UNITED NATIONS

ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN —ECLAC

Distr.
LIMITED

LC/MEX/L.373
26 April 1999

ORIGINAL: SPANISH

COSTA RICA: ASSESSMENT OF THE DAMAGE CAUSED BY HURRICANE MITCH, 1998

Implications for economic and social development and for the environment

99-4-32

CONTENTS

PREFACE

This study has been carried out within the framework of United Nations support for the Central American region following the disaster caused by hurricane Mitch in October 1998. A request for this social, environmental and economic impact assessment was submitted to the Economic Commission for Latin America and the Caribbean (ECLAC) by the Government of Costa Rica through the United Nations Development Programme (UNDP).

This document study provides an overall assessment of the damage based on sectoral estimates of the direct and indirect effects of the hurricane; it also analyses its macroeconomic and environmental impact and sets forth guidelines for rehabilitation and reconstruction programmes.

The study was carried out with the collaboration of Costa Rican authorities —coordinated by the Ministry of Foreign Affairs—, UNDP and other United Nations agencies, and international institutions and agencies.

The direct and indirect damages were assessed using the methodology developed by ECLAC more than 25 years ago. The results are based on the mission's estimates, which include the information available at the time and evidence collected through interviews. Although the magnitude of the losses is significant, the country has the capacity to address reconstruction needs; nevertheless, timely international cooperation will serve to complement national efforts.

This appraisal is designed to provide the government and the international community with guidelines for setting national and regional priorities in rehabilitation and reconstruction programmes. A strictly economic approach would be limited, so such programmes should include social actions to alleviate the suffering of groups that were already disadvantaged before the disaster occurred. Special attention and priority should be placed on including sustainability and increased-governance criteria in making social and productive investments, and on allocating resources to the reconstruction and replacement of infrastructure.

Costa Rican society and government have an opportunity to undertake the reconstruction with renewed values and criteria, and to embark at the same time on institutional, legal and structural reforms to reduce economic, social and environmental vulnerability. An important aspect of such reforms will be to strengthen the country's savings, investment and management capacity as part of the reconstruction.

I. THE PHENOMENON AND ITS EFFECTS ON THE POPULATION

1. Introduction

Natural disasters, whether climatic, seismic or volcanic, are frequent in Latin America. The annual losses caused by such phenomena in the region have been estimated at more that US$1.5 billion and almost 6,000 lives. [1] These effects are multiplied and exacerbated by structural disparities that place population segments already living in precarious economic and social conditions at greater risk.

Costa Rica has been affected by such disasters on many occasions; hurricanes, earthquakes and volcanic eruptions have caused considerable victims, in addition to economic and environmental losses. The most recent include hurricane Cesar in 1996 and the effects of the El Niño phenomenon in 1997-1998. [2]

Hurricane Mitch is one of the most violent hydrometeorological events to have struck Central America this century. Its force upon reaching the coasts of the region was exceptional, as were its diameter, the amount of moisture and rain it carried and the erratic path it followed for several days.

The extent of the damage and the enormous efforts required for the recovery point up the need for the country —and the region as a whole— to receive support and cooperation from the international community. Such support should include the creation of better conditions for its integration into world trade flows, as well as guaranteed access to its principal markets. International funds will be needed to complement national efforts —both public and private— to carry out the reconstruction programme. The attached project profiles show the magnitude of the efforts involved and indicate the degree of urgency and the priorities to be set, with the participation of the international community.

2. Previous disaster experience

Costa Rica has suffered the effects of a number of disasters during this century, some of which have been very severe, such as the earthquakes of 1910 in Cartago, of 1983 in Peréz Zeledón and Golfito, and of Limón in 1991, which was felt very strongly almost throughout the entire country. The country has also been subject to flooding on different occasions, as a result of strong tempests that are sometimes accompanied by cold fronts from the Caribbean, or of storms and hurricanes in the Caribbean corridor. The regions that are most affected by these events are the plains in the Caribbean basin, and the lowlands of Guanacaste and on the Southern Pacific, among others.

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[1] See, for example, Jovel, R. and R. Zapata (1993), *Macroeconomic effects of natural disasters in Latin America and the Caribbean*, a paper presented at the Fortieth North American Meeting of the International Association of Regional Science, Houston, 11-14 November.

[2] See, for example, ECLAC (1996), *Efectos de los daños ocasionados por el huracán César sobre el desarrollo de Costa Rica en 1996* (LC/MEX/L.312), 27 September.

The consequences of the strong rainfall that accompanies hurricanes are worsened by human intervention in the environment, which increase the damage resulting from indiscriminate deforestation in the upper reaches of valleys, the opening of roads and the building of infrastructure without sufficient environmental prevention and protection measures; human settlements have also been formed in humid lands, very steep slopes (or at the foot of slopes), river terrace lands, and other areas that are highly vulnerable to extreme weather. This has taken place together with a process of spontaneous settlement in more than 50 per cent of the country (Arcia, *et al.*, 1991; Mata, 1997) during the second half of this century. The interaction of these factors has had an extensive impact on the environment, and national participation on all scales and levels is required to rehabilitate it, as far as possible (CCT, 1982; Quesada, 1990).

Hurricanes Joan (1988) and Gert (1993) are among the strongest meteorological events of the recent past, but hurricane Cesar had the most severe consequences; it particularly affected the country's southern region, with extraordinary levels of rainfall on the Pacific side, amounting to nearly 90 per cent of all rainfall for the month of July in two days. During 1997-1998 the El Niño phenomenon particularly affected the Huetar Norte area.

Various studies (Lavell *et.al,*, 1991; Paniagua, 1995; UNDP/UNICEF, 1997, all quoted in the State of the Nation, 1997) show that during the past few decades the trend has been towards "greater population density and indiscriminate use of sites to build population infrastructure", and that "vulnerability to natural disasters has increased under such conditions". The situation has given rise to a highly significant, well-organized action front on the part of the government and other institutions and has strengthened the National Emergency Commission (CNE) in view of the great social and environmental pressure that these conditions cause.

The disasters caused by natural phenomena have yet to be overcome; hurricane Mitch has made it necessary to deploy government and private resources to reduce vulnerability, strengthen conservation and ensure that the programmes under way and those needed to rebuild and improve the country's infrastructure include a comprehensive strategy to mitigate the consequences of future natural disasters as much as possible, so that such efforts focus on improving the quality of life.

3. The mission

UNDP requested ECLAC's cooperation in carrying out a project to assess the environmental, social and economic impact of hurricane Mitch on the countries of Central America. [3]

Technical teams were formed to carry out the assessment under ECLAC coordination. The national UNDP offices and representative offices of different United Nations agencies extended their full support to the missions.

The mission visited Costa Rica from 13 to 17 December. The team was made up of two ECLAC officials (Jorge Máttar, coordinator, social sectors and transport infrastructure, and René A.

[3] Project RLA/98/020, "Evaluación del Impacto Socioeconómico de los Desastres Naturales (Huracán Mitch)".

Hernández, macroeconomic effects and farming, industrial, trade and services sectors) and an external consultant (Alfonso Mata, environment, water and sewerage services, energy).

This document contains an independent and objective assessment of the disaster and sets forth the overall magnitude of direct and indirect damages and the effects on the behaviour of the economy as a whole. It will serve as a basis in drawing up proposals for reconstruction priorities and needs, one of which should be the explicit incorporation of measures to reduce and mitigate the country's vulnerability and the risks posed by disasters.

4. Description of the phenomenon and its effects

The Atlantic Ocean hurricane season in the northern hemisphere (July to November) was unusually strong in 1998 and caused enormous devastation, loss of life, and economic, social and environmental damage. The concentration of very violent meteorological phenomena between August and October was historic: [4] a dozen tropical cyclones were given names during that period and affected densely populated areas throughout the Caribbean basin, including both the island countries and the states of the Central American Isthmus. [5] Table 1 shows the dates on which they occurred and the wind velocity. Their effects heighten and form part of other climatic disturbances affecting the region, such as the droughts and floods resulting from the El Niño phenomenon in the Pacific Ocean, [6] all of which have caused major damage throughout Latin America and the Caribbean.

Mitch arose from a tropical front between Monday, 19 October and Tuesday 20 October, developed into a low pressure zone and, at noon on 21 October, was classified as the thirteenth tropical depression of the season. At that time, it was located in the south-western Caribbean, some 580 kilometres south of Jamaica, with sustained 50 km/h winds, moving west-north-west at 15 km/h. On 21 October the National Metereological Institute issued the first of 61 status reports (over a period of 20 days) on the hurricane. On 22 October it was located some 500 km east of Puerto Limón, and satellite images showed thick cloud cover near the coast of Guanacaste and the Central Pacific. Although the country was no longer in danger of being directly affected by Mitch, a storm was forecast from the Pacific. Mitch followed an apparently erratic path, varying in intensity and changing direction several times between 23 October and 4 November (see Table 2 and figures 1 and 2).

Table 1

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[4] National Hurricane Center (NHC) (1998), *Monthly Tropical Weather Summary*, prepared by the US National Weather Service (NWS) and posted on the Internet for October and November.

[5] For an assessment of the damage caused in the Caribbean islands, see ECLAC (1998), *República Dominicana: Evaluación de los daños ocasionados por el huracán Georges, 1998. Sus implicaciones para el desarrollo del país* (LC/MEX/R.668), 29 October.

[6] These climatic disturbances have seriously affected the Latin American and Caribbean region, as is the case with Mexico, which has been afflicted by droughts and floods at different times, and the serious consequences of the El Niño phenomenon in the Andean countries and Central America. See ECLAC (1998a), *Ecuador: Evaluación de los efectos socioeconómicos del fenómeno El Niño en 1997-1998* (LC/R.1822/Rev.1 and LC/MEX/R.657/Rev.1), 16 July, and ECLAC (1998b), *El fenómeno El Niño en Costa Rica durante 1997-1998. Evaluación de su impacto y necesidades de rehabilitación, mitigación y prevención ante las alteraciones climáticas* (LC/MEX/L.363), 3 November.

MAIN HURRICANES IN THE CARIBBEAN IN 1998

Name	Dates	Maximum recorded wind velocity (kilometres per hour)
Danielle	24 August-3 September	170
Earl	31 August-3 September	160
Frances	8-13 September	105
Georges	15-29 September	240
Hermine	17-20 September	75
Ivan	20-27 September	145
Jeanne	21-30 September	170
Karl	23-28 September	170
Lisa	5-9 October	120
Mitch	21 October-4 November	290

Source: ECLAC, based on US National Weather Service (NWS-NHC) data, October and November 1998.

On Friday 23 October, Mitch (now classified as a storm) was 500 km north-east of Limón and causing stronger rainfall in the Pacific. By Saturday 24, 16 weather reports had been issued, stating that the system was growing and alerting Ciudad Cortés, Ciudad Neilly, Parrita, Quepo and the Los Santos region. [7] The storm was upgraded to a hurricane that day and headed towards Honduran waters with maximum steady winds of 160 km/h (category 2 on the Saffir-Simpson scale). On 25 October it became stronger and reached category 4, with 215-km/h winds. A low-pressure centre formed simultaneously in the Pacific off Nicaragua, interacting with the Inter-Tropical Convergence Zone (ITCZ) and with a south-western wind; this increased humidity levels, causing prolonged rains on the Pacific coast and overflowing rivers on the Nicoya Peninsula.

On 25 and 26 October the hurricane headed west at a speed ranging from 11 to 13 km/h, with maximum winds of 285 km/h that placed it at category 5, the highest on the Saffir-Simpson scale; this made it the third strongest hurricane in the tropical Atlantic basin, Caribbean and Gulf of Mexico this century. The rains continued in the western part of the country, the higher reaches of the Tempisque river and the Pacific coast; Mitch then changed course and headed west-north-west when it was 175 km north-north-east of Cape Gracias a Dios in Honduras; by this time the National Metereological Institute (IMN) had issued report number 31. On 27 October it was some 50 km off the coast of Honduras and had lost strength, although IMN reports 38 to 46 reported continuing rains on the Pacific coast (see Table 3). During the following two days Mitch remained over Honduras and became a tropical storm; it

[7] See National Metereological Institute (1998), *Informe No. 13*, San José, Costa Rica, 24 October.

moved slowly on encountering an anticyclone located in the continental United States, which prevented it from moving towards the Gulf of Mexico.

Table 2

PATH AND EVOLUTION OF HURRICANE MITCH

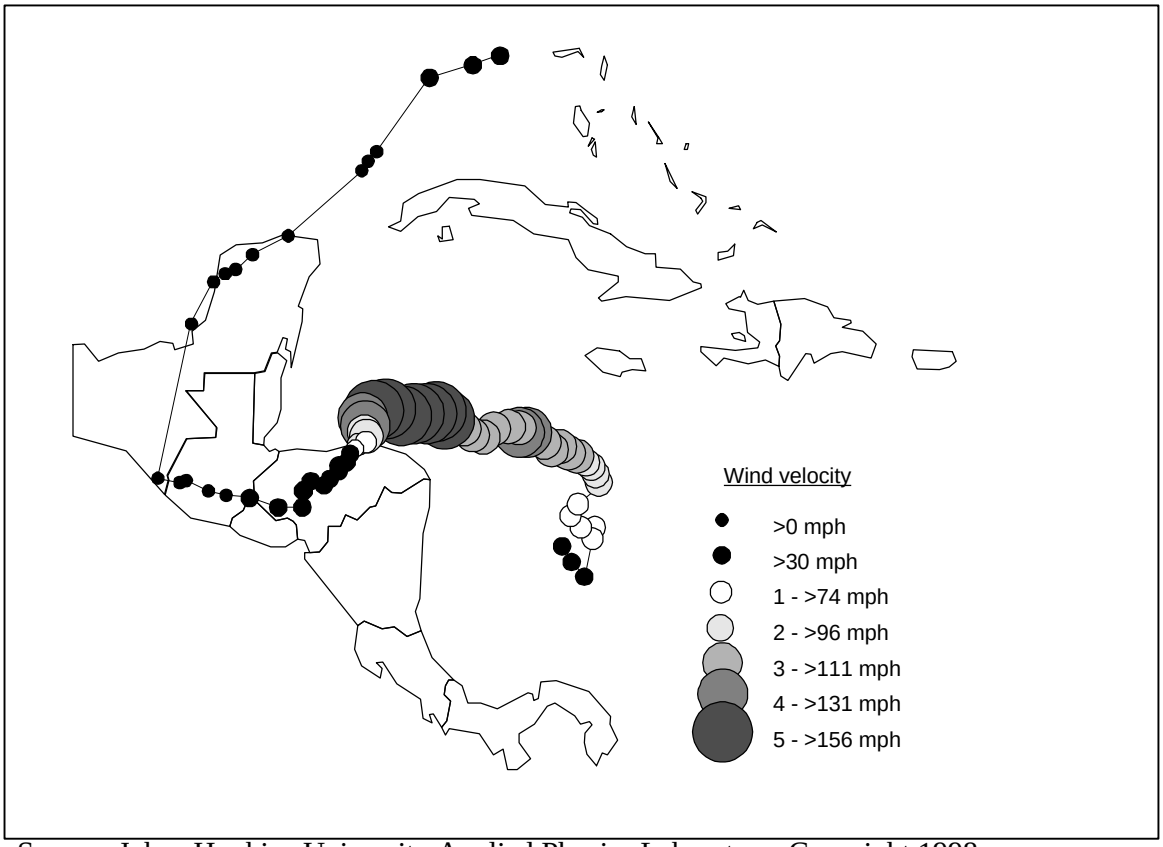
Date (day and local time)		Wind velocity (maximum sustained, km/h)	Classification (Saffir- Simpson scale)	Location		Barometric pressure (MB)
				Latitude North	Longitude West	
23 October	10 a.m.	95	Tropical storm	12.7	77.9	999
	10 p.m.	95	Tropical storm	13.0	78.1	997
24 October	10 a.m.	160	2	14.9	77.9	987
	10 p.m.	195	3	15.7	78.4	965
25 October	12 a.m.	200	3	15.9	78.9	953
	12 p.m.	235	4	16.4	80.3	929
26 October	12 a.m.	240	4	16.3	82.0	922
	12 p.m.	273	5	17.0	83.2	906
27 October	12 a.m.	285	5	17.4	84.5	918
	12 p.m.	250	5	16.9	85.4	928
28 October	12 a.m.	220	4	16.5	85.6	933
	12 p.m.	195	3	16.4	85.6	948
29 October	12 a.m.	160	2	16.3	86.0	970
	12 p.m.	120	1	15.9	85.6	990
30 October	12 a.m.	65	Tropical storm	15.3	86.5	997
	12 p.m.	85	Tropical storm	14.0	87.0	1,000
31 October	8 a.m.	55	Tropical depression	14.5	88.7	1,001
	8 p.m.	55	Tropical depression	14.6	90.5	1,002
1 November	8 a.m.	45	Tropical depression	14.9	91.6	1,005
3 November	5 p.m.	70	Tropical storm	20.0	90.6	997
	8 p.m.	65	Tropical storm	20.2	90.2	997
4 November	12 a.m.	65	Tropical storm	20.3	89.9	997
	2 a.m.	55	Tropical depression	20.8	89.4	998
	8 a.m.	75	Tropical storm	21.8	88.3	998

Source: ECLAC, based on Internet data, http://dyred.sureste.com.

