

**NATURAL
DISASTERS
and the
DEVELOPMENT
PROCESS**

Office of Foreign Disaster Assistance
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Natural Disasters and the Development Process:
A Discussion of Issues

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INTRODUCTION

The relationship between natural disasters and development is a subject of growing concern to the international community. The transition from a traditional to a modern society is a difficult process at best and natural disasters and the damage they cause are an added constraint to this process. Understanding this relationship is becoming increasingly important as losses in life and property from natural hazards continue to rise in most regions of the world.

Although per capita property losses due to natural disasters are higher in developed countries, the burden of loss is far greater in the developing world. This is because the "costs of hazard," that is the loss from property damage and expenditures on rehabilitation and reconstruction, must be seen relative to the resources of the society. Table 1 illustrates the cost of hazard per capita and as a proportion of GNP in selected countries. In all cases, the dollar value of per capita loss varies much less than the loss of GNP, which is about twenty times greater in developing countries. In absolute terms, the dollar damage in developing countries far exceeds the total amount of international financial aid received. In many cases, disaster losses effectively negate any real economic growth and, oftentimes, countries actually lose ground in relative terms. Furthermore, it has been estimated that 95% of disaster-related deaths occur among the two-thirds of the world's population that live in developing countries.

Table 1: National Studies: Hazard Costs and National Income *

Developing Countries Hazard Cost			Developed Countries Hazard Cost			
<u>Per Capita (\$)</u>	<u>% GNP</u>		<u>Per Capita (\$)</u>	<u>% GNP</u>		
1.38	Tanzania	1.84	Drought	3.31	Australia	0.10
3.55	Sri Lanka	2.13	Flood	5.79	United States	0.11
0.47	Bangladesn	0.73	Cyclones	2.11	United States	0.04

* Hazard Cost is the sum of damage loss and costs of adjustment expressed here as annual average per capita costs and as a percentage of gross national product.

Source: Ian Burton, Robert Kates, and Gilbert White, The Environment as Hazard, 1978 p.79.

¹United Nations, Office of the United Nations Disaster Relief Co-ordinator (UNDRO). The Protection of Human Settlements from Natural Disasters. Geneva: United Nations. February 24, 1976, p. 5.

This disparity between the effects of disasters on developed and developing countries becomes clearer once the term natural disaster is defined. Natural events, such as earthquakes and hurricanes, do not, by themselves, constitute disasters. It is the intensity of the event and the affected society's ability to cope with this event which actually determine a disaster.² It is, therefore, the relatively greater vulnerability of less-developed countries that is primarily responsible for their disproportionate suffering as a result of natural phenomena.

There are several factors that contribute to this increased vulnerability, some of which are linked to the very process of development. Rapid population growth in developing countries with limited resources has led to the undirected settlement of hazardous areas. While seeking the beneficial use of land resources, people have become more vulnerable to extreme natural events. Farmers have expanded their crop lands into dangerous coastal zones; new buildings have been constructed on alluvial and unconsolidated soils in seismically active areas; and growing cities in tropical areas have spread onto adjacent floodplains. Each situation represents a trade-off between economic return and social risk.

A corollary to this pattern of expansion is the increased exposure of the environment and destruction of its natural protective capacity. Poor land and water resource management, and practices such as deforestation and overgrazing have heightened the land's vulnerability to flood and drought. As pressure from growing populations increases, so, too, does environmental degradation and hazard risk.

The pattern of rapid urbanization, unaccompanied by improvements in communication, warning, evacuation, and transportation facilities, has also contributed to greater disaster risk in developing countries. Burgeoning urban slums and squatter settlements are characterized by substandard housing particularly susceptible to earthquake and wind damage. In addition, major industries, representing a source of employment, wealth, exports and essential goods, are usually centralized in these cities. This concentration of population and economic activity, in the absence of compensatory protective planning and preparedness measures, increases the potential for loss of life, destruction, and severe economic disruption.

In conjunction with these factors, many developing nations have suffered from a serious lag between perception of these problems and attention to their increased disaster vulnerability. The analysis of recent disasters has increased the theoretical understanding of ways to reduce vulnerability; but this knowledge and its application have often been unavailable to those to whom it is, perhaps, most applicable. With the benefit of

²Frederick Krimgold. Overview in the Priority Area Natural Disaster. New York: United Nations. October 15, 1976, p. 2.

greater scientific and administrative abilities, it is now possible to effect long-term mitigation measures to reduce disaster impact and undertake preparedness activities aimed at organizing a timely response to a crisis. Development projects in education, communication, community organizing, public health, and agriculture are programs in which preparedness and mitigation elements can easily be incorporated. Vulnerability can be reduced through analyses of hazard risk, public awareness campaigns, development of emergency plans and warning systems, and contingency planning for post-disaster rehabilitation and reconstruction. It is in these areas that disaster-prone countries must act if they are to protect both their people and their economies.

This paper will address some of the issues related to the question of disasters and development. It is not to be viewed as an exhaustive study, but rather as a point of departure for continued discussion of the problem. The paper is divided into two sections. The first examines four different types of disasters as they have occurred in various parts of the world. This section illustrates the magnitude of each disaster and its economic impact, and examines the disaster preparedness of the affected countries. The second section presents examples of disaster mitigation and preparedness projects sponsored by A.I.D.'s Office of U.S. Foreign Disaster Assistance and the developmental implications these efforts represent. These projects are only a sampling of techniques and measures available to combat disaster impacts and are meant to stimulate exploration of still other possibilities.

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NICARAGUA

On December 23, 1972, a series of earthquakes registering as high as 5.6 on the Richter scale shook the Central American nation of Nicaragua. The earthquake's epicenter was located precisely at the capital city of Managua and resulted in the destruction of the heavily populated central zone and damage to a total area of about 27 sq. km. Subsequent fires blazed throughout the city compounding the damages. In the wake of the disaster, of Managua's total population of 430,000, at least 8,000 were dead, 20,000 were injured, over 260,000 had fled the city, 50% of the employed were jobless, and 70% were left temporarily homeless. At least 10% of the nation's industrial capacity, 50% of commercial property, and 70% of government facilities were rendered inoperative. Seventy-five percent of Managua's population suffered an average loss of property and income equal to \$1,050, which is three times Nicaragua's 1972 per capita GNP of \$350. Overall, the dollar damage was estimated at \$845 million.

Earthquake destruction was not without precedent in Managua. In 1931 the city was destroyed by an earthquake and in 1968 it suffered severe, albeit localized, damage. In spite of these past experiences, the capital was rebuilt and expanded on the same location. It is, therefore, understandable that a major issue after the 1972 earthquake concerned future decentralization or relocation of the city. During the reconstruction period, decentralization was pursued selectively due to constraints imposed by interest group pressures, high costs and deep-rooted cultural factors. Although Managua is now considerably more decentralized than it was in the past, it still borders on a major geological fault.

