused by the natural phenomenon known as *El NiÒo*. The drought resulted in serious crop losses, particularly of several species of tubers that had been cultivated for centuries; consequently, thousands of rural farmers moved to nearby cities in search of food. In 1989 Peru initiated the Community Disaster Preparedness Project (PREDECO) to improve the rural economy in this area by reclaiming arable land, cultivating other land, and encouraging family participation in disaster reduction.

This project identified the greatest hazards facing the community, developed ways for detecting risks, formulated plans of action, and involved community organizations in disaster reduction and comprehensive socioeconomic development. Educational materials in both Quechua and Spanish were also produced.

Source: PREDECO.

Box 5.5

FROM INTERAGENCY PROJECT TO REGIONAL ORGANIZATION IN THE CARIBBEAN

The Pan-Caribbean Disaster Preparedness Project (PCDPP) was established in 1981 to improve national and regional disaster management in the Caribbean Basin. With headquarters in Antigua, it was launched jointly by UNDRO, CARICOM, PAHO/WHO, and the League of Red Cross Societies with the support of bilateral agencies (Canada, the United States, United Kingdom, and the European Economic Community). Although it was conceived as a short-term, 18-month project focused solely on preparedness, the PCDPP operated for almost ten years. In 1989, when the project extended its work to the prevention of disasters, its acronym was lengthened to PCDPPP to accommodate the term "prevention".

Recognizing the need to institutionalize the work begun by the PCDPPP, in 1991 the heads of Government of the Caribbean Community established a regional agency to enable countries to cope more effectively both in the threat of and in the aftermath of a disaster. The Caribbean Disaster Emergency Response Agency (CDERA) was formally established in September 1991 with its headquarters in Barbados. Its main objectives are: to provide emergency relief to any affected Participating State; to provide reliable information to governmental and non-governmental organizations regarding the effects of a disaster; to mobilize and coordinate the supply and delivery of disaster relief to an affected country; to mitigate or eliminate the immediate consequences of natural disasters; and to promote and establish sustainable disaster response capabilities among countries.

Sources: UNDRO; CDERA.

problems of poverty and underdevelopment. In small communities the lesson was learned that it is not possible to consider the link between disasters on the one hand and health on the other, without addressing comprehensive socio-economic development as a whole.

Experience also demonstrates that disaster preparedness efforts should be multisectoral since it is impossible for one sector alone to be assigned the responsibility for community preparedness.

COLLABORATION BETWEEN COUNTRIES STRENGTHENS PREPAREDNESS

At the same time that disaster preparedness activities were being decentralized at the national level, countries sharing geographical areas were meeting to strengthen their collective disaster preparedness capabilities.

The Caribbean has made particular use of this approach. In 1979 numerous disasters occurred, including volcanic eruptions in Saint Vincent and the Grenadines, floods in Jamaica and Belize, and—most devastating of all—Hurricanes David and Frederick, which ravaged Dominica and the Dominican Republic. The small size of the countries of this subregion made the impact of natural disasters all the greater. Although the 38 deaths in Dominica caused by Hurricane David may appear insignificant in overall terms, it affected the entire country, left 80% of the population homeless and destroyed the only hospital serving Dominica.

Because of the vulnerability of the Caribbean islands and the interdependence of island-countries in disaster situations, agreements were signed and a subregional organization

Photo: Gaggero, PAHO/WHO

Countries that share a common language and cultural ties are in the best position to help neighbors following disaster, particularly when help can arrive quickly.

was established to improve national and regional capacities for managing emergencies. This was the beginning of the Pan-Caribbean Disaster Preparedness and Prevention Project (PCDPPP), an external initiative that served as a precursor to a true regional approachó the Caribbean Disaster Emergency Response Agency (CDERA)(see Box 5.5).

Because of their small populations (for example, Montserrat has a population of 10,500; Antigua and Barbuda, 60,000; Saint Kitts and Nevis, 42,000), many Caribbean countries and territories had urgent, unmet needs in the wake of Hurricane Hugo in 1989, but the amounts needed were relatively modest. In most cases, relief could be supplied by neighboring countries. But situations arose where assistance destined for several stricken countries was shipped in large aircraft that were not able to land on smaller islands such as Nevis or Montserrat for lack of adequate airports. As a result, the supplies had to be distributed from another staging area.

The relatively short distances between many Caribbean islands and their cultural similarities enable them to help each other easily. Neighboring countries are in the best position to meet needs immediately after a disaster, while other regions can provide less urgently needed supplies for rehabilitation and reconstruction. The concept of ì first responderî has been a topic for discussion among many neighboring countries (see Box 5.6).

One disaster can affect several neighboring territories; thus, disaster preparedness is often a matter of concern for an entire region. Countries are

Box 5.6

THE FIRST TO RESPOND ARE NEIGHBORS

The concept of "first to respond" refers to identifying a single neighboring country that will respond and provide assistance immediately after a disaster. This concept was the subject of a meeting in 1987 attended by Caribbean health coordinators and representatives of donor countries and international agencies. Although much discussion took place at the political level, no formal agreements with budgets were signed to implement this policy of immediate assistance. At times, signs of political agreement appear, but they do not always parallel the technical priorities. Nevertheless, certain positive agreements have been reached, such as those between Saint Lucia and the French Department of Martinique. Other countries and territories—for example, the British Virgin Islands, Dominica, Guadeloupe, and the U.S. Virgin Islands—have made progress in this field.

Source: PAHO/WHO.

Box 5.7

CENTRAL AMERICAN PRESIDENTS STRENGTHEN DISASTER INSTITUTIONS

At their XIV Meeting in 1993, the Presidents of the countries of Central America adopted the following resolution: "We recognize the social and economic impact caused by the recurrence of natural disasters in the Region, and for this reason hereby agree to strengthen our national institutions to coordinate disaster prevention, management, and mitigation efforts with the support of the Centro de Coordinación para la Prevención de los Desastres Naturales en América Central (Center for Coordination for the Prevention of Natural Disasters in Central America—CEPREDENAC). We recommend the execution of a Regional Plan for Disaster Reduction in Central America."

As witnessed by this resolution, CEPREDENAC plays an important role in uniting the countries of Central America in disaster preparedness. Established in 1988, with headquarters in Guatemala, CEPREDENAC is an association of technical and scientific centers, formal emergency organizations, and universities that evaluate and monitor natural phenomena, coordinate response in case of emergency, and promote regional exchange of information. The Regional Disaster Reduction Plan includes disaster reduction as a component in regional integration, promotes the participation of various sectors, and the interdependence of planning and administration in technical and scientific organizations.

Source: CEPREDENAC; SICA.

looking at intercountry collaboration, including joint planning and the shared use of human, material, and technological resources in developing national and intercountry policies for disaster preparedness and response.

In South America, several general technical and economic cooperation agreements have been drawn up between countries and subregions that share a common vulnerability, such as Peru and Chile, and Ecuador and Colombia. Formalizing a border agreement can be hindered more by requirements about customs procedures than by real questions about foreign affairs or civil defense. The number of agencies or institutions involved is great; the ability to meet and reach consensus takes patience. These considerations often do not coincide with the control mechanisms employed by the governments which

Box 5.8

NEIGHBORS AT RISK

Chile and Peru, located in what is known as the "ring of fire" along the Pacific Rim, are highly vulnerable to earthquakes. Both countries face the challenge of preparing communities along their shared border to deal with what could be a common disaster, until help arrives from their respective capitals. The border cities of Tacna (Peru) and Arica (Chile) had disaster plans, but neither country's central emergency organization coordinated their development. Finally, a border cooperation agreement was signed in 1993. This agreement will allow joint training of health personnel, the establishment of warehouses for disaster equipment, a relief coordination center in border areas, and the adoption of common measures to reduce the vulnerability of the localities involved. This agreement is an example of the decentralization of disaster management in each country.

Colombia and Ecuador share volcanic, seismic, tsunami, and hydrometeorologic risks. The Imbabura, Mojanda, and Cachimbiro volcanoes in Ecuador; the Cumbal, Azufral, and Galeras in Colombia; and the Cerro Negro volcano on the border can cause damage to both countries if they erupt. In April 1990, the Ministries of Foreign Affairs of both countries signed an agreement to coordinate activities and to carry out joint studies in border areas to identify natural hazards. In case of disaster, they will make available to each other their monitoring, communication, and warning networks, emergency management equipment, and basic health infrastructure.

Source: PAHO/WHO.

customarily discourage direct and informal contacts between officials of cooperating countries. The outcome is that too often collaboration between countries remains at a solely technical and informal level without the backing of a formal cooperation agreement—although such an agreement is not a guarantee that action will occur either (see Boxes 5.7 and 5.8).

TRAINING: A KEY TO PREPAREDNESS

People—administrators, physicians, engineers, logisticians, and other experts—manage disasters. Without well-trained professionals, the laws, emergency plans, and other efforts will be insufficient. Since the end of the 1970s, an entire educational discipline has been developed at the regional level and directed toward disaster management. One of the strengths of Latin America and the Caribbean is the Region's shared technical and managerial approach to disasters (see Box 5.9), which is the result of a variety of professionals being exposed to a closely coordinated regional training program, developed in the health sector by PAHO/WHO and in other sectors by OFDA/USAID and others.

Programs were adapted to different situations and expanded and enriched by including a country's own individual disaster experience in them. Since the beginning of the 1980s, the number of training courses, workshops, and seminars in Latin America and the Caribbean has dramatically increased. Simply maintaining a list of the most important ones has become a challenge, as more and more countries and institutions disseminate their knowledge to new groups. The Ministries of Foreign Affairs, for example, now carry out intercountry exchanges of professors for their regular courses. This dynamism in training is demonstrated by the fact that

Box 5.9

STUDENTS OF DISASTER MANAGEMENT

Training of Trainers

The Office of U.S. Foreign Disaster Assistance of the U.S. Agency for International Development (OFDA/USAID) launched in May 1988 a training program in which three types of courses were developed using interactive training methodologies: "Course for Instructors," "Disaster Management," and, more recently, "Evaluation of Damages and Analysis of Needs." More than 3,200 people in Latin America and the Caribbean have been trained in 139 courses: 104 courses at the national level and 35 at the regional or subregional level.

National level activities are carried out with funds allocated by each country, an indication of the country's interest and commitment. OFDA/USAID continues to finance activities at the regional and subregional levels. After six years, the program has developed a cadre of well-trained instructors and sound learning methodologies in the Region, as well as a network of managers for disaster situations.

Reaching Future Generations of Disaster Preparedness Professionals

The World Health Organization has established a multi-institution network of collaborating centers worldwide to support the Organization's technical cooperation activities. In 1988, the Faculty of Public Health of the University of Antioquia (Colombia) was designated as a WHO Collaborating Center in Emergency Preparedness to promote the teaching of emergency preparedness and disaster management activities at the undergraduate and graduate levels in universities in Latin America and the Caribbean.

This recognized academic institution carries out training, research, and information dissemination within the framework of PAHO/WHO planned activities.

United Nations Staff as Students of Disaster Management

Staff members of the United Nations along with officials from key national agencies are learning to provide organized and coordinated responses when they or their agencies are called on in emergencies and when humanitarian assistance is required. The Disaster Management Training Program (DMTP) originated as a joint initiative between the United Nations Development Program (UNDP) and the UN Department of Humanitarian Affairs (DHA—formerly UNDRO) and was launched in 1990 to fulfill the goals of the IDNDR. The Disaster Management Center of the University of Wisconsin (U.S.A.) developed training materials for the program.

United Nations Offices and national institutions in 60 countries worldwide that are highly vulnerable to natural disasters are the venue for the courses. The program collaborates with regional and national agencies with experience in disaster management; in the Region of the Americas, PAHO/WHO and the OAS have worked together to develop courses both in individual countries, and at subregional levels for the Caribbean and South America. Training has taken place in Barbados, Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Peru.

The DMTP seeks to create awareness of the negative impact that disasters have on countries' efforts to achieve socioeconomic development. It also promotes the development of case studies, research protocols, and projects for presentation to the UNDP for possible financing.

Source: OFDA/USAID; PAHO/WHO.

Box 5.10

GETTING INFORMATION TO THE USERS: THE DISASTER DOCUMENTATION CENTER

In 1990 PAHO/WHO established a Disaster Documentation Center in San José, Costa Rica, with support of that country's National Emergency Commission (CNE). The Center was created to remedy a perceived shortage of scientific and technical documents and training material on disasters, particularly in Spanish, that was of particular relevance to the Region. One of the greatest challenges was finding what already existed, as it was (and still may be) common to find desks and offices flooded with valuable material which, in many cases, would be filed away and forgotten.

Today, professionals and students in Latin America and the Caribbean are tackling issues of disaster management from different perspectives. They not only need the most up-to-date information, they are also producing new studies that their counterparts in other countries should know about.

One of the Center's unique features is the importance given to distributing information, ensuring that users ultimately get what they need most: actual hard copies of the documents. To do this, they have used a combination of traditional procedures combined with new technologies available in the field of automated information. To catalogue the Center's collection, a database was created using MICROISIS, a U.N. standard software developed by UNESCO. In mid-1994, the database contained almost 5,000 records, and grows at the rate of approximately 1,500 documents per year. This disaster database is available in print form through DESINDEX, a chronological listing of the Center's holdings; BIBLIODES, a bibliographic index by subject; and on PAHO's CD-ROM LILACS, which is distributed in Latin America and the Caribbean through BIREME, the Latin American and Caribbean Center on Health Sciences Information.

Disaster reduction is not only a health sector issue. It requires a multisector focus that covers topics from geology to economy; from the design of seismic-resistant housing and public works to the design of a disaster curriculum for faculties of civil engineering. Demands for non-health disaster reduction material are received by the Center and cannot be met at this time. To expand the scope of the Disaster Documentation Center to meet requests from users outside the health sector requires that the many institutions that research, legislate, and provide disaster assistance collect information from as many sources and disciplines as possible to integrate the various scientific fields, professions, and approaches that focus on preventing and mitigating disasters.

Source: PAHO/WHO.

in the health sector alone, PAHO/WHO is able to maintain only a list of the events to which it offers its technical or material support.

In recent years, training has been extended to the universities in the Region, both public and private. In many institutions it has been possible to introduce disaster preparedness into the curriculum of public health, medicine, and nursing. Similar activities have been initiated in faculties of mass communication, education, and, more recently, engineering and architecture. A study carried out in 1991 by the WHO Collaborating Center in Medellín, Colombia, shows that approximately 80% of the faculties of public health in South America included the subject of health management as it relates to disasters in their curricula. Approximately 20% of the public health schools in the Caribbean have intensive short courses on health aspects of disasters in addition to the two-month course on disaster medicine taught in Barbados.

Having disaster management become a part of school curricula produces a common language among professionals. The technical and scientific development

of the countries is generating a vast volume of information regarding disasters that should be made available and shared. The importance of a common terminology and common language should not be underestimated (see Box 5.10).

Communication and information sharing are essential for disaster management. In this area, Latin America and the Caribbean have achieved great success, even during such difficult circumstances as the civil conflicts in Central America and border disputes in South America. The success of this region in disaster management may be credited to the periodic meetings that are organized subregionally to provide professionals with opportunities to examine and share accomplishments and identify solutions to common problems. These meetings, designed originally for those in charge of disaster programs in the Ministries of Health, now include the participation of other sectors such as civil defense, foreign affairs, and the Red Cross.

More recently, the initiative of the United Nations system to develop a disaster management training program (DMTP) at the global level has increased the collaboration of UN agencies with national institutions.

THE CURRENT SITUATION: FROM PREPAREDNESS TO PREVENTION AND MITIGATION

The era of preparedness led to new thinking about disaster organization; countries began establishing national coordination bodies that adopted comprehensive approaches. Today, these civilian, scientific, and multidisciplinary bodies have received the mandate to guide, standardize, and coordinate policies for disaster prevention, mitigation, and preparedness. They leave the response mechanisms to the institutions that already exist for this purpose, such as the armed forces, the Red Cross, and fire departments.

The concept of civil defense is also adopting a more comprehensive approach to disaster reduction. Institutions such as Mexico's SINAPROC (Sistema Nacional de ProtecciÛn Civil), established after the 1985 earthquake, and the institution of the same name in Panama, demonstrate civil protection systems that have replaced civil defense offices. These institutions not only respond to disasters but formulate policies for communities and their institutions at all levels. They encourage communities to protect themselves against natural and manmade hazards by learning about and organizing in the areas of disaster prevention, mitigation, and preparedness.

SPECIALIZED PREPAREDNESS INITIATIVES

The ongoing development of preparedness activities has led to specialized projects in which technology, local participation, self-management, and a multisector approach have been used to meet diverse needs. These initiatives have been developed in the following areas:

- Schools
- Mass media
- Early warning systems
- Water supply and sanitation services
- Management of relief supplies (SUMA)
- Hospital preparedness

Photo: Waak, PAHO/WHO

School-based disaster training programs do not require large initial investments of time and money, since they are developed and integrated into the school curriculum.

