

destruction of public buildings and by the loss or destruction of archives and communications systems.

A total loss of about 900 million dollars was estimated. Direct damages, including capital stock and inventory losses, were estimated at 685 million; indirect losses amounted to 219 million more. The sectors most affected by material losses in infrastructure were those of housing, commerce and public buildings. Commerce was the sector most affected by production losses, while the basic services utilities were forced to incur in heavy losses due to higher expenditures and to diminished income.

While other disasters in the region have caused much higher material and production losses, the San Salvador earthquake imposed a greater economic impact. In this case, the total losses amounted to approximately one quarter of the country's gross domestic product or to about 40 per cent of its external debt at the time.

Secondary effects on the economy will be felt for several years. Due exclusively to the disaster, in 1986 gross domestic product growth diminished by 2 per cent; the fiscal deficit rose by more than 24 per cent; public administration was severely disrupted, and the external sector experienced a doubling of its current account deficit due to increased imports for reconstruction. In the five years following the disaster, the public sector is expected to suffer a negative effect of 935 million dollars due to increased expenditures and despite increased tax revenues, while the external sector position would be affected by some 350 million, due to increased imports for reconstruction and in spite of reinsurance payments from abroad. (See Table 1).

The social impact is even more significant. The already considerable housing shortage increased substantially and unemployment rose 26 to 35 per cent in the metropolitan area of San Salvador. There was also a drastic reduction in public health services and facilities. These social consequences of the disaster were superimposed on the very poor living conditions of a population suffering from the effects of an internal war.

(ix) The March 1987 Earthquake in Ecuador.<sup>15</sup> This event caused the death of about 1,000 persons. More than 5,000 people had to be evacuated from the disaster area and re-housed in temporary shelters. About 3,000 dwellings were completely

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<sup>15</sup> See ECLAC, The Natural Disaster of March 1987 in Ecuador and its Impact on Social and Economic Development, (E/CEPAL/G.1465), Santiago, 1987.

destroyed and 12,500 more had to be repaired. Several hospitals and health centres were also affected. Water-supply and sewerage systems were damaged, as well as a number of educational establishments.

Mudflows caused by the quake and subsequent rains destroyed more than 40 kilometers of the trans-Ecuadorian pipeline used to transport oil from the Amazon region to the refineries and export centres located on the Pacific Coast, as well as the only highway connecting the eastern Provinces with the rest of the country. Moreover, agricultural production was affected by the erosion of arable land caused by landslides, and the floods carried away thousands of heads of livestock and deposited silt over large areas of grazing lands.

The total damage imposed by this disaster was estimated at 1,000 million dollars. Direct damages to the capital stock and inventories of the country's social and economic sectors were estimated at 186 million. Indirect damages -which include extremely large losses by the petroleum-exporting sector, together with the higher costs incurred to satisfy domestic energy demands, and production losses in the agricultural sector were estimated at 815 million. (See Table 1).

Even though it covered a relatively small surface area the disaster brought about a considerable fall in Ecuador's production and export capacity. It has been estimated that in 1987 gross domestic product declined by 3 %, instead of the 2.5% growth foreseen before the disaster. The external sector suffered losses of about 790 million due to reduced exports of oil and other products (635 million) and to increased imports for rehabilitation and reconstruction. Public sector finances experienced an increased deficit of about 397 million due to increased outlays and decreased revenues. (See Table 1). Further deterioration of these macro-economic variables is foreseen for 1988 and subsequent years as an effect of the disaster.

The disaster had harsh consequences on the welfare of some 400,000 people who were directly affected. The brunt of the disaster was borne by population groups living in rural and marginal urban areas located in a number of Provinces where unemployment levels and rates of illiteracy are high and where the provision of basic social services -health, sanitation and education- is limited. In addition, approximately 75,000 persons living in the Amazon region were isolated from the rest of the country for several months; essential supplies needed by the population had to be transported by air and it was impossible to bring their products to the markets.

(x) Hurricane Joan. <sup>16</sup> In October 1988 the tenth hurricane of the Caribbean season caused a disaster of major consequences in Nicaragua and imposed damages in neighbouring Costa Rica, Panama, and El Salvador. With sustained winds of up to 217 kilometers per hour, the hurricane entered Nicaraguan territory and destroyed several cities; after traversing the continental divide -and causing extraordinary rainfall and floods- its winds lost force and the meteor became a tropical storm before debouching into the Pacific Ocean.