In order to understand the impact of this disaster, one must realize that in addition to being the most heavily populated city, Managua is vital to the socio-economic development of the country. As is common in many developing countries, the capital is the focal point of the most productive activities, including those of trade, industry, and financial services, as well as the site of the Central Government. Thus, in addition to the loss of life and property damage, the cost of temporary upsets in public administration and disruption of economic activity must be taken into account.

Disaster prevention or preparedness measures were nearly nonexistent despite Managua's importance, its particularly centralized vulnerability, and its long history of seismic activity. Although a law requiring major structures to be seismic-resistant had recently been passed, it had not as yet been implemented. At the time of the earthquake, only six buildings had been constructed in accordance with the new regulations. Insurance against earthquake damage was rare and was in force on upper income housing only because local mortgage lenders required it. The only other known preparedness measure was the designation of a radio frequency for emergency broadcasts. This represented the totality of significant disaster planning and preparedness in a city which has had, and will most probably continue to have, repeated seismic events.

The country was equally devoid of institutional mechanisms to cope with a disaster. Prior to the crisis, the government lacked both a relief organization and a contingency plan. It was not until several days after the earthquake that a National Emergency Committee was formed to deal with the situation, and even then coordination of relief activities was inefficient. These structural and institutional deficiencies explain to some extent the delayed effort at fire-fighting and organized rescue operations as well as the general public disorder that occurred immediately following the earthquake.

Before proceeding with a discussion of the earthquake's impact, it should be kept in mind that Nicaragua never actually completed the reconstruction process. This analysis views effects and trends through 1977 only. After that point, political circumstances and the ensuing revolution had their own effects on the economy which distort any evaluation of the country's recuperation from the disaster.

The sectors that were hardest hit by the earthquake were housing, retail trade, and small manufacturing. These were concentrated in the overcrowded city-center closest to the epicenter of the earthquake. The massive destruction was due in part to their location, but also to inadequate building materials, structural deficiencies, and the absence of laws regulating construction. Therefore, in addition to the need for decentralization, the enforcement of building codes was a major concern in the reconstruction effort.

The housing sector sustained extensive damage with at least 35,000 dwellings totally destroyed. The upper and middle classes, in general, were able to take advantage of expanded credit made available after the disaster and most had reestablished their residences by 1974. However, a major challenge of reconstruction was to provide housing which contained basic services, met at least the minimum standards of construction, and was still within the budget of the typical working class family. The success of this effort, particularly in relation to the lower class, was marginal. Those who were relocated on the outskirts of the city suffered from poor urban planning, especially regarding transportation. Considerably higher commuter costs cut into their already meager family incomes. Those who returned to reside within the city faced other serious problems. With excessive rents in government housing projects, and with no access to credit, most low income families resorted to "spontaneous construction." Many of these shanty units lacked even the most essential public utilities and services and were highly vulnerable to seismic activity. Thus, people of the lower income bracket tended to suffer more long-term burdens from their losses, and by 1977 at least the visual discrepancies in standards of living between the upper and lower classes seemed to have increased.³

³ J. Eugene Haas, Robert Kates, and Martyn Bowden, editors, Reconstruction Following Disaster. Cambridge, Mass: MIT Press, 1977. pp. 129-135.

A discrepancy was equally evident in the effect on the manufacturing sector. Most large-scale manufacturing activities were located on the edge of the city and therefore escaped serious damage. However, 2,500 small businesses in the center of Managua were put out of operation. Most of these businesses provided only a modest living for their owners, but supplied many essential goods and services to the community and employed close to 10,000 individuals. The survival of these businesses depended upon the convenience of their location for people living and working in the immediate neighborhood. Consequently, their reestablishment was extremely slow since it depended upon where new houses and offices were to be constructed.

These patterns of reconstruction in the housing and manufacturing sectors had an important long-term effect on the geographic and economic structure of Managua. In the post-earthquake years, the city began to be increasingly divided according to income levels in terms of both residential areas and commercial districts. Highly skewed income distribution historically has been a serious economic development problem in Nicaragua, particularly between the rural and urban areas. During the reconstruction period, this problem became even more pronounced within the urban center of Managua.

The impact of the earthquake on the macro-economic level was varied. Nicaragua's economic expansion between 1972-77 was rapid but uneven, and characterized by sharp fluctuations in the growth of output and investment as well as in the size of the external and fiscal gaps. During this period, GDP grew at an average 6.3% per year as compared with only 3.2% from 1970-72, principally due to the new dynamism imparted by the reconstruction process. However, this rapid growth was achieved at the expense of turning an approximate resource equilibrium into a resource gap of over 7% of GDP in the later years.

The strongest effect was on the country's import bill, which swelled tremendously in response to the requirements of reconstruction. In 1974, the value of imports was 2.3 times higher than in 1972, while exports increased only 50%. Consequently, a resource surplus of \$51.0 million in 1972 turned into a deficit of -\$76.2 million in 1973, and widened to -\$214.2 million in 1974. The post-earthquake period was characterized by current account balance of payments deficits almost four times as large as past levels.

Public sector finances were also affected considerably. Current expenditures were increased in order to implement important emergency and development programs and to rehabilitate the public administration. Emergency taxes on traditional exports and civil servants' salaries were imposed so as to avoid a critical drop in the Central Government's income. In fact, the savings performance of the Central Government improved substantially in 1973-74 and resulted in a reduction of the fiscal deficit in 1973. It was not until after 1975 when the emergency taxes had been lifted, that the fiscal situation began its long deterioration. Yields from a substitute tax

package on income and real estate fell short of expectations due to weak tax administration that precluded effective enforcement. The sharp decline in Central Government savings, accompanied by substantial capital outlays and continually high current expenditures resulted in unusually high deficits in 1975, 76, and 77. (See Table 2 below.) Thus, in the case of the public sector, the most serious repercussions of the earthquake were not felt until nearly three years after it occurred.

Inflation also began to take its toll on the country after the disaster. Price stability had prevailed in Nicaragua for almost ten years, but came to an end in 1973. This was due to an increase in internal demand related to reconstruction and rising international prices for food products. Consequently, a portion of the critically needed reconstruction resources were absorbed by price increases.

Table 2: Nicaragua Summary Operations of the Central Government, 1971-1977
(in millions of Cordobas)

	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
I. Current							
Revenues	620.4	639.6	916.3	1,332.8	1,308.9	1,506.2	1,775
II. Current							
Expenditures	513.3	523.7	613.8	885.6	1,085.3	1,225.4	1,505.1
III. Savings on Cur-							
rent Account	107.1	115.9	302.5	437.2	223.6	280.8	270.5
IV. Capital							
Revenues	23.7	4.4	9.6	26.8	14.2	21.0	14.2
V. Capital Expen-							
ditures	278.7	340.5	461.3	804.7	897.3	776.7	1,234.4
VI. Deficit	-147.9	-220.2	-149.2	-340.7	-659.5	-474.9	-949.7

Source: World Bank. Memorandum on Recent Economic Development and Prospects of Nicaragua, 1978. p. 96.