Box 5.11

" STOP DISASTERS! FOCUS ON SCHOOLS AND HOSPITALS "

To promote the IDNDR, the United Nations has declared the second Wednesday of each October as the International Day for Natural Disaster Reduction. The slogan for the 1993 celebration, ÏStop Disasters! Focus on Schools and Hospitals,Ó increased awareness of how essential these facilities are in the day-to-day operation of communities and how critical they are in the event of natural disasters. This celebration advanced the placement of the study of natural disasters permanently in school curricula and the inclusion of disaster issues in the educational policies of the countries. It promoted the role that teachers, students, hospital personnel, national planners, and engineering, architecture and building professionals play as leaders in organizing and executing disaster plans in their communities.

Source: IDNDR.

Box 5.12

COVERING WHAT IS IMPORTANT: DISASTERS AND THE PRESS

Photo: Vizcarra, PAHO/WHO

A study of eight newspapers carried out by the University of Costa Rica revealed that 56% of the coverage of the earthquake in C¤bano, Puntarenas, was sensationalistic and alarmist in natureÛdescribing damaged areas, injuries suffered by the victims, the number of casualties and deaths, and the losses suffered in infrastructure and productive activities.

The study shows that although citizens have a right to this kind of information, emphasizing the sensational to sell newspapers excludes proper explanations, analysis, and education in general from the public. As a result, the public has limited knowledge and consequently is more fearful.

Following a disaster, explanations about the natural hazard appears infrequentlyÛ31% of the total space dedicated to disasters in daily newspapersÛand usually these articles focus on the environment and the community. The weekly papers do a better job of providing explanations, devoting 57% of their space to articles; however, information about disaster mitigation and prevention is insufficient.

Generally speaking, the press devotes a minimum of space to earthquake mitigation and prevention measures. According to the study, although some advice on prevention is published, it only appears once in each daily newspaper in the days immediately following the event. The importance of prevention is, however, dealt with in editorials, which encourage the authorities and professionals to take decisive measures to promote preparedness and prevention. Part of the problem has been that the sensational material is easily available to journalists while sources for non-sensational explanations are harder to locate.

Source: M. Bermudez, 1991.

Schools

Children are among the most vulnerable to disasters. For many years, governments, national institutions, and international organizations have recognized the advantages of teaching the school-age population disaster preparedness. While the principal aim of this training is to teach young people to keep themselves safe in case of disaster, children are also a valuable resource for expanding a disaster preparedness "culture". Although Latin American and Caribbean schools have not yet achieved Japan's level of preparedness, the school programs launched in the 1980s have had positive results in countries such as Chile, Colombia, Costa Rica, and Venezuela.

These countries have been able to implement their programs for several reasons. Their national institutions have demonstrated a political will to do so. Most importantly, they have succeeded because they have the support of educators in the country, the real decision-makers. One of the great advantages of school-based disaster training programs is that they do not require large initial investments of time and money, since they are developed and integrated into the school curriculum.

UNESCO supports emergency evacuation and preparedness programs in several countries in collaboration with the Ministries of Education and emergency organizations. National NGOs (such as FUNDAPRIS in Venezuela) and international NGOs (such as Partners of the Americas in Ecuador and Central America) help the Ministries of Education develop disaster preparedness programs in many schools.

Using school educational programs as instruments of change will reach a new generation sooner: the next generation of leaders, scientists, health workers and teachers will be better prepared to handle future disasters (see Box 5.11).

Mass Media

To a great extent the mass media determine the way people react to disasters: the community depends on the media for the information they need to make decisions during disasters. Therefore, many countries in the Region have initiated training campaigns for journalists on the importance of their role in preparing the community for disasters (see Box 5.12). Although Costa Rica, Honduras, and Colombia, among others, have had fruitful experiences in preparing seminars and workshops, experiences with the press and international television channels have been less successful. A more sustained, ambitious effort on the part of the entire Region, ideally supported by UN agencies, is needed to see that well-prepared information is distributed and used effectively by the media. This would also be an excellent theme for a future International Natural Disaster Reduction Day.

Early Warning Systems

Latin America and the Caribbean have made notable advances in the development of monitoring and early warning systems, both for geological and hydro-meteorological phenomena (see Box 5.13). However, developing early warning systems serves little purpose unless there is a way to communicate the warning to the population.

Weather forecasting has improved from a technical standpoint and provides some certainty of locations where tropical storms will strike, for example. But

"People did not believe that the volcano would erupt . . . They thought that the warnings were something invented by alarmists . . ."

(*Nosotros la Gente del Volcán*, 1988).

Photo: Cardona, DNPAD (Colombia)

The Galeras volcano in Colombia is one of seven volcanoes identified by the IDNDR as ìhigh risk.î While conducting research on the volcano in January 1993, six scientists were killed by an unexpected eruption.

accurate forecasting does not mean that enough time will be available to evacuate a threatened population. Ordering an evacuation when forecasting is imprecise may cause political problems and lead to a lack of credibility in the agency issuing the order.

In 1985, when the Nevado del Ruiz volcano in Colombia caused the death of almost 23,000 people, scientists had foreseen what might occur. The observatory in Manizales was on alert, and the map of potential volcanic threat had been designed and updated, indicating the places that would be affected in case of an eruption. The national authorities were aware of the problem, but when the local authorities in the areas likely to be affected received the warning, they didn't take it seriously. ìPeople did not believe that the volcano would erupt because it was an unknown and unpredictable phenomenon. They thought that the warnings were something invented by alarmists who wanted to create panic among the population.î (*Nosotros la Gente del Volc· n*, 1988).

As a result of this tragedy, Colombia developed warning and notification systems at the local and municipal levels in coordination with the scientific institutes at the national level.

The principal aim in obtaining information from early warning systems is to save lives (see Box 5.13). Now, when the hurricane season begins each year in

the Caribbean, mass information campaigns on how to be prepared for hurricanes and how to respond to warnings also begin. This scientific knowledge reinforces a well-known Caribbean refrain:

"June's too soon,
July . . . stand by,
August . . . a must!
September . . . remember,
October... all over".

. . . Or is it? Several hurricanes have occurred in the month of October.

The UN's World Meteorological Organization (WMO) has provided assistance to many countries in the Region through technical cooperation to improve their meteorological services or flood control systems. A project is ongoing to rehabilitate and improve service related to meteorology and hydrology in Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama (Proyecto para la Rehabilitación y Mejoramiento de los Servicios Meterológicos e Hidrológicos del Istmo Centroamericano—PRIMSCEN), with the support of Finland, WMO, and the Regional Committee on Water Resouces.

Several projects on flood control have been carried out in Jamaica, including mapping of flood-prone areas, improvement of control practices, and development of a flood forecast and warning system. In addition, the Dominican Republic has begun a project on management of reservoirs and flood control in the Yaque del Sur river basin. In Brazil, projects are under way for monitoring the Tocantins River in the Amazon basin, and in the State of Rio de Janeiro a forecasting and warning system is being set up for flood control as part of an integrated system to manage water resources and a program for the recovery of rivers and watersheds (see Box 5.14).

Seismic monitoring networks and systems have been developed at the national and regional levels, mainly in association with universities or vulcanologic and seismologic observatories. At the national level, the Centro Peruano-Japonés de Investigaciones Sísmicas y Mitigación de Desastres (Center for Seimic Research and Disaster Mitigation—CISMID) in Peru and the Centro Nacional de Prevención de Desastres (National Center for Disaster Prevention—CENAPRED) in Mexico have, with the support of Japan, installed seismograph and accelerograph networks. Other regional organizations that have improved monitoring systems are the Centro Regional de Sismología para América del Sur (Regional Center of Seismology for South America—CERESIS), CEPREDENAC, and the Seismic Research Unit (SRU) of the University of the West Indies in Trinidad. The Caribbean Meteorological Organization (CMO) is comprised of 16 English-speaking Caribbean governments and has responsibilities for issuing warnings to members who do not have forecasting capabilities, since it has been agreed that it is not necessary for every Member State to develop such a capability.

Water Supply and Sanitation Systems

Although the attention of the public and the mass media is focused almost exclusively on the deaths and injuries caused by natural hazards, these problems are short lived. The effects of disasters on the water supply, however,

Box 5.13

THE SUCCESS OF EARLY WARNING IN CUBA

The early warning system used in Cuba is an excellent example of employing appropriate technology developed at the community level. Hurricanes and tropical storms that recently affected the island caused severe infrastructure damage and economic loss, but cost surprisingly few lives. An efficient system of monitoring flood levels and forecasting hurricanes, together with a strict policy on timely evacuation from potential risk areas, deserves credit for the few deaths that occurred. However, two unexpected effects ensued from the low number of fatalities: first, there was scant coverage in the mass media about the disaster, and second, little support was offered from donor communities.

Source: PAHO/WHO.

Box 5.14

MONITORING FLOOD CONDITIONS IN COSTA RICA

Photo: PAHO/Waak

The watershed along the Atlantic coast of Coast Rica is an area repeatedly affected by major floods. The zone receives an average of 4,000 mm of rainfall annually. The seasonal vulnerability to flooding was exacerbated following the 1991 earthquake of LimÛn, Costa Rica, when vegetation cover was lost and enormous amounts of sediment accumulated in river basins increasing flood levels. Landslides brought on by the earthquake along the river basins, and standing water in low-lying areas were considered risk factors for serious flood conditions during future rainy seasons.

To address these risks, a plan to monitor hydrometeorological and geological events in the Atlantic region was implemented. Nineteen monitoring posts were located strategically in the river basins and outfitted with communication equipment and gauges to measure rainfall and river level. Indigenous settlements comprise the majority of communities in this area, and the operation and management of the monitoring system is executed principally by community members. This factor helps to ensure that early warnings of serious flood conditions are made known to the local population.

The main objective of this monitoring plan, which is to reduce the risk of death by floods and landslides, has been met. Since its implementation in 1991, flooding in this region has been the most serious experienced in over 70 years. Despite this fact, only three people have died as a result of flooding in this period.

The Plan has received technical and financial support from regional and international organizations such as CEPREDENAC and UNICEF, and is coordinated by the Hydrometeorological Section of the Costa Rican National Emergency Commission.

Source: CNE (Costa Rica).

affect more lives and don't disappear in a few days' time. After the 1985 earthquake in Mexico City, some 2 million people, one fifth of the capital's population, did not have access to water. At that time the city had the largest and most complex water system in the world, and normal service was restored to the population only after 40 days of round-the-clock work.

In the mid-1980s, the countries of Latin America and the Caribbean adopted preparedness for the water and sanitation authorities as a priority. People were trained in modern administrative techniques, especially in planning methods and risk management, with the support of the Pan American Center for Sanitary Engineering and Environmental Sciences (CEPIS), based in Peru, and using technical material developed with the assistance of PAHO/WHO.

In Peru, water authorities are experimenting with new methods for implementing emergency plans. The results obtained by Lima's SEDAPAL company have been disseminated widely in other countries in the Region. Contingency plans and other similar activities have been implemented in Argentina, Chile, and Ecuador. Mexico has placed particular emphasis on this priority, carrying out disaster preparedness activities in the water companies of four large cities: Monterrey, Tijuana, Guadalajara, and Mexico City. This subject area is now included in the curricula of the schools of sanitary, environmental, and civil engineering in universities in Brazil, Colombia, Ecuador, Mexico, Peru, and Venezuela. The subject has become important in regional organizations, such as the Inter-American Association of Sanitary Engineering (AIDIS), which is playing a leading role in training and preparedness in this sector.

Management of Relief Supplies (SUMA)

To put order to chaos, SUMA—the Supply Management Project—was designed by PAHO/WHO with the support of the Government of the Netherlands to assist in solving the vast and complex problem of management of relief supplies. Immediately following a major natural disaster, large donations of pharmaceutical products, medical and relief supplies arrive from other areas of the affected country or from abroad. Most donations have not been requested, and their usefulness, in terms of immediate needs, is questionable. Overwhelming logistics problems may prevent the affected country from sorting through and classifying these items, which quickly fill warehouses. Knowing the exact contents of shipments makes it possible for the country and the international community to better manage post-disaster relief supplies. The principal objectives of SUMA are to develop and maintain a national and regional capacity to manage the donated supplies and equipment; to facilitate the distribution of key supplies, marking them clearly upon their arrival; and to collaborate with neighboring countries to form trained teams to help at disaster sites. For this purpose more than 400 people have been trained in Central America, the Andean countries, and the Caribbean.

The importance of SUMA does not rest on its high technology (network of portable computers, telecommunications, and other inputs) but rather on its emphasis to develop a national capacity with the support of neighboring

Knowing the exact contents of shipments makes it possible for the country and the international community to better manage post-disaster relief supplies.


ARIEL
ARIEL

Photo facing page:

International assistance can be a mixed blessing. The overabundance of donated medical supplies kept Mexican health personnel from attending to other more pressing tasks.

Photo: Vizcarra, PAHO/WHO

countries. This is a critical concept at a time when the international community—in this case the Western countries—has a tendency to export its own experts and technology to solve problems—real or perceived—created by disasters.

Hospital Preparedness

Despite the loss of more than 20,000 beds as a result of disasters in the last 20 years, the use of field hospitals and medical teams from developed countries has never been justified. There are more than 13,000 hospitals in the Region, and in many countries there are sufficient national or local resources to respond to any demand caused by disasters. The key to this self-sufficiency has been the training of hospital personnel. In the 1980s the health sector and PAHO/WHO promoted hospital preparedness for disasters on a large scale. Hospital emergency plans were elaborated and put into practice throughout the Americas, health aspects of disasters became part of the continuing education for health professionals, and multisector emergency simulations in hospitals were carried out.

With the initiation of the IDNDR, most hospitals in the largest cities in the Americas have emergency plans for external and internal disasters, organize services in emergency situations, and set up criteria and guidelines for evacuating health facilities. However, health sector workers are also aware of the vulnerability of the old buildings they work in, and how little has been done to reduce this risk.

THE MORAL OF PREPAREDNESS

Maintaining a state of disaster preparedness year after year can be a challenge, especially in countries that experience long periods of relative "calm" between emergencies. The progress made by Latin America and the Caribbean has been spectacular, and achieved in a relatively short period of time. This is due to the government agencies that coordinated and led the work, and the existence of previously prepared, tested, and eval-uated plans.

Still, one must not fall into the trap of believing that a country or community is prepared simply because a disaster plan or law exists. In many cases, these plans are simply "paper exercises" that have never been tested or practiced. To make a true contribution to preparedness, these plans must represent a consensus of all the participants involved. Preparedness depends on people and on the institutions they organize.

Although disaster response is more effective when it is local or regional, the most effective preparedness, especially in the Caribbean and in Central America is achieved through collective or intercountry efforts. And the most effective assistance is the support for national preparedness initiatives.

Disaster preparedness alone is not enough to meet the countries' needs and expectations for reducing the effects of disasters. Disaster management, or what has been termed disaster reduction, must become a priority area, and disaster mitigation and prevention are keys to reaching that goal.

Disaster reduction must become a priority area, and disaster mitigation and prevention are keys to reaching that goal.

ONE STEP AHEAD OF DISASTERS: MITIGATION AND PREVENTION

DISASTER MITIGATION

Mitigation measures can bring the physical, social, and economic effects of disaster down to manageable levels thereby contributing to long-term development. Although measures to mitigate the effects of natural disasters may seem costly, they represent only a small fraction of the total cost if built into the initial design.

On the morning of 19 September 1985, Mexico City was struck by what was considered its most destructive earthquake of the century; strong aftershocks followed. Looking at photographs and other documents of the earthquake's effects on buildings and vital public services, people asked themselves: How could modern buildings, designed in accordance with a strict code, collapse and kill so many people? (see Table 6.1). Three answers were found: first, the characteristics of the soil in the city, especially downtown, allowed for an amplification of seismic waves; second, there was an underestimation of the design parameters for torsion in asymmetrical buildings; and third, there were probable flaws in construction practices.

From the perspective of science, the riddle was solved, but for the health sector, the event was a tragedy that meant attending to the survivors, recovering bodies, and monitoring the city's water supply. The spectacular collapse of the Juárez Hospital made headlines all over the world and took the lives of patients, visitors, and health workers, even though it was a relatively modern building and, even more serious, had an emergency plan.

The destruction of this hospital, combined with the collapse of the Obstetrics Tower of the General Hospital and the severe damage to other hospitals, put at least 5,000 hospital beds out of service when they were most needed. The use of these beds was not restored for two years. The destruction prompted another question: Are emergency plans for hospitals and essential services enough if there is no guarantee of how the structures that house these services will perform?