Figure 1

ROUTE OF HURRICANE MITCH

(Between 22 October and 5 November)

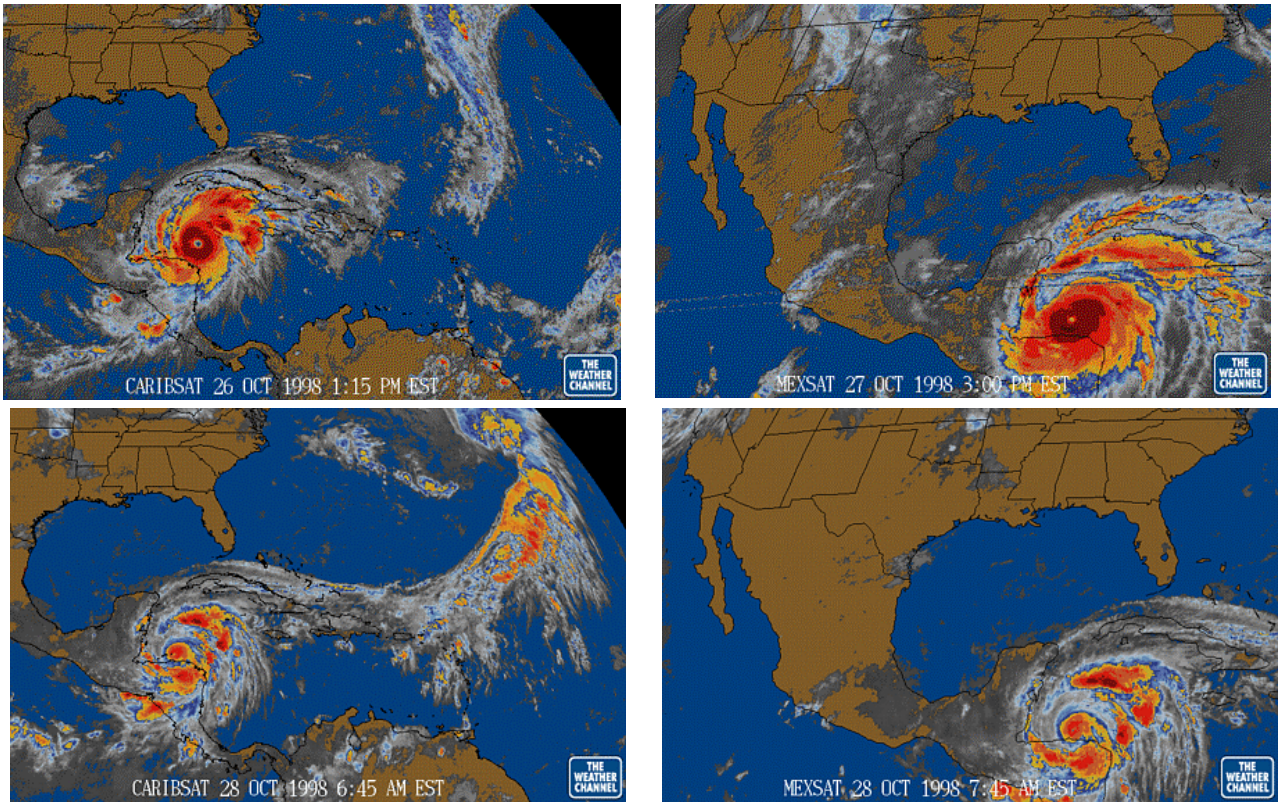


Source: Johns Hopkins University Applied Physics Laboratory. Copyright 1998 Ray Sterner and Steve Babin.

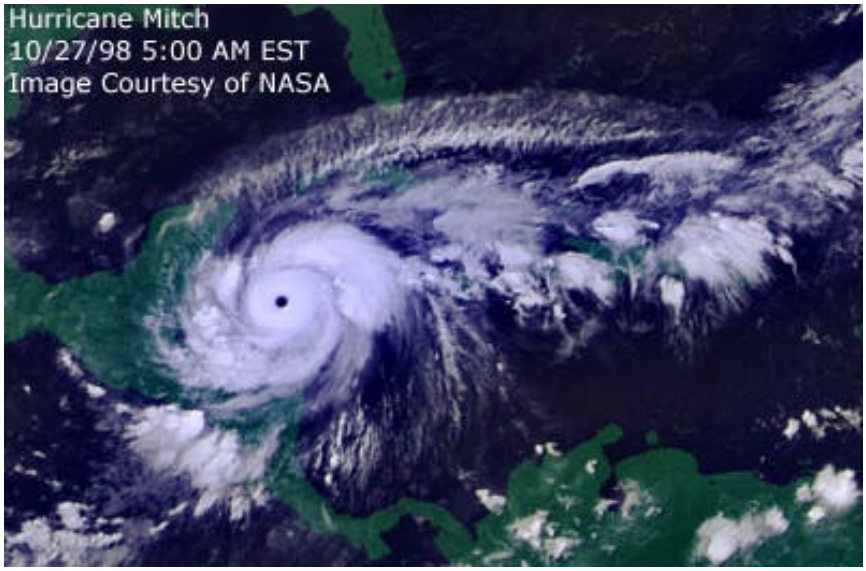
Figure 2

IMAGES OF THE PATH TAKEN BY HURRICANE MITCH

(Between 26 and 28 October 1998)



Source: The Weather Channel, Internet.



Source: NASA image, taken from the Internet.

Table 3

COSTA RICA: PRECIPITATION ON THE PACIFIC COAST, OCTOBER 1998

(Millimetres)

Station	October						Total	Average	Percentage
	21	22	23	24	25	26	21-26		
Coto 47		26.0	71.4	89.6	6.2	0.3	193.5	608.9	32
Buenos Aires		125.0	49.9	20.6	0	3.8	199.3	512.7	39
Hacienda Barú		187.8	70.8	87.6	1.6	83.0	430.8	733.7	59
Jacó	197.6	174.5	167.0	46.6	14.5	63.2	466.6	596.5	78
Lagunilla		104.0	149.0	15.0	24.0	46.3	338.3	324.2	104
Puntarenas		50.7	87.7	52.4	18.4	51.5	260.7	266.5	98
Nicoya		6.7	16.7	35.0	42.0	55.3	156.7	288.3	47
Moctezuma		4.8	8.8	29.6	30.4	86.4	160.0	318.6	55
Liberia		7.9	19.8	16.9	79.2	92.1	215.9	270.1	75
Peñas Blancas		12.3	4.1	22.5	38.4	49.5	126.8	284.4	45

Source: National Metereological Institute of Costa Rica.

Cloud banks associated with Mitch caused south-west to north-east winds with very high humidity levels, moving from the Pacific towards Costa Rica. On hitting the country's high range of mountains, these clouds released much of their water. Mitch continued to lose intensity due to friction on reaching land; its maximum winds dropped to 65 km/h on 30 October, and it was downgraded to a tropical storm on 31 October, as it headed towards Guatemala. The IMN issued its sixty-first report on 1 November; Mitch weakened further, travelling west at a speed of 13 km/h with winds of 45 km/h, by which time it was 140 km west-north-west of Guatemala and the weather in Costa Rica had resumed its normal rainy-season conditions. It headed towards the Gulf of Mexico, intensified again and became a tropical storm, then headed towards Florida in the United States.

The serious effects of the rains were worsened by previous human actions, such as deforestation —mainly on steep slopes— intensive land use, human settlements on hillsides and river banks and in high-risk areas in general. Nevertheless, Costa Rica has improved its disaster-preparedness capacity considerably. Its prevention system, the population's awareness and participation and the actions carried out by the CNE kept the loss of human lives at a minimum; the system was placed to the test once again, showing its effectiveness and reflecting the emergency units' capacity for rapid response.

The hurricane struck Central America at a time when the region was experiencing substantial economic growth, and when significant environmental-conservation and sustainability goals had been achieved, along with political transitions of enormous importance as a result of the Peace Summits. Nevertheless, the difficult situation following Mitch can be taken as a good opportunity to ensure economic growth is accompanied by sound social-development planning and environmental sustainability.

5. Population affected

Following the hurricane, the CNE mobilised its forces to temporarily relocate 16,500 people, thus reducing the effects of Mitch on the population. Only four deaths and three missing persons were reported; unfortunately they did not follow the indicated precautions.

Eighty-one shelters were prepared for 5,411 people in need of assistance during the most critical stage, which lasted from 22 to 30 November; practically all those displaced have now returned to their places of origin. Few injured persons were reported, and they did not require hospitalization. Table 4 shows the location of the shelters and the number of people housed over the critical nine days mentioned above.

As in other disasters, the most vulnerable groups were those worst hit by the hurricane, with children and youth among those most affected. UNICEF has therefore proposed a project to help children and adolescents among the immigrant Nicaraguan and Honduran population, which has grown in past years, and Costa Rican youth affected by Mitch in districts on the northern border with Nicaragua and in Pérez Zeledón and Puriscal.

The growing numbers of Nicaraguan immigrants in Costa Rica in recent years has led to growing concerns and placed extra pressure on public spending in health and education. This immigration is likely to increase in coming months, partly because of the impact of Mitch on Nicaragua. [8] The Costa Rican government has declared a special amnesty as of next February, to allow all Nicaraguans who entered the country before 1999 to legalize their immigration status. The increasing flow of Nicaraguans to Costa Rica will have a significant impact on public spending, employment levels, and the make-up of Costa Rican society.

[8] For an assessment of damage due to Mitch in Nicaragua, see ECLAC (1998), *Nicaragua: Evaluación de los daños ocasionados por el huracán Mitch, 1998. Sus implicaciones para el desarrollo económico y social y el medio ambiente* (LC/MEX/R.676), 23 December.

Table 4

COSTA RICA: TEMPORARY SHELTERS IN USE FROM 22 TO 30 NOVEMBER
(CRITICAL PHASE)

No.	Province	Canton	District	Shelter	Persons (peak day)	Date
1	San José	Pérez Zeledón	Pejibaye	Salón multiuso El Águila de Pejibaye	68	26/10/98
2	Puntarenas	Corredores	Corredores	Bo. La Fuente	164	27/10/98
3	Puntarenas	Corredores	Corredores	Ciudad Neily (Fca 12, 6, 11 y Sierpe)	60	27/10/98
4	Puntarenas	Osa	Puerto Cortés	Iglesia Asamblea de Dios	70	24/10/98
5	Puntarenas	Osa	Puerto Cortés	Esc. Valle del Diquis	125	24/10/98
6	Puntarenas	Osa	Puerto Cortés	Salón Comunal Bo. Alemania	110	22/10/98
7	Puntarenas	Osa	Puerto Cortés	Salón multiuso Hospital	12	22/10/98
8	Guanacaste	Carrillo	Filadelfia	Latas	36	22/10/98
9	Puntarenas	Buenos Aires	Volcán	Ceibo	11	22/10/98
10	Guanacaste	Sta. Cruz	Sta. Cruz	Cencinal Visión Mundial	102	24/10/98
11	Puntarenas	Montes de Oro	Miramar	N.D. (Bartolini)	42	23/10/98
12	Puntarenas	Puntarenas	Pitahaya	Pitahaya	50	23/10/98
13	Puntarenas	Corredores	Corredores	Ciudad Neily (2) La Vaquita	30	23/10/98
14	Puntarenas	Corredores	Corredores	Ebais	40	23/10/98
15	Puntarenas	Puntarenas	Lepanto	Lepanto	13	23/10/98
16	Puntarenas	Buenos Aires	Boruca	Lagarto	40	23/10/98
17	Puntarenas	Osa	Sierpe	Salón Comunal Sierpe	82	24/10/98
18	Puntarenas	Osa	Sierpe	Salón Comunal Sierpe (2)	23	24/10/98
19	Puntarenas	Garabito	Jaco	Casa Cural Jaco	8	23/10/98
20	Puntarenas	Golfito	Río Claro	Cooperativa Proagrosur	233	23/10/98
21	Puntarenas	Golfito	Río Claro	Edif. C.C.S.S.	8	23/10/98
22	Alajuela	San Ramón	San Ramón	Centro Pastoral de San Juan	13	24/10/98
23	Guanacaste	Sta. Cruz	Sta. Cruz	Mercado Sta. Cruz	164	28/10/98
24	Puntarenas	Osa	Puerto Cortés	Esc. Bo. Alemania	130	25/10/98
25	Puntarenas	Osa	Palmar	Salón Comunal Cañablancal	143	25/10/98
26	Puntarenas	Corredores	Laurel	Salón de Actos I.D.A.	125	25/10/98
27	Puntarenas	Corredores	Laurel	Salón Comunal Las Catañas	62	24/10/98
28	Puntarenas	Corredores	Laurel	Laurel	18	24/10/98
29	Puntarenas	Golfito	Golfito	Salón Comunal Río Claro	50	25/10/98
30	Puntarenas	Puntarenas	Paquera	Iglesia Playa Órganos	42	27/10/98
31	San José	Pérez Zeledón	Pejibaye	Salón Comunal de Pejibaye	68	25/10/98
32	Puntarenas	Corredores	Corredores	Salón Comunal Ciudad Neily	75	25/10/98
33	Puntarenas	Osa	Palmar	Empacadora Palmar Sur – Fca A 8	25	25/10/98
34	Puntarenas	Osa	Palmar	Empacadora Palmar Sur – Fca10	65	25/10/98
35	Puntarenas	Buenos Aires	Colinas	Centro Comunal Guagaral	54	25/10/98
36	Puntarenas	Golfito	Río Claro	Esc. Coto 54	12	25/10/98
37	Puntarenas	Carrillo	Filadelfia	Esc. Filadelfia	187	29/10/98
38	Puntarenas	Corredores	Corredores	Caracol	20	26/10/98
39	Guanacaste	Sta. Cruz	Tempate	Portegolpe	59	02/11/98
40	Guanacaste	Sta. Cruz	27 Abril	Río Seco	68	27/10/98
41	Guanacaste	Sta. Cruz	27 Abril	27 Abril	164	27/10/98
42	Guanacaste	Sta. Cruz	Bolsón	Ortega	200	27/10/98

/Cont.

Table 4 (Cont.)

No.	Province	Canton	District	Shelter	Persons (peak day)	Date
43	Guanacaste	Sta. Cruz	Cabo Velas	Brasilito	40	27/10/98
44	Guanacaste	Carrillo	Filadelfia	Salón Comunal Filadelfia	251	30/10/98
45	Guanacaste	Carrillo	Filadelfia	Paso Tempisque	14	27/10/98
46	Guanacaste	Carrillo	Filadelfia	Playas del Coco	25	27/10/98
47	Guanacaste	Nicoya	Nosara	Bo. Los Ángeles	124	27/10/98
48	Guanacaste	Cañas	Bebedero	Salón Comunal Bebedero	350	30/10/98
49	Guanacaste	Cañas	Cañas	Ing. Taboga	49	27/10/98
50	Guanacaste	La Cruz	Cuajiniquil	Cuajiniquil	86	27/10/98
51	Guanacaste	Nandayure	Carmona	Salón Comunal Sta. Rita	25	30/10/98
52	Guanacaste	Nandayure	Bejuco	Playa Coyote	52	27/10/98
53	Guanacaste	Hojancha	Hojancha	Salón Comunal Hojancha	75	27/10/98
54	Puntarenas	Esparza	Espíritu Santo	Esc. Caldera	15	27/10/98
55	Puntarenas	Puntarenas	Paquera	Esc. Río Grande	45	27/10/98
56	Puntarenas	Puntarenas	Paquera	Guaria	28	27/10/98
57	Puntarenas	Puntarenas	Paquera	Dulce Nombre	28	27/10/98
58	San José	Acosta	Palmichal	Esc. de Palmichal	27	30/10/98
59	San José	Aserri	Aserri	Gimnasio Polideportivo Aserri	20	30/10/98
60	Alajuela	Alfaro Ruiz	Laguna	Laguna	5	30/10/98
61	Alajuela	Alfaro Ruiz	Laguna	Llano Bonito	17	30/10/98
62	Alajuela	Alfaro Ruiz	Laguna	Salón Comunal Llano Bonito Sur	12	30/10/98
63	Guanacaste	Sta. Cruz	Sta. Cruz	Río Cañas	13	30/10/98
64	Guanacaste	Sta. Cruz	Tempate	Bejuco – Tempate	6	30/10/98
65	Guanacaste	Nicoya	Nosara	Matapalo	28	30/10/98
66	Guanacaste	Nicoya	Nosara	Morote	1	30/10/98
67	Guanacaste	Hojancha	Zapotal	Camaronal	19	30/10/98
68	Guanacaste	Hojancha	Zapotal	Mora	8	30/10/98
69	Guanacaste	Hojancha	Hojancha	Estrada	65	30/10/98
70	Guanacaste	Nicoya	Nicoya	Socorro	45	30/10/98
71	San José	Santa Ana	Santa Ana	Casa Pastoral Santa Ana	23	01/11/98
72	Alajuela	Upala	San José	Esc. Jesús Popoyoapa	60	01/11/98
73	Alajuela	Naranjo	Naranjo	Esc. Rep. de Colombia	75	01/11/98
74	Guanacaste	Sta. Cruz	Bolsón	Bolsón	210	02/11/98
75	Puntarenas	Parrita	Parrita	La Palma	92	02/11/98
76	Puntarenas	Parrita	Parrita	Los Ángeles	33	02/11/98
77	Puntarenas	Parrita	Parrita	Ligia	44	02/11/98
78	Puntarenas	Parrita	Parrita	Mercado	157	02/11/98
79	Puntarenas	Parrita	Parrita	Pueblo Nuevo	112	02/11/98
80	Puntarenas	Parrita	Parrita	C.N.P. Parrita	21	02/11/98
81	San José	Escazu	San Antonio	Salón Comunal Santa Teresa	40	30/10/98
				Total	**5,411**	

Source: National Emergency Commission, Disaster Management Directorate, Information and Analysis Centre.

6. Emergency actions

a) Government actions

With more than 20 years' experience, the CNE again demonstrated its capacity and the effectiveness of the recently formed Local Emergency Committees, which played a vital part in preventing worse losses. Prompt action by these committees and efficient coordination with the National Meteorological Institute (IMN) and other government agencies enabled the rapid evacuation of 16,500 people who were threatened by the hurricane.

The world scientific community is in general agreement that hurricanes are increasing their frequency and intensity year by year. Prevention is therefore becoming an priority issue, since human lives are at stake. Mitch proved the enormous usefulness of predictions based on statistics, and weather forecasts that utilise real-time data. The possibility of heavy rains on the Pacific Coast had triggered a level 1 alert many weeks in advance, so the authorities and the general population were able to prepare for the hurricane's arrival.