In Nicaragua, approximately 310,000 persons were evacuated from the dangerous areas before the hurricane struck; they were housed in temporary shelters to protect them from the winds, rains and floods, and to await the re-establishment of minimum environmental and health conditions in their original settlements. About 230,000 low-earning peasants and fishermen saw their homes and working capital destroyed or damaged. A total of 2.8 million people were directly or indirectly affected by the disaster.

Direct damages were estimated at 745 million Dollars. They include total or partial destruction of social infrastructure, especially housing; erosion of agricultural soils and devastation of extensive areas of tropical forests; the destruction or damage to economic infrastructure, particularly transport facilities; and damage to the infrastructure as well as losses of agriculture and industrial output. Indirect losses were estimated at 95 million Dollars; they refer to greater expenditures to supply health services, attend necessary emergency and relief operations, and production losses in the near future. Total losses were thus estimated at 840 million. (See Table 2).

These losses constitute a very high burden for Nicaragua. They represent slightly less than 10 per cent of the country's accumulated capital stock or about 40 per cent of the gross domestic product for 1988. Furthermore, the disaster came at a time when the Nicaraguan economy was showing signs of increased weakness as it continued to undergo a state of semi-permanent crisis brought about, in part, by the marked deterioration of the external sector -which has been severely hurt by an economic blockade since 1985- and by the need, in recent years, to allocate to defence a large share of its scarce resources.

Secondary effects on economic performance will be felt for a number of years. In 1988 alone, the fall of the gross domestic product will be increased by 2 percentage points and per capita

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<sup>16</sup> See ECLAC, Damage Caused by Hurricane Joan in Nicaragua, its Impact on Economic Development and on Living Conditions, and International Cooperation Requirements for Rehabilitation and Reconstruction, (LC/G.1544), Santiago and Mexico City, 1988.

income will be further eroded; in addition, the already-large fiscal deficit will be increased due to the additional expenses made to meet emergency requirements. In 1989 and the following years, even though some recovery is expected in the productive and construction sectors, public sector finances will deteriorate further due to the new investments and expenditures required for rehabilitation and reconstruction, and the balance of payments will exhibit greater disequilibria as a result of the need to increase imports and the inevitable fall in exports. (See Table 2). No doubt this will lead to a further speed-up of the hyper-inflationary trend which existed before the disaster.

The government will be forced to revise its most recent goals for re-establishing macro-economic equilibria. Moreover, the country does not have the capacity to -on its own- undertake the necessary rehabilitation and reconstruction work while at the same time continue its long-term efforts to achieve sustained development and to improve the living conditions of the population. It may be necessary to postpone major economic and social development programmes which were underway or about to be initiated.

The above considerations are more important in view of the fact that the people most affected by the disaster include about 62,000 low-income peasant families who lost their subsistence crops and their very limited belongings and who are now faced with the task of rebuilding their highly fragile family-based economy.

### 3. The Consequences of Natural Disasters

#### a) Region-Wide Estimates of Losses.

The following conclusions can be drawn after analyzing the available information on the type and value of social and economic losses caused by recent, selected major disasters in Latin America and the Caribbean.

Depending on the origin of the natural phenomena which caused the natural disaster:

- natural disasters of meteorological origin -such as floods, hurricanes and drought- usually cover a more extensive geographical area than those of geological origin;
- due to population density, the number of victims caused by natural disasters of geological origin -such as

- earthquakes- is likely to be higher than in cases of events caused by meteorological phenomena;
- capital stock losses -in physical and social infrastructure- resulting from earthquakes are usually much higher than those caused by floods;
  - production and indirect losses, on the other hand, are likely to be much higher in cases of floods and droughts, and
  - when a geological phenomena gives rise to floods or mudflows, production and other indirect losses are much higher than in normal cases of geological disasters.

The following general effects are common to all types of natural disasters:

- a significant number of victims which reduces the already limited, trained human resources capacity of the affected countries;
- an important reduction in the availability of housing, and health and education facilities, thus increasing pre-disaster deficits;
- a temporary reduction in the income of low-earning social strata and a corresponding increase in already-high subemployment and unemployment rates;
- temporary interruptions of water supply and sanitation, electricity, communications and transport services, and
- temporary shortages of food supplies and raw materials for agricultural and industrial production.

On the quantitative side, the analysis of the case studies previously described gives an idea of the amount of losses caused by major natural disasters in the region. However, additional significant losses arise from less-severe natural disasters which affect the region on a more frequent basis.