The response, a logical one after the tragedy occurred, set the stage in Mexico for a process in which most Latin American and Caribbean countries are cur-rently engaged: disaster mitigation. At the end of the 1980s the concepts of prevention and mitigation began to consolidate as a basic element of disaster management.

To mitigate natural disasters means to act before a disaster occurs to minimize the human and material losses it causes. Mitigation would not be of such concern today if the colonizers of Latin America and the Caribbean had been familiar with the region and built their towns in the least dangerous rather than in the most attractive and advantageous sites. Some time later they discovered, at a high price

Photo: de Ville de Goyet, PAHO/WHO

in terms of human lives and ruined infrastructure, that many of these areas and buildings were prone to destruction by frequent volcanic eruptions, earthquakes, floods or hurricanes. The city of Antigua in Guatemala, which has been struck several times by earthquakes since colonial times is an example of this lack of foresight due to ignorance. In the aftermath, the authorities resorted to safety regulations—limiting the height of buildings, planning land use, and designing broader plazas and streets—to lessen damage from subsequent events. Without so stating, they sought to mitigate the effects of disasters.

Population growth has led to the proliferation of human settlements in areas that are prone to natural hazards. In this context, programs aimed at disaster mitigation are becoming a fundamental element in development planning. In view of this irreversible trend, the UN declared the 1990s as the International Decade for Natural Disaster Reduction (see Box 6.1).

Two questions are in order: 1) Are mitigation and prevention valid in a cost-benefit analysis of the investment 2) Can countries afford to lose human lives and multimillion dollar investments in infrastructure and services in the event of disasters because they failed to invest in mitigation measures during the planning, design, and execution of the projects?

No reliable studies have been done that justify, in cost-benefit terms, more investment in disaster mitigation or prevention. Organizations such as the Economic Commission for Latin America and the Caribbean (ECLAC), the World Bank, the Inter-American Development Bank (IDB), and other institutions, as well as some insurance companies, are developing such studies, but no definitive results are yet available. One of the strategies of the International Decade for Natural Disaster Reduction is precisely to involve such institutions in demonstrating the medium- and long-term economic profitability of investments in disaster mitigation and prevention as part of each country's planning and sustainable development.

The effects of disasters, in terms of social and economic losses, should alert governments and agencies to the need for mitigating disaster impact instead of simply preparing to react. However, nationwide mitigation programs, in the form of medium- and long-term projects, do not yield visible results for political leaders. The same reasoning applies to financial analysis: investing in disaster mitigation where the probability of a significant natural event seems remote is not considered profitable. Mitigation measures are even overlooked in the design of infrastructure, since they are considered to make the initial investment

Table 6.1

Number and type of damaged buildings, Mexico City, 1985.

Category	No.	%
Public offices	765	11.5
Schools	1,657	24.9
Hospitals and health centers	892	13.3
Cinemas and theaters	76	1.1
Private buildings	1,133	17.1
Sports centers	11	0.2
Pedestrian overpasses	1	—
Markets	1,785	26.9
Roads	310	4.7
TOTAL	6,630	100.0

Source: Metropolitan Emergency Commission, Mexico.

DISASTER PREVENTION

Disaster prevention includes activities designed to provide permanent protection from disasters by controlling the effects of natural phenomena. Depending on technical feasibility and cost/benefit considerations , investing in preventive measures is justified in areas frequently affected by disasters.

Box 6.1

GOALS OF THE IDNDR

The main goal of the International Decade for Natural Disaster Reduction is that by the year 2000 all countries should include the following three items in their plans for sustainable development:

- National evaluations of vulnerability and of the risks posed by natural hazards;
- Medium and long-term mitigation and prevention plans, at the national and local level, including preparedness and community awareness campaigns;
- Access to world-wide, regional, national, and local warning systems, in addition to the widespread broadcasting of warnings.

Advances have been made in Latin America and the Caribbean toward attaining these goals; many began before the proclamation of the Decade. However, the Decade is a starting point for developing new concepts and organizations dedicated to disaster management. It also provides an opportunity for horizontal cooperation between neighboring countries and the exchange of positive experiences.

At the regional level, the Regional Office of the IDNDR Secretariat, PAHO/WHO, the OAS, and La RED, among others, have been the principal agencies in charge of promoting the goals of the IDNDR.

Source: IDNDR Regional Office.

Box 6.2

DISASTER MITIGATION IN HOSPITALS: AN IDNDR DEMONSTRATION PROJECT

Photo: Vizcarra, PAHO/WHO

A hospital is an essential building. Not only does it represent a major investment because of the sophisticated equipment it houses, but its role in the community is very important, especially during emergencies. At critical times, such as after a natural disaster, the demand for its services is most important.

However, an estimated 50% of the 13,000 hospitals in Latin America and the Caribbean are located in areas at risk due to natural hazards, and more than half of them lack disaster preparedness or mitigation plans.

Early on in the Decade, PAHO/WHO began a project aimed at engineers, architects, and persons in charge of hospital maintenance, as well as political and administrative decision makers to show the need for investing in the protection, maintenance, and reinforcement of existing buildings. This is in addition to creating awareness of the responsibility to design and construct new buildings with specific safety criteria that take into account the effects of natural disasters. As a part of the initiative, PAHO developed guidelines and pilot projects and has supported vulnerability analyses in hospitals in Chile, Saint Lucia, and Venezuela.

This initiative has been welcomed by several countries, many of which are implementing corrective measures. As always, the main obstacle to the success of these projects will be budgetary limitations.

Source: PAHO/WHO.

Box 6.3

INSURANCE POLICIES IN THE CARIBBEAN... UNFORESEEN MITIGATION

As a result of the damage to the Caribbean islands caused by Hurricanes Hugo, Gilbert, and especially in 1992 by Andrew, which also lashed the coast of the United States, reinsurance companies were not willing to continue covering such heavy and frequent economic losses. The possibility of eliminating reinsurance for natural events was even discussed. Local insurance companies then decided to double and even triple premiums, whereupon insurance became unaffordable for the private sector. Rates usually depend on the proximity of a building to the coastline and the quality of construction materials used.

Some businesses decided to forego the peace of mind afforded by insurance policies and to conduct cost-benefit studies of probable losses versus the cost of reinforcing or upgrading buildings. Not surprisingly, these studies demonstrated that it is more profitable to reinforce buildings and systems, even if it requires major investment, than to pay for the repair of frequent damage. In other words, it is more economical to mitigate the effects of hurricanes than to cope with the losses.

There is little incentive—in the form of preferential premiums—for those who take measures to prevent wind damage to their property. After disasters, premiums are increased indiscriminately for all buildings, regardless of their degree of vulnerability.

Source: OAS; PAHO.

unnecessarily more expensive. Changing these patterns of thinking and behavior takes time (see Box 6.2).

Some measures, such as reinforcing existing structures, seem too expensive for the limited budgets of many countries. Others, such as land-use regulations in at-risk areas, depend not only on legal backing but also on the ability to monitor enforcement. For these reasons some financial institutions and cooperation agencies are reluctant to provide funds for disaster mitigation programs. They prefer to support the relief and rehabilitation phases because of their greater visibility.

In some countries that have achieved progress in disaster mitigation, insurance agencies are becoming indirect promoters of improved construction designs or of retrofitting existing buildings. Economic incentives, in the form of preferential premiums, may be given for buildings that are well-protected and that comply with safety regulations (see Box 6.3).

Many mitigation projects have been completed in the countries of Latin America and the Caribbean, frequently with the financial and technical support of international agencies and institutions. These projects are in three basic areas: studying risks, reducing vulnerability, and training. For mitigation projects to work, an organized national system for disaster management must exist to support and lend continuity to a project. Ideally, a system with multidisciplinary and multisectoral representation and with legal and political backing is best suited to mitigation programs.

DISASTER MITIGATION: MAPS AND SCENARIOS FOR PLANNING

The information displayed on a map, with its striking colors and easy-to-interpret data, is a powerful tool for teaching about natural hazards. A map can summarize the findings of detailed scientific research and present it in a way that nonspecialists can understand. For

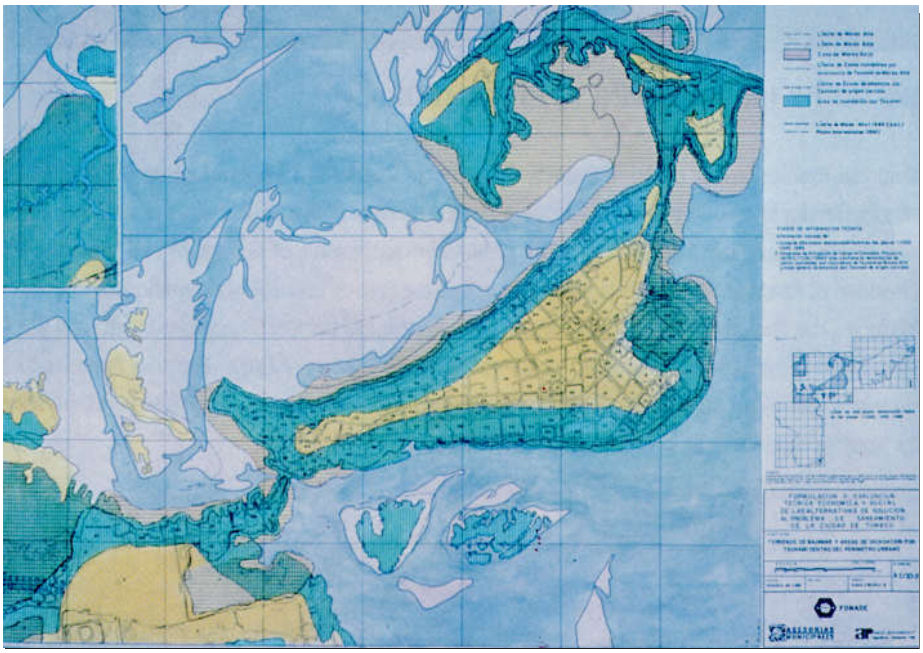


Photo: Courtesy of Bustamante, DNPAD

Hazard map created as part of the Tsunami Risk Mitigation Project in Tumaco, Colombia.

this reason, most disaster mitigation projects include an initial phase in which maps of different degrees of complexity are prepared to establish restrictions on land use or urge structural strengthening of buildings. A vulnerability analysis is performed during this first stage, and is complemented by information on population and infrastructure.

Geographical Information Systems (GIS) are a relatively new form of information technology. This system requires a large initial investment in computer hardware, software, and training for managers and users; however, it facilitates data management, allowing flexible updating of maps and the immediate incorporation of information from aerial photography and data obtained by satellites. Whereas with manual map making, correcting inaccuracies and updating used to take hours, the versatile GIS performs these operations in virtually no time.

After geographical information is collected, GIS becomes a tool for forecasting trends in urban growth and locating areas and infrastructure at risk, thus producing useful visual aids for planning rational land use. However, the impressive technology and attractive maps should be considered only as powerful tools, not as ends in themselves. GIS has two drawbacks: first, the initial investment, operation, and maintenance of the equipment may outstrip the budgets of the institutions that use them. Second, mechanisms for updating information should be established from the start, but many institutions do not have the infrastructure to meet this demand.

The Bahamas, Barbados, the British Virgin Islands, Costa Rica, Jamaica, Mexico, Peru, Saint Lucia, and Trinidad and Tobago are among the countries in the Region with experience in preparing natural hazards maps. Examples of projects at the local level include the UNDP project in MedellÌn, Colombia; the ì Infographicî Atlas of Quito, Ecuador (see Box 6.4); and the volcanic-hazard maps developed by Ecuador's Geophysical Institute of the Polytechnic

Box 6.4

HAZARD MAPS GUIDE URBAN PLANNING IN ECUADOR

The Constitutional Resolution that declared Quito a Metropolitan District in 1978 marked the beginning of a project to plan the future development of the nation's capital. A central element of the project was the work of Ecuador's Chapter of the Instituto Panamericano de Geografía e Historia (Pan American Institute of Geography and History—IPGH), the Military Geographic Institute of Ecuador, the Municipality of Quito, and the French Institute of Scientific Research for Development (ORSTOM) in producing the "Infographic Atlas" of Quito. This document has maps with scales ranging from 1:1,000 to 1:50,000 showing detailed geographic, demographic, and socioeconomic aspects of Quito. The atlas includes a chapter on the natural hazards to which this city of more than two million is exposed. The importance of this atlas is demonstrated by the fact that its maps have been incorporated, by law, into Quito's urban planning.

Source: Instituto Geográfico Militar (Ecuador), 1992.

School. CEPREDENAC's database on hazards in Central America, and the OAS projects to diagnose and reduce sectoral vulnerability also deserve special mention.

Costa Rica's Integrated Emergency Information System is an example of the use made of GIS to manage the phases of the disaster cycle, including prevention and mitigation. This system includes graphics that interact with a database to strengthen two central elements of the planning process: the country's "Atlas of Natural and Manmade Hazards" and the "Inventory of Strategic Resources for Disaster Preparedness, Response, and Rehabilitation". The summary, "Restrictions on Land Use," complements the atlas with legal, geological, hydrometeorological, technological, and engineering references and recommendations for local government authorities and the public at large.

The Fundación de Asesoría para la Prevención del Riesgo Sísmico (Foundation for the Prevention of Seismic Risk—FUNDAPRIS; formerly known as CEAPRIS) in Venezuela has gained valuable experience in developing zoning maps of geological hazards. These maps help to formulate state emergency plans and regulate the granting of construction permits based on land-use restrictions. Its disaster-mitigation activities at the local level include education and training, construction and urban development, and management of emergencies.

In the Caribbean, the British Virgin Islands have a new national physical development plan. The section on the Anegada area contains important information and conclusions on the island's natural hazards—the areas endangered by hurricanes, floods, seismic movements, soil liquefaction, and water pollution. The territory's Office of Disaster Preparedness provided information on hazards and disasters which has been incorporated into the plan. The project has the backing of the United Nations Center for Human Settlements (HABITAT).

Disaster scenarios are included in Colombia's comprehensive program for risk mitigation. As part of this program, two activities related to risk maps deserve to be singled out: the preparation of the tsunami hazard map in Tumaco, and the

preparation of the volcanic hazard map for Ibagué. For these two activities, scientists, politicians, and community groups successfully worked together to implement the measures planned.

The "Tumaco Tsunami Risk Mitigation Project" illustrates a project for which a recent disaster was not the catalyst; rather the process began with the possibility that such a disaster could occur. In addition to mapping the hazards, the Tsunami Detection and Alert Network has been expanded; a comprehensive relocation and housing improvement project is being undertaken, and the private sector is backing and spurring economic and social development in the region.

The UN Department of Humanitarian Affairs promotes the idea of drafting natural hazard maps in several countries of the Region as the first step in a comprehensive disaster management program. For example, DHA supports Argentina in formulating and implementing a national disaster mitigation program emphasizing emergencies arising from volcanic eruptions and technological disasters. The initial phase of this project focuses on one of the 42 potentially dangerous active volcanoes in the country to estimate hazards, develop monitoring procedures, and encourage community preparedness. The experience will subsequently be repeated with the remaining volcanoes.

In Peru, UN/DHA and the Canadian International Development Agency (CIDA) have carried out and financed a disaster mitigation program, with the Instituto Nacional de Defensa Civil (National Institute of Civil Defense—INDECI). It consists of the following components: a study of seismic, volcanic, and flood risk in the city of Arequipa; a study of seismic and tsunami risk along the southern coast; and the organization of the national disaster mitigation databank. One aim of the project is to draft hazard maps to formulate and implement emergency plans which will be incorporated into the urban plans of the localities studied.

In 1987, the Civil Defense of Ecuador and the National Polytechnic School with support from OFDA/USAID and UN/DHA, developed a project to evaluate natural hazards and integrate their implications into community protection planning. One of the results of this effort was the publication of hazard maps for active and inactive volcanoes. On the basis of these maps it has been possible to:

- Analyze potential socioeconomic impact;
- Estimate the vulnerability of threatened areas;
- Monitor the active volcanoes on a permanent basis;
- Improve Civil Defense response plans.

In summary, to mitigate the effects of natural disasters it is necessary, first, to be familiar with the hazard and, second, to locate it geographically in order to analyze the vulnerability and prepare risk maps. On the basis of these maps:

- Legal measures can be taken for design and planned development of urban areas;
- New buildings can be designed taking into consideration identified risks;
- Existing buildings can be reinforced and upgraded;
- Civil engineering works can be constructed to limit the destructive effects of disasters;
- Decisions can be made (in extreme

Box 6.5

THE CARIBBEAN UNIFIED BUILDING CODE (CUBiC)

An informal meeting of engineers from several Caribbean countries in 1968 led to the establishment of what is known as the Council of Caribbean Engineering Organizations (CCEO). One of their goals was to develop building codes.