When the IMN went to an emergency level 2 alert, the CNE's coordinated mobilisation was already under way. For example, supplies were placed in strategic sites many hours before important communication links could be cut, thus ensuring communities would not be left completely isolated and without basic aid. This system, the result of many years of training and preparation, began with hurricane Joan in 1988, when close communication was already being developed between the IMN and the CNE, based on personal trust and clear goals (Ramírez, P., IMN, personal note, 1998).

In numerical terms the advantages of this relationship are huge; the hurricane's impact was enormously reduced through effective attention for victims and the salvage of goods. However, in terms of the human lives that could have been lost to Mitch, the figure is inestimable. The benefits of early preparation to provide a rapid response to the disaster are obvious and more than justify the investment made in this field.

Nevertheless, improvements must still be made in such areas as i) public readiness, and ii) quantitative, real-time information to fine-tune weather forecasts. A metereological radar system should be installed to measure rainfall levels, at least in critical river basins; the network of stations should also be improved to provide real-time analysis, at least in critical areas (those at greatest risk, with high population density, or of economic importance). The country could well become a source of experience and knowledge that could be shared with the rest of Central America.

b) International aid

Foreign governments. Costa Rica received much less international aid than the other four countries affected by Mitch, not because of a lack of interest or attention on the part of the international community, but due to a government decision —in solidarity with the other countries affected by the hurricane, it was decided from the outset that to support humanitarian aid and rehabilitation in the region, Costa Rica would use its own resources to deal with the emergency, and that international aid arriving in the critical first few days would be redirected to the most affected countries. However,

according to information provided by the Ministry of Foreign Affairs, US$100,000 dollars sent by Taiwan Province of Chine were used for emergency attention in the district of Desamparados. Likewise, US$45,000 from the United States embassy were used to charter aircraft.

II. ASSESSMENT OF THE DAMAGE

This chapter includes an evaluation of the damage caused by hurricane Mitch in the following sectors: social (housing, education, health), infrastructure (energy, transport and communication, and water and sewerage), productive (farming, fisheries, industry and services) and the environment.

In line with ECLAC methodology, estimates cover both direct (physical infrastructure and capital assets), and indirect (lost production of goods and services or extra spending) damage. [9] Direct damage is evaluated on the basis of the value of assets prior to the disaster, i.e., taking depreciation and normal wear into account. [10]

Lost agricultural output is recorded as direct damage when crops were ready for harvesting or about to be warehoused for distribution; in the industrial sector, damaged inventory and manufacturing interrupted in process are listed as direct damage.

The cost of rebuilding damaged assets has also been calculated. If the aim were to return to the situation prior to the hurricane, the value would be the same as the direct damage assessed in accordance with the methodology described above. However, for the purposes of a reconstruction programme, the assessment should include the **improved replacement value**, which includes disaster prevention and mitigation criteria, incorporating technological improvements, higher quality, and stronger structures.

The ECLAC mission interviewed representatives from the government, the private sector, international agencies, UNDP and other agencies in the United Nations system, all of which provided data and valuable suggestions for the preparation of this document.

Amounts are expressed in colones and US dollars. The exchange rate used was 270 Costa Rican colones to the US dollar, the rate in effect when the hurricane struck.

1. Social sectors

a) Housing

The housing stock is relatively well developed in Costa Rica. More than three-quarters of all homes are owned by their occupiers. The lowest income levels cannot easily purchase housing under

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[9] The terms direct and indirect **damage, effect and cost** are used indistinctly in the document.

[10] See ECLAC (1991), *Manual para la estimación de los efectos socioeconómicos de los desastres naturales*, Santiago de Chile.

current market conditions, but social-interest programmes and financing systems have been implemented for middle-income sectors. [11]

The high rate of home ownership means buildings are relatively well maintained, which significantly increases their resistance to natural phenomena such as Mitch. In fact, damage to the country's housing stock was relatively slight compared to other neighbouring countries. [12]

Damage to houses was concentrated in the provinces of San José, Alajuela, Puntarenas, and Guanacaste (see Ministry of Housing map, Hurricane Mitch Damage Report). In all, 2,135 dwellings were affected: 242 were completely destroyed, 1,333 sustained slight damages, and 560 were flooded but not damaged. Most of the houses that were destroyed were in Puntarenas, and only one was lost in Guanacaste (see Table 5). [13] Dwellings in marginal areas, river banks, gullies and the slopes of hills were the most affected.

In calculating direct damage, the average cost per dwelling destroyed was estimated at 1.45 million colones (US$5,390), making a total of US$1.3 million. For houses affected slightly or partly, damage was assessed at an average of 5 per cent and 20 per cent, respectively, of the value of the dwelling, giving an approximate total of US$823,000 (see Table 6). Under dwellings destroyed, US$600 per house were included for losses of furniture and fittings, or a little over US$145,000 in total (in partly damaged homes it was assumed that no contents were lost). Direct damage totalled 612 million colones (US$2,300,000).

Table 5

COSTA RICA: DWELLING-UNITS AFFECTED BY HURRICANE MITCH

Locality	Total dwelling-units affected	Damage			
		Destroyed	Partial	Slight	None
Total	**2,135**	**242**	**577**	**756**	**560**
San José	295	87	158	18	32
Alajuela	202	16	98	50	38
Puntarenas	1,041	138	214	578	111
Guanacaste	597	1	107	110	379

Source: ECLAC, based on figures provided by the Ministry of Housing and Human Settlements and the National Emergency Commission (CNE).

Since people only had to leave their homes for a short period, indirect damages due to lost rent (paid or due) and expenses incurred in shelters are estimated to be minimal.

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[11] See Proyecto Estado de la Nación (1998), *Estado de la Nación en Desarrollo Humano Sostenible*, Informe 4, San José, Costa Rica.

[12] Cf. ECLAC (1998), *Nicaragua: Evaluación de los daños ocasionados por el huracán Mitch…*, op. cit.

[13] See Ministry of Housing and Human Settlements (1998), *Informe de daños huracán Mitch*, San José, November and ECLAC (1999), *Honduras: Evaluación de los daños ocasionados por el huracán Mitch* (LC/MEX/L.367), 26 January.

Total damage is calculated at US$2.3 million, mostly in direct losses.

Cost of reconstruction. According to the Ministry of Housing and Human Settlements (MIVAH), some 2,000 affected dwellings in high-risk areas must be relocated; 88 homes need repairs and the 242 dwellings destroyed must be rebuilt and relocated.

To calculate the cost of rebuilding the dwellings destroyed, an average area per dwelling of 42 m^2 and construction cost of US$127.8 per m^2 were used, bringing the total to US$1.3 million. An additional cost of US$25 per m^2 of construction was included for urbanization and electricity and water services, making a total of US$254,100. The cost of land, estimated an average of US$3,600 for 120 m^2, was also added, the total being US$871,000. The total cost of rebuilding the homes destroyed therefore amounts to US$2,425,000 (see Table 6).

Repair of the 88 partly damaged houses, using an estimated unit cost of US$2,778, gives a total of US$244,444. To relocate the 2,022 dwellings currently in high-risk zones, an average construction cost of US$5,370 per 42 m^2 dwelling was used; land was calculated at 120 m^2 per house, and plots at US$3,600 each. The total cost of land therefore amounts to US$7.3 million, and of construction US$10.9 million. In all, reconstruction costs total US$20.9 million (see Table 6.)

Table 6

COSTA RICA: DAMAGE IN THE HOUSING SECTOR AND COST OF RECONSTRUCTION

	Damage			Cost of reconstruction
	Total	Direct	Indirect	
Total (thousands of US$)	**2,296.0**	**2,275.9**	**20.1**	**20,806.7**
Total (thousands of colones)	617,625	612,225	5,400	5,617,809
242 dwellings destroyed	350,892	350,892		654,750 a/
577 dwellings partly affected	167,319	167,319		65,988 b/
756 dwellings slightly affected	54,810	54,810		
Domestic furniture and fittings	39,204	39,204		
Lost rent	4,050		4,050	
Spending on shelters	1,350		1,350	
Relocation of 2,022 high-risk dwellings				4,897,071
Cost of land				1,965,384
Cost of construction				2,931,687

Source: ECLAC, based on figures from the Ministry of Housing and Human Settlements, the Joint Social Assistance Institute and own estimates.

a/ Includes price of improved housing, cost of land, basic services and basic furniture and fittings.

b/ According to the plans of the Ministry of Housing and Human Settlements, this item only covers repairs to 88 dwellings.

The disaster-prevention recommendations made by the CNE and the MIVAH in the housing sector deserve special mention; the CNE's efforts over the last twenty years helped to mitigate the effects of Mitch and should therefore be maintained. The main recommendations include banning building on steep slopes, at the foot of hills, or near fault lines; controlling development in coastal areas, banning construction on sandy soil or near the sea, and controlling building on sanitary landfills. [14]

b) Education

Sixteen schools in various provinces were damaged. Most damage was to classrooms; furniture was mostly unaffected. Educational equipment and material were not lost and in general the damage was relatively slight. Nevertheless, some schools on vulnerable sites will have to be relocated. No damage to the country's cultural heritage was reported.

Damage to educational facilities is estimated at nearly 79 million colones (US$293,000). School buildings were the most affected, with damage to classrooms, teachers' houses, staff rooms, administrative offices, bathrooms and dining rooms. Very little furniture was damaged (see Table 7.)

Table 7

COSTA RICA: DAMAGE TO EDUCATION SECTOR

	Damage			Cost of
	Total	Direct	Indirect	reconstruction
Total US$ (thousands)	**414.7**	**293.2**	**121.5**	**429.0**
Total colones (thousands)	111,731	78,867	32,864	115,408
Damage to classrooms, staff rooms, dining rooms, bathrooms and administrative offices	78,408	78,408		90,408
Damage to furniture	459	459		
Land to relocate school				25,000
Damage to schools and community centres used as shelters a/	32,684		32,684	

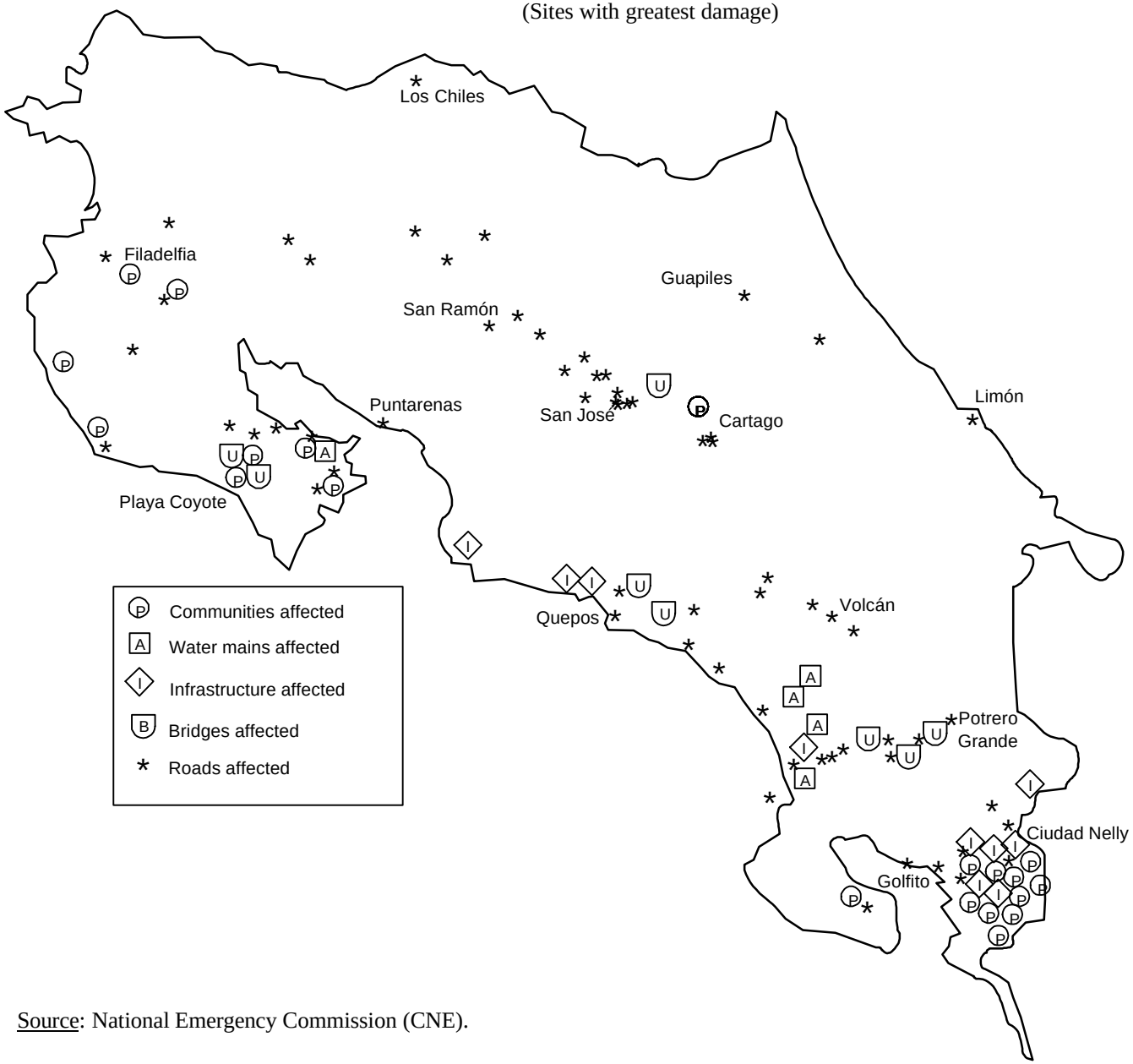
Source: ECLAC, based on estimates from the National Productive Infrastructure Centre (CENIFE) of the Ministry of Education, Culture and Sport; National Coordination Secretariat and own estimates.

a/ Includes 81 facilities used as shelters.

[14] Ibid.

Figure 3

COSTA RICA: AREAS AFFECTED BY HURRICANE MITCH
(Sites with greatest damage)



Source: National Emergency Commission (CNE).

Figura 4

COSTA RICA: MAP OF CANTONS AFFECTED BY HURRICANE MITCH

Source: National Emergency Commission (CNE), Information System.

A total of 81 schools, churches, community halls, industrial installations and other buildings were used as temporary shelters. Following ECLAC methodology, the cost of wear and tear while such places were used as shelters was calculated. They were only used for a short period and the cost is calculated at US$1,500 per shelter (403,500 colones), making a total of US$121,500 (32,684 million colones; see Table 7).

Reconstruction is estimated at 115 million colones (US$429,000), including land for one school that needs to be relocated (25 million colones). The land for two other high-risk schools that need relocating is not included, because it will be donated.

Calculations were carried out on the basis of unit values furnished by the Ministry of Public Education: 72 m^2 classroom: 3 million colones; dining room: 2.75 million; set of small-sized bathroom fixtures: 1.25 million; teacher's house: 2.55 million; set of bathroom fixtures: 3.5 million; administrative offices: 2.55 million; desks: 5,000 colones each.

c) Health sector

Costa Rica's health services are one of its most important assets, and reflect its advanced level of human development. As a result of programmes implemented in the seventies to extend health services, 90 per cent of the population is covered by the Sickness and Maternity Plan (REM). [15]

This wide-ranging coverage in medical services has been aided by improvements to infrastructure in hospitals, health centres, and equipment to ensure the provision of a more comprehensive range of services for the population, including the hundreds of thousands of Central American immigrants, mainly Nicaraguans, who have arrived in recent years.

The Ministry of Health network comprises 1,393 health care facilities, including 93 health centres, 545 health stations, 602 comprehensive care centres, 76 dental school clinics, 64 mobile dental units, and 13 dental clinics in health centres. The Costa Rican Social Security Fund (CCSS) has 211 establishments (29 hospitals and 182 clinics). As regards hospitals, nine are national, 7 regional, and 13 cover outlying regions. In May 1998 there were 585 Basic Comprehensive Health Care Teams (EBAIS), a new model for primary care implemented since the beginning of 1995. [16]

The preventive measures taken by the CNE, in coordination with its local committees and the Ministry of Health, were instrumental in mitigating the impact of Mitch on the health sector. The worst damage was at the Dr. Tomás Casas Hospital, in Ciudad Cortés, Osa canton, Southern Pacific region, where floodwaters reaching 80 centimetres damaged facilities and equipment. [17] Floors and beds in the delivery and operating rooms were totally destroyed, and electrical installations, drains, water tanks, autoclaves, engines and furniture were damaged.

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[15] Proyecto Estado de la Nación, *Estado de la Nación en…*, op. cit, p. 77.

[16] See Ministry of Health, *Informe Anual 1997* and Proyecto Estado de la Nación, *Estado de la Nación en…*, op. cit., p. 81.

[17] This region suffers frequent flooding, so it would be advisable to relocate the hospital and not to build facilities of any kind in the area, which was affected by hurricanes Joan in 1988, and Cesar in 1996.

Total damage to the hospital is estimated at over 100 million colones (US$372,000). However, the cost of reconstruction is considerably higher, because it must be relocated. According to estimates by the Ministry of Health's Project Development Directorate, the new hospital will have eight consulting rooms and 46 beds, and will be built on 8,500 m^2 of land. The cost of construction is estimated at 1,600 million colones and equipment at 700 million.

Indirect damage is estimated at a little over 133 million colones (US$496,000). The reduction of hospital care and outpatient services led to income losses amounting to 49 million colones. Care for cases of diarrhoea, dengue and malaria absorbed 4.5 million colones. Active monitoring was conducted in campaigns to prevent and mitigate diseases and epidemics; wells were cleaned and disinfected, and vector proliferation was controlled through fumigation and cleaning. Drinking water was distributed, dead animals were buried and incinerated, and support was extended to affected communities, which also participated in such tasks. The cost of cleaning and disinfecting water sources totalled 3.8 million colones, and vector control cost 5 million (see Table 8).