Although this earthquake was quite localized, it struck directly at the economic and administrative heart of Nicaragua and left its mark for years to come. The public sector entered a deteriorating deficit situation that showed no signs of improving. The country's balance of payments also registered an unprecedented deficit that continued to grow. The dramatic in-

crease in economic growth rates during the period is somewhat deceiving. This was due in large part to dynamism in construction, but this was construction to replace and rebuild.

In absolute terms, the magnitude of destruction of physical assets and the loss of life were overwhelming and highlight the particular vulnerability of developing societies. A comparison of the Managua earthquake with the San Fernando Valley earthquake of February 9, 1971, illustrates this clearly. Although Managua's earthquake registered an interval of magnitude lower, deaths in Managua were 100 times greater and injuries 10 times greater than those in California. Property losses were roughly comparable, but in terms of income, the relative impact was 15 times greater in the Nicaraguan capital.

Because of its position over a geological fault and its susceptibility to seismic activity, Managua will almost surely experience more earthquakes of equal or greater magnitude in the future. Given this probability, implementation of disaster preparedness and mitigation measures are vital to the survival of the city. The decentralization that has been pursued should help limit some of the damage. However, in addition, a more rapid organizational response and more appropriate construction are essential to saving lives and property. Whether the destruction of 1931 and 1972 will once again be repeated depends largely on the public response to difficult lessons learned from these previous earthquakes.

HONDURAS

From September 18-20, 1974, Hurricane Fifi battered the small Central American nation of Honduras. With winds of 110 mph and rainfall of up to 16 inches in 24 hours, the storm left nearly one third of the country flooded and razed the productive northern coastal region. At least 8,000 people died and a total of 600,000 were seriously affected. Sixty percent of the transportation infrastructure and 15,000 houses were destroyed. Staggering losses were sustained by the agricultural industry and the national cattle herd was reduced by over 6%. Overall the dollar damage was valued at \$540 million in a country with an annual GNP in 1973 of \$850 million.

This was not the first time Honduras had experienced the fury of a hurricane. Located on the Caribbean Sea, the country is extremely susceptible to the tropical storms prevalent in that area and had suffered deeply from hurricanes in both 1954 and 1969. Cognizant of its vulnerability, the government had established a weather observation and warning service. Unfortunately, it did not adequately predict the imminent danger of Fifi, perhaps due to the highly irregular path followed by the storm. Since then, however, the system has been expanded and improved, and it has been suggested that a supplementary hydrological warning system be established to forecast water levels. Furthermore, it should be noted that the population did not heed the few warnings it received, implying a need for further public

education regarding emergency procedures. The government has responded to this by distributing informational brochures for public use during disasters. It is hoped that these measures may help avoid a repetition of such widespread devastation.

Before discussing the impact of Fifi, it is important to note the unfortunate timing of this tragedy in relation to the country's development plans. Honduras, considered one of the least developed nations in Latin America, was already faced with critical short-term economic problems, particularly in the external sector. The disaster struck precisely when the government was beginning implementation of a major economic and social recovery program designed to address serious development issues. Fifi thus set back a National Plan that had been years in the making and was to have mobilized the entire organizational capacity of the public sector.

The hurricane had its most disastrous effects on agriculture. This sector employs about 66% of the active population, accounts for 35% of GDP, and 80% of exports. In the early 1970's, bananas alone constituted 40% of all exports. The vast majority of this most important economic activity is concentrated in the Sula, Leon, and Aguan Valleys, the areas hardest hit by Fifi. Nearly 90% of the banana crop was destroyed and virtually all cereal production was wiped out. Since the disaster occurred shortly before the cereal harvest, it was too late in the season to replant and attempt to recuperate losses. African palm, citrus fruit, and sugar cane proved more resistant to the heavy winds and rain and therefore suffered relatively less.

This last point illustrates an issue concerning future development of these fertile valleys. Despite the force of Hurricane Fifi, it appears that at least some crops were able to survive with minimal damage. Given the frequency of storms in this area, the cultivation of crops that are less vulnerable to hurricane damage would be a valuable disaster mitigation measure. To this end, the Economic Commission for Latin America has recommended that further study be done on the hurricane resistance of various crops.

Because of the structural imbalance of the Honduran economy with its dependence on agricultural exports, particularly bananas, the losses sustained by the sector exacted a high toll from the entire economic system. Since agriculture accounted for about 1/3 of GDP in the 1970's it is easily understood why GDP dropped from \$968.3 million in 1974 to \$963.4 million in 1975. This implies negative growth for the period that was to be the initial biennium of the government's massive development plan.

The balance of payments position was already precarious due to a substantial rise in imports after the 1973 oil price increases. Hurricane Fifi exacerbated this situation through its effects on both exports and imports. The export levels of Honduras' four major export commodities - bananas, coffee, lumber, and beef - all declined. (See Table 3 below.) Banana

exports, the lifeline of the economy, dropped 21% in 1974 and another 50% in 1975. The volume of banana exports did not regain its 1973 level until 1979. Imports to replace damaged goods and compensate for domestic deficiencies increased substantially. This resulted in an increase in the resource gap from -\$8.3 million in 1973 to -\$108.9 million in 1975. Accordingly, the deficit in current accounts rose from -\$34.6 million in 1973 to -\$119.6 million in 1975.

Table 3: Honduras: Volume of Principal Exports, 1973-1976
(in metric tons)

<u>Item</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
Bananas	825.6	651.6	368.4	609.8
Coffee	39.8	30.8	48.5	43.1
Lumber	591.0	479.0	396.0	364.0
Beef	19.8	13.1	16.7	20.7

Source: World Bank. Memorandum on Recent Economic Development and Prospects of Honduras, 1978. p. 37.

In the public sector, both current and capital expenditures increased owing to special appropriations for reconstruction. Concomitantly, the decline in banana production adversely affected public finance in terms of both export and income tax receipts. Corporate income tax payments were temporarily suspended in order to support the rehabilitation of banana enterprises damaged by Fifi. Although this imbalance was eased somewhat by foreign donations, the overall effect was a marked increase in the deficit from -\$15.6 million in 1973 to -\$56.8 million in 1975.

The storm also had tremendous repercussions on the well-being of the population. Unemployment soared as between 2.5% and 3.5% of the economically active population lost their jobs after the hurricane. Many of these were from the labor intensive banana industry. This is added to a habitual overt unemployment rate of 10% and an underemployment rate in the agricultural sector of around 70%. The contraction of the job market in agriculture led to massive migrations to already overcrowded cities and a rise in urban marginality.