With a view to standardizing code criteria, several meetings were held in Jamaica between 1970 and 1974, with a final conference in Trinidad in 1978 devoted entirely to the discussion and presentation of studies on seismic activity in the Caribbean and on earthquake-resistant designs. This conference gave rise to a CCEO committee to prepare guidelines that engineers could use until a formal code was published.

With initial support from USAID and CARICOM, the Caribbean Uniform Building Code (CUBiC) was finally proposed in 1985. Its application, however, has not been made obligatory in any of the countries, although the governments of Bahamas, Bermuda, Turks and Caicos Islands, and the French Departments are considering its implementation. HABITAT is promoting the adaptation of CUBiC to the particular conditions of each country or territory in the eastern Caribbean.

The initiative to formulate a regional code is advantageous, since it provides a reference document geared to actual conditions, both in the characterization of hazards and with regard to construction technologies, and can be adapted to each country. CUBiC has not enjoyed wide acceptance, however, due to the unfounded fear that the cost of implementation may be high. Its success depends on having resources for inspection and enforcement and on legal support for these measures.

Source: Gibbs, 1992; PAHO/WHO.

cases) to totally or partially relocate human settlements as a preventive measure.

These examples of the use of risk maps show that maps should not be ends in themselves but tools for planning the orderly growth of cities and for developing institutional and community preparedness activities. In addition, although the technical and financial cooperation of donor institutions and countries is necessary to promote mitigation programs in their initial phases, to continue and attain objectives requires maturity and commitment on the part of those receiving this support.

DISASTER MITIGATION AND THE ENVIRONMENT

The recent trend toward lessening the adverse impact of development on the environment, promoted by the World Conferences on the Environment (held in 1972 in Stockholm and in 1992 in Rio de Janeiro), has awakened planners to consider natural hazards when they assess social and economic development projects. The commitments made by the majority of the world?s countries in Agenda 21 of the ÏEar th SummitÓin Rio de Janeiro include the proper management of forests and options for combating the degradation of soil, air, and water, as well as the need to eradicate poverty in order to achieve sustainable development. Accordingly, many of the solutions adopted in Agenda 21 are part of the same strategy of mitigating and preventing disasters.

Even though many countries of the Region have formulated environmental agendas or laws, few include actions to reduce vulnerability to natural hazards. However, two positive examples include the law creating Colombia's Ministry of

Environment and Honduras' Law on the Environment enacted in 1993. They both promote municipal decentralization as a major component in controlling and executing policies for environmental protection, natural resources management and, finally, measures to reduce the effects of disasters. Although there are many such laws, most countries have trouble enforcing them and monitoring compliance.

The trend now is for administrators and planners who are involved in disaster management to include an environmental impact analysis in development projects. Unfortunately, ì environmentalistsî rarely relate environmental deterioration to increased vulnerability to natural hazards.

MITIGATING THE EFFECTS OF DISASTER ON INFRASTRUCTURE

To mitigate the effects of natural disasters, the most common actions are those involving modifications to existing structures. Most of the countries of the Region are making effortsó within their limited budgets and occasionally with the technical and financial support of international agencies and other donorsó to adapt building codes to local conditions; to reinforce existing buildings, especially critical facilities (such as hospitals, schools, drinking water supply, and electric systems); and to undertake prevention projects. In some of these projects, the community has played a decisive role in pressing for the most urgent measures.

Existing buildings are the main concern. Nevertheless, if during the planning of a project, special design and construction requirements were established with legal and institutional backing to enforce them, and if the project were built on an appropriate site, there would be no need for costly retrofitting assuming that maintenance is sustained. Experience demonstrates that the economic impact of losses due to structural damage from disasters leads to overseas borrowing and delays in normal development programs, in addition to the immeasurable cost in human lives. For this reason, scientists and technicians in most countries of the Region need to formulate and apply building codesó especially in the case of earthquakesó that will insure that a building can withstand the impact of natural phenomena with an acceptable and pre-determined level of damage. Due to the lower costs of wind resistant reinforcement, engineers and other technicians recognize that during hurricanes, buildings should not suffer from damages other than those caused by flying objects.

The main obstacle to the effectiveness of building codes as a tool for disaster mitigation is their enforcement. Some countries of the Region do not have their own standards; they merely adapt European or United States parameters that are not geared to local conditions. Others, such as Colombia, Costa Rica, Mexico, and some Caribbean countries (see Box 6.5) have developed their own excellent codes, but they do not fully achieve their goals because they are not legally binding or because they are not enforced.

In the case of hospitals and other critical facilities, functional rather than structural collapse is most often the principal effect of a disaster. The solution to this problem lies in preventive maintenance programs. Maintenance not only slows deterioration but also ensures

Even though many countries of the Region have formulated environmental agendas or laws, few include actions to reduce vulnerability to natural

Box 6.6

STRUCTURAL REINFORCEMENT OF THE HOSPITALS OF THE COSTA RICAN SOCIAL SECURITY FUND

Photo: Cruz

Costa Rica, a small country of slightly more than 50,000 square km has suffered several high-magnitude earthquakes in this century that have caused heavy economic and social losses.

The Costa Rican Social Security Fund (CCSS), which provides universal health care coverage, is responsible for the operation of the nation's most sophisticated hospitals. The effects of several earthquakes in Costa Rica and in neighboring countries in the 1980s on health care infrastructure, led to efforts to reduce vulnerability of hospital buildings. This trend culminated in a decision in late 1986 by the CCSS to authorize vulnerability studies and plans for reinforcing unsafe buildings belonging to the institution. Conditions at the Mexico and Children's Hospitals were assessed first, and subsequently at the Monsignor Sanabria and Ciudad Neily Hospitals and the central CCSS offices. The reinforcement of all these buildings was completed in 1988, before a period of intense seismic activity between 1990 and 1991.

In contrast, the Tony Facio Hospital, which lies near the epicenter of the April 1991 earthquake (7.4 magnitude on the Richter scale), had not been a priority in the initial evaluations because it was located in an area where seismic risk was presumed not to be high. As a result, it suffered major damage and had to be evacuated.

The best lesson learned from Costa Rica's experience with reinforcing vital buildings, such as hospitals, was that mitigating the effects of earthquakes should begin before any disaster occurs. The success of this approach was evident when the strong earthquakes of 1990 and 1991 occurred. Had actions not been taken, the Tony Facio Hospital would not have been the only one damaged by the quake.

Source: M. Cruz, 1992.

that utilities (water, gas, electricity) and nonstructural components (facades, ceilings, fixtures, etc.) resist the disaster impact. Moreover, the cost is not onerous if considered as another item in the normal operating budget of a building (see Box 6.6).

There is a deep-rooted myth that to make a building hurricane- or earthquake-resistant means making a greater initial investment unjustified by the likelihood that a disaster will occur. In the case of large-scale projects, this increase in the initial cost, estimated at 4% to 10% in light of experiences in the Region (studies by the U.S. Federal Emergency Management Agency estimate the increase at only 0.5% to 2%), is not an unnecessary expenditure since the cost of replacing these buildings is significantly greater, not to mention the human and social losses caused by their destruction. International financial institutions can promote protection from natural hazards as a variable in the formulation of investment proposals. Priorities in the countries of Latin America and the Caribbean in this regard

are to:

- Make a hazard analysis of future construction sites compulsory;
- Require that designs produce buildings that can withstand natural disasters as conditions for the granting of a loan.

The financial institutions would thus promote effective disaster mitigation and protect investments.

However, the bulk of losses of human life and damage to structures from disasters occurs through damage to dwellings. For example, the 1991 earthquake in Costa Rica totally destroyed a few buildings, seriously damaged the communication and drinking water supply systems, started a fire in the country's most important oil refinery, and caused substantial indirect losses. However, the most significant damage was in the housing sectoró some 5,000 units were affected. A similar pattern of damage was seen in the earthquakes in El Salvador and Guatemala.

This pattern is common in most disasters, especially among segments of the population that, owing to social and economic limitations, construct their dwellings without appropriate professional supervision and on land not suited for residential use. For this reason, research is being conducted on the materials and methods of ì nativeî construction, not only to improve designs but also to reinforce existing dwellings (see Box 6.7). The numerous examples in the Region include the experiences of CENAPRED in Mexico and CISMID in Peru; the National Bamboo Project, under

Box 6.7

REINFORCEMENT OF ADOBE DWELLINGS: IT SAVES LIVES

Photo: de Ville de Goyet, PAHO/WHO

The Centro Regional de Sismologìa para AmÈrica del Sur (South American Regional Center for Seismologyó CERESIS), located in Lima, Peru, is conducting a project to overhaul existing adobe dwellings to mitigate the damages sustained to these buildings during earthquakes.

Although research has been done worldwide to develop new technologies for adobe use in seismic-resistant buildings, these new technologies cannot be applied to reinforce older housing. Most adobe dwellings were constructed without technical advice, and because of limitations inherent in the material, the massive and fragile walls, defects of configuration, inadequate joints, and problems in the foundation, they usually collapse in earthquakes.

For this reason, CERESIS proposed establishing simple, low-cost procedures to improve the condition of existing dwellings, taking into account the type of soil on which they were built and their size and shape, so that they can withstand earthquakes, or at least remain standing until the occupants can vacate them.

The main objective of this project is to teach communities reinforcement methods, and then motivate them to improve the dwellings themselves, without external technical or financial support.

Source: CERESIS, 1994.

Box 6.8

PARAGUAY: THE PROBLEM OF FREQUENT FLOODING

Photo: L. Calle

The Paraguay River's greatest floods occur approximately every 5 to 10 years. In intervening years however, major floods can occur along specific stretches of the river's basin; the variable rainy seasons in the upper and lower river basin produce this uneven flooding. For example, serious floods in the upper basin have affected cities such as Fuerte Olimpo, Puerto Casado, and ConcepciÛn, while in the middle and lower basins the river barely rose. Conversely, there has been flooding in the middle or lower basin that affected major towns such as AsunciÛn, Alberdi, and Pilar, while the upper basin saw nothing that could be considered abnormal.

The behavior of the Paran· River is less predictable, and its flow is determined to a great degree by the fact that there are 18 hydroelectric plants built on its tributaries and on the Paran· River itself.

The damage caused by flooding in Paraguay is considerable, which means that people must be relocated and infrastructure built for basic services: water, sewage disposal, vector control, food hygiene, and waste disposal. In addition, because flooding occurs at the coldest time of the year, the victims need blankets and temporary shelter, obtained mainly from international donations and governmental funds at an estimated cost of US$150,000 per flood.

The city of AsunciÛn, whose population is hit hardest by annual flooding, has made plans to build a wall around the city, and storm waters will be pumped toward the Paraguay River during periods of rain. The government invested approximately US$5.2 million to construct dikes for riverbank protection in the cities of ConcepciÛn in the north and Pilar in the south (both on the Paraguay River) and to build 150 km of embankments along several routes commonly affected by the flooding of the Paraguay River. These embankments will reduce the vulnerability of more than 400 km of roads connecting riverine towns that tend to be isolated from the rest of the country when major access routes are flooded.

There are still no laws restricting the use of areas prone to flooding.

Source: PAHO/WHO.

the Housing Ministry of Costa Rica; and experiments in building with bamboo and reed in Panama and Colombia. In addition, research is underway on the improved use of adobe, *quincha* (construction using cane or sticks and mud), and *taquezal* (blocks consisting of mud and organic materials) in Nicaragua, Guatemala, and Peru.

In Jamaica and other countries of the Caribbean, a pilot project was conducted with typical dwellings to assess first their response to hurricanes and subsequently to promote scientifically designed anchorings and connections. The project received technical and financial support from the International Development Research Center (IDRC) of Canada, the Faculty of Engineering of the University of the West Indies, and a Jamaican NGO, the Center for the Development of Research in Construction. This project is linked to similar activities that the OAS and the Regional Office of OFDA/USAID for Housing and Urban Development in the Caribbean are sponsoring, such as a project to inspect electric power grids and other infrastructure, map areas susceptible to natural hazards, cooperate with insurance companies to improve risk management, and improve building codes.

The purpose of research and experiments with construction technologies and materials is similar to that of developing hazard maps; that is to say, they are a means, not an end to a mitigation program. The need to convey all findings of these studies to communities, in easy-to-understand language so that they can be applied and become effective tools for reducing the impact of natural disasters, is imperative.

The city of Santiago de los Caballeros, Dominican Republic, is located in an area of high seismic activity that is also exposed to heavy rains from hurricanes affecting the Caribbean. In 1989, vulnerability analysis was conducted on both the water supply and sanitation systems which were susceptible to extensive rupture and damage because of inadequate maintenance programs, structural flaws, and improperly used piping materials. Corrections to the systems have been carried out in part, but an indirect and even more important consequence has been the government's decision to reinforce and modernize drinking water supply systems in the entire country.

Aside from modifications to existing infrastructure and special designs for new projects, measures can be taken to directly influence the impact of natural disasters. A wide range of engineering works to prevent disasters is available, depending on technical feasibility and cost-benefit ratio considerations. Investments in disaster prevention projects are readily justified in areas frequently hit by disasters; thus, it is not surprising that the control of hydrometeorological disasters through engineering is one of the most common preventive measures taken.

At certain times of the year, reports of flooding in susceptible areas are common. If we compare these reports year after year, we see that the damage is practically the same. . .until some political body decides to tackle the problem by building control devices (see Box 6.8).

The wide range of flood protection works runs from traditional dikes and retaining walls to river channel modifications. The design of such works, in addition to the high cost, often poses challenges to hydraulic and structural engineers. However, in many cases, the

Box 6.9

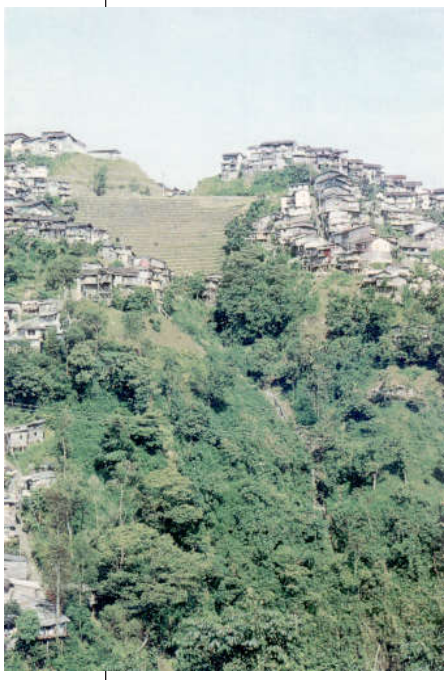


Photo: Molin Valdes/IDNDR

MANIZALES: MORE THAN MAPS FOR MITIGATION

Manizales, Colombia has been struck repeatedly by landslides, caused by the instability of the slopes on which the city is built, as well as by intense seismic activity. To mitigate these conditions, local and national authorities, scientists and specialists at universities and private companies, and the community joined efforts and resources to implement safety measures within the framework of a project known as ì Comprehensive Management of Disaster Prevention and Response Activities.î

Phase II of the Project included a hazard study, preliminary mapping of dynamic characteristics of the soil, a building vulnerability study, and relocation programs for at-risk dwellings. In addition, the entity restructured as CORPOCALDAS working with the Mayor's Office, developed a program for slope protection which is currently financed with national and local funds. This program includes the restoration of plant cover, drainage systems, and other engineering works. The latter projects go beyond the traditional retaining walls and gabions, displaying an originality that has served as an example for specialists in other regions and countries facing the same problem.

In 1993 the Municipal Council of Manizales created a Municipal Fund for Calamities equivalent to 1% of the city's tax revenues. It also granted a real estate tax exemption to property owners who make structural modifications and take steps to conserve the architectural heritage of the city by reducing its vulnerability. These urban development policies are based on the results of the municipal project known as the Comprehensive Plan for Disaster Prevention and Response of Manizales (PADEM).