Table 8

COSTA RICA: SUMMARY OF DAMAGE TO THE HEALTH SECTOR

	Costs			Cost of
	Total	Direct	Indirect	reconstruction a/
Total (thousands of US$)	**867.5**	**371.7**	**495.8**	**8,519**
Total (thousands of colones)	233,360	100,000	133,360	2,300,000
Damage to Tomás Marcos Hospital	100,000	100,000		2,300,000
Buildings		N/A		1,600,000
Equipment		N/A		700,000
Lost income due to reduced health care	49,000		49,000	
Care for cases of dengue, diarrhoea and malaria	4,545		4,545	
Prevention and mitigation campaigns	8,815		8,815	
Environmental sanitation	71,000		71,000	

Source: ECLAC, based on figures from the Ministry of Health, National Emergency Commission (CNE) and own estimates.

N/A: Not available.

a/ The land has already been purchased.

The health of the population on the border between Costa Rica and Nicaragua has become a major issue in recent years. Immigration from Nicaragua has led to greater demand for health services, which are subject to greater pressure in emergencies such as Mitch.

2. Infrastructure

a) Transport and communications

Costa Rica's roads are subject to heavy wear. The country's high rainfall levels and its exposure to hurricanes accelerate the deterioration of surfaces. Apparently, maintenance has not been sufficient to keep roads and bridges in satisfactory condition.

Roads and bridges were damaged by the floods caused by Mitch. Damage was concentrated on the southern inter-American highway, which had already been affected by hurricane Cesar in 1996. Although damages were minor, the vulnerable condition of various bridges and road sections requires work to minimise damage from extreme weather in the future.

Landslides at various points along the inter-American highway damaged various stretches in the south of the country, and traffic was reduced to a single lane. The Ministry of Public Works and Transport (MOPT) repaired a total of 1,300 kilometres of roads affected by landslides and avalanches. Calculations indicate 740 kilometres of surfacing were lost on paved roads and on 1,200 kilometres of unpaved (ballast-surface) roads. A total of 126 bridges were damaged, as were more than 1,000 drains, many along the inter-American highway. [18]

Direct damage is estimated at close to 6,500 million colones (US$24.07 million), of 4,428 corresponds to damage to roads (US$16.5 million); the rest is for bridges (see Table 9). [19] Damage by province was highest in Puntarenas, where damage to road and bridge infrastructure totalled US$17.5 million (73 per cent of all direct damage), followed by Guanacaste (3.73 million), San José (1.99 million), Alajuela (0.63 million), and Heredia (0.24 million).

Indirect damage was not substantial, because traffic was only interrupted on a few sections and for very short periods. Transport was therefore not severely disrupted; perishable goods were not lost and normal conditions were quickly restored. However, in some cases travel times and transport expenses increased.

On calculating reconstruction costs, it was assumed that in addition to repairing damage caused by Mitch, improvements will be made to correct infrastructure problems as a result of other recent natural phenomena, such as hurricane Cesar and El Niño. CNE estimates, based on MOPT reports, were used for this purpose.

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[18] See Ministry of Public Works and Transport (1998), *Daños ocasionados por el huracán Mitch en la red de carreteras y caminos de Costa Rica*, San José, Costa Rica, November.

[19] Unit values of construction materials (drains, concrete, filler, concrete slabs, and other items) and of labour to repair damage caused by landslides, among others, were provided by the Ministry of Public Works and Transport and used to calculate direct damage.

Table 9

COSTA RICA: DAMAGE TO ROADS AND BRIDGES

	Damage			Cost of reconstruction	Imported component (percentage)
	Total	Direct	Indirect		
Total US$ (thousands)	**24,122**	**24,070**	**52**	**40,190**	
Total colones (millions)	6,489	6,475	14	10,811	27
Damaged bridges	2,047	2,047		3,418	20
Roads	4,428	4,428		7,393	30

Source: ECLAC, based on Ministry of Public Works and Transport figures and own estimates.

Table 10 shows direct damages by province; Puntarenas sustained the most damage, accounting for 63 per cent of the total.

Table 10

COSTA RICA: DAMAGE TO ROAD INFRASTRUCTURE BY PROVINCE

Province	Landslides and cave-ins in roads	Damaged bridges	Damaged drains	Damaged dikes and retaining walls and silted watercourses	Estimated damage (millions of colones)
Total	**515**	**126**	**1,421**	**85**	**6,420**
San José	158	26	991	26	986
Alajuela	55	5	64	3	235
Cartago		2		3	120
Heredia	10	2			66
Guanacaste	39	17	217	23	959
Puntarenas	253	74	149	30	4,056

Source: ECLAC, based on National Emergency Committee figures.

No major losses were reported in telecommunications. The national radio emergency network worked perfectly, as a result of investment in preparation for such events.

b) Energy

i) Electricity subsector

1) Transmission and distribution. No major damage was reported. Both the Costa Rican Electricity Institute (ICE) and distribution companies have teams to deal with emergencies; a few downed lines were quickly repaired.

The Strategic Business Unit (UEN) is responsible for the ICE's electricity distribution and marketing systems. The network consists of 14,000 km of power lines serving an area of some 20,000

km^2. The system is prepared for emergencies, and includes a decentralised system of stores of materials and equipment in different regional operation centres, so no area is directly dependent on the headquarters in San José (Mayorga, G., Energy Management/ICELEC, personal note, 1998). Emergencies are handled by the central headquarters and local coordination of the different networks is carried out through the Local Network Operation Centres (CLOR).

This system works even if routes are impassable; teams are in constant communication and if a road is obstructed, assistance can be provided by the nearest group on the other side. Although no damage was reported in substations, some access roads were affected and several towers suffered stability problems by landslides.

Repairs of such damages amounted to 11.65 million colones (see Table 11). The most affected region (not including road repairs) was the Southern zone, where posts and towers collapsed or were damaged, and cables were broken or shorted. These were repaired quickly, so indirect damage is negligible. Actual spending on transmission and distribution problems was taken as a reconstruction cost, although only repairs were in fact involved.

Table 11

COSTA RICA: ESTIMATED DAMAGE IN THE ELECTRICITY SUBSECTOR, TRANSMISSION AND DISTRIBUTION

	Total damage	Direct damage a/	Indirect damage	Cost of reconstruction b/
Total (thousands of US$)	**43.8**	**43.3**	**0.5**	**43.3**
Total (thousands of colones)	11,650	11,650		11,650
Puerto Cortés	1,500	1,500		1,500
Quepos	1,000	1,000		1,000
Santa Rita	2,000	2,000		2,000
Others	7,150	7,150		7,150
ICE hydrometeorological network	120		120	120

Source: ECLAC, based on figures from the Office of Energy Development, ICE and own estimates.
a/ Includes personal expenses, material, equipment and use of vehicles.
b/ The damage had been repaired as of this report.

The protection and prevention system has gradually been incorporated to the network and has increased energy costs, but indirect savings are considerable.

2) Production. Generation plants were not damaged. The access roads to the La Garita station suffered minor damage that was repaired immediately using ICE machinery. The Ciruelas intake was damaged and is still being repaired, and the control facility foundations will have to be checked. Significant flooding took place near the Virilla intake desander, where damage will be assessed during the dry season.

The main reservoirs were properly regulated and there are no reports of overflowing. No damage to current projects has been reported, other than some weather stations where the cost has yet to be assessed. The impact on the ICE's hydrometeorological network was minor. Stations 24-06

(Balsa, on the Grande de Tárcoles) and 31-12 (Cabagra) sustained considerable damage. A total of 120,000 colones were spent on immediate repairs.

ii) Oil subsector. No damage reported.

c) Water and sewerage

i) Latrines and wells. Apart from damaging homes, flooding caused by excess of rainfall destroyed furniture and fittings, and caused latrines and some sanitation systems to overflow. Several wells on the Río Coto-Colorado plateau that supply drinking water to the Brunca region became fouled, but Ministry of Health work teams pumped them out, and cleaned and disinfected them as soon as the floodwaters receded. The population's health was endangered by overflows of sewage from latrines.

ii) Water mains. Most damage to drinking water and sewerage systems was in municipalities on the Pacific, particularly in the Central Pacific region (San Ramón, Palmares, Quepos, Puntarenas), the Central Region (San Ignacio de Acosta and Ciudad Colón), the Brunca Region (Coto Brus, Ciudad Cortés, Buenos Aires, San Isidro), Chorotega, and the Metropolitan Region. Some systems suffered major damage. Fourteen minor rural water mains suffered moderate to serious damage but were quickly repaired. The active presence of the Rural Water Main Boards was one of the reasons damage was repaired so quickly.

The country has more than 1,700 rural water mains, owned by the Water, Water Mains and Sewer company (AyA), and other public concerns. Small organizations of community leaders try to solve problems as they arise, without waiting for assistance from centralised state organizations. In some cases AyA only receives damage reports after repairs have been made, because these organizations have become used to acting on their own initiative. In cases of major damage or when special consultations are required, they contact the Rural Works Directorate in San José; however, regional operation units will soon be in service to provide even more accessible, faster service.

The largest water main with severe damage is the Toma de Chontales intake, which supplies Ciudad Cortés and is directly managed by AyA. The main 25 cm diameter pipe broke and a long section was lost. Emergency repairs were effected by installing a 10-cm pipe and direct damage stands at 82 million colones. The pipeline needs to be rerouted, and new intake, pumping, desander, plant and storage tank installations will be required. The total cost of repairs is 135 million colones (nearly US$500,000).

Other considerable damages were sustained in Bajo Barrantes (San Ramón and Palmares water supplies), with 30 million colones in direct damage. Repairs and other minor but important works will have to be carried out. Total direct damage to water supply systems is calculated at US$765,000, and reconstruction costs will amount to approximately US$1.3 million (see Table 12).

Table 12

COSTA RICA: DAMAGE TO DRINKING WATER, WATER MAIN, SEWER, AND PURIFICATION SYSTEMS

	Damage			Cost of reconstruction
	Total	Direct	Indirect	
Total (thousands of US$)	**929.3**	**820.7**	**108.6**	**1,390**
Total (thousands of colones)	249,985	220,785	29,200	374,000
Water main (Chontales intake)	82,000	82,000		135,000
Water supply	30,000	30,000		…
Others	93,785	93,785		…
Emergency spending a/	29,200		29,200	
Drainage (Valle Coto Colorado dyke)	15,000	15,000		20,000

Source: ECLAC, based on figures from the Costa Rican Sewerage Services Institute, AyA, and own estimates.

a/ Includes overtime paid, relocation of assets to safe places, preparation of bags of water, distribution of water, replacement of materials, and losses of certain equipment and materials not included in the rehabilitation and reconstruction stage.

Estimates of short-term emergency expenses provided by the Costa Rican Water and Sewerage Services Institute were used to calculate indirect damage (see Tables 12 and 13).

Table 13

COSTA RICA: SHORT-TERM EMERGENCY EXPENSES PAID BY COSTA RICAN WATER AND SEWERAGE SERVICES INSTITUTE

Region	Thousands of colones	US$
Total	**29,192**	**106,151**
Central Pacific	12,910	46,945
Brunca	3,330	12,110
Central West	538	1,956
Metropolitan (drinking water)	7,000	25,454
Metropolitan (sewers)	2,000	7,272
Chorotega	2,400	8,727
Water bags	163	593
Others	850	3,092

Source: Costa Rican Water and Sewerage Services Institute.

d) Irrigation and drainage

i) Moracia irrigation district. The Guanacaste irrigation system was not affected. Although the Miguel Dengo reservoir was quickly overcome by the volume of water, warning messages made it possible to close sluices and to reinforce storm drains in time. The Grupo de Canaleros team, responsible for cleaning primary and secondary intakes and channels, was in a state of permanent readiness and the entire network was monitored during the hurricane. Such costs are borne by the National Underground, Irrigation and Drainage Waters Service (SENARA).

ii) Valle Coto-Colorado flood control. The drainage system in the Río Coto-Colorado valley sector, in the area next to the river, depends on a dyke to protect farming projects such as Fincas Costa Rica. A long section of the dyke collapsed and requires urgent reconstruction. The dyke runs along the banks of the Grande de Térraba river and protects banana plantations in small and medium-sized farms, and eight small communities. Direct damage amounts to almost 15 million colones and reconstruction will cost approximately 20 million, around US$75,000 (see Table 12).

iii) Other systems. A small water-control installation in Tierra Blanca de Cartago, which is part of the La Maya de La Esperanza project, designed to prevent further erosion, has yet to be assessed, but appears to have sustained considerable damage.

3. Productive sectors

This section includes estimates of the damage caused by hurricane Mitch to the farming sector, fisheries, industry and services. Severe weather such as hurricane Mitch often causes major losses, especially in commodity-producing sectors. Crops are often the worst affected, due to excess water in the soil. Crop damage can vary, depending on the factors detailed below.

The estimate of direct damage in the farming sector includes losses of infrastructure and capital assets (processing plants, tractors, etc.) along with lost harvests and stored goods. In Costa Rica's case, direct damage mainly refers to lost harvests. Indirect damage is calculated on the basis of the hurricane's effects on future agricultural production.

a) Farming sector

In 1997, farming accounted for 18 per cent of GDP and was the second most important sector in the country's economy. [20] The sector's output had already shrunk (0.5 per cent in 1996 and 0.7 per cent in 1997) because of climatic problems that affected export-crop harvests [21] (bananas, coffee and sugar), and some basic grains, particularly beans. Moreover, El Niño lengthened the dry season into a drought and then caused heavy rains that affected the flowering of certain crops and hindered the use of machinery.

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[20] See ECLAC (1998), *Información básica del sector agropecuario. Subregión norte de América Latina y el Caribe, 1980-1997* (LC/MEX/L.364), 13 November.

[21] See ECLAC (1998), *Costa Rica: Evolución económica durante 1997* (LC/MEX/L.353), 16 July.

The main effects of El Niño were felt in the Huetar Norte and Chorotega (Northern Pacific) regions, where most of the rice and beans for domestic consumption are grown and where cattle raising is concentrated. The bean harvest was so poor that it became economically unfeasible, and cattle raising was affected by the extended dry season (two months longer than normal), which reduced meat production and wiped out some of the cattle population. [22]

Output in the agricultural subsector fell by 0.5 per cent in 1997. Beans were the worst affected crop, mainly due to the late rains, but rice yields were high.

As regards traditional export crops, the cultivated area decreased by 7.1 per cent, as did coffee, banana, cacao and sugar cane production. The crop area of non-traditional commodities such as fruit, starchy roots and tubers fell, whereas that of vegetables increased.

Cattle raising fell off by 1.6 per cent in 1997, due to the drought which affected meat production because cattle lost weight. Dairy output rose, however, as a result of measures to protect the dairy sector and the growing importance of exports to the region.

Fisheries declined by 11 per cent, especially small-scale and shallow coastal fishing.

Total exports rose by 7.7 per cent in 1997, whereas traditional exports —except coffee— fell for the second year running. The GDP share of exports fell from 40.8 per cent in 1995 to 34.4 per cent in 1997. [23]

The farming sector performed better than in previous years in 1998, [24] with a growth rate of 3.2 per cent, but remained lower than the overall GDP growth rate. This was due to weather problems and the effects of El Niño in the first five months of the year, which reduced basic-grain harvests and meat production. Traditional export crops did well (unlike non-traditional crops) once weather conditions improved. However, hurricane Mitch affected some areas devoted to traditional crops, especially coffee plantations.

As was the case in other Central American countries, the impact of Mitch on the farming sector initially affected foreign currency earnings and employment and will subsequently undermine food security, in addition to other foreseeable financial effects, such as affected farmers defaulting on loans and migration of labour to seek employment elsewhere. [25]

i) Crops for domestic consumption. These include rice, maize, fruit, tomatoes, peppers, beans, potatoes, papaya and other garden produce, as shown in Table 14. The worst affected was rice, with losses totalling 816 million colones (12.7 per cent). Tomato production saw losses of 583 million colones (9.1 per cent); bean losses amounted to 286 million colones (4.5 per cent). As of the date for which information was available no losses had been registered in fisheries and aquaculture.

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22 See ECLAC (1998), *El fenómeno El Niño en Costa Rica durante 1997-1998…*, op. cit.

23 See ECLAC (1998), *Información básica…*, op. cit.

24 See ECLAC (1998), *Costa Rica: Balance preliminar de la economía, 1998*.

25 See CORECA (1998), *Huracán Mitch: Efectos sobre el sector agropecuario centroamericano y acciones para la recuperación*, 1 December.

ii) Export crops. The most affected traditional export crop was coffee; the damaged area is estimated at 20,266 hectares, [26] or 70 per cent of all land affected by the hurricane (28,942 hectares), including traditional export crops, basic grains, and fruit and vegetables (not including bananas). Lost coffee production is estimated at 3,362.3 million colones, (US$12.5 million) in direct damage alone. If indirect damage to coffee production is included, the total damage amounts to 10,062 million colones (US$37.3 million). This means that 62 per cent of all damage in the sector was sustained by Costa Rica's main traditional export crop, with direct consequences on the foreign sector, the trade balance and the balance of payments. Sugar cane production was also badly affected, with 751.6 million colones (11.7 per cent; US$2.8 million) in direct damage and total damages of 2,249 million colones (US$8.3 million).

The regions with the largest affected areas were the Western Central Valley and the Central Pacific and Brunca regions, whereas the most affected in terms of damaged production were the Western Central Valley, Chorotega, the Central Southern Valley and Brunca, followed by the Central Pacific and the Eastern Central Valley regions.

In short, total damage in the farming sector has been estimated at approximately 17,000 million colones (US$63.8 million), [27] of which almost 7,000 million colones (US$25.9 million) were direct damage. This figure does not include estimates of damages in fisheries, forestry, and lost assets, which have yet to be calculated by the Agriculture and Livestock Ministry (MAG).

Tables 14, 15, 16, and 17 summarise total damage and provide a breakdown by region and by crop.