In regard to the latter, ECLAC has estimated that during the 15-year period between 1962 and 1976, the Central American countries alone were affected by natural disasters of different types which inflicted 39,600 deaths and capital stock, production and inventories losses of about 8,500 million dollars of 1987.<sup>17</sup>

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<sup>17</sup> The following is the breakdown of losses:

<u>Type of disaster:</u>	<u>Deaths</u>	<u>Million of 1987 US\$</u>
Floods and winds	6,054	1,896
Drought, hail and cold fronts	--	163
Volcanic eruptions and earthquakes	33,500	6,453
<u>Total</u>	<u>39,554</u>	<u>8,512</u>

Combining the latter figures with those of the case studies analyzed and of other less-studied disasters, it is possible to conclude that for the whole Latin America and Caribbean region more than 6,000 lives and more than 1.5 billion dollars (of 1987) are lost per year due to natural disasters.

#### b) Economic and Social Consequences

While the amount of direct and indirect losses indicated above is of such large magnitude, the social and economic consequences of natural disasters are staggering.

In fact, depending on the size and degree of diversification of the affected country's economy, the secondary effects of natural disasters include:

- a reduction in economic growth, and in the improvement of social conditions, in general;
- an increase in public sector deficit in view of unexpected relief, rehabilitation and reconstruction expenditures and of reductions in tax revenues;
- a deterioration in the balance of payment position due to reduction of exports and increases in imports of equipment and materials for relief, rehabilitation and reconstruction; and
- an increase in cost of living indexes caused by shortages of essential goods and speculation.

The short-term effects of relief and immediate rehabilitation have been assimilated through efforts undertaken by the affected governments with generous assistance provided by the international community. The disasters have longer-term implications whose solution have often required great sacrifices by the affected country's population.

In fact, in the case studies analyzed, rehabilitation and reconstruction have been made possible through the combination of the following measures, depending on the specific economic position of the affected country:

- reorientation of existing fiscal resources and internal savings;
- reorientation of existing bilateral or multilateral loans; and
- securing of additional foreign financing.

The above measures have resulted in the deferment or cancellation of development projects which had been included in already-approved long-term development plans, and in the delay of improving social conditions in general.

c) The Need to Reduce Losses and their Consequences.

While the natural phenomena which originate these disasters can not be avoided, it is possible to take measures to reduce their social and economic consequences to more manageable levels and thus to contribute to long-term development. Such measures, while costly themselves, would represent only a small fraction of the present level of losses mentioned above. They include preventive, planning and preparedness measures which are briefly described below.

Disaster prevention measures are designed to prevent natural phenomena from causing or resulting in disasters or at least to limit their consequences.

A first group of prevention measures is related to the forecasting and warning of natural phenomena, and is based on a thorough scientific study of the natural phenomena -their intensity, and chronological and geographical distribution- which may originate disasters. They include the setting up of networks to monitor the development and evolution of meteorological events, and the implementation of early-warning systems in the vicinity of human settlements. <sup>18</sup>

The second set of prevention measures refers to the adoption of technical and legislative regulations, such as zoning laws based on vulnerability analysis and the regulation of building codes, to ensure that buildings are able to withstand the anticipated effects of natural phenomena. The education and training of the population to make people aware of disaster risks and of prevention requirements is also included in these measures.

There are two main areas for action in connection with disaster-related planning. First, physical planning should include disaster vulnerability analyses of all large-scale development works -including human settlements- to decide their optimum location and anti-disaster characteristics. Second, long-term development planning should include potential disaster effects as a new variable -giving due consideration to needs for disaster relief programmes and contingency measures to be adopted in cases of disaster- as well as rehabilitation and reconstruction requirements following a major disaster.

Finally, disaster preparedness involves the adoption of measures to organize and facilitate rescue and relief operations

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<sup>18</sup> No similar monitoring and early-warning systems have been developed as yet for disasters of geological origin, except in a few isolated cases of volcanic eruptions.

in cases of disasters. They include the formulation of emergency plans, the setting up of effective relief organizations, the training of personnel for these activities, the stockpiling of supplies and the setting up of special funds for relief.

In addition to its work on damage assessment ECLAC is assisting Member Countries in the design and installation of flood forecasting and early warning systems. More efforts are required to reduce losses brought about by natural disasters in the region.

Table 1  
ECONOMIC LOSSES IMPOSED BY RECENT NATURAL DISASTERS  
OF GEOLOGICAL ORIGIN IN LATIN AMERICA AND THE CARIBBEAN

(In Million U.S. Dollars of 1987) a/

Losses and effects	Earthquakes:				Eruption	
	Managua 1972	Guatemala 1976	Mexico City 1985b/	San Salvador 1986c/	Ecua- dor 1987d/	Nevado Ruiz 1985
<u>Total Losses</u>	<u>1,967</u>	<u>1,437</u>	<u>4,337</u>	<u>937</u>	<u>1,001</u>	<u>224</u>
<u>Direct Losses</u>	<u>1,580</u>	<u>1,402</u>	<u>3,793</u>	<u>710</u>	<u>186</u>	<u>154</u>
Capital Stock	1,412	1,381	3,777	694	184	150
Inventories	168	21	16	16	2	4
<u>Indirect Losses</u>	<u>387</u>	<u>35</u>	<u>544</u>	<u>227</u>	<u>815</u>	<u>70</u>
Production	...	35	154	71	704	17
Services e/	387	..	390	156	111	53
<u>Secondary Effects</u>						
<u>Public Sector Finances</u>	<u>687</u>	<u>368</u>	<u>1,899</u>	<u>935</u>	<u>397</u>	<u>...</u>
Increased Expenditures	673	368	2,025	974	55	...
Decrease in Revenues	14	---	(126)	(39)	342	...
<u>External Sector</u>	<u>186</u>	<u>419</u>	<u>8,579</u>	<u>350</u>	<u>781</u>	<u>...</u>
Reduction of Exports	---	---	1,650	--	635	...
Increase in Imports	186	419	9,075	447	155	...
Disaster-related Income f/	...	...	(2,146)	(97)	(9)	...

Source: UN-ECLAC.

a/ All figures adjusted for inflation through 1987 to enhance comparability.

b/ Secondary effects estimated for 1985 to 1987, and projected thereafter through 1990.

c/ Secondary effects estimated for 1986 and 1987, and projected thereafter through 1991.

d/ Included are damages caused by ensuing floods and mudflows which represent a very high percentage of the total.

e/ Losses of income due to reduction or stoppage of services, and/or higher expenditures for the provision of services.

f/ From relief assistance and reinsurance payments from abroad.

Table 2  
 ECONOMIC LOSSES IMPOSED BY RECENT NATURAL DISASTERS  
 OF METEOROLOGICAL ORIGIN IN LATIN AMERICA AND THE CARIBBEAN  
 (In Million U.S. Dollars) a/

Losses and Effects	Hurricanes:			El Niño Floods and Drought 1982-1983 e/
	Fifi 1974 b/	David and Frederick 1979 c/	Joan 1988 d/	
<u>Total Losses</u>	<u>588</u>	<u>1,057</u>	<u>840</u>	<u>3,970</u>
<u>Direct Losses</u>	<u>388</u>	<u>842</u>	<u>745</u>	<u>1,311</u>
Capital Stock	329	506	668	1,060
Inventories	14	230	18	251
Production	45	106	59	---
<u>Indirect Losses</u>	<u>200</u>	<u>215</u>	<u>95</u>	<u>2,659</u>
Production	175	185	15	1,284
Services f/	25	30	80	1,375
<u>Secondary Effects</u>				
<u>Public Sector Finances</u>	<u>224</u>	<u>303</u>	<u>605</u>	...g/
Increased Expenditures	214	264	605	
Decrease in Revenues	10	39	---	
<u>External Sector</u>	<u>362</u>	<u>464</u>	<u>241</u>	<u>621</u>
Reduction of Exports	48	167	27	547
Increase in Imports	314	296	223	74
Disaster-related Income h/...	...	...	(9)	...

Source: UN-ECLAC.

a/ All figures adjusted for inflation through 1987 in order to enhance comparability.

b/ Damages refer to Honduras only, even though other countries were affected as well.

c/ Damages refer to the Dominican Republic only, even though other countries were affected as well.

d/ These figures are in U.S. Dollars of 1988. Secondary effects have been projected through 1993.

e/ Damages in Bolivia, Ecuador and Peru; other countries were affected as well.

f/ Losses of income due to reduction or stoppage of services, and/or higher expenditures for the provision of services.

g/ Sizable increases in the fiscal deficit occurred but no accurate estimates are available.

h/ From relief assistance and reinsurance payments from abroad.