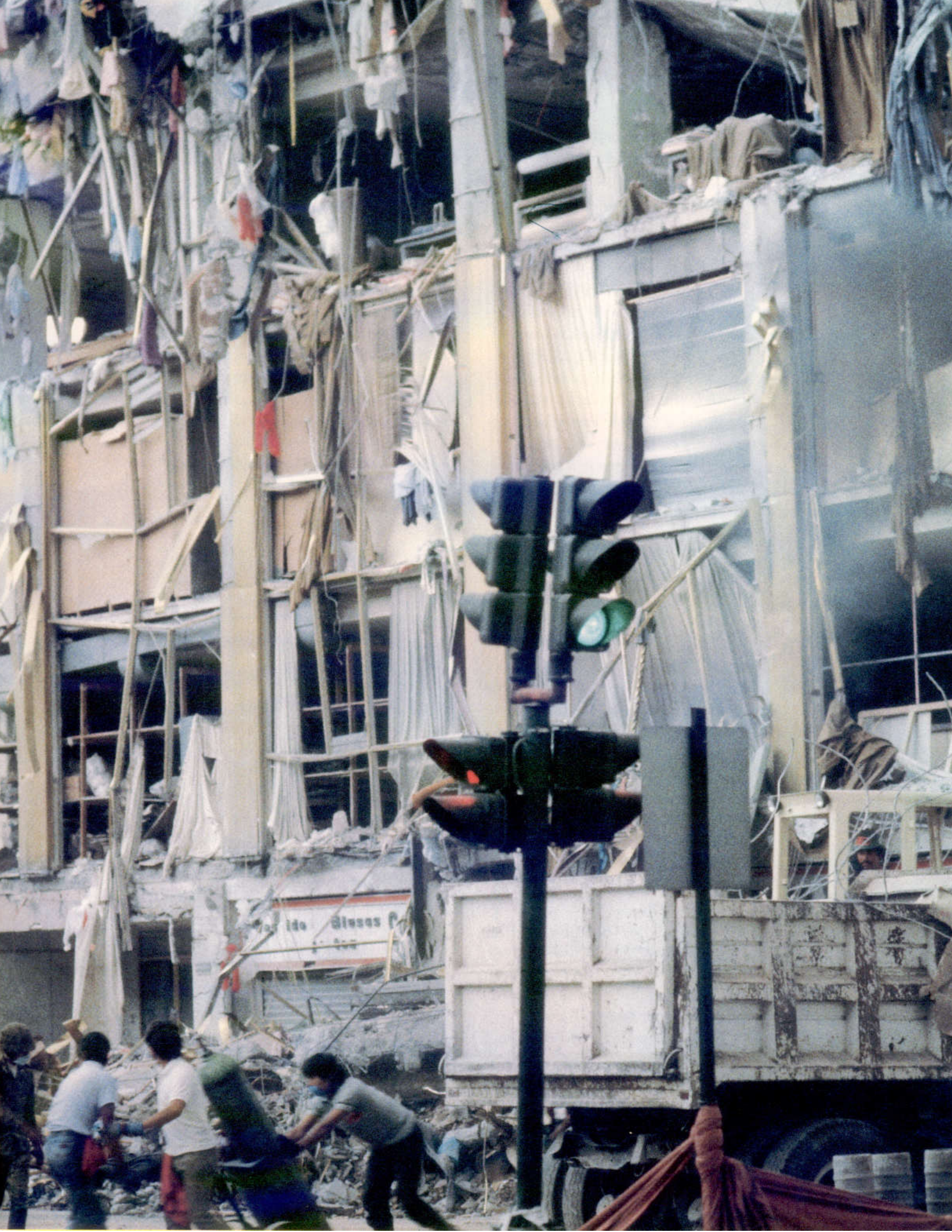
Sources: UN/DHA; PAHO/WHO; PADEM; IDNDR Regional Office.

real solution to the problem is not possible since it would require the enforcement of a strict land-use policy that prohibits construction on or the use of this land for purposes other than the preservation of the rivers. The solution thus entails relocating human settlements and other structures, which could turn out to be not only more expensive but politically detrimental as well. A happy medium needs be found.

Owing to scientific and technological advances in the countries of the Region, innovative engineering solutions have been implemented to control the impact of flooding. In the city of Manizales, Colombia, ingenious, effective ideas are practiced to control landslides (see Box 6.9). There are also valuable examples of low-cost prevention works constructed with the participation of the communities. Among them is the program to improve the lower channel of the Juan DÌaz River in Panama, which had public and private support and which, by preventing annual flooding in that area, offered a viable solution for other communities.

In summary, there are two direct ways of mitigating the effects of violent natural phenomena: first, know the threat, (for example, through maps or land-use regulations); second, respond appropriately to vulnerable elements (for example, by properly designing infrastructure projects or by reinforcing buildings). To take such action, the actors in the process must be aware of the consequences of disasters and have

Photo facing page: Vizcarra, PAHO/WHO



the technical and scientific knowledge and the motivation to propose solutions.

THE ACTORS—GATHERING AND APPLYING KNOWLEDGE

The challenge of the IDNDR in Latin America and the Caribbean is to apply the knowledge that has been accumulated and developed in the Region.

The challenge of the IDNDR in Latin America and the Caribbean is to apply the knowledge that has been accumulated and developed in the Region. The institutions of higher learning in the health sector have opened their doors to initiatives from agencies like PAHO/WHO to make emergencies and disasters an integral part of their curricula.

In disciplines such as engineering and the applied sciences, the study of natural disasters is approached from a rigorous analytical perspective, sometimes ignoring socioeconomic considerations. The contribution of this research to the improved knowledge of natural hazards has been important, but such studies now must be increasingly directed toward bringing benefits to communities.

Some institutions of higher learning are motivated by an ever-increasing awareness of their role in community health and safety. There are many examples, but mention should be made of the postgraduate-level curricula at the University of the Andes in Venezuela and the University of the Andes in Colombia in the areas of structural and seismic engineering; the Center for Disaster Prevention Studies of the Faculty of Physical Sciences and Engineering of the University of Chile; the applied studies and research being carried out by the National University of Engineering, Peru; the Geophysical Institute of the Polytechnic School of Ecuador; the ongoing support for updating the Seismic Code that is provided by the Seismic Engineering Laboratory of the Faculty of Civil Engineering of the University of Costa Rica; and the applied studies of the Seismic Research Unit of the University of the West Indies in Trinidad. Mention must also be made of the interest of the National University of Nicaragua in developing a postgraduate program in disaster prevention and management in Central America; the fundamental role that the National University of Mexico plays in connection with CENAPRED; and the willingness of the Schools of Architecture of Federico de Villarreal University in Peru and of the Piloto University in Colombia to formally incorporate the study of disasters in their curricula. Box 6.10 describes some of the prominent centers carrying out applied research in disaster mitigation in the Region.

The ICAROS project (the IDNDR "Roving Seminar in the Caribbean") was initiated by the International Union of Technical Associations and Organizations and the World Federation of Engineering Organizations (UATI/WFEO), and other regional and multilateral organizations to disseminate and share high-quality information on natural disasters in the countries and territories of the Caribbean. The principal subjects of discussion are risk maps, training at the local level, workshops and demonstrations of proper construction methods, improvement of warning systems, case studies on the role of insurance companies and the socioeconomic impact of disasters, and analyses of cost-benefit ratios.

In the area of the social sciences, La RED, the Latin American Network of Social Studies in Disaster Prevention, analyzes the influence of governmental organization on disaster prevention, response and recovery measures and

Box 6.10

CENTERS OF APPLIED RESEARCH IN DISASTER MITIGATION

The **Centro Nacional para la Prevención de Desastres** (National Center for Disaster Prevention—CENAPRED) was inaugurated in 1990 in Mexico City with three aims:

- To study, develop, and apply technologies for disaster prevention and mitigation
- To promote technical training
- To disseminate information on preparedness and self-protection for the Mexican people

The Center's research encompasses the following areas: geological risks, seismology equipment, seismic experiments, hydrometeorological risks, and chemical hazards. CENAPRED supports the implementation and operation of detection, surveillance, and forecasting activities and risk evaluation networks in cooperation with other government agencies.

The **Centro Peruano-Japonés de Ingeniería Sísmica y Mitigación de Desastres** (Peruvian-Japanese Center for Seismic Research and Disaster Mitigation—CISMID) is an academic research center for the study and improvement of techniques to reduce human and material losses caused by natural disasters. CISMID, established by the Faculty of Civil Engineering of Peru's National University of Engineering, receives support from the National Council for Science and Technology of Peru.

The Center's facilities in Lima include a geotechnical laboratory and a building materials laboratory, and offer specialized courses in structural engineering and building materials sciences. CISMID's efforts have led to the creation of a standard for building codes and land use statutes in Peru. Both CENAPRED and CISMID receive technical and financial support from JICA.

The **Centro Regional de Sismología para América del Sur** (South American Regional Center for Seismology—CERESIS) was established in Lima (Peru) as an autonomous intergovernmental agency by the governments of the South American countries in 1971, with initial backing from UNESCO and other agencies. It has had a major scientific and technical impact on the region in the evaluation of seismic risk, digital seismic networks, production of maps and geophysical catalogues, and in developing South America's own professional capacity.

Since 1989 CERESIS has been carrying out a regional standarized methods project to evaluate seismic risk in South America, based on national maps and catalogues produced by each country. The project is associated with the Latin American Map Program on Seismic Hazards and will contribute to the Global Seismic Hazard Assessment Program.

The Seismic Research Unit (SRU) of the University of the West Indies in Trinidad was established 40 years ago to monitor seismic events throughout the Commonwealth and Eastern Caribbean islands. It coordinates earthquake-related activities by centralizing data on events in the area. In addition, it maintains ties with earthquake centers in the French departments of Martinique and Guadeloupe and in Puerto Rico, the Dominican Republic, and Cuba.

policies in a society faced with disasters, and evaluates the experiences of the countries in implementing these measures. The Institute for Training in Public Administration (ICAP), located in Costa Rica and serving all of Central America, is making an important contribution in this field; it offers a well-structured master's degree program that includes natural hazards in the management of investment projects. In addition, the Department of Social Work of the University of Antioquia, Colombia, has established a graduate-level program that emphasizes aspects of social development as related to emergency and disaster situations.

As a consequence of the commitment by institutions of higher learning to disaster studies, many professional engineering and architectural associations, which influence political decision-making and enjoy credibility among the public in countries of the

Region, are giving more importance to the consideration of natural hazards in all phases of a project, from its planning to its construction and maintenance. To illustrate the multiple possibilities of cooperation and the influence of this type of professional group, the Civil Engineering Association of Ecuador and the Colombian Association of Engineers signed a Letter of Intent for cooperation. One of the points of this agreement calls for mutual support in emergency situations and joint activities to train and update their professionals in disaster-related subjects.

Society on the whole, because it comprises a range of different actors from government-level planners to the beneficiaries of an individual project, is familiarizing itself with the terms associated with disaster management. This process ideally leads to a greater awareness of the problem, and helps to promote the idea that mitigation of natural disasters profits everyone.

DISASTER: A WINDOW OF OPPORTUNITY

A disaster can provide opportunities for a sector to reorganize, as was the case with the decentralization of the health care system in El Salvador's capital in 1986 (see Box 6.11), or for the reorganization of disaster management systems themselves. To cite only a few examples, the 1985 earthquake in Mexico prompted the creation of the Sistema Nacional de Protección Civil (National Civil Protection System—SINAPROC); in Colombia, the violent eruption of the Nevado del Ruiz Volcano in 1985 led to the establishment of the Sistema Nacional de Prevención y Atención a los Desastres (National Disaster Prevention and Response System) and at the same time promoted guidelines for mitigating future disasters during reconstruction. The example of municipal development of La Paz, Bolivia (see box 6.12), illustrates perfectly how disasters provide the opportunity to promote long-term development programs.

Box 6.11

THE RECONSTRUCTION OF THE HEALTH SECTOR IN EL SALVADOR: AN EXPERIENCE IN MITIGATION

In terms of damage caused to the health care infrastructure, the 1986 earthquake in the city of San Salvador was not much different from the one that hit Mexico City barely a year before. The most striking example of this destruction was the Benjamín Bloom Children's Hospital. This public institution became inoperative just when it was most needed—during the phase of emergency relief—because of structural damage and shifting and falling nonstructural components. Thanks to the preparedness of its personnel, the existence of emergency plans, and the evacuation, there were no casualties, and medical care was organized promptly in temporary facilities. The hospital was subsequently renovated and underwent structural reinforcement.

This experience prompted a reorganization of the health sector so that it would not be dependent on the services of one "mega-hospital" of 400 beds or more. In an effort to decentralize hospital care, four new health centers with 100 beds each were constructed on the outskirts of the city.

Source: PAHO/WHO; ECLAC.

Box 6.12

MUNICIPAL DEVELOPMENT OF LA PAZ, BOLIVIA

Photo: PAHO/Waak

In 1988, the Municipality of La Paz, Bolivia, with assistance from the World Bank, designed a Municipal Development Project to strengthen administrative capacity and solve the problems of infrastructure and natural disasters in this capital, located in the Andes at an altitude of 3,630 meters. Every year this city of more than one million inhabitants, located in a valley surrounded by very steep slopes, suffers serious consequences from mudslides and floods brought on by rain. The population of La Paz grows at approximately 5% a year and is under enormous pressure to find areas suitable for human settlements.

The Project attempts to overcome the shortcomings in infrastructure and services that contribute to rapid erosion and chronic landslides, to strengthen the municipal government, and to encourage, through education and public information programs, local participation in disaster mitigation. The component of disaster management was based on the Urban Development Plan of La Paz, produced by a team of ecogeologists and urban planners, with the assistance of the French government in the late 1970s.

Based on the analyses of disasters that occurred over the last 10 years and on the probability that severe disasters will occur again, the project team recommended mitigation and prevention measures, as well as priorities for investment, which are being implemented at present.

Among the major achievements of the Project, the following stand out:

- A notable trend toward the reduction of floods and landslides in the city;
- The creativity of the municipality in directing and carrying out these projects;
- Complementary environmental programs financed by the IDB, the European Community, the German Agency for Technical Cooperation (GTZ), and JICA.

Source: World Bank, 1994.

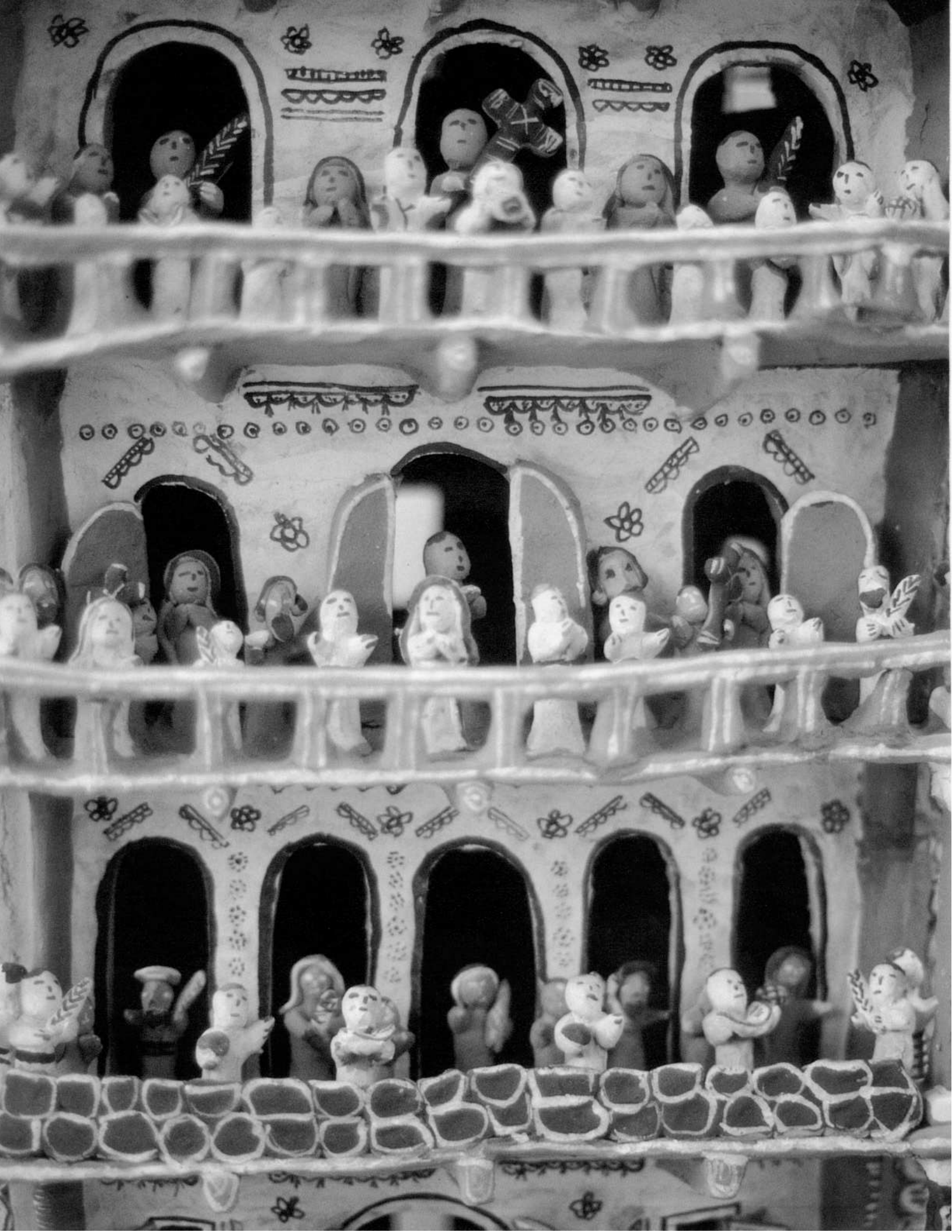


Photo facing page:

Disaster mitigation measures are especially important for buildings sited in densly-populated areas, or for those housing critical facilities.