Table 14

COSTA RICA: MAIN CROPS AFFECTED BY HURRICANE MITCH BY REGION

Region	Area affected (hectares)	Millions of colones
Total	**28,941.7**	**6,418.1**
Western Central Valley	14,284.6	2,047.8
Central Pacific	1,157.2	270.3
Southern Central Valley	8,025.0	1,369.1
Chorotega	3,463.0	1415.1
Eastern Central Valley	265.9	243.8
Brunca	1,746.0	1,072.0

Source: ECLAC, based on SEPSA/MAG data base and own estimates.

[26] Preliminary estimates from the Agriculture and Livestock Ministry.

[27] Includes lost dairy production and pasture for cattle raising, but not losses in forestry resources, fisheries and soil.

Table 15

COSTA RICA: AREA OF MAIN CROPS AFFECTED BY HURRICANE MITCH

Crop	Western Central Valley		Central Pacific		Central Southern Valley		Chorotega		Eastern Central Valley		Brunca		Total	
	Hectares	Millions of colones	Hectares	Millions of colones	Hectares	Millions of colones	Hectares	Millions of colones	Hectares	Millions of colones	Hectares	Millions of colones	Hectares	Millions of colones
Total	**14,284.6**	**2,047.8**	**1,157.2**	**270.3**	**8,025.0**	**1,369.1**	**3,463.0**	**1,415.1**	**265.9**	**243.8**	**1,746.0**	**1,072.0**	**28,941.7**	**6,418.1**
For domestic consumption														
Rice	0.0	0.0	1,065.0	219.0	0.0	0.0	1,630.0	593.7	0.0	0.0	13.0	3.5	2,708.0	816.2
Maize	0.0	0.0	0.0	0.0	125.0	2.8	60.0	9.0	0.0	0.0	93.0	31.5	278.0	43.3
Fruit	0.0	0.0	18.5	2.3	30.0	8.2	0.0	0.0	65.0	14.1	0.0	0.0	113.5	24.6
Tomatoes	78.5	442.7	14.7	10.3	1,100.0	30.0	0.0	0.0	12.5	100.7	0.0	0.0	1,205.7	583.7
Peppers	76.1	137.1	0.0	0.0	30.0	0.0	0.0	0.0	3.4	35.7	0.0	0.0	109.5	172.8
Beans	465.0	164.7	0.0	0.0	1,265.0	114.2	105.0	7.1	0.0	0.0	0.0	0.0	1,835.0	286.0
Potatoes	56.0	52.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.0	37.0	124.0	89.1
Other vegetables	390.0	212.0	0.0	0.0	61.0	43.0	23.0	18.0	0.0	0.8	0.0	0.0	474.0	273.8
Papaya	0.0	0.0	43.0	14.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.0	14.7
For export														
Coffee	13,034.0	1,030.0	16.0	24.0	5,414.0	1,170.9	45.0	44.9	185.0	92.5	1,572.0	1,000.0	20,266.0	3,362.3
Sugar cane	185.0	9.2	0.0	0.0	0.0	0.0	1,600.0	742.4	0.0	0.0	0.0	0.0	1,785.0	751.6

Source: ECLAC, base on MAG figures, other official figures and own estimates.

Table 16

COSTA RICA: MAIN CROPS
AFFECTED BY HURRICANE MITCH

(Hectares)

Crop	Area affected by hurricane
For domestic consumption	
Rice	2,708.0
Maize	278.0
Fruit	113.5
Tomatoes	1,205.7
Peppers	109.5
Beans	1,835.0
Potatoes	124.0
Other vegetables	474.0
Papaya	43.0
For export	
Coffee	20,266.0
Sugar cane	1,785.0

Source: ECLAC, based on SEPSA/ MAG figures and own estimates.

b) Cattle raising

Damage in this sector was mainly to dairy (26.2 million colones) and pasture production (41.8 million). The impact on both amounts to 0.5 per cent of the total damage in commodity-producing sectors. However, it will have an effect on the supply of meat and dairy products for domestic consumption. Although precise information is not available, the highest cattle losses are known to have been in the Southern Central Valley region, and pasture land was most affected in the Brunca region.

c) Fisheries

Details of damage in the fisheries sector were not available when this report was drafted, but newspaper reports indicate small-scale losses in shrimp farming.

d) Industry, trade and tourism

According to information provided by the Ministry of the Economy, Industry, Trade and Foreign Trade, damage to industry, trade and tourism was very slight. Although private-sector representatives and business organizations agreed that damage in these sectors was not substantial, the mission nevertheless believed it important to make the following comments on the industrial and trade sectors.

Table 17

COSTA RICA: CLASSIFICATION OF LOSSES IN AGRICULTURE, CATTLE

RAISING AND FISHERIES CAUSED BY HURRICANE MITCH

(Millions of colones)

	Damage			Impact on foreign sector	
	Total	Direct	Indirect	Increase in imports	Reduction in exports
Total US$ (thousands)	**62,424.4**	**25,908.5**	**36,515.9**	**3,888.5**	**14,544.3**
Total colones (millions)	16,854.6	6,995.3	9,859.3	1,046.0	3,915.1
Agriculture	16,786.6	6,931.1	9,855.5	1,046.0	3,915.1
For domestic consumption					
Rice	2,442.5	816.2	1,626.3		
Maize	47.6	43.3	4.3		
Fruit	24.6	24.6	0.0		
Tomatoes	583.7	583.7	0.0		
Peppers	172.8	172.8	0.0		
Beans	286.0	286.0	0.0		
Potatoes	89.1	89.1	0.0		
Other vegetables	301.1	273.8	27.3		
Papaya	14.7	14.7	0.0		
For export					
Coffee	10,062.3	3,362.3	6,700.0		
Sugar cane	2,249.2	751.6	1,497.6		
Assets					
Plantations					
Soil	513.0	513.0			
Machinery and equipment					
Cattle					
Dairy production	26.2	26.2	0.0		
Others (pasture)	41.8	38.0	3.8		
Fisheries					
Shrimp					
Assets					

Source: ECLAC, based on SEPSA/MAG figures and own estimates.

i) Manufacturing sector. Infrastructure and facilities were not affected and the only possible losses are due to temporary stoppages in the few factories that suffered minor flooding or equipment damage. However, no official information is available.

In **agro-industry** the main damage consisted of the losses in production described above, with a consequent reduction in processed agricultural, meat and fish products. The main damage is probably in coffee and sugar cane processing.

The **forestry** subsector was not included in the government's evaluation of damages and the hurricane's effects are considered minimal. Nevertheless, indirect damage includes loss of income resulting from the recovery of damaged plants and generation of new seedlings.

The **chemical** industry suffered no losses.

ii) Mining. Official information indicates no damage to the minerals, non-metal mining, or extraction industries.

iii) Trade. In general the trade sector was not affected by the hurricane, with the exception of small-scale informal trade in the most affected areas.

iv) Tourism. According to information furnished by the National Chamber of Tourism there was no direct damage in the sector. Indirect damages owing to cancelled reservations or fewer tourists booking holidays because of the tragedy in Central America have not been significant.

4. Effects on the environment

a) Definitions and methods used in environmental assessment

Natural disasters can cause moderate or serious damage to the environment, or even the total deterioration of a natural heritage that provides society with environmental benefits. Quantifying the environmental impact of natural disasters on this heritage on the basis of relative indicators or in monetary terms is a relatively recent practice. This type of assessment has been used to analyse the impact of El Niño (1997-1998) on Costa Rica (ECLAC, November 1998), of hurricane Georges on the Dominican Republic (ECLAC, November 1998), and most recently of hurricane Mitch in Honduras, Nicaragua, Guatemala and El Salvador (ECLAC, February 1999).

The theory for the purposes of this assessment is that natural habitats or ecosystems are generally in a state of ecological balance; natural phenomena involving high energy dissipation are normal, although they may only occur once in several years or decades and affect geographical areas at random; these processes are believed to shape biosphere physiography over time. Their main impact is therefore on an ecosystem's sensitivity, depending on its geophysical characteristics and its environmental conditions. The vulnerability of areas that have been affected by settlements and human activities in general depends on the measures taken to prevent or mitigate the consequences of changes to natural ecosystems. These consequences can be fatal, particularly if human intervention lacks appropriate preventive land-use measures and planned, sustainable management of natural resources.

The studies conducted in Central America were based on the average value of environmental services provided by forests in terms of carbon fixation, water protection and production, biodiversity, ecosystems and scenic quality (ECLAC, op. cit., 1998). These values are approximate, since economic assessment of the effects of damage on the natural environment still requires further studies and certain environmental services, one of the most important being soil services, are not being taken into account. No damage was reported to protected areas in Costa Rica; only infrastructure and access roads were affected.

This preliminary assessment was based on a rapid overland field visit to Guanacaste and on studies of photographs and films and other information provided by technicians, specialists and government authorities such as the CNE, the Ministry of the Environment and Energy (MINAE), the National Metereological Institute (IMN), local NGOs (Tropical Scientific Centre, Earth Council),

international collaboration programmes (UNDP, IDNDR/CRID), and technicians from international missions who extended assistance during the emergency and to expedite the recovery process.

The alterations caused by hurricane Mitch (which was already affecting the country on passing through the Caribbean, prior to entering the Gulf of Honduras) to Costa Rican territory are measured as direct impact in this study, since they specifically altered natural assets through losses or serious damage, in a matter of a few hours. Impacts are classified as primary and secondary; the primary impact is caused by the storm's *in situ* energy dissipation, whereas the secondary impact refers to subsequent, cumulative dissipation, such as the major flooding that occurred in densely populated alluvial valleys and near the rivers that run through them.

Two types of hurricane impact were defined:

i) Immediate or primary direct impact (PDI) on the environment. Harmful or noxious impacts of a large-scale natural phenomenon, which occur during the event itself and have a direct effect on the state of natural assets as they were when the disaster began. Examples include strong winds that knock down, twist and defoliate plants, disturb fauna, and produce large waves and groundswell, or landslides and large-scale erosion of topsoil (which is particularly strong when trees have fallen) caused by heavy, sustained rainfall on mountain slopes, as was the case in Costa Rica.

ii) Secondary direct impact (SDI) on the environment. In addition to their local impact, the direct effects can also have an impact on the vicinity and areas some distance away from where a disaster initially broke out; these may be felt immediately, in a few hours or even days later, with explicit damage caused in areas rendered vulnerable by human activities. Examples include landslides, the formation of gullies and ravines left barren by waterlogging of the topsoil after losing its original vegetation, large sedimentary deposits in river beds and estuaries, sedimentary deposits on beaches and reefs, the formation of river islands that subsequently flood, drowning animal species, and floods and avalanches, among others. These effects may be intensified by other factors resulting from primary direct damage, such as rivers dragging vegetation uprooted by gusts or sustained winds, mud and accumulated rubble from cave-ins and landslides.

iii) Indirect impacts (II) on the environment. These stem from the action of weather phenomena involving major energy dissipation, and their effects depend on the type and extent of primary and secondary direct impacts, both of which indirectly affect the condition of natural assets when the disaster struck. These consequences can arise as soon as the direct impact takes place, or may appear and continue over a period of days, months or even years. One example is the disappearance of nutrients in an aquatic system, thus causing changes in the food chain; another is the disappearance of seed, fruits or flowers, the food source of birds and mammals, owing to the lack of a habitat, such as a forest. Although a tree can regenerate and sprout new leaves when it has lost its branches in hurricane winds, it will take longer to flower and produce fruit. Additionally, the lack of natural insect predators, such as bats, when they have been driven from an area, owing to the lack of a forest habitat, encourages the proliferation of insects that could be harmful to crops adjacent to the forest or to riverbanks. The lost habitat could also have been producing pollinating insects or insects generally beneficial to the agricultural environment of neighbouring man-made surroundings. The damage caused by Mitch in these fields has yet to be evaluated.

b) Conservation policies and environmental education

After nearly two decades (1970-1990) of conservation activities, national environmental policies to rescue natural heritage that remains in good condition had already been established; these included the creation and development of national parks and their equivalent in reserves, gradual diminishing of encroachment on and elimination of natural forests, regulation of the use of certain important resources and biomes, land planning, soil and catchment-basin management, and environmental conservation in general. In recent years state policies have focused more on consolidating these achievements, incorporating sustainable-development actions, and strengthening environmental education. Inter-institutionally coordinated disaster-preparedness programmes have also been implemented.

However, environmental imbalance has not been solved and appears to continue; recent evidence indicates that the overall environmental situation remains negative. [28] Nevertheless, conditions are in place for strengthening and extending the policies and laws in force and are obviously to favour a greater recovery. A recent study shows that an important shift from pasturelands to secondary forests occurred from 1979 to 1992, and that 45 per cent of that recovery took place in Guanacaste, which is one of the country's more critical areas (CCT/CIEDES/CI, 1998); although the change is apparently due to a reduction in intensive cattle raising, and to reforestation projects to a lesser extent, it could also be an indication of an environmental awareness among farmers and communities, who are now showing greater interest in recovering lands that previously had no forest cover.

In the case of the effects of El Niño on Costa Rica, different institutions have made more precise calculations of the losses stemming from this phenomenon on economic assets and output; estimates of the impact and losses caused to the environment have also been useful. [29] The total loss of assets amounted to approximately US$6 million.

Although much remains to be done, as in other parts of Latin America, the country's capacity to address emergencies has improved substantially, and more can be achieved as a result of the experience gained. The following sections describe Mitch's main effects on the environment, so as to provide a more comprehensive overview for assessing economic damages and propose methods and measures to prevent and mitigate disasters.

c) Direct impact on the environment

Hurricanes and tropical storms originating in the Caribbean basin every year produce massive humid air currents that move towards the epicentre of such storms. Those coming out from the Pacific Ocean have to cross Central America, where they encounter mountain ranges; in Costa Rica these are particularly high —the Cordillera de Talamanca has a dozen peaks over 3,000 metres above sea level, the highest being Chirripó at 3,882 m— and make an almost perpendicular front to such currents. As the currents rise, expand adiabatically and cool, they generate unusual amounts of rainfall for many hours on Costa Rica's Pacific side, particularly the Río Grande de Terralba basin and its surroundings,

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[28] See Proyecto Estado de la Nación, *Estado de la Nación en...*, op. cit., pages 130-135.

[29] ECLAC (1998), *El fenómeno El Niño en Costa Rica durante 1997-1998...*, op .cit.

and others, such as the Tempisque basin. Hence the recurrence of floods when such weather phenomena pass through the Caribbean or near the Isthmus.

Official information was too limited to provide an accurate estimate of damage to the environment when this report was written. Direct observations by the staff in charge of forest management reveal that damage in terms of fallen trees is not significant, except those along river banks, which are protected by law in Costa Rica (15 metres from each bank).

They have nevertheless been given a value in this study, on the basis of the ECLAC mission's observations and the preliminary assessment provided by the Ministry of the Environment and Energy and the Tropical Scientific Centre. In general the damage is slight, but should be taken into account. The impact on the wood-based industry has not been measured, and wind and oceanic effects are not considered as important as they were in Honduras, for example. [30]

i) Impact of rain. According to MINAE no direct primary impacts on the environment of any consequence were recorded. However, the small amounts of damage, especially to riverside forests, reflect an impact that should be taken into consideration, although it is too early to make an accurate estimate. Reports for Corcovado National Park and the International La Amistad Park (the country's largest conservation and biodiversity area, in the Cordillera de Talamanca range) indicate only minor damage; a few trails and access roads were destroyed in areas affected by human activity, and the Visitors' Centre in Osa sustained more substantial damages. The same can be said of Guanacaste area.

Slight damages have been reported to trails and paths in private reserves; for example, a very visible landslide took place on an access road within the Monteverde Rain Forest Biological Reserve, which is managed by the Tropical Scientific Centre.

ii) Soil loss. Field research conducted in several Central American countries to assess the impact of Mitch on soil conditions is very revealing: on comparing soil loss in mountainous areas with forest cover —particularly those in a natural state— with the loss on hillsides devoted to agriculture and grazing, it was found that in general there is a 1 to 10 ratio of landslides and formation of gullies, mainly on steep slopes. In certain extreme cases, the ratio is even higher.

Moreover, studies carried out by the IDB on the effect of hurricane Georges in the Dominican Republic show that between 16 per cent (of general damages) and 30 per cent (in some sectors) of damage was due to unsustainable use of land and natural resources, stemming from "deforestation, defective design and inappropriate location of infrastructure, careless water management and conservation, deterioration of catchment basins, excessive land use, and others". Although this is a preliminary and conservative estimate, the report states that it must be taken into account. The study also indicates that vulnerability caused by artificial changes to the environment accounted for some 30 per cent of the damage caused by the hurricane in Honduras' case, and a little less in other Central American countries: the general average is approximately 25 per cent.

The direct but secondary consequences stemming from vulnerability due to human intervention are catastrophic in Central America. ECLAC studies of the impact of Mitch in the region indicate that the current state of the environment in these countries and the deterioration of soil and other resources

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[30] ECLAC (1999), *Honduras: Evaluación de los daños ocasionados...*, op. cit.

are a threat to economic and political stability, perhaps more in some countries than in others, and an obstacle to comprehensive development in the region. This obstacle will be increasingly difficult to overcome unless advantage is taken of this opportunity to adopt a different approach to development.

d) Indirect impact on the environment

Since only a few weeks have passed between the hurricane and this study, the effects that damage to plants, fallen fruit in forests and loss of foliage may have had on birds and mammals is still unknown; in fact, virtually nothing is known about the food sources (seeds, fruits, etc.) of various species. This highlights the importance of conducting scientific studies, since they are of great practical value.