Health problems, which were already serious in rural areas, became even more critical after the hurricane. Water contamination and damage to sewerage systems posed a health risk to all sectors of the population. Disease

and malnutrition increased, particularly among children, and typhoid and malaria were rampant in certain regions.

The USAID Mission has suggested that some of this suffering, particularly in relation to health problems, could have been alleviated by improved relief operations. COPEN, the Permanent Council for National Emergencies, was created in 1973 as Honduras' principal relief organization. Although its performance was described as "adequate," given the magnitude of the storm, transportation difficulties, and the inexperience of personnel, the Mission deemed COPEN unable to handle a disaster involving more than 2,000 victims.⁴ Efforts have been made in recent years to improve COPEN's capability and the government, to supplement in-country training programs, has sent several participants to disaster preparedness seminars abroad. The issue of minimizing health-related effects has also been addressed. Before Hurricane Fifi, no information was available concerning stockpiled medicines. Now, a list providing this data is issued quarterly. Inadequacies that persist include the lack of continuity in personnel and insufficient emergency supplies. Resolving these problems before the next hurricane strikes may prove critical to avoiding such extensive loss of life and property.

Hurricane Fifi proved to be the worst national disaster in Honduras' recorded history causing unprecedented devastation. It forced the country to temporarily abandon its badly needed development program and make unforeseen expenditures to reconstruct and rehabilitate. For an already suffering economy, it represented a setback of several years, an experience it can certainly ill afford to repeat.

The impact of Hurricane Fifi on Honduras vividly illustrates the destructive potential of a natural disaster and the particular vulnerability of a monocultural society. It is not uncommon for developing countries to concentrate resources in the production of one crop, even though the inherent economic dangers of doing so are well known. But in the case of Honduras, the choice of banana cultivation appears to be especially dangerous. It is a crop which is relatively susceptible to hurricane damage and which requires a subsequently long reconstitution period. As has already been demonstrated, the losses in banana production disrupted the entire economic fabric of the country, and its effects were being felt up until as late as 1979. While crop diversification may be simply a desired goal for some nations, for hurricane-prone Honduras it is, perhaps, a necessity. By engaging in such long-term mitigation efforts and by addressing some of the other issues presented herein, Honduras might be better prepared to meet the challenge of hurricanes to come.

⁴United States Agency for International Development, Office of U.S. Foreign Disaster Assistance. Honduras: A Country Profile. Washington D.C.: USAID, 1981, p.13.

BANGLADESH

Bangladesh is a riverine country where recurrent flooding is both common and necessary. Every year large areas are submerged during the monsoon season and fertilized by deposits of fresh alluvium. However, if the waters remain stagnant for too long, these beneficial floods become major disasters. Such was the case in the summer and fall of 1974 when flooding extended over nearly one-half of the country and stagnated for more than a month. At least 1,200 people died in the floods and another 27,500 died from subsequent disease and starvation. Approximately 425,000 houses were destroyed or severely damaged and the losses to agriculture were estimated at \$325.9 million. A total of 36 million people suffered severe hardship and losses due to the disaster.

Even before the floods, Bangladesh was in a difficult economic and political situation. The country achieved independence in 1971 and was in need of a new administrative and economic apparatus. Pressures were mounting from a large, rapidly growing population superimposed on an insufficient resource base. Low agricultural productivity and annual food deficits had become common phenomena. The fledgling government was already faced with the enormous tasks of post-war reconstruction and development in one of the world's poorest countries; it was ill-equipped to cope with the added demands of a natural disaster.

According to some sources, the devastation of the floods can be attributed to more than just a malicious act of nature. Neglect, ignorance and lack of administrative control were also contributing factors.⁵ Under the British, regular dredging had helped to maintain adequate river depth. In the first post-independence exuberance, protective measures were ignored and silting of rivers and deforestation had resulted in gradually increasing floodlevels. This slow environmental degradation left Bangladesh virtually defenseless against destructive flooding. Furthermore, flood prediction was limited to occasional monitoring of upstream river flows. This served little purpose because, without proper communication, people downstream remained unaware of any impending danger.

The most devastating effect of the floods was on the agricultural sector. Although agriculture accounts for 60% of GDP and employs 80% of the population, Bangladesh has never been able to feed itself. Given this situation, the ramifications of a 4 million acre loss in standing crops are enormous. Ninety percent of this loss was to rice, the country's major crop. Little of this could be recuperated since the replanting season had already passed. The World Bank estimated that total foodgrain production in 1974-75 was reduced by about 1 million tons because of the floods.

⁵ J.G.F. Anten and S. Franken, The Pattern on Famine in Bangladesh. Amsterdam, Netherlands. p. 144.

Supply problems were compounded by the lack of a buffer stock, absence of foreign exchange to purchase food, and failure of food aid shipments to arrive in time. There was simply not enough foodgrain available for public distribution. In the past, Bangladesh had compensated for production losses by drawing down stocks and increasing imports. However, stockpiles had dwindled to one-third their pre-independence level and only one-half of this was available for local distribution. The rest was located either on ships and in central storage depots, or was in transit throughout the country. The foodgrain gap consequently increased from 1.42 million tons in 1973-74 to 2.38 million tons in 1974-75. As a result, many people who escaped drowning, died of starvation.

These facts underline the urgent need for Bangladesh to maintain an adequate buffer stock of foodgrain to meet contingencies. The World Bank estimated 700 thousand tons to be the minimum requirement. In conjunction with replenishing emergency food supplies, other issues that warrant attention include: rehabilitation of the transportation and storage network to accommodate the increased tonnage and expansion of the distribution system to better serve the rural population. Adjustments must be made in these critical areas. If not, Bangladesh is destined to relive the tragedy of mass starvation.

The country was already in the midst of a serious payments crisis when the floods exacerbated the situation. Jute and jute goods, which provide about 80% of foreign exchange earnings, were experiencing a recession in demand on the world market. The reduction in export revenue from this crop coincided with massive import requirements for food assistance after the disaster. The result was a severe trade imbalance and an increase in the current account deficit from -\$656 million in 1973-74 to -\$917 million in 1974-75.

Per capita income and income distribution also suffered during this period. In 1969-70, per capita income was about \$90. Immediately following independence, this dropped significantly, but began a gradual climb until 1974. Unfortunately, the momentum of the early 1970's was negated by the floods. The countryside became increasingly impoverished as many small landholders lost both their crops and land. The decline in agricultural output led to higher levels of unemployment and underemployment. Masses of destitute rural people migrated to urban areas where job opportunities proved equally scarce. Added to this was a 50% inflation rate fueled by escalating prices of essential commodities now in short supply. In sum, deteriorating levels of output, combined with rising unemployment and inflation, disturbed the once moderately equitable nature of Bangladesh society.

Beyond the effects already mentioned, it is difficult to distinguish economic trends directly relatable to the floods from characteristics typical of the struggling Bangladesh economy. Given the absence of a functioning administrative or economic structure, the country had yet to embark on any serious development effort. Although large infusions of external assis-

tance were intended to stimulate economic growth, continuous requirements for food aid repeatedly depleted these foreign resources. Thus, in the case of Bangladesh, the disaster did not truly represent an interruption of the development process. Rather, it prolonged the country's state of chronic deprivation and prevented even an initial attempt at progress.

The floods in Bangladesh were not an isolated occurrence. They were symptomatic of the highly disaster-prone nature of this already beleaguered nation. The country is subject to both floods and droughts, and is located on the path traditionally followed by cyclones in the Indian Ocean. Situated along an active geological fault, it is also susceptible to both earthquakes and tidal bores. Therefore, disasters must be recognized as an inevitability in Bangladesh.

The country must prepare itself to deal with this reality. This implies adoption of the measures already suggested herein, as well as plans designed to combat other types of disasters. Moreover, it is important that Bangladesh establish an institutional framework capable of providing effective relief. The six-tiered hierarchy of the Government Relief Committee has proved inefficient in emergency situations, and efforts are being made to consolidate this administrative structure. The costs of disaster prevention and preparedness are certainly high, particularly for a country with such limited resources. But, given the economy's dependence upon environmental vagaries, and the high probability that disasters will occur, there are few alternatives. Unless action is taken, the future of Bangladesh will most surely be marked by a series of human tragedies.

CHAD

The Sahel comprises six countries in West Africa and represents the southern border of the Sahara desert. The survival of the nomadic herdsman and subsistence farmers of the area is heavily dependent on sparse and variable rainfall. As a region in fragile ecological balance, the threat of drought is ever present and desert encroachment has been a constant fear. Although periodic droughts have occurred throughout this century, the prolonged drought of the early 1970's may well constitute the worst in history.

Chad, the largest landlocked country on the continent, suffered greatly from the disaster, particularly during the period 1972-1974. Based on a 60% reduction in cereal output and 50% loss in the livestock herd, the dollar damage was assessed at more than \$83 million. Because of inadequate data, the actual number of starvation victims and displaced persons is unknown. However, it is estimated that over 900,000 people were severely affected by the drought.

Inadequate and poorly distributed rain were not the only factors in this devastating drought. Improved medical and veterinary practices had led to large increases in the population of both humans and livestock.

The growing populations put excessive pressure on the already barren land leading to overgrazing, continuous cropping, and lowering of the ground water table. Although the region became increasingly vulnerable to erosive forces, land use and water management programs to prevent depletion of already limited resources were nonexistent. Thus, the sharply lower rainfall of 1972 and 1973 served to exacerbate a degenerative process that was already underway.

For this reason, the response to the drought has been twofold. While provision of emergency relief was an obvious priority, efforts have also been made to reverse the pattern of environmental degradation and seek answers to underlying ecological problems. Groups such as the International Union for the Conservation of Nature and Natural Resources have engaged in considerable study and experimentation. They have promoted greater understanding among African governments of how semi-nomadic and semi-sedentarized patterns of land use contribute to the destruction of rangeland and desertification. They have also encouraged changes in range and water management to include projects such as careful programming of animal movements in order to control the use of forage resources. Host government planners are now being educated in these matters; but substantive action in these areas depends upon extending the training process beyond the governmental level to the local populations. Teaching nomads to adapt to a different way of life will require considerable education and may ultimately prove impossible. But the experience of nearly a decade of drought, has finally underlined the fundamental disharmony that exists between man and his environment in the Sahel. Only now that this fact has been established can steps be taken to combat further deprivation of the land and its inhabitants.

While attention has been focused on the magnitude of human suffering, the drought's impact on the economy has been equally profound. In real terms, the GDP of Chad was down 9% in 1973, the worst year of the drought. Overall, it is estimated that the disaster resulted in a loss in real growth of between 1.5% and 1.8% per year between 1967 and 1975. This was a devastating setback for Chad whose 1975 per capita GNP of \$120 ranked it as one of the lowest income countries in the world.

The critical loss to agriculture was manifested in a 14% decline in the agricultural component of GDP in 1973. (See Table 4.) This drop had especially severe implications as agriculture represents over 50% of GDP, provides a living for about 80% of the population, and accounts for nearly all exports. Until the onset of the drought in 1967, Chad was self-sufficient in the production of most foodgrains except wheat. This situation changed as crops failed or were reduced due to lack of water. In addition, the three major river systems failed to flood because of insufficient rainfall. Therefore, neither flood recession cropping nor rice cultivation in flooded areas could be undertaken. The result was a 100,000 ton grain deficit for 1973/74 and consequent famine.

Table 4: Chad: Production of Food Crops, 1971-1974
(In thousands of tons)

<u>Crop</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>
Millet and Sorghum	610	585	415	380
Paddy	39	41	42	30
Wheat	8	5	7	6
Total Foodgrain Production	657	631	464	416

Source: World Bank. Republic of Chad Economic Memorandum, 1977, table 7.1.

Although the international community responded to this situation with extensive aid, much of the assistance failed to reach the affected population. The reasons for this revolve around transportation problems and underline an area of particular concern for Chadian relief organizations and development planners.

As a landlocked country, Chad must rely upon the ports of its neighbors for any overseas shipments. To date it has depended almost entirely on Nigerian ports for grain movements. A breakdown in Nigeria's railway operations, strikes by railway and port workers, and a conflict between Chadian and Nigerian trucking associations impeded relief operations during the crisis period. Distribution within Chad was equally deficient. The internal transportation system consists of a limited network of inadequately maintained roads. In the past, lake transport was used extensively, but as Lake Chad was reduced to one third its normal size by the drought, this mode of transit became obsolete. Resolving these domestic transportation problems and assuring access to distant ports across its borders is a priority for the Chadian government. Not only is this critical should future relief be required, but it is essential to any meaningful development effort in the country.

One of the greatest effects of the drought was on livestock production, an important source of income, employment, and exports in Chad. The national herd of 4.7 million cattle, goats, and sheep was reduced by one half, and the remaining animals suffered from malnutrition and disease. Because of the slow process of reconstituting the herd, the World Bank estimated that pre-drought production levels would not be resumed until after the mid-1980's. Due to prolonged civil strife in the country, an even longer recuperation period is anticipated.

Because of the importance livestock played as a foreign exchange earner, the losses had a severe impact on the budgetary and balance of payments situations. From 1970-1974, overall budgetary deficits averaged around 25% of current revenues which was considerably more than during the

late 1960's. A growing disequilibrium between government revenues and expenditures led to an increase in the deficit from CFAF -2.3 billion in 1969/70 to CFAF -4.2 billion in 1973/74.

The balance of payments position also suffered as the resource gap widened significantly. From CFAF -7.1 billion in 1972, it swelled to CFAF -18.7 billion in 1975. An increase in food imports and a decrease in meat exports appear to be responsible for this gap.⁶ A parallel increase was recorded in the balance on current accounts which rose from CFAF -5.4 billion in 1972 to CFAF -17.6 billion in 1975.

Population and employment also registered the effects of the disaster. About half of the population of 4.0 million lived in the Sahelian zone. As the drought persisted, many people migrated in search of relief. Some followed their herds into neighboring Cameroon, Niger, and the Central African Empire while others settled in urban centers within Chad, particularly the capital city of N'Djamena. Squatter settlements grew; urban overcrowding and unemployment increased; additional burdens were placed on limited social services; and political instability intensified.

There has always been an income gap between farmers in northern Chad and those in the south, and this discrepancy appears to have widened during the drought years. The reason for this centers around the production of cotton. Because cotton exports account for about 70% of foreign exchange, its producers have benefited from continual government incentives and supports. Furthermore, its cultivation is concentrated in the southern portion of the country which is blessed with considerably better climatic conditions than the dry northern region. As the drought spread and life became increasingly difficult for subsistence farmers of the Sahel, the imbalance in income distribution between these two groups was exacerbated. The World Bank notes, however, that in real terms both sectors have suffered a loss from their pre-drought income levels.

The poor performance of the Chadian economy during the 1970's, can to a large extent, be attributed to the drought. Its impact was felt in almost every sector of the economy and exacted new demands from an already restricted national budget. Government revenues had rarely covered the operating budget, so current expenditure and public investment had been financed principally by external aid. With more foreign assistance coming in the form of food aid, less capital was available for development programs. The government was forced to switch from a concentration on development to measures to maintain the status quo ante.

Drought has become a way of life in the Sahel and a reality for which the Chadian government must always be prepared. To date no general government plan of relief action exists, perhaps due to the chronic political

⁶World Bank. Republic of Chad Economic Memorandum (Report No. 1340-CD). Washington, D.C.: World Bank, June 30, 1977, pp. 20-22.

unrest that has persisted throughout the past decade. But as the recent drought has disrupted the country's entire economic system, issues concerning environmental preservation, transportation, communications, and relief operations have come to the forefront. They now represent not only measures to prevent a future disaster, but the foundations for comprehensive development.

Conclusions

As we have seen, there are a number of variables that play a role in determining the impact of natural disasters on developing countries. As the type, intensity, timing, and location of natural events vary, so, too, do their effects. An earthquake in a relatively underpopulated area is of comparatively little significance when contrasted with one in a capital city such as Managua. Quick onset disasters, such as hurricanes or earthquakes are distinct in character and consequence from creeping disasters, like drought. Furthermore, the impact will differ depending on the country's state of development as is evidenced by the cases of Nicaragua and Honduras versus Bangladesh and Chad. While all four countries sustained serious human losses and economic setbacks from disasters, it appears that the magnitude of these effects was greatest for those at the lower end of the development scale. The more limited the human and material resources of a country are, the less equipped they are to avoid indirect and prolonged suffering and to resume economic activity. A striking example of this is Bangladesh where almost thirty times as many people died of starvation following the disaster than of the floods themselves.

Although the factors which influence the severity of a disaster's impact vary from case to case, there are some conclusions of a general nature applicable to nearly all cases. Most developing countries are agriculturally-based societies. Agriculture accounts for high percentages of GDP and exports, and employs the vast majority of the active populations in these countries. The performance of this sector is, therefore, a major determinant in the overall performance of their economies. With the possible exception of earthquakes, the effects of natural disasters are usually felt most severely in the agricultural sector. The disasters in Honduras, Bangladesh and Chad illustrate the calamitous economic consequence of destruction to agriculture. In all three countries GDP fell, export levels dropped, and unemployment increased dramatically. A National Research Council report states that "weather variability is the single most important factor affecting fluctuations in world food production." Given the rapid population growth rates in developing nations, feeding their people is a major challenge for governments in these countries. Therefore, safeguarding agriculture against damage from disasters is paramount to the survival of both their economies and their citizens.

Almost inevitably public sector finances are adversely affected by natural disasters. Current and capital expenditures increase due to

special appropriations for relief and reconstruction purposes, while government revenues suffer from declining export and income tax receipts. In the four case studies presented herein, this effect was manifested in marked increases in public deficits. Ultimately, this situation implies less capital for investment in development programs and an impediment to national progress.

Another characteristic common to developing economies is a precarious balance of payments position. Exports, which tend to consist of raw materials, rarely cover the costs of more expensive imports of finished goods, technological inputs for industry, and other development needs. Natural disasters exacerbate this imbalance. Production declines lead to a contraction in export levels and both the quantity and composition of imports are altered. More imports are needed to compensate for domestic deficiencies and for reconstruction rather than development purposes. The result is a balance of payments crisis similar to that experienced by the four countries under review.

In addition to negative effects on these macro-economic indicators, natural disasters also exact a high toll from the human resources of these countries. Losses of capital assets are relatively easily quantified and the magnitude of these losses have been documented in the four cases studied. To quantitatively assess the damages suffered by populations is a somewhat more difficult task. However, the impact is considerable not only from a moral and humanitarian standpoint, but from an economic standpoint as well. As a result of natural disasters many thousands of people die, are left homeless, lose their jobs, migrate to already overcrowded cities or suffer disease and malnutrition. This loss of life and, more generally, the lowering of the standard of living, seriously affects human potential as a production factor. Such losses represent a real decline in national assets and have long-term economic repercussions.

As we have seen, the impact of natural disasters goes beyond the direct effects of loss of life and property. In fact, perhaps even more important are the indirect and long-term effects that play a decidedly significant role in disrupting the economic and social fabric of disaster-prone countries. This fact adds an entirely new element to traditional thinking on the causes of underdevelopment and economic stagnation, and represents a new field in need of attention if these development problems are to be adequately addressed.

Since natural disasters do constitute a serious impediment to economic and social progress, alleviating their effects through preventive, preparedness, and mitigation measures is a valuable contribution to promoting development. Disaster prevention is directed toward the long-term reduction of disaster risk and is typically based on information derived from hazard assessments. This information can then be used by planners to determine appropriate land use, new development sites, building code formulation, and other such hazard reduction measures. Preparedness may be described as

action designed to minimize loss of life and damage, and to organize timely and efficient rescue, relief and rehabilitation in disaster situations. Preparedness activities encompass forecasting, warning, contingency and relief planning, and emergency operations training and management. Mitigation measures also contribute to preparing populations to cope with disasters but they tend to involve more long-term, physical alterations of the environment. Afforestation to reduce flood damage and economic diversification to reduce dependence and vulnerability are examples of mitigation techniques.

Disaster prevention and preparedness measures facilitate the development process by reducing the impact and subsequent economic disruption caused by natural events. And, just as disasters can have widespread indirect effects on development, so too, can efforts to mitigate these effects. Disaster planning involves very vital, fundamental sectors of a society: health, housing, agriculture, education, communications, and transportation. In directing attention to these important areas, disaster planning projects are addressing basic development issues. AID/OFDA, in concert with other offices in AID, has sponsored several disaster programs that could have a valuable multiplier effect on the economic and social systems of developing countries. It is the purpose of the following section of this paper to describe some of these projects and the potential they have for furthering the development process.

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Early Warning Systems

For centuries weather variability and its effects have been perceived as "acts of God" over which man has had little or no control. Although technology for modifying weather on a large scale is still beyond our reach, sophisticated techniques have been developed for forecasting and monitoring weather patterns. The ability to predict weather activity, while not infallible, has become an important tool for persons responsible for natural disaster planning and preparedness. Prior warning of impending adverse weather can allow time to alert threatened populations, thereby saving both lives and property.

The foundation of any severe weather warning system begins with the acquisition of accurate and timely data. Other essential elements include the ability to analyze this data, formulate forecasts and disseminate warnings. Although they are of extreme value, such systems are not universally available. The level of technical sophistication in this field varies considerably from country to country; the National Research Council estimates that only about one-third of the world can be termed well advanced with respect to both the collection and utilization of weather data.

Establishing weather data systems from satellite information can contribute substantially to improving weather forecasts in developing countries. Relatively small investments in ground receiving equipment can allow these countries to use information resulting from large investments in satellites by developed countries. The Bangladesh Disaster Alert System, sponsored by AID/OFDA, is an example of this.

During the past 17 years, Bangladesh has suffered 28 storm-related disasters. These disasters killed over 390,000 people, seriously affected over 107 million, and caused more than \$900 million in damage. In an effort to address this situation, the Government of Bangladesh requested assistance in improving its tropical cyclone early warning system. AID/OFDA responded by providing a low-resolution cyclone detection and monitoring system in October, 1978. Although the system adequately detected cyclones for nearly three years, more detailed reception and comprehensive monitoring was desired and an improved high resolution system was subsequently installed in 1981.

The overall purpose of this project was to strengthen the Bangladesh government's capacity to obtain and use remote sensing data for disaster alert, environmental monitoring, and agroclimatic analyses. The project provided equipment, technical assistance, and training for the installation and operation of a meteorological satellite ground reception station. In addition, it included training for the government officials responsible for cyclone preparedness and flood warning networks in the countryside so as to assure the actual warning of affected villagers. A public education component was also incorporated to increase public awareness and insure the system's credibility among the populace. The incorporation of these various

aspects implies a total approach to the provision of a warning system. Not only is Bangladesh able to identify and analyze cyclones, floods, and storm surges, but it is able to distribute this information and prepare its people to act accordingly.

The direct beneficiaries of this project are the rural inhabitants in disaster-prone areas along the coast and rivers. Although all people in these regions will benefit, the possibilities for lower income families are particularly noteworthy. The quality of their housing is generally poor, making them relatively more vulnerable to the ravages of wind and rain. Furthermore, a high percentage of total family assets tend to be movable, such as livestock and household effects, as opposed to fixed. Therefore, with adequate warning, the poor have the opportunity to save many of their assets as well as their lives.

The utility of remote sensing technology is not limited to the field of weather prediction. It can also be applied to a variety of other development problems, particularly in relation to agricultural and water resource management. Several agencies representing a myriad of sectors within Bangladesh are being trained to make use of the information now available to them. The Department of Fisheries can use the data to predict the probable location of fish concentrations in the Bay of Bengal. The Water Board will prepare a hydrological profile of the river system to be used for predicting floods, evaluating flood management proposals, and determining irrigation schemes. The data can also be used for studying land erosion, forestation, transportation routing, mapping, and crop forecasting.

Remote sensing is an important tool for making weather assessments, but it does not represent the sole method available. Nor are cyclones and floods the only types of disasters for which early warning systems are possible. Methods are also available for detecting seismic and volcanic activity, and monitoring rainfall patterns that may lead to drought. Toward this end, OFDA is conducting a number of projects using various agroclimatic techniques aimed at predicting drought-induced food shortages around the world.

These projects are at various stages of implementation and are being carried out in such diverse areas as the Caribbean Basin, Southeast Asia, and semi-arid regions of Africa and Latin America. Some of the agroclimatic techniques being developed include climate/crop yield models, historical yield indices, and crop calendars. These can then be utilized on an operational basis as elements of a systematic early warning assessment program for subsistence food crops in these countries. For instance, one early warning program for the Caribbean and Sub-Saharan Africa is based on weekly weather assessments and monthly crop condition reports. This program proved successful in providing significant leadtime information on drought and potential food shortages for the 1978 drought in Haiti and the severe 1979 drought throughout most of the Sahel.

Knowledge about crop/weather relationships can be valuable throughout the food production spectrum, from farmer to consumer. With better information concerning the optimum time to plant, irrigate, and harvest, farmers can avoid needless seed, fertilizer and water waste. Consequently, severe fluctuations in the supply and price of food products can be curbed. Moreover, as the ability to project growing conditions is increased, better policy decisions about food supplies can be made on both a national and international basis.

Promoting meteorological technology is of great importance to developing countries and represents a field with applications to many individual climatic and geographic circumstances. Its use in predicting natural disasters has been stressed here; but its relationship to the development process has also been noted. The economies of most developing countries depend upon the rational exploitation of their natural resource base. It is, therefore, a priority to know the extent, location, and state of these natural resources in order to plan sound national development. In light of this, remote sensing technology and other weather data systems are more than just the basis of disaster prediction and warning programs. They also contribute to the acquisition, analysis, and utilization of the essential natural resource information needed to promote development.

Disaster Preparedness

Scientific advances have made it possible to forecast patterns of certain types of natural disasters and probabilities of their occurrence. They have contributed to the development of extensive monitoring and warning systems, damage mitigation, and preparedness measures. However, the process of developing a comprehensive policy for disaster preparedness and establishing an effective system of response to disasters extends beyond the boundaries of natural science. Because disasters usually result in the temporary failure of normal societal functions and responses, it is imperative that the human response to disasters, and the technical, political, and sociological means to improve that response, be incorporated into any disaster preparedness program. It is only recently however, that social scientists, economists, and policy analysts have begun to address this field. Disaster planning, preparedness, relief, and rehabilitation programs constitute an integral part of overall public policy and must be formulated in accordance with prevailing socio-economic conditions. The coordinated interaction between and among representatives of these disciplines is therefore a requisite to identifying effective solutions to the problems natural disasters pose at the regional, national, and local levels.

AID/OFDA is sponsoring a number of projects utilizing this interdisciplinary approach to disaster preparedness at various organizational levels. These programs focus on the needs and vulnerabilities of specific disaster prone communities, countries, and geographic regions. At the

regional level, OFDA has been instrumental in organizing a Caribbean Disaster Preparedness Team at the request of the Caribbean Island governments. Headquartered in Antigua, this team of full-time disaster specialists is prepared to respond in the event of a disaster in this hurricane and earthquake-prone region. The team will also train local government officials from the various Caribbean countries in preparedness and prevention planning, emergency operations center management, emergency health care, first-aid, communications, public education, simulation exercises, and warning systems. By pooling their resources, the participating governments are enhancing their individual, as well as their collective capacity to anticipate, respond to, and recover from future disasters.

This program also makes valuable use of the available expertise in many international organizations. The team is coordinated by representatives from the United Nations Disaster Coordinator's Office (UNDRO), the Pan American Health Organization (PAHO), the League of Red Cross Societies (LORCS), the European Economic Community (EEC), the East Caribbean Common Market (ECCM), the Caribbean Community (CARICOM), and AID/OFDA. This allows local officials responsible for disaster planning to tap the resources and benefit from the accumulated experience of all these institutions.

Regional cooperation among developing countries has many precedents beyond the field of disaster planning that have proven to be significant in resolving important development issues. Many developing countries have found that economic cooperation and integration offer possible solutions to the country-specific problems of limited domestic markets and inadequate national resources. Through organizations such as the Andean Pact, the Central American Common Market, and the Economic Community of West African States developing countries employ national resources and expertise to promote the region's overall development. Political questions, too, are being addressed through regional forums such as the Organization of American States and the Organization of African Unity. A multinational approach to disaster planning serves to strengthen regional capabilities and foster further progress in economic and political cooperation. A regional response also enlarges the resource base available in disaster-prone regions and lowers the individual country disaster assistance costs. By sharing costs, a more comprehensive program becomes feasible for these small nations. If successful, regional disaster planning could prove to be a valuable model for other costly development endeavors.

Another approach to disaster planning is one designed to coordinate activities within individual countries. At this national level, OFDA is engaged in a project with the Government of Jamaica (GOJ) to expand that country's preparedness capability. In 1979, in collaboration with UNDRO, OFDA recommended that the Jamaican government establish an office to coordinate disaster preparedness and relief activities. Recognizing its long history of destructive disasters and its continuing vulnerability, the GOJ formed the Office of Disaster Preparedness Emergency Relief Coordination (ODIPERC), and subsequently established an Emergency Operations Center. In

further recognition of the high priority disasters represent, ODIPERC then merged with the Office of the Prime Minister where disaster relief activities are usually initiated.

OFDA is now involved in a project to assist ODIPERC in implementing a national disaster response plan and to help integrate preparedness planning into national development priorities. This project addresses a broad spectrum of issues ranging from administrative and organizational concerns to operational matters and involves the participation of all appropriate GOJ ministries and agencies. Among its objectives is the development of a unified hazards management program that incorporates disaster prevention, preparedness and mitigation measures. Program components include the development of forecasting and warning systems capabilities; the identification of hazard-prone areas and a review of physical planning designs in these zones; an assessment of the need for protective engineering works; a public awareness campaign; and the definition of agency responsibilities in post-disaster reconstruction activities.

The GOJ program is a model of a comprehensive approach that considers all stages of the disaster cycle from prediction through rehabilitation, while concomitantly supporting the larger goals of the development process. By promoting the coordinated functioning of the government structure, the overall planning capabilities of the nation are strengthened. Lives and property are safeguarded and, by protecting the investment and employment climate from degradation or destruction, the economy too, is protected. Thus by investing in protection, the Government of Jamaica is providing insurance for both its human and capital assets.

Because of the very isolated nature of many areas in the Third World, regional and national preparedness strategies cannot always protect all endangered populations. For this reason, AID/OFDA also sponsors projects directed at the community level. Designed to address the needs of some of the poorest sectors of the community, these projects are usually low cost, flexible in design, and can easily be duplicated in other areas.

One such project takes advantage of the valuable worldwide network of Peace Corps Volunteers (PCV) to introduce preparedness at the community level. The project proposes to train volunteers in basic preparedness, and then provide them with comprehensive materials with which they can promote community disaster preparedness in the field. The volunteers will train village level practitioners, who, in turn, will be responsible for preparing their communities. Villagers will learn methods to safeguard their environment through reforestation and flood mitigation measures. Better construction practices to both protect homes from the effects of disasters and contribute to an overall improvement in the housing sector will be taught. Health needs, a critical problem particularly among the rural poor, will also be addressed through health sector assessments and first-aid training. It is hoped that this program will foster greater public awareness and stimulate other local self-help efforts.

A similar community-based project has been proposed to UFDA by the World Relief Corporation (WRC), a branch of the National Association of Evangelicals. WRC has compiled a manual entitled "Coping with Disaster - A Guide to Disaster Preparedness and Assistance." The manual was prepared in response to a clear need expressed by WRC missionaries who have found themselves involved in disaster relief without any prior training or experience. Designed as a working handbook rather than an authoritative program, the manual will be distributed through the WRC to 20,000 missionaries and numerous indigenous churches and missionary organizations throughout the world, where it will ideally serve as an impetus to the development of locally-tailored disaster plans.

The breadth and flexibility of this type of project have far reaching implications. Since these service-oriented individuals are usually in leadership roles and able to influence communities and congregations, they have the potential for improving the disaster preparedness of many regions yet to be covered by host government emergency plans. As part of an information distribution network, they are vehicles for educating people who are otherwise beyond the reach of disaster specialists and planners. And, because they are living within the subject communities, they are in an ideal position to recognize local social and cultural characteristics and adapt their programs accordingly.

In most developing countries large segments of the population remain outside the functioning economic, political and social system. Incorporating these people into the mainstream of their societies as healthy, productive individuals is one of the most challenging goals of development. Community development is an effective way of helping people to change from dependence to self-reliance as they learn how, through their own efforts and some selective technical assistance, they can improve their standards of living, economic productivity, and general well-being. These community-based disaster assistance projects encourage the active participation of villagers in defending themselves from natural hazards. They rely mainly upon the use of local resources, both material and human, for implementation. By the nature of their design, they can contribute significantly to the goal of increasing the human resource capabilities of developing countries.

Concluding Remarks

Two principal conclusions may be drawn from this paper: that disasters constitute an acute development problem as they affect people, property and entire economies; and that disasters, distinguishable from the natural events which cause them, can often be prevented or at least mitigated.

This paper has presented some of the efforts of one U.S. Government agency concerned with the problems of disasters and development. However, UFDA's activities represent only a select few of the possible solutions. If the problem is to be adequately addressed, further research and action is

needed at all levels: international, regional, national, and local. It is hoped that this presentation will serve as the introduction to a constructive dialogue between and among concerned parties. Greater communication and cooperation can contribute to the formulation of creative and coherent disaster planning and policy. With the benefit of shared experience, progress can be made toward the attainment of an important dual objective: the reduction of natural disaster impact, and the promotion of economic and social development throughout the world.

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