Photo: Fernández, ULTRA

CONCLUSIONS: DISASTER MITIGATION IS IRREVERSIBLE

Practical and concrete experiences prove that investing in mitigation, either directly or indirectly, profits everyone. Planners in Latin America and the Caribbean, who can demonstrate the cost effectiveness of disaster mitigation in plans must be more aggressive, especially in promoting the following measures:

- Gathering data on hazards and vulnerability through GIS and preparing risk maps for incorporation into development plans and assessments;
- Legalizing and applying efficient regulations on land use;
- Studying sectoral vulnerability;
- Using political decisions to formalize restrictions and economic incentives to achieve mitigation.

An analysis of the various activities being developed or implemented in the countries of the Region to mitigate the effects of natural disasters shows a common denominator that has acted to trigger this process: countries cannot afford to face disasters with a "response" mentality alone; their budgets cannot sustain it, and the social cost of disasters has helped to heighten the public's awareness of the problem. Making mitigation a fundamental part of disaster management is irreversible.

Reflecting on the advances, obstacles, and setbacks in the area of natural disaster mitigation, we can identify the following priorities at both the national and regional levels:

- National and international financial institutions should incorporate the variable "natural hazard" in feasibility studies for new investment projects. A regional meeting is being planned at which international financial organizations, bilateral agencies, and country representatives will discuss this concern and formulate a common approach for the protection of investments in the social and health sectors.
- Developing countries must include plans to reduce vulnerability to natural disasters in their requests for support from the international community. In the case of the Caribbean, for example, these plans should receive more attention and visibility in the negotiations with the European Community within the framework of the Lomé Conventions.
- Planners and scientists should play a more active role to influence senior political officials and thus strengthen disaster mitigation.
- The active participation of insurance and reinsurance companies in the national IDNDR Committees should be promoted. These companies have enormous potential as sources of incentives for making prevention and mitigation measures more attractive to the governmental and the commercial private sector and to owners of private dwellings.
- The efforts by PAHO/WHO and other regional agencies in the training and sensitization of administrators, engineers, and architects should be expanded with the leadership of professional associations.
- Most importantly, communities pressing for political decisions that take hazards into account will result in a renewed effort to educate the public, with the constructive participation of the mass media. Thus, the entire motivational potential of the IDNDR will serve as a catalyst for broad dissemination of the concept of the integrated management of natural hazards. ◆

LOOKING TOWARD THE FUTURE

In the 1970s, advances in telecommunications permitted the mass media to relay images and information about natural disasters directly to a world audience with unprecedented speed. People saw what happened to their neighbors as the result of disasters. This new knowledge helped erase boundaries between societies and has given rise, in the 1990s, to a focus on sustainable development. This new way of looking at disasters has integrated the concepts of prevention, mitigation, and preparedness to reduce the social and economic impacts of natural disasters.

TOWARD NATURAL DISASTER REDUCTION—THE ACTORS

No country nor agency could have reached its present level of maturity with regard to disaster reduction had it remained isolated from others. The slow process of transforming from vulnerable to more secure implies the participation of numerous protagonists both at the national and international levels. The protagonists in this enterprise of disaster reduction are listed below in order of visibility, not in order of importance:

- International agencies
- Scientific associations, universities, and nongovernmental organizations
- Governments
- Communities

International Agencies

Much of this report has emphasized the achievements of the principal protagonists, that is, the countries. It is also important to address the contribution of the international—multilateral and bilateral—agencies, which have served as catalysts in promoting disaster reduction in the Region of the Americas.

Among the international actors involved in disaster reduction is the United Nations system. Initially, disaster reduction activities were the mandate of UNDRO, the Office of the UN Disaster Relief Coordinator, until the creation of the Department of Humanitarian Affairs in 1991. Other U.N. agencies that have played important roles are the World Meteorological Organization, leader in coordinating early warning systems for hydrometeorological hazards; UNESCO, promoting research in the fields of volcanology and seismology; and, more recently, the United Nations Development Program (UNDP), which provides training for the entire UN system through the Disaster Management Training Program. In short, all agencies in the system contribute to reducing natural disasters in the Americas.

At the regional level, the Economic Commission for Latin America and the Caribbean (ECLAC) has evaluated the economic repercussions of major disasters in the last decades and created a database of great value in preventing and

Photo facing page: Gaggero, PAHO/WHO

mitigating the effects of disasters.

Since the early 1980s, the Organization of American States (OAS) has helped its member countries to reduce the impact of natural hazards by: evaluating them as part of the study of natural resources; identifying and formulating mitigation measures; making information on hazards more accessible; and training planners in evaluation of natural hazards and disaster mitigation techniques.

The Pan American Health Organization, Regional Office for the Americas of the World Health Organization (PAHO/WHO), is convinced that socioeconomic development goes hand in hand with protecting the people of the Region from natural or manmade hazards. PAHO's Emergency Preparedness and Disaster Relief Coordination Program places people's health as the force driving disaster reduction in the Americas. Thus, they support some 200 courses and workshops annually and produce and disseminate publications, video and slide programs, and other materials of key importance. Disaster professionals in the Region benefit from PAHO/WHO's Disaster Documentation Center whose primary purpose is to offer quick access to disaster management information.

At the subregional level, the creation of the Caribbean Disaster Emergency Response Agency (CDERA) by the Caribbean Community (CARICOM) deserves mention. It was the first intergovernmental organization in the Americas established exclusively for the management of natural and manmade disasters and funded by its Member Countries.

Bilateral agencies have supported disaster reduction activities in Latin America and the Caribbean either directly or through the U.N. and nongovernmental organizations. International cooperation agencies such as the Canadian International Development Agency (CIDA), the U.S. Office of Foreign Disaster Assistance of the U.S. Agency for International Development (OFDA/USAID), the Japan International Cooperation Agency (JICA), the Swedish International Development Authority (SIDA) and agencies of other Nordic countries, the Overseas Development Administration (ODA) of the United Kingdom, the Government of the Netherlands, and the French and Italian Cooperations provide financial support and technical assistance to a variety of projects.

In 1987, OFDA/USAID, through its regional program located in Costa Rica, began an interactive course for the training of trainers in disaster management, damage evaluation, and needs assessment. They also developed courses on planning and school safety, creating a fertile field for the complementary initiative, UNDP's Disaster Management Training Program. OFDA/USAID, through the U.S. Geological Survey, also collaborates with governments and scientific institutions in the Region on volcano surveillance and monitoring. The reorientation of their priorities—from preparedness to prevention and mitigation—is exemplified by agreements made with PAHO/WHO on disaster mitigation for hospitals and health installations, and with the OAS for a Caribbean mitigation project.

In addition to its support for specific projects such as flood prevention, JICA emphasizes scientific cooperation in engineering and seismology. CISMID in Peru, and CENAPRED in Mexico, are centers of scientific and investigative

excellence in the Region (see chapter 6) that owe their existence to the material and technical support of Japan.

The Nordic countries in turn, led by Sweden, developed CEPREDENAC. Conceived with a scientific scope for disaster prevention, CEPREDENAC now focuses on the social and political dimensions of disaster reduction. Currently, CEPREDENAC is recognized as an intercountry agency, and following the example of CDERA in the Caribbean, must secure funding from the countries of Central America themselves for its core activities.

Other countries, such as Canada and the United Kingdom, have given up a high level of visibility derived from direct involvement and have opted to act through existing agencies (UN, Red Cross, NGOs). These countries have exerted considerable influence on disaster reduction efforts in Latin America and the Caribbean.

With so many protagonists, coordination has, at times, been an issue, but one that is being satisfactorily resolved. At the end of the 1970s the number of protagonists at the regional level was limited (UNDRO, OFDA/USAID, the League of Red Cross and Red Crescent Societies, today the International Federation, the OAS and PAHO/WHO, among others). As the numbers grew, more dialogue was needed among the protagonists. One way to build and maintain this dialogue was to hold meetings at the regional and subregional level. Two notable examples are the meetings of national IDNDR Committees: in Guatemala in 1991 for Latin America and the Spanish-speaking Caribbean, and in Jamaica for the English, French, and Dutch-speaking Caribbean. The U.N. World Conference in Yokohama provided another opportunity for dialogue. The 1994 Inter-American Conference on Natural Disaster Reduction in Cartagena, Colombia, represented the last stage of preparation for the World Conference by the countries of Latin America and the Caribbean (see the Conference Resolutions in Box 7.1).

Scientific Associations, Universities, and NGOs

Natural disaster reduction must be multidisciplinary and multisectoral; it cannot be the exclusive territory of any one group. Scientists, professional associations, and universities have developed risk mapping, early warning systems, and other preventive measures. Nevertheless, despite successful results and model projects, the percentage of scientists in the Region that actually participate in and contribute to this field is not high, and the field continues to be dominated by a few experts in each country.

In the last 15 years, many countries have successfully included disaster management and preparedness in the formal curriculum of universities. The goal is to familiarize all graduates with disaster reduction as it relates to their specific discipline.

The revitalization of intergovernmental associations such as CERESIS (Peru), the SRU (Trinidad) and others that enjoy international and national support, can be credited to the IDNDR. The objectives of the Decade also have strengthened other scientific and management initiatives: the establishment of a scientific IDNDR Committee, as in the case of Chile; the creation of networks focused on technical or social aspects of disasters such as La RED or the Latin American Partnership of CUSEC; and the formation

Box 7.1

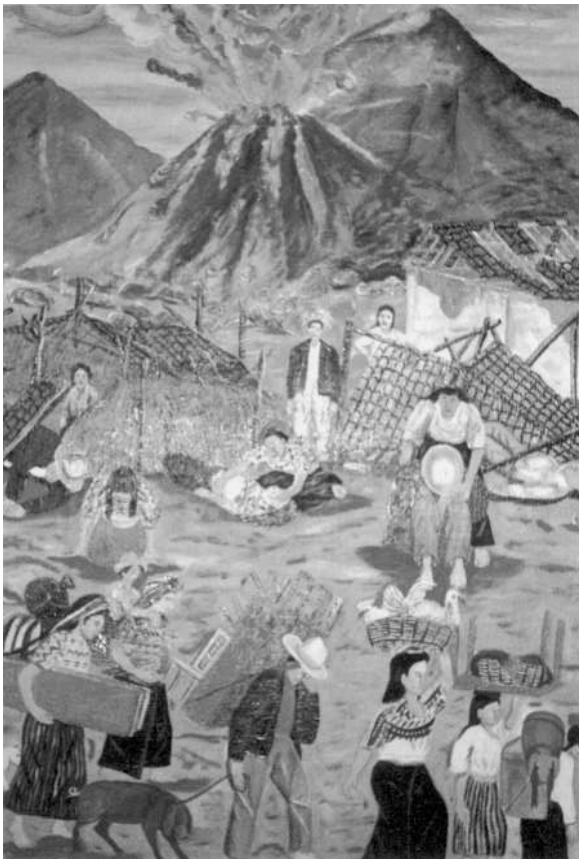
THE INTER-AMERICAN CONFERENCE

Cartagena, Colombia, March 1994

THE FINAL STEP IN THE REGIONAL PREPARATION FOR THE WORLD CONFERENCE

More than 1,000 representatives of governments, international organizations, regional agencies, and scientific and academic institutions responded to the call from the Government of Colombia to review the progress achieved during the first half of the IDNDR, and to identify regional priorities for the remainder of the Decade.

Following are highlights from observations and recommendations made by Conference participants:



Painting by Rafael Gonz lez; photo courtesy of Count de la Barre d'Erquillines

A REVIEW OF THE FIRST HALF OF THE DECADE

The International Decade has stimulated the interest and attention of most countries and of international and regional organizations in disaster reduction. As a result, many institutions have initiated effective disaster reduction programs in a variety of sectors: institutional building, health, education, infrastructure, and distribution of information and documentation.

However, due to development policies and practices and a lack of political commitment, the Region's vulnerability to natural disasters continues to grow. Areas of concern or needing improvement are:

- Many IDNDR initiatives have focused on scientific studies and technological solutions, with insufficient regard to their social, cultural, or economic feasibility.

- National agencies responsible for disaster reduction frequently have a centralized structure that

ON NATURAL DISASTER REDUCTION

excludes the participation of local communities and other sectors. These agencies are directed toward post-disaster response rather than prevention and mitigation measures.

- The link between disaster prevention and management of the environment has not been implemented because disaster reduction, as an essential strategy for sustainable development, has not been explicitly promoted.

LOOKING TOWARD THE FUTURE

Within their areas of expertise, the participants at the Inter-American Conference committed themselves to promote and implement the following actions:

- Adopt disaster reduction as both an objective and an indicator for reaching sustainable development;
- Develop regional and national techniques to assess and monitor vulnerability to natural disasters;
- Ensure the active participation of individuals and communities at risk;
- Translate technological results into effective policies for disaster response by reviewing and compiling regional experiences and studies that integrate the social and scientific sectors;
- Give priority to educating the general population and the main protagonists to establish a disaster prevention "culture" adapted to the reality of the Region;
- Provide practitioners and scientists with rapid access to information by expanding regional and national disaster documentation centers with a multisectoral and multiagency approach;
- Strengthen the trend toward decentralization of institutions and promote greater participation of the entire society in the effort to reduce vulnerability to disasters;
- Promote the establishment of national and regional parliamentary commissions on disaster reduction to review and strengthen existing legislation;
- Recognize and support the role of the Ministries of Foreign Affairs in promoting effective international cooperation, as well as between developing countries of the Region;
- Request that the international community support not only relief and preparedness activities, but also horizontal cooperation and networking between countries to achieve the goals of the IDNDR;
- Encourage financial institutions at global and regional levels to support disaster reduction activities by including vulnerability reduction aspects in national development projects.

This is a summary of the conclusions elaborated at the Inter-American Conference on Natural Disaster Reduction, Cartagena, Colombia, March 1994. They have been translated into English and abridged by PAHO/WHO.

of specialized centers to promote the teaching of integrated disaster management, such as the WHO Collaborating Center in Medellín, Colombia.

Governments

During the 1980s, civil defense and emergency response agencies made major advances in coordinating and supporting disaster response. Today, other sectors are beginning the more complex process of reducing the vulnerability of infrastructures as well as communities and their property to disasters. The best results have been obtained in those countries where development authorities take a leadership role and obtain the technical backing of disaster experts.

All countries in Latin America have established IDNDR Committees; the broader the participation of the public sector, the private sector, the Red Cross, NGOs, churches and community groups in these Committees is, the more dynamic they are. In those countries where ministries of finance, public works, education or health play a dominant role, a sustainable development approach has taken place. But where a traditional operational response command has simply been relabeled "The IDNDR Committee," little progress toward disaster reduction has been made.

New challenges face governments in the second half of the International Decade. For example, finance and planning sectors, on being invited to regional disaster reduction meetings, may still ask "What does our department or ministry have to do with disasters?" This reaction is identical to that of the health sector when, 15 years ago, it was encouraged to establish preparedness programs. The IDNDR, and in particular the U.N. World Conference, make a powerful argument for why they should be involved.

The Community

The other protagonists in disaster reduction are community groups and the general public. The illusion that the government can solve all problems while communities passively wait is fading. Individuals need to participate in the plans that shelter them from the effects of natural disasters. Community projects and experiences demonstrate that disaster reduction issues cannot be isolated from those of sustainable development. Community members contribute great energy and creativity to the solutions for their own progress; their participation must be developed and nurtured. The annual celebration of International Natural Disaster Reduction Day has opened the door to greater community involvement, and this will continue to be a priority for the second part of the Decade.

THE FACTORS

Progress toward reducing vulnerability to natural disasters varies from country to country in this Region and a number of factors determine the degree of progress made.

Acceptable Level of Risk

Each authority, each community, and each individual has a different notion of what constitutes an "acceptable" level of risk. Some countries do not invest in mitigation measures, but follow a "pay-the-price-later" philosophy, and choose to wait for the consequences of disasters. The more developed countries may have

a greater collective conscience of the importance of disaster management, thereby investing more in mitigation and prevention. These countries also have more resources available to enforce legislation and finance prevention, factors that influence what constitutes their acceptable level of risk.

The "triggering" role that serious natural disasters have played in awakening a collective awareness cannot be underestimated; a disaster occurring in one's own country does much more to motivate change than simply hearing of a disaster in a neighboring country. But motivating communities, institutions, or governments to invest in works meant to reduce damages caused by *potential* disasters is a challenge. A well-known anecdote tells of a Latin American engineer who was evaluating post-earthquake damages. Looking for lessons that the community learned that might be applicable to future situations, he asked a victim of the disaster what might be done to prevent another such occurrence. The response was: "I am much more worried about how I will get a chicken for my soup today than about how to protect myself from some other disaster." This anecdote illustrates the need to seek solutions to the problems of disasters within a broader national and local agenda aimed at eradicating poverty and meeting urgent needs.