This study also places emphasis on including the environmental value lost in rivers, since they are highly productive ecosystems that extend throughout the country's farmlands. Other effects on important and valuable aspects of these habitats could be occurring or will occur, and should be studied. Research conducted in Guanacaste National Park has shown that the environmental services provided by protected areas to singlecrop farming are highly beneficial.

e) Short-term projection

If human activities that make use of the environment are carried out without taking into account their possible adverse consequences on natural resources, they will almost certainly affect the stability or sustainability of natural resources by making them more susceptible to alteration and destruction when the environment suffers the impact of a natural disaster. In other words, human technological activities can easily worsen the effects of natural disasters. Moreover, if human settlements are not planned, do not take into consideration land-use management, prevailing biophysical factors and the risk involved in settling in high-risk areas, vulnerability increases in direct proportion to the lack of foresight.

For example, a basin that has been placed under strain through construction, road building, extensive farming, logging in natural forests, etc. will be unable to absorb exceptional, prolonged amounts of rainfall as well as it would under conditions of controlled and planned use. Water flows will be lower than their natural minimum during the dry season and rise excessively when it rains, even when there are no extraordinary weather patterns. If the dry season lasts longer than usual, groundwater storage will be insufficient; conversely, when there are large amounts of rainfall, the water flowing through the destabilised basin will be excessive. Either situation can be disastrous.

Another example is excessive population growth, a factor that heightens the impact of any disaster when a human settlement is located in an unstable area that can be devastated by the effects of exceptional natural phenomena. Here the consequences of a natural impact are multiplied by man's alteration of environmental conditions, by the precarious living conditions of victims (such as poorly constructed housing built on slopes subject to landslides), and by causes stemming from a lack of foresight, management and social improvement.

Urban planning, land-use management, soil conservation measures, environmental restoration, structural prevention measures for roads, bridges, reservoirs and other works, and any other technical

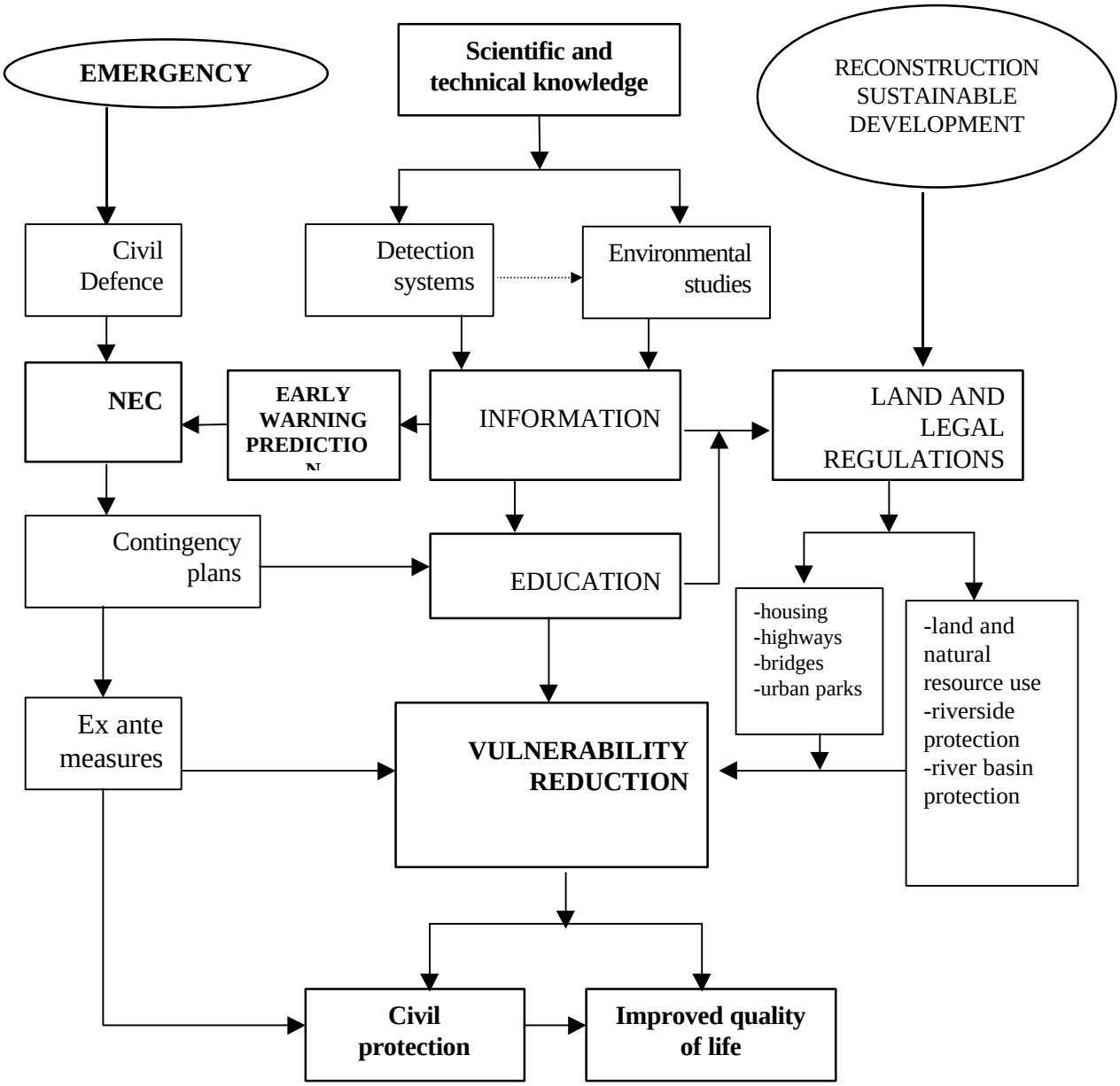
measures designed to change or improve a natural setting within a framework of sound and respectful use of the environment and the laws of nature are certain to improve the quality of life through sustainable development. However, even if all these measures are taken, they are unlikely to be fully effective unless they are carried out with the participation of communities, the fostering and participation of natural regional leaders, and democratic management by society in every sense. Participation does not merely refer to elections, but to resource management, protection of nature, land ordinance, sound use of environmental assets, and ultimately, development of the capacity of people to come to terms with the environment, and reach full environmental, social and political sustainability in order to achieve equity and an ever-improving quality of life.

These aims require scientific research, databases on natural phenomena and early-detection measures whenever possible, as well as continuous education to create awareness of environmental management in society (as shown in the middle section of Figure 5) and provide an orderly response to natural disasters, which can otherwise become catastrophic. This is the only means of establishing a juridical system to make sound use of the environment in terms of urban development, overland communications, land use and environmental protection (right section of Figure 5) to reduce vulnerability on a sustained basis. These actions are in fact long-term preventive measures and will help to streamline efforts and improve coordination during the initial stages of an emergency, particularly if the country has good warning and civil-defence mechanisms (left section of Figure 5).

Important approaches and projects are being adopted in Costa Rica to that end, as was effectively demonstrated by the CNE in the case of Mitch. A number of government and non-governmental organizations devote all or part of their efforts to this field; the country has nearly 200 organizations that focus on the environment in one way or another, and about 40 have gained wide-ranging experience on the subject. The Ministry of the Environment and Energy has developed a Protected Areas System (SINAC), which focuses on appropriate management and conservation of natural assets, and significant achievements have been made in environmental education.

Figure 5

POSITIVE LINKAGE FOR INFORMATION, REACTION AND DEVELPMENT PROCESSES TO REDUCE VULNERABILITY AND PROMOTE SUSTAINABLE DEVELOPMENT



Measures taken during the reconstruction stage following a natural disaster should be added to everyday conservation activities, so as to achieve an optimum approach to sustainable development. Government and international agencies have stated the need for a change of attitude in dealing with natural disasters, focusing on disaster prevention, reduction of vulnerability and early warning. The International Decade for Natural Disaster Reduction (thus declared for the nineties by the United Nations General Assembly) has undertaken the task of incorporating multidisciplinary approaches in order to gain further understanding of the actions needed to deal with these phenomena and reduce negative effects through prevention.

5. Summary of damage

According to the calculations contained in previous sections of this report, hurricane Mitch is estimated to have caused more than US$92 million in damages, of which US$55 million are direct and the rest indirect. The total amounts to nearly 1 per cent of estimated GDP in 1998. Partly or totally destroyed infrastructure must be repaired or rebuilt as soon as possible to prevent economic growth and social development from being hampered over the medium term. As has been stated, criteria to improve infrastructure and prevent or mitigate disasters should be included in the reconstruction.

The worst damage was to the farming sector (69 per cent of the total), followed by infrastructure (27 per cent) and the social sectors, which accounted for the rest. Damage to the environment was not taken into account. Losses in the farming sector will have a significant impact on the country's balance of trade, in that more imports will be required and exports will fall.

Infrastructure losses mainly refer to damaged roads and bridges. Although damage in the social sectors was relatively small, the unassessed effects on the living conditions of people who lost their homes, jobs, etc. should be taken into consideration, i.e., in qualitative terms the damage sustained by social sectors has a special connotation that should be taken into account on engaging in the tasks of rehabilitation and reconstruction.

Table 18 includes a column showing the estimated cost of reconstruction, which serves as an indication of the approximate amount required to improve the country's transport, health, housing and education infrastructure and that of other sectors. The appendix contains profiles of reconstruction projects and their time frame, which is important in that it is related to the country's capacity to absorb and manage resources. The imported component of reconstruction costs has also been included, to provide an estimate of the foreign currency needed to complete the reconstruction process.

Table 18

COSTA RICA: SUMMARY OF DAMAGES AND COST OF RECONSTRUCTION

(Thousands of US$)

	Total damage	Direct damage	Indirect damage	Cost of reconstruction a/
Total	**91,089.9**	**53,775.5**	**37,314.3**	**98,378.0**
Social sectors	3,569.7	2,932.4	637.3	29,754.7
Housing	2,287.5	2,267.5	20.0	20,806.7
Education	414.7	293.2	121.5	429.0
Health	867.5	371.7	495.8	8,519.0
Infrastructure	25,095.8	24,934.6	161.1	41,623.3
Communications and transport	24,122.7	24,070.6	52.0	40,190.0
Energy	43.8	43.3	0.5	43.3
Water and sanitation	929.3	820.7	108.6	1,390
Productive sectors	62,424.4	25,908.5	36,515.9	27,000.0
Agriculture and livestock	62,424.4	25,908.5	36,515.9	27,000.0
Environment	…	…	…	…

Source: Tables 5-17.

a/ Includes projects to improve infrastructure, relocation of housing, schools and health centres where applicable. Some sectors have already been rehabilitated.

III. OVERALL EFFECTS OF THE DAMAGE

1. Costa Rica's economic performance prior to the disaster

a) Economic activity in 1998

GDP grew 5.5 per cent in 1998, an increase of half a percentage point over the rate established for the year. This was due to the impetus given to economic activity on making monetary and fiscal policy more flexible. [31]

In fiscal policy, greater economic activity led to higher revenue for the central government (23.6 per cent in nominal terms and 9 per cent in real terms), stemming from higher tariff collection and from income and excise taxes. Spending increased at a slower pace than revenue, so the deficit was cut from 3.9 per cent of central-government GDP in 1997 to 2.9 per cent in 1998. The consolidated public sector deficit amounted to 3.1 per cent of GDP.

Monetary policy had the effect of expanding monetary aggregates more than had been programmed during the first three quarters (total liquid assets increased 13.3 per cent between January and September) [32] and interest rates dropped, leading to a strong upsurge in economic activity. The direct effect —hand in hand with a decrease in the reserve requirement ratio—generated increased credit in the economy, particularly credit to the private sector, which grew more than 30 per cent during the year according to Central Bank preliminary estimates. Conversely, public-sector credit only increased 4.4 per cent.

The policy of reducing interest rates within the context of the international financial crisis led to capital flight. However, the Asian crisis did not pose significant problems during the year, partly due to the small size of the financial market in Costa Rica and partly because the United States is the country's main export market.

In general, the impetus given to the economy came from increased investment (16.3 per cent) and the vitality of exports, which were higher than the previous five years (13 per cent).

The manufacturing sector grew at a rate of 7.4 per cent, which was second only to construction and certain services such as electricity and water, and transport, storage and communications. As mentioned in the section on productive sectors, the agricultural sector's growth rate was 3.2 per cent, which was lower than the GDP rate but higher than in 1997 (-0.9 per cent), one of the main reasons being the El Niño phenomenon.

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31 See ECLAC (1998), *Costa Rica: Balance...*, op. cit.

32 Ibid.

The consumer price index rose to 13.5 per cent, a slight rise over the 11.2 per cent registered in 1997, and is explained by greater demand pressures stemming from the economy's liquidity and the quickening of economic activity.

The foreign sector performed favourably. Exports grew 23.9 per cent and imports 19.4 per cent, thereby improving the trade balance as compared to 1997. The strongest single contribution to exports came from the sales of the Intel company, since the turnover in foreign-trade zones increased 80 per cent between January and September in comparison to 1997.

b) The outlook for 1999

The outlook for 1999 is positive in view of stable trends in the main economic aggregates and the economic policy adjustments carried out at the end of 1998, which will continue to boost the demand stemming from investment plans and strong exports. [33]

This outlook will depend on external and internal factors, such as delays or cancellations of investment projects due to the international financial crisis, the departure of multinational companies or corporations (Motorola and DSC Communications, for example), availability of international credit from different sources, pressures to raise interest rates —to prevent greater capital flight— or a drop in the international prices of traditional export products due to slackening international demand. All this in addition to the direct and indirect effects of Mitch, which will be felt in 1998 and 1999.

Prospects regarding the foreign sector are favourable, since the European Union raised Latin America's banana export quota from 23.4 to 25.6 per cent, and the United States lifted restrictions on exports of certain articles of clothing, which will benefit such exports in coming years.

2. General economic effects of the disaster

a) Effects on economic growth

According to Central Bank estimates, the hurricane did not affect the projected GDP growth rate for 1998 (5.5 per cent) and is not expected to constrain growth (estimated at 4.5 per cent) in 1999. Growth targets for 1999 will depend on two factors: whether the international financial crisis deepens or becomes more acute, and a US$300 million securities placement on the international market, in addition to a US$150 million loan from the IDB, which may depend on the signing of an agreement with the International Monetary Fund (IMF). According to the Finance Ministry, the US$300 million placement is scheduled for the first quarter of 1999, and the IDB funds for the first half of the year.

Table 19 shows the main economic variables for 1997, estimates for 1998, and projections for 1999 carried out by the Central Bank and the Finance Ministry.

Table 19

[33] Ibid.

COSTA RICA: ECONOMIC TRENDS 1997-1999

(Percentages)

	1997	1998 a/	1999 b/
Productive sector			
GDP growth (percentage)	3.7	5.5	4.5
Inflation (percentage)	11.2	12.6	10.0
Base interest rate	20.9	24.5 c/	…
Foreign sector			
Exports d/ (variation rate)	14.4	31.8	19.9
Imports d/ (variation rate)	17.1	26.4	19.2
Current account (percentage of GDP)	-3.5	-3.6	-3.9
Capital account (percentage of GDP)	-5.7	-2.8	-4.8
Foreign investment (millions of US$)		500.0	400.0
Change in reserves (millions of US$)	215.7	-80.0	100.0
Monetary sector			
Private sector credit (variation rate)	24.4	36.0	26.0 e/
Public sector			
Deficit (percentage of GDP)	-3.4	-3.1	-3.3
Government	-4.0	-3.0	-3.6
Rest of public sector	2.4	1.5	1.8
Central Bank	-1.8	-1.6	-1.5

Source: Central Bank and Finance Ministry.

a/ Estimate.

b/ Projection.

c/ In force at the beginning of December.

d/ Figures for 1998 and 1999 are based on a change in methodology to include the gross value of in-bond (maquila) and customs-free exports and not the value added.

e/ Between October 1998 and December 1999.

b) Effects on public finances

In 1999 the fiscal deficit is estimated at 3.3 per cent of GDP, the government deficit at 3.6 per cent, and the Central bank deficit at 1.5 per cent, with a 1.8 per cent surplus in the rest of the public sector. One of the most important issues in 1999 will be pressure on spending to finance rehabilitation and reconstruction projects stemming from Mitch, since this could raise the central-government deficit. Alternative means will also have to be found to address spending constraints derived from internal debt servicing, pension payments and outlays on tax-credit certificates, which were designed to provide incentives to non-traditional exports and will cease to be issued in 1999, but their fiscal impact will continue until 2001.

Reconstruction of the social infrastructure affected by Mitch and higher spending on internal debt-servicing payments may increase current deficit levels.

c) Effects on the balance of payments

No significant changes are expected to be made to the Central Bank's balance of payments projections for 1999 as a result of hurricane Mitch. As can be seen in Table 20 the balance is expected to positive (US100 million), as compared to the negative balance (US$80 million) in 1998. This is explained by investment variations in the private sector's financial account.

Another important variation in the balance of payments will be in the current account, which showed a rate of 24.7 per cent, rising from a US$377 million deficit in 1998 to a projected US$424 million, due to an expected increase (14 per cent) in the goods and services account deficit.

d) Effects on other variables

The effects of the hurricane are not expected to lead to significant changes in other variables; for example, as regards exchange-rate policy, the crawling peg exchange rate showed a 12 per cent devaluation in 1998, or 1.5 per cent below the inflation rate. The exchange rate was adjusted in April and May to bring it into line with inflation, but even so the real exchange rate was slightly overvalued.

e) Consequences on monetary and financial policy

In line with the Central Bank's projections, interest rates should fall in 1999, particularly the basic borrowing rate, which is used as a benchmark for investment returns. As mentioned previously, if the US$300 million bond issue is successfully placed on international markets this will ease pressure on interest rates, but they may rise if the international financial crisis worsens.

Moreover, the US$300 million bond placement and the US$150 million IDB loan will enable the Finance Ministry to sell bonds on the local market, and this will reduce pressures to raise interest rates. This will add to Central Bank restrictions on private-sector credit, which will encourage companies to seek financial leverage from foreign banks. [34]

f) Effects on inflation, wages and salaries and employment

The Central Bank estimate for inflation in 1999 is 10 per cent, down from 12.6 per cent for 1998, which will involve a moderate devaluation and lower interest rates. The effects of hurricane Mitch are not expected to lead to higher inflation.