What today is considered a clear two-way relationship between disasters and socioeconomic progress, was ignored until recently. Disasters were seen as unavoidable events to be dealt with when they happen, not events to consider during the design and preparation of development projects. Today, the sophisticated and costly infrastructure and burgeoning economy in many countries in the Region has significantly lowered the threshold of what is considered an acceptable risk.

Political and Administrative Stability

Disaster reduction has few immediately visible benefits, and until a major catastrophe occurs, the results are hidden. Disaster reduction requires political maturity and administrative stability. Preventing and mitigating the effects of natural disasters had little support during the social conflicts in Central America during the 1980s or in the midst of the political crisis of Haiti in the 1990s. Stable government and continuity at high decision-making levels are decisive factors in the countries that have achieved advances in the field. Harmony and a history of joint working relations between civil and security sectors also are important.

Availability of Resources

Poverty indisputably increases a population's vulnerability. Yet the countries with the highest per capita incomes are not necessarily those that succeed best in protecting their investments. Vulnerability can be reduced with even a modest economic investment if it is coupled with the appropriate political commitment. However, a lack of financial or human resources is the factor most often cited as limiting the implementation of mitigation and prevention measures.

Future solutions to the problem of vulnerability to disasters will require that "natural hazards" be included in analyses for new investment proposals, and that projects for reducing the effects of natural disasters be given priority in requests made for technical cooperation or loans from the international community.

In Latin America and the Caribbean, as in other regions of the world, political decisions are often the result of demands by populations exposed to risks. Two main objectives of the IDNDR are to create a level of awareness in the general public and to develop a "critical mass" of scientists, experts, and journalists, along with academic, social, and religious leaders who can serve as advocates of disaster prevention.

THE SECOND HALF OF THE DECADE . . . AND BEYOND

The trends in natural disaster reduction observed at the regional level and the extensive consultation process carried out in regional meetings (e.g., Guatemala 1991, Jamaica 1992, Colombia 1993 and 1994) could be summarized as follows:

Expand the "culture" of disaster prevention: The traditional tendency to equate disaster management with post-disaster response is being replaced by an approach to disaster reduction based on the realization that the effects of disasters may be, in part or in whole, prevented. Increasing public awareness of the benefits of disaster reduction is essential; this will be achieved through:

- Educational campaigns, using celebrations such as International Natural Disaster Reduction Day and other public events;

- Participation of the mass media at joint meetings, briefing workshops, and above all, through open and joint dialogue;

- Emphasis on including disaster prevention and preparedness in school curricula . . . a slow but powerful process.

Increase political support and commitment: The IDNDR should not only stimulate more scientific and technical activities, but raise the level of political commitment for prevention and mitigation measures despite the lack of immediate or obvious returns.

To consolidate the progress achieved at the World Conference on Natural Disaster Reduction in Yokohama, the following actions can be taken:

- Brief elected officials and, in particular, the legislative bodies at national, subregional, and regional levels; stressing the link between socio-economic development and disaster reduction.

- Discuss natural disaster reduction policies and priorities periodically with subregional and regional political bodies;

- Organize regional conferences to maintain a high level of political visibility of the topic. In particular, PAHO/WHO, with other interested regional and global organizations, will convene a regional meeting on mitigating damage to hospitals and other critical health facilities.

Disseminate technical knowledge: Much scientific knowledge and know-how is not sufficiently shared with those responsible for formulating and implementing disaster reduction policies and strategies. Although Latin America and the Caribbean are placing more emphasis on the development of human resources, regional preparatory meetings should:

- Compile and disseminate successful pilot projects and other achievements at local or national levels;
- Expand the existing regional or national disaster documentation centers using a multisectoral and multi-agency approach, to facilitate free access to existing documentation;
- Strengthen existing networks of scientists by increasing the participation of practitioners;
- Include disaster reduction in the curricula of academic institutions, schools of engineering and architecture, faculties of medicine, etc.;
- Reduce duplication, and fill existing gaps of training activities undertaken by bilateral, regional, or global agencies.

Emphasize the social dimension through local participation: Political commitment and scientific knowledge do not guarantee the reduction of community vulnerability to natural disasters. Those attending the Cartagena Inter-American Conference were committed to the social dimension of disaster reduction by:

- Involving local communities in practices that reduce their vulnerability;
- Promoting scientific findings that translate into effective policies;
- Improving understanding of natural hazards, and the relationship between behavior, development, and disaster reduction.

Strengthen institutions through multisectoral participation: The trend from centralized relief-oriented institutions toward multisectoral natural disaster reduction efforts will be encouraged and will require:

- Promoting the participation of government development institutions;
- Decentralizing governmental agencies to involve communities and their leaders in decision making;
- Providing a legal framework for disaster prevention, mitigation, and preparedness;
- Creating disaster committees in national parliaments and discussing disaster mitigation in subregional or regional parliamentary consultative bodies.

Recognize interdependence between countries: Solidarity and cooperation traditionally are strong in Latin America and the Caribbean in times of catastrophe. Now a common purpose is emerging: to prevent the occurrence of a disaster. To achieve this, countries will need the following during the remainder of the IDNDR:

MAP OF LATIN AMERICA AND THE CARIBBEAN

- Frequent contacts between officials of neighboring countries at periodic meetings; informal technical consultation and exchange of information on a routine basis; and use of modern communications, such as electronic mail;

- Support from the Ministries of Foreign Affairs to incorporate disaster reduction into existing or upcoming intercountry agreements;

- Increased collaborative efforts in border areas exposed to natural disasters such as volcanic eruptions or earthquakes;

- Support and leadership from regional or subregional institutions.

Emphasize the link between urbanization, development of human settlements, and increased vulnerability: Regional urban regulatory plans and land-use laws do not always require the analysis of natural disaster risk when creating development plans. To correct this, countries should:

- Include risk analysis and natural hazard data in land regulation plans supported by UNHCS (HABITAT), the OAS, and others;

- Include the topic at national and intergovernmental meetings, commissions on housing and human settlements, and place it on the agenda of the World Conference, *Habitat 2*, in 1996.

Pay greater attention to the causes and effects of flooding and landslides, which place a heavy burden on the countries and have not received a proportionate share of attention, by:

- Making systematic studies of the causes and effects of floods and landslides on agriculture and human settlements at the national and regional levels;

- Creating integrated flood control programs, including Ministries of Agriculture, hydrometeorological institutes, municipalities, the housing sector, and others.

In the same way that current achievements of Latin America and the Caribbean have been the result of a process started long before the proclamation of the IDNDR, the drive toward reducing the effects of natural disasters as an explicit objective and requirement of the development process will not end with the Decade.

In Latin America and the Caribbean, the notion that the factors involved in natural disaster reduction are the same as those that influence socioeconomic development is gaining widespread acceptance. This is to the credit of the IDNDR. And, it is not surprising that the two go hand in hand, since it is impossible for one to advance without the other. To achieve disaster prevention and mitigation without socioeconomic development and political maturity in a society is not possible. Nor can sustainable development be achieved without reducing the vulnerability of people and nations to disaster. ◆

REFERENCES

Anderson, M.B. and P.J. Woodrow. 1989. *Rising from the ashes, development strategies in times of disaster*. Boulder, Colo.: Westview Press.

Bailey, W. 1989. *Hurricane Gilbert*. Disaster Reports No. 5. Washington, D.C.: PAHO.

Barreto Vaquero, R. 1993. "Manejo ambiental y prevención de desastres naturales con participación comunitaria: el caso de los barrios populares del noroccidente de Quito." Paper presented at the International Seminar on Prevention and Mitigation of Disasters in Communities. Tegucigalpa, Honduras, September 1993.

Bates, F.L. 1982. *Recovery, change and development. A longitudinal study of the 1976 Guatemalan earthquake*. Final report. Volume 1. University of Georgia.

Bender, S. 1993. "Preparación en caso de desastres y desarrollo sostenible." *Desastres y Sociedad*. No. 1, Vol. 1., July-December.

Bengoa, J. 1987. *Historia del Pueblo Mapuche*. Santiago: Ediciones Sur.

Bermúdez Peralta, R. 1993. "Los socios en preparación y prevención de desastres." Working document. San José, Costa Rica: OFDA/USAID.

Bermúdez Chavez, M. 1991. "Desastres naturales en la prensa escrita de Costa Rica," *Ciencias Sociales*. No. 53, pp. 83-94.

Bolis, M. 1993. "Legislación para el manejo de desastres en los Países Andinos." PAHO/WHO working document. Washington, D.C.

Bolivia, Dirección General de Salud, Depto. Nacional de Emergencias y Desastres. 1990. "Guía de atención en salud, nutrición y otros aspectos sociales en sequías." (Draft version.) La Paz.

Bolt, B.A., Horn, W.L., Macdonald, G.A., and R.F. Scott, editors. 1977. *Geological hazards*. Second edition. New York: Springer-Verlag.

Bonilla González, C. D., Céspedes Robles, R., and H. Prado Monje. 1993. *Diseño de un instrumento de evaluación de daños y análisis de necesidades post desastre para la toma de decisiones, con base en el análisis del terremoto de Limón, Costa Rica, Abril 1991*. Master's Thesis. University of Costa Rica, Faculty of Medicine, Department of Public Health, San José.

Brazil, Ministerio do Interior, Superintendencia˜do Desenvolvimento de Nordeste. 1993. "Orientações básicas e reaçao de municípios críticos da seca nordeste." Brasilia: SUDENE.

Bustamante, M. 1994. Personal communication (Dirección Nacional para la Prevención y Atención a los Desastres, Colombia).

Callihan, D. 1989. *Managing resource coordination for sudden onset foreign disasters: A case study of the response to hurricane Gilbert/Jamaica*. Washington, D.C.: VITA.

Candanedo, C. 1994. "Una experiencia en previsión de desastres en Panamá." Working document. Instituto de Recursos Hidráulicos y Electrificación de Panamá.

Cardona Arboleda, O.D. 1993. "Evaluación de la amenaza, la vulnerabilidad y el riesgo." In La Red, *Los desastres no son naturales.* Santafé de Bogotá: Tercer Mundo Editores.

____. 1993. "Manejo ambiental y prevención de desastres: dos temas asociados." *In* La Red, *Los desastres no son naturales*. Santafé de Bogotá: Tercer Mundo Editores.

Centro Nacional de Prevención de Desastres (CENAPRED). 1993. *Prevención*. Mexico City: CENAPRED.

Centro de Coordinación para la Prevención de los Desastres Naturales en América Central (CEPREDENAC). 1993. *Plan institucional de reducción de desastres en Centroamérica*. Mimeographed document.

____. 1994. "El Plan Regional de Reducción de Desastres y CEPREDENAC" (Interview with L.R. Durán Vargas, 1994, President, CEPREDENAC).

Centro Regional de Sismología para América del Sur (CERESIS). 1989. *Riesgo volcánico : Evaluación y mitigación en América Latina*. Lima: CERESIS.

Chile, Ministerio del Interior, Oficina Nacional de Emergencia (ONEMI). *Plan nacional de emergencia*. Santiago.

Chile, Ministerio de Salud. 1993. *Situación y atención de la salud en Chile.* Santiago.

____. 1991. "El sector salud en Chile y su rol frente a emergencias y desastres naturales." (L. Busco Costa, Departamento Asuntos de Emergencia y Catástrofe). Santiago.

Collier, S., Blakemore, H., and T.E. Skidmore. 1985. *The Cambridge encyclopedia of Latin America and the Caribbean*. Cambridge: Cambridge University Press.

Colombia, Ministerio de Gobierno, Dirección Nacional para la Prevención y Atención a los Desastres. 1993. *Programa de mitigación de riesgos en Colombia. Informe de avance: Fase II*. Santafé de Bogotá: Ministerio de Gobierno.

Colombia, Ministerio de Gobierno, Dirección Nacional para la Prevención y Atención a los Desastres. Interview with the Director General, O.D. Cardona Arboleda, Costa Rica, 27 November 1993.

Colombia, Ministerio de Gobierno, Plan Integral para la Prevención y Atención de Desastres de Manizales (PADEM). 1994. Project report. Manizales.

Colombia, Ministerio de Salud, Dirección de Saneamiento Ambiental. "Atención al ambiente en emergencias de origen

volcánico." Santafé de Bogotá.

Colombia, Presidencia de la República. Oficina Nacional para la Atención de Desastres. 1988. *Nosotros la gente del volcan: Prevención de riesgos con participación comunitaria*. Santafé de Bogotá: Dirección General para la Cooperación al Desarrollo del Ministerio de Relaciones Exteriores de Italia.

Colombia, Presidencia de la República. 1985. "El volcán y la avalancha". Santafé de Bogotá: Imprenta Nacional.

Comisión Económica para América Latina y el Caribe (CEPALC). 1994. *Manual para la estimación de los efectos socioeconómicos de los desastres naturales*. Santiago: CEPALC.

____. 1986. "El terremoto de 1986 en San Salvador: daños, repercusiones y ayuda requerida." Project profiles, 16 December. Santiago.

____. 1973." Informe sobre los daños y repercusiones del terremoto de la ciudad de Managua en la economía Nicaraguense." Santiago: CEPALC.

Costa Rica, Comisión Nacional de Emergencias. 1994. Personal communication with R. Durán and J. J. Chacón.

Costa Rica, Ministerio de Vivienda y Asentamientos Humanos. 1993. Proyecto Nacional de Bambú. *Información general*. San José.

____. 1991. "Bambusetum". *Boletín del Proyecto Nacional de Bambú*. May.

Cruz, M. 1991. "Comportamiento de hospitales en Costa Rica durante los sismos de 1990." Project report prepared for PAHO, San José, Costa Rica.

Cuny, F.C. 1983. *Disasters and development*. New York: Oxford University Press.

De Castro, J. 1975. *Geografía del hambre*. Buenos Aires: Solar/ Hachette.

De Ville de Goyet, C. 1994. "Itinéraire pour un monde plus sécuritaire" *Ecodecision*. No. 12, April.

Durán Vargas, L.R. 1994. "Centroamérica: El reto de la reducción de desastres en el contexto de la integración regional." Paper presented at U.N. World Conference on Natural Disaster Reduction, Yokohama, May 1994.

Economic Commission for Latin America and the Caribbean (ECLAC). 1979. "Report on the effects of Hurricane David on the Island of Dominica." 13th special session, New York, 19 October 1979.

____. 1984. The natural disasters of 1982-1983 in Bolivia, Ecuador and Perú. Santiago: ECLAC.

Ecuador, Ministerio de Salud Pública. 1990. "Desastres naturales en los últimos 25 años en Ecuador." (J.V. Cedeño, Director, Planeamiento de la Seguridad para el Desarrollo Nacional.)

Ediciones Ubillus. 1985. *Aspectos científicos sobre el fenómeno de "El Niño" y su incidencia en la region Piura-Tumbes.* Ediciones Ubillus: Piura, Perú.

El Salvador, Centro de Colaboración para Situaciones de Emergencia. 1991. *Organización local para situaciones de emergencia*. Rome: Cooperación Italiana.

Encyclopaedia Britannica, Inc. 1993. *1993 Britannica book of the year*. Chicago: Encyclopaedia Britannica, Inc.

Farrer, H. 1989. "Informe de la asesoría sobre aspectos de atención de emergencias y desastres a la Corporación de Acueducto y Alcantarillado de Santiago de los Caballeros (CORASAAN)." Santo Domingo, Dominican Republic, 1989.

Fundación para la Prevención del Riesgo Sísmico del Estado Mérida (FUNDAPRIS). 1993. Informe de actividades. Mérida, Venezuela: FUNDAPRIS.

Gavidia, J. 1992. "Los efectos económicos y sociales de los desastres naturales." Santiago: CEPAL.

Gibbs, T. 1994. "Caribbean Uniform Building Code" (personal communication).

Gibbs, T. 1992. "Case study: The mitigation of damages to critical facilities due to natural disasters in the Commonwealth Caribbean." Paper presented at the Caribbean IDNDR Meeting, Kingston, Jamaica, May 1992.

Giesecke, A. 1994. "Reconditioning of existing adobe housing to mitigate the effects of earthquakes." Lima: CERESIS.

Gueri, M. "Trip report; 9-17 February 1983". PED/PERU. Lima, Perú, 1983.

Instituto Geográfico Militar (Ecuador), Instituto Panamericano de Geografía e Historia Sección Nacional del Ecuador, L'Institut francais de recherche scientifique pour le développement en coopération. 1992. *Atlas Infográfico de Quito*. ORSTOM: Quito.

Inter-American Development Bank. 1993. *Economic and social progress in Latin America, 1993 report*. Washington, D.C.: IDB.

International Federation of Red Cross and Red Crescent Societies. 1993. *World disaster report*. Dordrecht: Martinus Nijhoff.

Jamaica, Construction Research Development Centre. Interview with the Executive Director, Mr. Steven Hughes, 19 January 1994.

Jovel, R. 1989. *"Los efectos económicos y sociales de los desastres naturales en América Latina y el Caribe."* Santiago: CEPALC.

Jovel, R. and R. Zapata Martí. 1993. *Macroeconomic effects of natural disasters in Latin America and the Caribbean*. Santiago: ECLAC.

Kreimer, A. and M. Preece. 1994. "Case Study: La Paz Municipal Development Project". World Bank working document.

Kreimer, A. and M. Munasinghe. 1991. "Managing natural disasters and the environment". Selected materials from the Colloquium on the Environment and Natural Disaster Management. Washington, D.C.: World Bank.

Kuroiwa, J. and L. Castro. 1987. "Planeamiento regional del Departamento de Piura para la mitigación y (o) prevención de desastres." *In* CISMID, *Report of First National Symposium on Prevention and Mitigation of Natural Disasters*; 1-3 June 1987. Lima: Centro Peruano-Japonés de Investigaciones Sísmicas y Mitigación de Desastres (CISMID).

Lavell, A. 1993. "The Costa Rican Hospital Retrofitting Program: Decision-making, implementation, procedures and the construction

process." Project summary prepared for OFDA/USAID. Washington, D.C.

Lescano, J. L. "Proyectos de reconstrucción de los efectos de las inundaciones." *In* CISMID, *Report of First National Symposium on Prevention and Mitigation of Natural Disasters*; 1-3 June 1987. Lima: Centro Peruano-Japonés de Investigaciones Sísmicas y Mitigación de Desastres (CISMID).

Luzuriaga C., C. "La vulnerabilidad y la respuesta institucional para el manejo de los desastres en el Ecuador." 1993.

Maskrey, A. 1993. "Vulnerabilidad y mitigación de desastres." In La Red, *Los desastres no son naturales*. Santafé de Bogotá: Tercer Mundo Editores.

Meditz, S.W. and D.M. Hanratty, editors. 1989. *Islands of the Commonwealth Caribbean: A regional study*. Washington, D.C.: US Government Printing Office.

Mexico, Sistema Nacional de Protección Civil. 1993. Primer ciclo de conferencias sobre prevención. Mexico City: SINAPROC.

___. 1992. *Atlas nacional de riesgos de la República Mexicana*. Mexico City: SINAPROC.

Mexico, Universidad Nacional Autónoma de México. 1991. *Preparativos para casos de desastre*. Mexico City: UNAM.

Molin Valdés, H. 1994. "IDNDR and its links with Agenda 21." *Ecodecision*. No. 12.

Monzón, H. "Repair and retrofitting of a brittle reinforced concrete building: The rehabilitation of a seismically damaged hospital in San Salvador." Proceedings, International Symposium on Earthquake Disaster Prevention. Volume II.

Morales, L. D. and D. Salgado. 1993. "Sistema de información para emergencias (SIE)." Mimeographed document. San José: Comisión Nacional de Emergencia de Costa Rica.

Morales, L. D. 1993. "Atlas de amenazas naturales de Costa Rica." *Emergencia*. No. 2. (April-June). San José: Comisión Nacional de Emergencia de Costa Rica.

Nemec, J. 1993. "Inundaciones en Ecuador." *Stop Disasters*. No. 15, pp. 12-13.

Neruda, P. 1974. *The yellow heart*. Translation by William O'Daly. Port Townsend, Washington: Copper Canyon Press.

Organization of American States. 1991. *Disasters, planning, and development: managing natural hazards to reduce damage*. Washington, D.C.: OAS.

Organization of American States, Department of Regional Development and the Environment. 1994. Personal communication with J. Vermieren.

Pan American Health Organization. 1994. *Health conditions in the Americas*. Draft version. Washington, D.C.: PAHO.

___. 1990. *Health conditions in the Americas*. Washington, D.C.: PAHO. (Scientific Publication No. 524).

___. 1989. *Report on disasters and emergency preparedness for Jamaica, St. Vincent and Dominica*. Disaster Reports No. 2. Washington, D.C.: PAHO.

___. 1986. *Health conditions in the Americas*. (Scientific Publication No. 500). Washington, D.C.: PAHO.

___. 1986. *Evaluation of the strategy of Health for All by the Year 2000: Seventh report on the world health situation*. Vol. 3. Washington, D.C.: PAHO.

___. 1985. *The earthquake in Mexico*. Disaster Reports No. 3. Washington, D.C.: PAHO.

___. 1981. *Emergency health management after natural disaster*. (Scientific Publication No. 407). Washington, D.C.: PAHO.

Peraldo, G. 1993. "Desastres históricos y planificación urbana." *Emergencia*. Jan/March. San José: Comisión Nacional de Emergencia de Costa Rica.

Peru, Comisión Ejecutiva. 1991. "Informe del programa de emergencia pro sequía." Lima.

Peru, CRYRZA. 1971. "Los recursos financieros y técnicos." Comisión de Reconstrucción y Rehabilitación de la zona afectada por el terremoto del 31 de mayo de 1970. Lima, Peru.

Peru, Instituto Nacional de Defensa Civil. 1994. Personal communication.

Peru, Proyecto de Preparación para Casos de Desastre en Comunidades (PREDECO). 1994. Personal communication. Lima.

Ramírez Rojas, M. A. 1993. "La educación escolar para casos de emergencia." Working document. San José, Costa Rica: Partners of the Americas, USAID/OFDA.

Red de Estudios Sociales en Prevención de Desastres en América Latina. 1993. "Agenda de Investigación y Constitución Orgánica." Lima: COMECSO/ITDG.

Reid, U.V. 1980. "Dominica - Hurricane David, 29 August 1979". *Disasters*, Vol 4, No. 3, pp 277-282.

Rennie, D. 1970. "After the earthquake." *The Lancet*, October 3, pp. 704-707.

Rosales, V. 1991. *Pérdidas en infraestructura: sismo del 22 de abril de 1991, provincia de Limón*. San José: Comisión Nacional de Emergencia de Costa Rica.

Rossi, E.E. and J.C. Plano. 1992. *Latin America: A political dictionary*. Oxford: ABC-CLIO.

Saragoni Huerta, R. 1994. Personal communication, Univ. of Chile.

Sistema de la Integración Centroamericana (SICA). 1994. Personal communication, Mr. P. Pastor.

South America, Central America and the Caribbean 1993. 1993. Fourth Edition. London: Europa Publications Limited.

Susuki Lopez, L. 1972. *Imborrable recuerdo, terremoto en Huaraz, 1970*. Lima: Servicio de Salud de Ancash.

UNESCO. 1993. *Environmental and Development Briefs*. No. 5. Paris: UNESCO.

United Nations, Population Division. 1993. *World population prospects: The 1992 revision*. New York.

United Nations, UNDRO, and Colombia, Ministerio de Gobierno, Sistema Nacional de Prevención y Atención a los Desastres. 1991.

"Programa de Mitigación de Desastres en Colombia 1988-1991. Informe de proyecto." Mimeographed document. Santafé de Bogotá.

United Nations, Department of Humanitarian Affairs. Situation reports. 1980-1993. Geneva.

____. 1992. "Disaster mitigation programme in Peru." Working documents. Geneva.

____. 1992. "Disaster mitigation programme in Argentina." Working document. Geneva.

____. 1992. *Glossary: Internationally agreed glossary of basic terms related to disaster management*. Geneva: UN/DHA.

United Nations Development Programme (UNDP). 1993. *Human development report 1993*. New York: Oxford University Press.

United Nations Development Program (UNDP) and United Nations Office of the Disaster Relief Coordinator (UNDRO). 1991. *Disasters and development: Trainer's guide for the UNDP/UNDRO Disaster Management Training Program*. (Module prepared by R.S. Stephenson). Madison, Wisc.: University of Wisconsin, Disaster Management Center.

United Nations, Office of the Disaster Relief Coordinator (UNDRO). 1988. "Hurricane Gilbert", *UNDRO News*, September/October, pp. 15-16.

____. 1990. "Disaster prevention and preparedness project for Ecuador and neighbouring countries." Project report. Geneva.

United Nations, Population Division. 1988. *World demographic estimates and projections*, 1950-2025. New York.

United States, Agency for International Development, Office of U.S. Foreign Disaster Assistance. 1979-1993. OFDA annual reports. Washington, D.C.: USAID.

____. 1993. *Disaster history: Significant data on major disasters worldwide, 1900-present*. Washington, D.C.: OFDA.

United States, Federal Emergency Management Agency (FEMA). 1990. *Seismic considerations—Health care facilities*. Earthquake Hazards Reduction Series 35. Washington, D.C.

United States, National Oceanic and Atmospheric Administration, National Geophysical Data Center. Maps.

Universidade do Estado de Santa Catarina. 1991. Seminario sobre inundações da Gacia do Brata e na Região Sul do Brasil. Florianopolis, S.C., Brazil: CETREM.

Universidade Federal de Santa Catarina. 1984. "As enchentes de Jul/83 e a busca de solução. Grupo de Trabalho em hidrologia e controle de enchentes Depto. de Engenharia Civil. Florianopolis, S.C.. Brazil: UFSC.

Urrutia de Hazbun, R. and C.L. Lazcano. 1993. *Catastrofes en Chile, 1541-1992*. Santiago: Editorial La Noria.

Vargas de Mayo, C. A. "Vigilancia de la calidad bacteriológica del agua en situaciones de desastre en los departamentos de Piura y Tumbes." PAHO/WHO working document, October 1983-June 1984, Lima.

Venezuela, Ministerio de Sanidad y Asistencia Social. 1994. "Sistema integrado de emergencia." Caracas.

Venezuela, Ministerio de Sanidad y Asistencia Social, Dirección General. 1993. "Información de situación en Venezuela por Huracán Bret." Caracas.

Voight, B. 1990. "Nevado del Ruiz Volcano catastrophe: Anatomy and retrospection." *Journal of Volcanology and Geothermal Research*. No. 44. pp. 349-386.

World Bank. 1992. *World development report 1992*. New York: Oxford University Press.

____. 1993. *World development report 1993*. New York: Oxford University Press.

____. 1994. *The World Bank atlas*. Washington, D.C.: World Bank.

World Meteorological Organization, Division for Latin America and the Caribbean. 1994. "Proyectos de cooperación técnica en el area de prevencíón y alerta contra desastres naturales." (Personal communication with V. Torres, Chief of Department of Technical Cooperation.)

World Meteorological Organization. 1994. "Proyecto para la Rehabilitación y Mejoramiento de los Servicios Meteortológicos e Hidrológicos del Istmo Centroamericano (PRIMSCEN)." (Personal communication with M. Molina, Technical Advisor.)

World Resources Institute and the International Institute for Environmnent and Development. 1992. *World resources 1992-93*. New York: Oxford University Press.

____. 1990. *World resources 1990-91*. New York: Oxford University Press.

____. 1989. *World resources 1988-89*. New York: Basic Books, Inc.

World Health Organization. 1989. *Spotlight on the cities: Improving urban health in developing countries*. Geneva: WHO.

Worrell, J. 1994. Personal communication, Office of Disaster Preparedness, British Virgin Islands.

Zamorano Godoy, M. 1991. "Informe sobre el aluvión de Antofagasta." Ministerio de Salud, Servicio de Salud, Chile.

Zeballos, J.L. 1986. "Health aspects of the Mexico earthquake." *Disasters*. Vol. 10, no. 2.

Zevallos, O. 1994. "Paute River disaster in Ecuador" (Personal communication.)

Zupka, D. 1988. "Economic Aspects of Disasters." *UNDRO News*. Geneva: UNDRO.

ACRONYMS

AIDIS	Asociación Interamericano de Ingeniería Sanitario (Inter-American Association of Sanitary Engineering)
BIREME	Latin American and Caribbean Center for Health Sciences Information
CARICOM	Caribbean Community
CCEO	Caribbean Council of Engineering Organizations
CCSS	Caja Costarricense de Seguro Social (Costa Rican Social Security Fund)
CDERA	Caribbean Disaster Emergency Response Agency
CDRC	Center for the Development of Research in Construction (Jamaica)
CENAPRED	Centro Nacional de Prevención de Desastres (National Center for Disaster Prevention), Mexico
CEPIS	Centro Panamericano de Ingeniería Sanitaria (Pan American Center for Sanitary Engineering and Environmental Sciences)
CEPREDENAC	Centro de Coordinación para la Prevención de los Desastres Naturales en América Central (Center for Coordination of the Prevention of Natural Disasters in Central America)
CERESIS	Centro Regional de Sismología para América del Sur (Regional Center of Seismology for South America)
CERO	Central Emergency Relief Organization (Barbados)
CIDA	Canadian International Development Agency
CISMID	Centro Peruano-Japonés de Investigaciones Sísmicas y Mitigación de Desastres (Center for Seismic Research and Disaster Mitigation), Peru
CMO	Caribbean Meteorological Organization
CNE	Comisión Nacional de Emergencias (National Emergency Commission), Costa Rica
CONASE	Comité Nacional de Salud para Emergencias (National Health Committee for Emergencies), Ecuador
CONE	Comité Nacional de Emergencia (National Emergency Committee), Guatemala
CUBiC	Caribbean Uniform Building Code
CUSEC	Central U.S. Earthquake Consortium
DMTP	Disaster Management Training Program
DNPAD	Dirección Nacional para la Prevención y Atención a los Desastres (National Directorate for Disaster Prevention and Response), Colombia
ECLAC	Economic Commission for Latin America and the Caribbean
FEMA	Federal Emergency Management Agency (U.S.A.)
FUNDAPRIS	Fundación de Asesoría para la Prevención del Riesgo Sísmico (Foundation for the Prevention of Seismic Risk; formerly CEAPRIS), Venezuela
GIS	Geographical Information Systems
GTZ	German Agency for Technical Cooperation
HABITAT	United Nations Center for Human Settlements
ICAP	Instituto Centroamericano de Administración Pública (Central American Institute of Public Administration), Costa Rica
ICAROS	IDNDR Roving Seminar in the Caribbean
IDB	Inter-American Development Bank
IDNDR	International Decade for Natural Disaster Reduction
IDRC	International Development Research Center (Canada)
INDECI	Instituto Nacional de Defensa Civil (National Civil Defense Institute), Peru
IPGH	Instituto Panamericano de Geografía e Historia (Pan American Geography and History Institute)

JICA	Japan International Cooperation Agency
MERCOSUR	Mercado Común del Sur (Southern Common Market)
NEMA	National Emergency Management Agency (Trinidad and Tobago)
OAS	Organization of American States
ODA	Overseas Development Administration (United Kingdom)
ODPEM	Office of Disaster Preparedness and Emergency Management (Jamaica)
OECS	Organization of Eastern Caribbean States
OFDA/USAID	Office of U.S. Foreign Disaster Assistance/U.S. Agency for International Development
ONEMI	Oficina Nacional de Emergencias del Ministerio del Interior (Ministry of the Interior, National Emergency Office), Chile
ORSTOM	French Institute of Scientific Research for Development
PADEM	Plan Integral para la Prevención y Atención de Desastres de Manizales (Comprehensive Plan for Disaster Prevention and Response of Manizales), Colombia
PAHO	Pan American Health Organization, Regional Office of the World Health Organization
PARLACEN	Parlamento Centroamericano (Central American Parliament)
PCDPPP	Pan-Caribbean Disaster Preparedness and Prevention Project
PREDECO	Proyecto de Preparación para Casos de Desastres en Comunidades (Community Disaster Preparedness Project) Peru
PRIMSCEN	Proyecto para la Rehabilitación y Mejoramiento de los Servicios Meterológicos e Hidrológicos del Istmo Centroamericano (Central American Project for the Rehabilitation and Improvement of Meteorologic and Hydrologic Services)
PRODERE	Programa de Desarrollo Regional (Program for Regional Development)
La RED	Red Latinoamericana de Estudios Sociales en Prevención de Desastres (Latin American Network for Social Studies on Disaster Prevention)
SELA	Sistema Económico Latinoamericano (Latin American Economic System)
SICA	Sistema de la Integración Centroamericana (Central American Integration System)
SIDA	Swedish International Development Authority
SINAPROC	Sistema Nacional de Protección Civil (National Civil Protection System), Mexico; Panama
SNPAD	Sistema Nacional para la Prevención y Atención a Desastres (National System for Disaster Prevention and Response), Colombia
SRU	Seismic Research Unit, University of the West Indies, Trinidad and Tobago
SUMA	Supply Management Project in the Aftermath of Disasters
UATI	International Union of Technical Associations
UN/DHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Program
UNDRO	Office of the United Nations Disaster Relief Coordinator
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
USGS	United States Geological Survey
UWI	University of West Indies
WFEO	World Federation of Engineering Organizations
WHO	World Health Organization
WMO	World Meteorological Organization

Pan American Health Organization
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