Table 20

COSTA RICA: BALANCE OF PAYMENTS

[34] Between October and December 1998, the Central Bank set the maximum credit-growth rate for companies and individuals at 26 per cent.

(Millions of dollars)

	1997 (Preliminary)	1998 (Estimated)	1999 (Projected)
I. Current account (A+B+C+D)	**-330**	**-377**	**-424**
A. Goods	-785	-757	-863
Exports fob	4,283	5,646	6,767
Imports cif	-5,067	-6,403	-7,630
B. Services	533	578	655
Transport	134	141	150
Travel	394	429	494
Other services	5	9	11
C. Income	-192	-313	-333
Foreign public debt interests	-173	-174	-181
Other income	-19	-19	-152
II. Capital and financial accounts	**546**	**297**	**524**
A. Capital account	0	0	0
B. Financial account	546	297	524
Public sector	-63	97	100
Disbursements	353	388	534
Amortizations	-462	-279	-354
Others	46	-13	-80
Private sector	609	201	424
Direct investment	483	518	400
Others	126	-317	24
III. Balance of payments position	**216**	**-80**	**100**
Reserve assets	**-216**	**80**	**-100**
GDP (millions of US$)	9,528.9	10,443.6	10,976.4
Current account deficit/GDP a/	3.5	3.6	3.9
Trade deficit/GDP a/	8.2	7.3	7.9
Exports/GDP a/	44.9	54.1	61.7
Imports/GDP a/	53.2	61.3	69.5
Services balance/GDP a/	5.6	5.5	6.0
Travel/GDP a/	4.1	4.1	4.5
Income balance/GDP a/	-2.0	-3.0	-3.0
Public capital/GDP a/	-0.7	0.9	0.9
Private capital/GDP a/	6.4	1.9	3.9
Direct investment/GDP a/	5.1	5.0	3.6
Trade liberalisation index a/	105.9	123.5	139.8

Source: Central Bank of Costa Rica.
a/ Percentages.

In regard to wages, the two annual minimum-wage increases in 1998 meant a raise of 14.8 per cent in nominal terms and of 1 per cent in real terms. [35]

Unemployment levels fell in 1998 as the economy grew, partly due to the construction sector's hiring capacity, which expanded significantly during the year. However, the considerable losses sustained in coffee and sugar cane crops may increase unemployment levels in affected rural areas; the situation may continue until lands and crops are recovered.

[35] ECLAC (1998), *Costa Rica: Balance...*, op. cit.

IV. GUIDELINES FOR A REHABILITATION AND RECONSTRUCTION PROGRAMME

Although different emphasis is required in each country depending the type of damage and the vulnerability existing prior to the disaster, the devastating consequences of hurricane Mitch in Central America call for the adoption of new rehabilitation and reconstruction criteria to prevent the inhabitants of the region from being as exposed to damages as they were in this case.

It will be important to set priorities and consider the time frame and the necessary changes to design, construction and land use regulations in keeping with the situation in each country. In any event, reconstruction should be carried out on the basis of a significant qualitative improvement over the previous circumstances. Another fundamental factor regarding the viability of any reconstruction process is a country's internal capacity to conduct the process and programme it so that national capacity is not exceeded. Each country must decide on the time frame and priority of its actions and strike a balance between the urgent task of replacing what has been lost and its capacity to accomplish such works.

Once the emergency phase is over, rehabilitation and reconstruction programmes must be established in order to restore the facilities, assets and services damaged or destroyed by the devastating effects of the hurricane in each country. The content, priorities and scope of such programmes must necessarily be a national, sovereign decision of each country and respond as much to the magnitude of the damages as to a country's pre-existing conditions and economic and social policy criteria. Its foreign debt commitments and stabilisation policies must also be taken into account on determining the content, scope and scheduling of the programmes.

On addressing this topic, it is important to compile and analyse extensive background data so as to draw up investment and management programmes that will make optimum use of available resources while following the country's economic and social development objectives.

One factor to be borne in mind at this stage is that reconstruction cannot be carried out by a country on its own; it requires international cooperation. Each country's rehabilitation and reconstruction programme must therefore be structured in line with the international community's offers, which are due to take shape within the framework of the special Advisory Group convened by the IDB; after an initial session in December 1998, the Group will meet again to establish the bases for cooperation in reconstruction work. This section was included in this report to provide an idea of the investment projects deemed pertinent for repair and reconstruction, but are merely profiles at this stage. The list of projects neither replaces nor runs counter to the proposals submitted by national authorities to the Advisory Group. In many cases the proposals encompass more than just actions to tackle the damage caused by the hurricane, since each country's development strategy must also establish bases for sustained, less vulnerable development with growth, including components to reduce vulnerability to natural disasters and promote a more effective, competitive integration into a globalise world.

Consequently, rather than focusing on a national strategy —which, as stated above, must be devised by each country— the purpose of the following sections is to develop the guiding principles

behind the generation of projects and the basic guidelines to be followed on preparing rehabilitation and reconstruction plans and programmes. We believe this could be of assistance to national authorities on defining their strategy, which should be devised on the basis of consensus-reaching with society, particularly civil society, economic players, academic and non-governmental organisations and local authorities, among others.

1. Project generation

The main aims of the proposed projects are to attend to victims of the disaster, rebuild and improve destroyed and damaged assets, re-establish productive and export processes, and in general help to reactivate the process of economic and social development.

The initiatives presented here are a list of investment projects currently being developed as profiles to provide basic information on their aims, scope, expected results, activities and tasks to be carried out, investment to be made, expected financing, and the special characteristics of each project.

Each profile will subsequently be analysed in depth in order to draw up definitive projects and prioritise them so as to design repair and reconstruction programmes. This will make it possible firstly to improve the living conditions of disaster victims and recover the material and economic losses stemming from hurricane Mitch's devastating effects; secondly to enhance the design standards in use prior to the disaster, and thirdly to carry out works and establish mechanisms to control and mitigate the enormous damage caused by hurricanes and floods.

It should be mentioned in that regard that the main physical damage caused by the hurricane —aside from its tragic aftermath of death and suffering— was to infrastructure and agriculture and livestock production facilities. The after-effects are not limited to such losses, however, since the initial damages unleashed a multiplier effect with serious economic and social consequences; rural and semiurban population groups lost their housing, livelihoods and access to public services, and were subjected to other equally serious hardships stemming from environmental and sanitary crises, in addition to food shortages.

As a result, many victims that were already poor prior to the hurricane were left in conditions of extreme poverty. Government and international community support should therefore focus on addressing the problems described above and in preceding chapters.

To carry out the projects efficiently —once they have been definitively assessed and ranked— it will be essential to develop execution programmes so as to bring resources into line with needs. It would first be advisable to draw up a rehabilitation programme to deal with the emergency situations facing disaster victims, followed by a reconstruction programme to overcome economic and social adversities, restore and improve infrastructure and production facilities, and prevent or reduce the effects of similar events.

2. Rehabilitation stage

This initial phase will focus on normalising the living conditions of victims —while also reactivating the economy— by meeting their vital needs and delivering basic services. The victims' food, health care and employment needs must take priority, and should be met expeditiously through the following actions:

a) Provision of food.

b) Provision of potable water.

c) Medical attention to the wounded.

d) Control and thorough prevention of diseases, particularly contagious diseases.

e) Housing repair.

f) Establishment, albeit provisional, of sanitation services.

g) Generation of productive jobs.

h) Provisional repair of access roads to affected areas.

i) Supply of seeds and basic inputs to affected small and medium-scale farmers, along with financial support and soft loans.

j) Repair of different types of infrastructure.

The suggested rehabilitation programme should be implemented as swiftly as possible, partly to meet vital and basic needs that are an ethical imperative, and partly due to the need to control and check the spread of diseases and epidemics in order to prevent hardships from becoming more acute. It is important to remember that the rainy season begins in April, so the rehabilitation programme must be concluded by that time.

Timely implementation of the above actions will bring the victims' living conditions back to relative normality and help to reactivate the country's economy.

3. Reconstruction stage

This is the most crucial stage in economic and social terms, since it will lead to the full re-establishment of normal living conditions and the country's economic and social development momentum prior to hurricane Mitch.

This phase will bring about the implementation of specific projects —duly assessed, ranked, and coordinated— in line with available resources, i.e., fully programmed and provided for in the reconstruction programme, which should be worked out as soon as possible.

The main aim of the reconstruction stage and the projects thereof is to effectively overcome the direct and indirect problems stemming from the hurricane, although hurricane-prevention infrastructure and management deficiencies and flaws will also have to be addressed. For instance, the effects of the hurricane showed that a number of structures were unsafe and that other types of infrastructure, such as roads, bridges, hospitals, potable water systems, schools, etc. were inappropriately located; there is also an absence of watershed, infrastructure and environmental management schemes, and a lack of natural disaster prevention and control facilities —particularly for floods— to manage and mitigate their after-effects.

Moreover, on designing the reconstruction programme it will be important to take into account macroeconomic principles so as to prevent the undesirable consequences of overly ambitious reconstruction programmes. These include inflation, divergences in the exchange rate or in the supply and demand of certain resources such as labour and building materials, or undesired, disorderly migration.

There follows a summary of the basic considerations that should guide the process of designing the reconstruction programme.

a) Restoring lost support infrastructure

This mainly implies building the infrastructure needed to conduct economic and social activities, and includes roads and bridges, potable water and sewerage systems, power networks, and other lesser works.

It should be borne in mind that current conditions call for new approaches in designing infrastructure works. The aim is not merely to replace the facilities in existence prior to the floods, but to take advantage of the opportunity to modernise infrastructure by building it to meet current and future demand, incorporating recent technological developments, and constructing on sites that will minimise the after-effects of future disasters; the idea is to construct modern, adequate, efficient and safe structures.

For example, numerous bridges are located in places where they can be swept away by high water flows; this risk can be reduced by building them on higher ground, which in turn means rerouting roads. Similarly, many works in existence prior to the hurricane were built many years ago and were defectively laid out, whereas recent technological developments have reduced costs, thus providing the possibility of building works of much greater magnitude. Moreover, many facilities in existence prior to the hurricane already lacked the capacity to meet current demand.

It will also be important to establish alternate routes to prevent similar events from paralysing regions left inaccessible, or from leaving productive areas without access to the capital or export-shipping ports. In short, the country's highway system needs to be expanded.

b) Replacing lost social infrastructure

This guideline is similar to the one above and focuses on providing the population with basic services and facilities such as housing, hospitals and schools. As above, improving design and capacity will be an important consideration, particularly as regards hospital and school services.

Ironically, natural disasters often damage or destroy the facilities needed to deal with emergency situations, and this must be taken into account in the reconstruction programme. New hospitals should be built in safe, risk-free locations, since their services are essential in emergency situations. Schools must be made safe for the same reason, since they are often turned into shelters for disaster victims.

It is a known fact that many facilities were already overburdened prior to the hurricane, so it will be necessary to increase their capacity. Technological improvements must also be made, particularly in hospitals.

The main consideration in regard to the housing sector is to extend support to the most disadvantaged groups by securing them relocation and housing to meet their basic needs. This can be achieved through donations, material contributions, "work for food" programmes, and other such mechanisms. Less needy groups can be given support in the form of soft loans.

c) Re-establishing agricultural activities

The hurricane led to the partial or total loss of many agricultural assets; much cropland (bananas, sugar cane, palm, pineapple, grains, etc.) became unusable. Earth dikes, feeder roads and farm roads were seriously damaged by overflowing rivers, mud and debris such as large rocks, tree trunks and sand. Many rivers are full of silt, stones, trees and other material swept along by the current, and large deposits have formed where rivers meet the ocean. The living standards of farmers have also deteriorated significantly, since many lost their livelihood and housing.

Investment should therefore focus on reclaiming farmland and restoring production infrastructure —irrigation and drainage systems, fruit packaging and canning facilities, etc.— and on facilitating fruit crops.

d) Food support

One of the most severe consequences of the hurricane is that many subsistence farmers lost their crops, and their land will remain unproductive for many years. This group lost their housing, livelihood and income. Semiurban and low-income population groups are in a similar position, since they also lost their homes and jobs. It is therefore imperative to support them, especially by satisfying their basic needs.

As suggested above, "work for food" plans could be put into practice in view of funding shortages and the need for efficiency and equity. People working to improve their housing or fields could thus be given food in exchange for work performed in their own benefit.

e) Generating productive jobs

This is a very important social consideration, since one of the worst indirect consequences of the hurricane was the loss of thousands of jobs.

The main idea is to create efficient jobs in productive activities, among them the construction of support infrastructure, community facilities and housing, and agricultural jobs.

Programming of construction works and of work in general should therefore focus on making intensive use of unemployed workers, in accordance with their skills.

f) Control of epidemic risks

The aim here is to make every effort to provide medical care to infected patients and check the spread of diseases. Cases of cholera, malaria, rabies, hepatitis and classic dengue, among others, have been reported in most disaster areas, so there is risk that contagious diseases will spread.

g) Waterbasin management and environmental conservation

There are some initiatives related to this issue aiming to the rational and efficient usage of existing natural resources and to environmental management works. Thus, there is a need for improving the information network, strengthening the protected areas system, adopting proper management and sustainable development techniques on the country's waterbasins, strengthening those institutions in charge of sanitation and urban solid waste management services, controlling environmental pollution, promoting reforestation in wide areas and training public servants and farmers on reforestation methods and advantages.

h) Flood control and prevention

The countries of Central America have been suffering the consequences of natural disasters for many years. However, the frequency and intensity of such disasters have increased to an alarming degree in recent years, and the material damage and victims are higher every time.

In the past large sums were not invested in disaster prevention, partly because statistical records showed disasters to be relatively infrequent, so prevention measures were not considered a worthwhile investment.

The situation today has obviously changed, since hurricanes are more frequent (Joan, Georges, Cesar, and Mitch among them), as are forest fires, the effects of El Niño, etc. It would therefore be advisable to carry out an in-depth study of this complex subject so as to design policies to prevent natural disasters, particularly floods.

A fundamental aim would be to ensure that prevention policies contain appropriate guidelines to regulate and manage a country's natural resources.

Another would be to identify socially beneficial investment options to prevent or reduce the costly consequences of natural disasters. Studies should focus on the type, location and scale of infrastructure designed for that purpose.

In keeping with that approach, it will be important to conduct studies in the following fields: identifying which areas are prone to disasters (floods, landslides, droughts, fires and earthquakes), establishing land use management measures to prevent settlements and construction on land frequently subject to the effects of natural disasters, designing infrastructure to control the forces of nature (drainage, river dikes, dams, etc.), establishing appropriate design and layout criteria for civil works threatened by river overflows and floods (road routing, bridges, potable water and sewerage systems, public services works , etc.), restructuring and extending the highway system to provide alternative routes, etc.

It is worth noting that reservoir construction is becoming increasingly easier to justify, partly because natural disasters are occurring more frequently, and partly because reservoirs can be used for several purposes by different sectors. For example, a flood-prevention reservoir can also be used for irrigation during the dry season, and for interannual regulation of the El Niño and La Niña phenomena, among others. Moreover, since natural disasters are becoming more frequent and more intense, they are leading to ever higher losses, so one of the benefits of multipurpose infrastructure works is that they reduce building costs.

i) Strengthening national emergency or civil defence committees

In view of the recurrence of disasters and the experience gained as a result of hurricane Mitch, it will be essential to strengthen national emergency and civil defence institutions, not only by increasing their budgets but also by adapting their regulatory frameworks whenever necessary. These institutions should also establish regional links and an effective network for early warning and cooperation purposes; existing regional institutions as CEPREDENAC could extend support in this regard.

Appendix

PROJECT PROFILES FOR THE REHABILITATION AND RECONSTRUCTION STAGE

Table 1

COSTA RICA: LIST OF PROJECTS

Sector		Title of project	Investment required (millions of US$)
1. Agriculture and livestock			
	1.1	Development of agro-forestry systems in the Central Southern region	1.3
	1.2	Survey and identification of critical soil-degradation areas in Costa Rica's Pacific river basin	0.2
	1.3	Application of protected horticultural crop practices in affected areas	1.2
		Sectoral subtotal	**2.7**
2. Technical assistance			
	2.1	Design of an investment programme for natural disaster prevention	0.6
		Sectoral subtotal	**0.6**
3. Education			
	3.1	Programme to rehabilitate and rebuild educational facilities and infrastructure	0.5
		Sectoral subtotal	**0.5**
4. Emergency			
	4.1	Care of children and adolescents during the hurricane Mitch emergency	0.5
		Sectoral subtotal	**0.5**
5. Environment and natural resources			
	5.1	Strengthening of protected forestry areas to prevent and mitigate natural disasters	0.2
	5.2	Institutional strengthening for the appropriate use and management of catchment basins on the Pacific coast	20.0
	5.3	Relocation of control stations in Palo Verde and Corcovado National Parks	0.3
		Sectoral subtotal	**20.5**
6. Health			
	6.1	Support to control dengue outbreaks stemming from Mitch in the Brunca region	0.1
		Sectoral subtotal	**0.1**
7. Sanitation			
	7.1	Programme to rehabilitate and rebuild drinking water supply systems	1.3
		Sectoral subtotal	**1.3**

/Cont.

Table 1 (Cont.)

Sector	Title of project	Investment required (millions of US$)
8. Transport		
8.1	Highway and road repair/rebuilding programme	34.0
	Sectoral subtotal	**34.0**
9. Housing		
9.1	Acquisition of housing plots and basic supplies for affected families	8.4
	Sectoral subtotal	**8.4**
	TOTAL	**68.6**

Costa Rica

No. 1.1

Development of agro-forestry systems in the Central Southern region

Sector: AGRICULTURE AND LIVESTOCK | **Subsector:**

Background: Sustainable production systems covering 1,747 km^2 and a population of 197,499 are being developed with farming services agencies in Acosta, Santa Ana, Mora, Puriscal, Turrubares and La Gloria, to promote ecological stability and reduce the use of herbicides and insecticides to a minimum, recycle nutrients, and stabilize and improve soil.

Project objectives: Improve and promote agro-forestry systems as a production alternative for small and medium-scale farmers in the central southern region, by adopting environmentally friendly farming techniques.

Tentative duration: 3-5 years

Estimated starting date: May 1999

National agency in charge: Ministry of Agriculture and Livestock.

Description of activities and tasks: Traditional coffee-growing areas will be transformed into agro-forestry systems while improving existing systems by introducing improved technology to reduce the use of agrochemical products.

Expected results: Greater economic, social and ecological sustainability of ecosystems. Higher profits from combining agro-forestry crops with coffee.

Total investment required (US$):	1,286,200
• Labour	
(375 man/months)	750,200
• Domestic inputs:	396,000
• Imported inputs:	140,000
Financing (US$)	
• Local:	396,000
• Foreign:	
• Donation:	890,200
Potential financing sources	
External credit:	
Donor: International cooperation agencies.	

Special observations:

Costa Rica	**No. 1.2**

Survey and identification of critical soil-degradation areas in Costa Rica's Pacific river basin

Sector: AGRICULTURE AND LIVESTOCK | **Subsector: SOILS**

Background: The Pacific basin has been affected by cyclic weather phenomena such as excess rain, droughts, hurricanes and recently El Niño and La Niña. The country lacks studies to explain soil creep, avalanches and obstructions in river beds, which affect the region's agricultural capacity.

Project objectives: Improve national institutions' capacity to identify critical soil-degradation areas and prepare technical prevention and mitigation studies.

Tentative duration: 1 year

Estimated starting date: March 1999

National agency in charge: Ministry of Agriculture and Livestock.

Description of activities and tasks: Compile information to prepare indicators, select work methodology, identify critical areas and prepare technical recommendation studies.

Expected results: Characterization of critical areas on the basis of established indicators, inventory of critical areas, action plan to mitigate the impact of natural disasters, and strengthening and training of national institutions.

Total investment required (US$):	212,000
• Labour	
(60 man/months)	72,000
• Domestic inputs:	90,000
• Imported inputs:	50,000
Financing (US$)	
• Local:	72,000
• Foreign:	
• Donation:	140,000
Potential financing sources	
External credit:	
Donor: International agencies.	

Special observations:

Costa Rica

No. 1.3

Application of protected horticultural crop practices in affected areas

Sector: AGRICULTURE AND LIVESTOCK | **Subsector: HORTICULTURE**

Background: The horticultural areas that withstood the effects of Mitch were those physically protected by tunnels, greenhouses and plastic sheeting. The use of plastic sheeting is a practice introduced by the Ministry of Agriculture, whereas tunnels and greenhouses are built on farmers' own initiative.

Project objectives: Ensure production and prevent natural-disaster losses by protecting crops through the use of plastic sheeting, tunnels and greenhouses.

Tentative duration: 4 years

Estimated starting date: March 1999

National agency in charge: Ministry of Agriculture and Livestock.

Description of activities and tasks: Training farmers in the use of appropriate irrigation techniques (drip, microspraying and fertilized irrigation); implementation of organic production methods and production of protected seedlings.

Expected results: Protection of 150 hectares of lettuce, coriander and beet; 50 hectares of tomato and pepper and celery greenhouses, and 400 hectares of tomato and pepper under plastic sheeting. The aim is to raise productivity and reduce production costs, while also encouraging comprehensive resource management and organic agriculture.

Total investment required (US$):	1,200,000
• Labour	
(48 man/months)	100,000
• Domestic inputs:	450,000
• Imported inputs:	650,000
Financing (US$)	
• Local:	100,000
• Foreign:	
• Donation:	1,100,000
Potential financing sources	
External credit:	
Donor: International agencies.	

Special observations:

Costa Rica	**No. 2.1**

Design of an investment programme for natural disaster prevention

Sector: TECHNICAL ASSISTANCE | **Subsector:**

Background: Costa Rica and the rest of Central America are recurrently exposed to natural disasters, whose scope and impact have increased in recent years, causing loss of life and damage to production and infrastructure. This highlights the need to design and develop an investment plan to prevent and mitigate the impact of natural disasters, while also conducting formal, in-depth studies on which to base prevention policies.

Project objectives: Establish socially advantageous investment options to prevent or reduce the effects of natural disasters, while focusing analyses on identifying, locating and scaling prevention and mitigation infrastructure.

Tentative duration: 24 months

Estimated starting date: June 1999

National agency in charge: National Disaster Commission.

Description of activities and tasks: Identify critical areas (floods, landslides, droughts, fires, earthquakes), design land-planning proposals bearing in mind disaster prevention and mitigation infrastructure works, preliminary design of infrastructure such as drainage, rain protection and dams, design criteria for civil works threatened by overflows and flooding (road routes, bridges, drinking-water and sewerage systems and public-services facilities).

Expected results: Technical studies and analyses for use in designing a comprehensive investment plan for disaster prevention and mitigation infrastructure.

Total investment required (US$):	600,000
• Labour	
(man/months)	
• Domestic inputs:	600,000
• Imported inputs:	
Financing (US$)	
• Local:	
• Foreign:	
• Donation:	600,000
Potential financing sources	
External credit:	
Donor: International agencies	

Special observations:

Costa Rica	**No. 3.1**

Programme to rehabilitate and rebuild educational facilities and infrastructure

Sector: EDUCATION | **Subsector:**

Background: The hurricane affected 30 educational facilities throughout the country. The National Education Infrastructure Centre has earmarked 16 schools that require priority attention, either because they are vulnerable or deteriorated, or because they are exposed to landslides and floods. They are located in the districts of Santiago, Zapote, Tarbaca, Tirrases, Sabanillas, Desamparados, Tarcoles, Guaycara, Changuena, Filadelfia, Bebedero, Bagaces and Nacascolo.

Project objectives: Rebuild or rehabilitate 16 damaged schools using prevention and mitigation criteria to reduce their vulnerability to natural disasters. This implies improving their design, location and building materials.

Tentative duration: 2 years

Estimated starting date: March 1999

National agency in charge: CENIFE (Public Education Ministry) and National Buildings (Ministry of Public Works and Transport).

Description of activities and tasks: Design infrastructure, purchase plots, contracting or subcontracting of technical staff, construction and supervision of works, evaluation of works, and relocation of facilities if the risk of future disasters is very high.

Expected results: 16 rehabilitated or rebuilt schools with new prevention and mitigation criteria.

Total investment required (US$):	500,000
• Labour (man/months)	
• Domestic inputs:	100,000
• Imported inputs:	
Financing (US$)	
• Local:	
• Foreign:	
• Donation:	400,000
Potential financing sources	
External credit:	
Donor: International agencies.	

Special observations: The total required investment includes the value of land where applicable.

Costa Rica

No. 4.1

Care of children and adolescents during the hurricane Mitch emergency

Sector: EMERGENCY

Subsector: CHILDREN AND ADOLESCENTS

Background: Forty per cent of the approximately 16,000 persons affected by the hurricane are children belonging to more than 800 families. The most affected districts are Osa, Parrita, Coto Brus, Pérez Zeledón, Aguirre, Nandayure, Santa Cruz, Carrillo, Nicoya, Acosta, Turrubares, Puriscal and Puntarenas.

Project objectives: Support the Costa Rican Government in attending to migrant Nicaraguan and Honduran children and adolescents affected by the hurricane in districts on the northern border with Nicaragua and in Pérez Zeledón and Puriscal.

Tentative duration: 24 months

Estimated starting date: April 1999

National agency in charge: Government, municipalities and universities in affected districts

Description of activities and tasks: i) Strengthen follow up, evaluation and management of humanitarian assistance (situation analysis, migration map, assistance needs); ii) support the immediate provision of health and education services and food for children; iii) communication and advocacy campaign to promote solidarity, non-discrimination and acknowledgement of children's priority status; promote the economic incorporation of migrant victims, iv) design and implement care and material protection models for orphaned and abandoned children and adolescents; v) establish horizontal cooperation for early warning and disaster prevention and mitigation systems with Honduras and Nicaragua .

Expected results: Situation analysis and migrant map, support for local and national health systems, local communication and advocacy campaigns, horizontal cooperation in early warning and prevention and mitigation mechanisms.

Total investment required (US$):	550,000
• Labour	
(48 man/months)	120,000
• Domestic inputs:	430,000
• Imported inputs:	
Financing (US$)	
• Local:	
• Foreign:	
• Donation:	550,000
Potential financing sources	
External credit:	
Donor: International agencies.	

Special observations:

Costa Rica

No. 5.1

Strengthening of protected forestry areas to prevent and mitigate natural disasters

Sector: ENVIRONMENT AND NATURAL RESOURCES

Subsector:

Background: Natural disasters, particularly hurricanes, have become recurrent in Central America, and Costa Rica is no exception; it has been affected by hurricane Cesar, the El Niño phenomenon, and hurricane Mitch, with negative effects on agriculture, losses due to floods, reduced productivity and soil deterioration. It is therefore necessary to assess and quantify the benefits of protected areas in preventing natural disasters; such areas cover approximately 25 per cent of the country.

Project objectives: Strengthen national institutions in identifying environmental services that help to protect basins and hillsides and therefore to prevent and mitigate natural disasters, while highlighting the benefits of the environmental services provided by protected areas.

Tentative duration: 18 months

Estimated starting date: February 1999

National agency in charge: Ministry of the Environment and Energy.

Description of activities and tasks: Characterize and pinpoint risk-prone areas, while identifying environmental services of use in preventing natural disasters and assessing the current and future economic potential of each risk area, simulating scenarios for different protection situations.

Expected results: i) Conduct four workshops with institutions that deal with natural disasters; ii) prepare two analysis documents containing economic policy guidelines for natural disaster prevention; iii) draw up a case study with the support of geographical information systems; iv) submit policy recommendations to the National Emergency Commission, SINAC and municipalities.

Total investment required (US$):	200,000
• Labour (65 man/months)	130,000
• Domestic inputs:	55,000
• Imported inputs:	15,000
Financing (US$)	
• Local:	50,000
• Foreign:	
• Donation:	150,000
Potential financing sources	
External credit:	
Donor: International agencies and cooperating countries.	

Special observations:

Costa Rica	**No. 5.2**

Institutional strengthening for the appropriate use and management of catchment basins on the Pacific coast

Sector: ENVIRONMENT AND NATURAL RESORUCES

Subsector:

Background: The impact of natural disasters on a country's productive infrastructure increases when soil use and management in main basins is inappropriate. The hurricane affected 110 basins on the Pacific coast, particularly the Central Pacific, Chorotega, Central Western, Central Southern and Brunca basins.

Project objectives: Support national efforts to reduce the adverse effects of natural disasters through proper soil use and management in the main basins on the Pacific coast, while also promoting the sale of environmental services, developing the commercial and conservation aspects of the forestry sector, and promoting the use of agricultural, forestry and grazing conservation techniques to ensure the sustainability of production systems in selected basins.

Tentative duration: 24 months

Estimated starting date: June 1999

National agency in charge: Ministry of Agriculture and Livestock.

Description of activities and tasks: i) Draw up and use and management plan for main basins; ii) Identify priority basins; iii) identify critical areas in such basins; iv) Conduct a study of current and potential uses; v) make use of agricultural, forestry and grazing conservation techniques in basin management, and vi) establish farm-management plans that include forestry production and conservation through carbon fixing and oxygen liberation.

Expected results: Basin management plan in effect; training plan designed and implemented; strengthened farms able to sell environmental services.

Total investment required (US$):	20,000,000
• Labour (83 man/months)	250,000
• Domestic inputs:	10,750,000
• Imported inputs:	9,000,000
Financing (US$)	
• Local:	6,000,000
• Foreign:	14,000,000
• Donation:	
Potential financing sources	
External credit: IDB.	
Donor:	

Special observations:

Costa Rica	**No. 5.3**

Relocation of control stations in Palo Verde and Corcovado National Parks

Sector: ENVIRONMENT AND NATURAL RESOURCES

Subsector:

Background: Hurricane Mitch damaged some infrastructure and equipment in national parks, among them Corcovado, Palo Verde, Carara, Tortuguero and the Diriá Forest Wild Fauna Refuge. This makes it necessary to relocate park infrastructure and acquire new equipment.

Project objectives: Relocate control stations in Corcovado, Palo Verde and Diriá Forest Wild Fauna Refuge.

Tentative duration: 8 months

Estimated starting date: April 1999

National agency in charge: Ministry of the Environment and Energy.

Description of activities and tasks: Design of civil works; construction of El Tigre and Los Patos control stations in Corcovado, the control station in Palo Verde and administrative offices for the Bajo Carara, Tortuguero, Diriá Forest Wild Fauna Refuge control stations, along with other infrastructure.

Expected results: Three control stations relocated and rebuilt, two administrative offices rebuilt and in operation, and various infrastructure works.

Total investment required (US$):	347,910
• Labour	
(man/months)	
• Domestic inputs:	347,910
• Imported inputs:	
Financing (US$)	
• Local:	
• Foreign:	
• Donation:	347,910
Potential financing sources	
External credit:	
Donor: International agencies, cooperating countries.	

Special observations:

Costa Rica	**No. 6.1**

Support to control dengue outbreaks stemming from Mitch in the Brunca region

Sector: HEALTH | **Subsector:**

Background: The Golfito zone was flooded by the hurricane, raising the region's exposure to dengue; an outbreak of classic and haemorrhagic (type 3) dengue had already taken place in 1998, although no deaths were reported.

Project objectives: Support the Health Ministry's actions to reduce cases of dengue and prevent mortality form haemorrhagic dengue.

Tentative duration: 24 months

Estimated starting date: March 1999

National agency in charge: Ministry of Health .

Description of activities and tasks: i) Follow up on the inter-institutional, inter-sectoral system at the local and regional levels; ii) review, adapt and integrate the epidemiological, serological and entomological health monitoring system; iii) human resource training; iv) review and adjustment of health prevention programmes, and v) follow up on cases.

Expected results: Reduction of dengue cases, prevention of death from haemorrhagic dengue.

Total investment required (US$):	100,000
• Labour	
(man/months)	80,000
• Domestic inputs:	10,000
• Imported inputs:	10,000
Financing (US$)	
• Local:	
• Foreign:	
• Donation:	100,000
Potential financing sources	
External credit:	
Donor: PAHO/WHO, UNICEF, UNDP.	

Special observations:

Costa Rica

No. 7.1

Programme to rehabilitate and rebuild drinking water supply systems

Sector: SANITATION | **Subsector: DRINKING WATER**

Background: The Costa Rican Water Mains and Sewerage Services Institute's drinking water supply systems were damaged by the hurricane, which implies relocating sections, building retaining walls, replacing tubing and building other infrastructure works in the Central Pacific, Central, Chorotega and Metropolitan regions.

Project objectives: Support national efforts to rehabilitate or rebuild damaged infrastructure.

Tentative duration: 36 months

Estimated starting date: June 1999

National agency in charge: Costa Rican Water Mains and Sewerage Services Institute.

Description of activities and tasks: Design, purchase of land, bids to contract construction work.

Expected results: Rehabilitation-rebuilding of 54 infrastructure works. Each will be a project forming part of a single programme. The most important projects are the construction of the Chontales intake (US$500,000) and improvements to the San Ramón-Palmares conveyance pipe (US$75,000).

Total investment required (US$):	1,268,365
• Labour	
(man/months)	
• Domestic inputs:	1,268,365
• Imported inputs:	
Financing (US$)	
• Local:	268,365
• Foreign:	1,000,000
• Donation:	
Potential financing sources	
External credit: IDB, CABEI.	
Donor:	

Special observations:

Costa Rica

No. 8.1

Highway and road repair/rebuilding programme

Sector: TRANSPORT | **Subsector: HIGHWAYS AND ROADS**

Background: The hurricane highlighted the high risk and vulnerability of several sections of highways, roads and bridges, so works will have to be undertaken to mitigate the impact of future disasters and prevent substantial losses in high traffic areas.

Project objectives: Mitigate the vulnerability and reduce the risks of landslides and other effects of natural disasters on various sections of highways, roads and bridges.

Tentative duration: 48 months

Estimated starting date: June 1999

National agency in charge: Ministry of Public Works and Transport.

Description of activities and tasks: Design, purchase of land, and bids to contract construction work.

Expected results: Rebuilding of 155 drains and bridges, rehabilitation of 740 km of asphalt road surfacing, and of 1,200 km of metalled surfacing.

Total investment required (US$):	34,000,000
• Labour (48 man/months)	
• Domestic inputs:	34,000,000
• Imported inputs:	
Financing (US$)	
• Local:	
• Foreign:	34,000,000
• Donation:	
Potential financing sources	
External credit: IDB, CABEI, World Bank.	
Donor:	

Special observations:

Costa Rica

No. 9.1

Acquisition of housing plots and basic supplies for affected families

Sector: HOUSING

Subsector:

Background: The hurricane affected housing in marginalized areas and river banks, and also flooded some dwellings. The Joint Social Assistance Institute (IMAS) has implemented emergency programmes in the past, especially an emergency programme for hurricane Joan in 1996, designed to provide assistance in relocating families at risk.

Project objectives: Cooperate with government and IMAS efforts to purchase plots for 1,667 families directly affected by hurricane Mitch and provide housing solutions.

Tentative duration: 36 months

Estimated starting date: June 1999

National agency in charge: IMAS

Description of activities and tasks: Help families to replace lost basic household fittings and furnishings, purchase plots and extend assistance in reincorporating them into productive activities and building their homes.

Expected results: Purchase of lots for 1,667 families through government financing plans for housing either negotiated or facilitated by IMAS.

Total investment required (US$):	8,426,200
• Labour	
(man/months)	
• Domestic inputs:	8,426,200
• Imported inputs:	
Financing (US$)	
• Local:	
• Foreign:	
• Donation:	8,426,200
Potential financing sources	
External credit: IDB, CABEI, World Bank.	
Donor:	

Special observations: