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SUMMARY

From 9 to 13 April 1992 the Cerro Negro volcano in north-western Nicaragua erupted, causing damage to León (the country's second largest city), to other neighbouring urban zones and to an extensive area of farmland and forests.

The eruption blanketed the zone with a layer of sand and ash of varying thicknesses which has damaged the area's social and economic infrastructure and the land itself in the vicinity of the volcano, as well as occasioning production losses in the agricultural, commercial and industrial sectors. It has also revealed the great vulnerability of the area —and of Nicaraguan territory in general— to natural disasters.

The eruption affected a total area of 240 square kilometres and had a direct or indirect impact on about 150,000 people, 12,000 of whom had to be temporarily evacuated. The evacuees lived on the volcano's slopes and in the surrounding area and had been engaged in a very low-yield form of agriculture which did not even produce enough to cover their most basic needs. Moreover, as a result of the sharp decline in cotton production in Nicaragua, this population group has been unable to find paid employment and has therefore begun to engage in environmentally harmful wood-cutting activities in the vicinity of the volcano in an effort to earn at least some income (even so, this income has not been enough to lift them out of their extreme poverty).

Although the physical damage caused by the eruption is not that great (an estimated US$19 million), the disaster's indirect effects are significant. Firstly, large tracts of the zone's flatlands will have to be rehabilitated by means of deep-level plowing before they can be farmed again, while the uplands will now be suitable only for forestry rather than food production. Secondly, the area's natural drainage channels have been clogged with volcanic material, and this may lead to another disaster when the rainy season begins. Finally, agricultural, commercial and industrial output will be lower this year.

The upland population's very survival is threatened owing both to the possibility of further eruptions in the future and to the fact that it is now impossible for these people to generate income or produce food on their land. It is therefore necessary to provide them with emergency aid (food, drinking water, building materials, health care and other basic elements) to keep them going until October, when they can harvest their first crops, as well as to provide a definitive solution for the problems facing around 640 of these families by settling them on safe, suitable land and furnishing them with the social infrastructure, agricultural inputs and appropriate financing they need to overcome their present situation.

In order to deal with all these problems, the Government should adopt a comprehensive action-oriented strategy for shifting the zone over to different types of production activities, increasing its inhabitants' incomes and levels of social equity, and ensuring an environmentally sustainable form of development. Under the umbrella provided by such a strategy, specific rehabilitation and reconstruction programmes and projects should then be designed to complement the emergency measures taken.

The cooperation of the international community will be essential in order to implement the above-mentioned strategy, programmes and projects. Even though the impact of the eruption on the country's macroeconomic performance will be minor —in terms of decreased output and the effect on the balance of payments— the Government does not have the capacity to meet the combined financial demands posed by the emergency and by the rehabilitation and reconstruction work entirely on its own. In other words, unless external assistance is forthcoming, there is a danger that the problems facing the affected population may take longer to solve or may not be solved at all, or that the initial success of the economic adjustment programme being carried out by the Government could be undone.

This study, which has been prepared at the request of the Nicaraguan Government, sets forth an independent, objective baseline assessment of the situation created by the natural disaster along with its repercussions on the affected population and on the country's economic performance. It also presents a number of guidelines for the comprehensive strategy that will need to be adopted in order to carry out the rehabilitation and reconstruction work and identifies —on a preliminary basis— a series of programmes and projects whose implementation will require the technical and financial support of the international community.

I. INTRODUCTION

1. Background

a) General considerations

Very frequently natural disasters adversely affect the Latin American and Caribbean countries and cause major setbacks in their economic and social development. Specifically, it has been found that in an average year natural disasters are the cause of property damage and production losses amounting to US$1.5 billion as well as over 6,000 deaths.[1]

Nicaragua has been hit by a large and varied array of natural disasters in its recent history whose after-effects have not yet been entirely overcome. Examples include the earthquake that leveled much of the city of Managua in late 1972, the various floods and droughts that have affected the country during the succeeding 20 years, and Hurricane Joan, which left a path of destruction in its wake when it traversed the country in 1988.[2]

From 9 to 13 April 1992, an eruption of the Cerro Negro volcano, located in the north-western part of the country, blanketed an extensive area with volcanic ash and sand, thereby adversely affecting the living conditions of an important sector of the population in terms of housing and income, means of production, roads and other components of the zone's economic and social infrastructure.

Although the geographic scope of the phenomenon is fairly limited, its impact on the most directly affected sector of the population has been quite serious. Moreover, this disaster hit the country at a time when it is still in the grips of a severe, almost decade-long economic recession as well as a time when

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[1] See ECLAC, "Natural disasters and their economic and social impact", CEPAL Review, No. 38 (LC/G.1570-P), Santiago, Chile, August 1989.

[2] See, for example, ECLAC, "Informe sobre los daños y repercusiones del terremoto de la ciudad de Managua en la economía nicaraguense" (CEPAL/MEX/73/NIC.1), Mexico City, ECLAC subregional headquarters in Mexico, 1973; "Nicaragua: The May 1982 floods and their repercussions on the economic and social development of the country" (E/CEPAL/G.1206; E/CEPAL/MEX/1982/R.2/Rev.1), Mexico City, ECLAC subregional headquarters in Mexico, 1982; and "Damage caused by Hurricane Joan in Nicaragua. Its effects on economic development and living conditions, and requirements for rehabilitation and reconstruction. Note by the secretariat" (LC/G.1544), Santiago, Chile, 1988.

the Government of Nicaragua is in the midst of a major economic stabilization and adjustment effort which was beginning to produce promising and significant results in 1991.[3]

The disaster caused by the eruption of the Cerro Negro volcano has created new needs which can almost certainly not be met in their entirety by the government alone. The support of the international community will therefore be essential in ensuring that these new and unforeseen rehabilitation and development needs are fulfilled.

b) Purpose of the report

This report has been prepared at the request of the Government of Nicaragua and of the Latin American and Caribbean community.

Immediately following the eruption, the Nicaraguan Government asked for international assistance to cope with the emergency and to assess its medium- and long-term impacts. Furthermore, during the twenty-fourth regular session of the Economic Commission for Latin America and the Caribbean, which was held in Santiago, Chile, at exactly the same time that the eruption was occurring, the member States of the Commission adopted a resolution in which they requested, inter alia, that the countries of the region contribute to the effort to assist Nicaragua and that the ECLAC secretariat take steps to aid the Government of Nicaragua in the tasks of rehabilitation and reconstruction arising out of the emergency.[4]

The report's aim —now that the work required to deal with the emergency phase has virtually been completed (with the exception of a few areas which are identified in the final chapter)— is to help orient the rehabilitation and reconstruction efforts of the Government of Nicaragua and the international community.

The social and economic sectors which were most severely affected by the disaster and which will require priority attention in order to overcome the post-emergency phase will be discussed in the last chapter of this report as well.

The identification of these sectors and areas has been based on a systematic and comprehensive evaluation of the damage caused by the disaster as well as of its impact on macroeconomic variables in the country at the present time. This evaluation has been conducted using a special methodology developed by ECLAC precisely for this type of task.[5]

The closing section of the report includes guidelines for a short- and long-term rehabilitation strategy along with a list of possible rehabilitation and reconstruction programmes and projects which, once they have been formulated in sufficient detail, could be presented to the international community to request its support.

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[3] See ECLAC, "Notas para el estudio económico de América Latina y el Caribe, 1991; Nicaragua", Mexico City, ECLAC subregional headquarters in Mexico, April 1992.

[4] See ECLAC resolution 531(XXIV), "Damage caused by the eruption of the Cerro Negro volcano in Nicaragua" of 15 April 1992.

[5] See ECLAC, Manual para la estimación de los efectos socioeconómicos de los desastres naturales, Santiago, Chile, January 1991.

c) The mission

In response to the above-mentioned requests, the United Nations system swiftly organized an inter-agency mission composed of staff members, experts and consultants specializing in a number of different subject areas.

The mission was coordinated by the Resident Representative of the United Nations Development Programme (UNDP), acting as the United Nations system Resident Coordinator. The UNDP office provided the mission with all the information and logistical support it required to perform its assignment.

The mission team included personnel from ECLAC, the Office of the United Nations High Commissioner for Refugees (UNHCR), the United Nations Centre for Human Settlements (UNCHS), the United Nations Children's Fund (UNICEF), the Pan American Health Organization (PAHO), the Food and Agriculture Organization of the United Nations (FAO) and the Office of the United Nations Disaster Relief Coordinator (UNDRO). Valuable inputs were also provided by representatives of the World Food Programme (WFP), by experts working on UNDP-funded national technical cooperation projects and by other sources of multilateral and bilateral cooperation.

The mission worked in close collaboration with Nicaraguan officials of central- and local-government agencies in the affected region, and numerous working meetings and field trips were conducted in order to refine the existing supply of information or to compile independent data concerning the disaster on a firsthand basis.

This report contains information on those components of the mission's cooperative effort which were assigned to ECLAC.[6] It is the outcome of an independent and, in so far as possible, objective evaluation of the impacts of this disaster.

2. Description of the event and its overall effects

The Cerro Negro volcano is located 20 kilometres north-east of León, the country's second-largest city (see map 1). It is a very young volcano in geologic terms, since it was formed towards the end of the last century, and has erupted fairly frequently —most recently in 1968 and 1971.

With no prior warning, at 11:45 p.m. on 9 April 1992 a violent eruption occurred which spewed volcanic ash and sand into the air for an unbroken period of approximately 65 hours. Then, on 13 April a second, less violent eruption occurred which lasted about seven hours.

The force of the eruption caused the volcanic cloud to rise to an altitude of over 8,000 metres, whereupon it was dispersed by the prevailing winds, which carried the material in a westerly direction. The acidic ash fell over an estimated surface area of some 240 square kilometres (see map 2, based on information supplied by the Nicaraguan Institute of Territorial Studies (INETER)).

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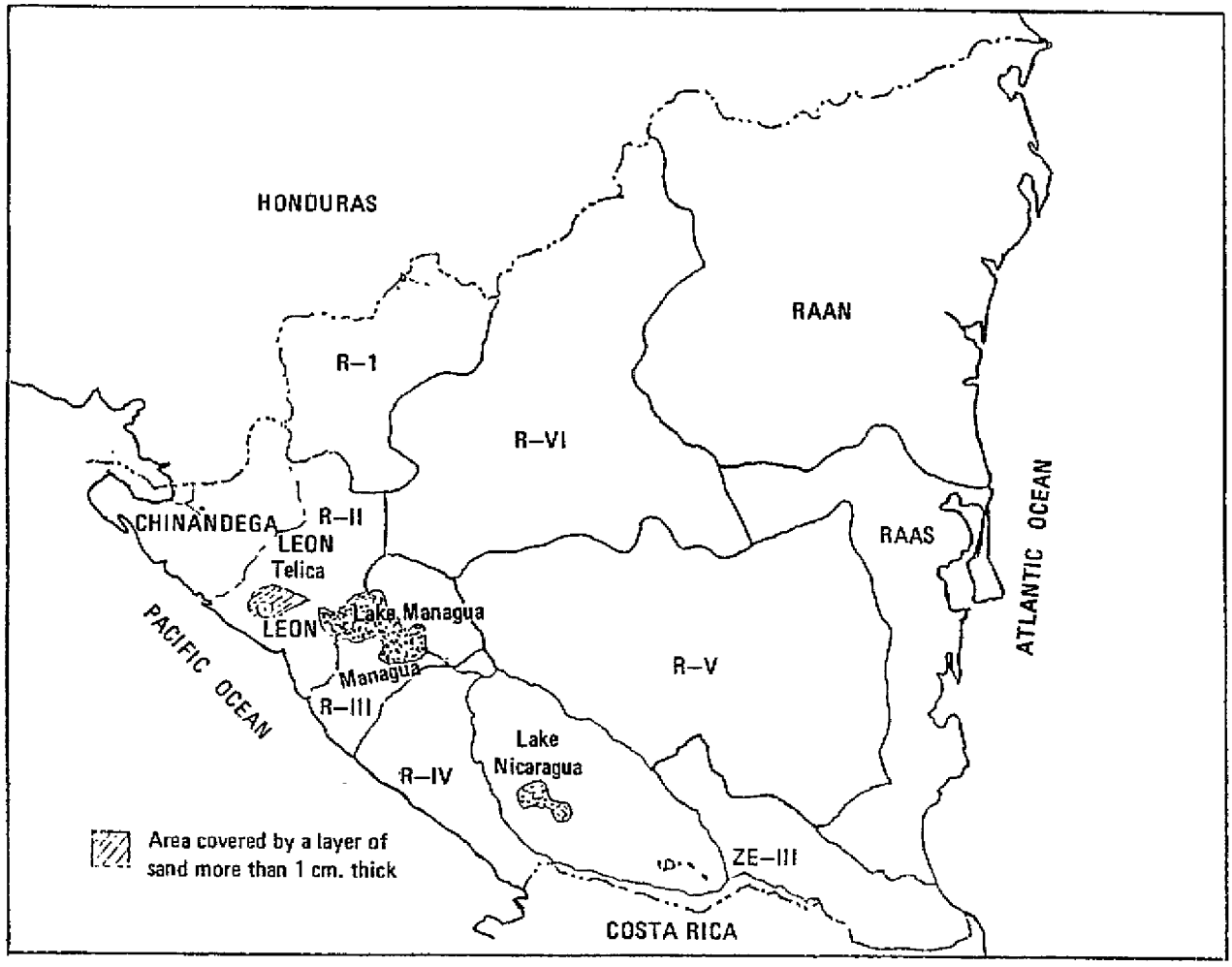
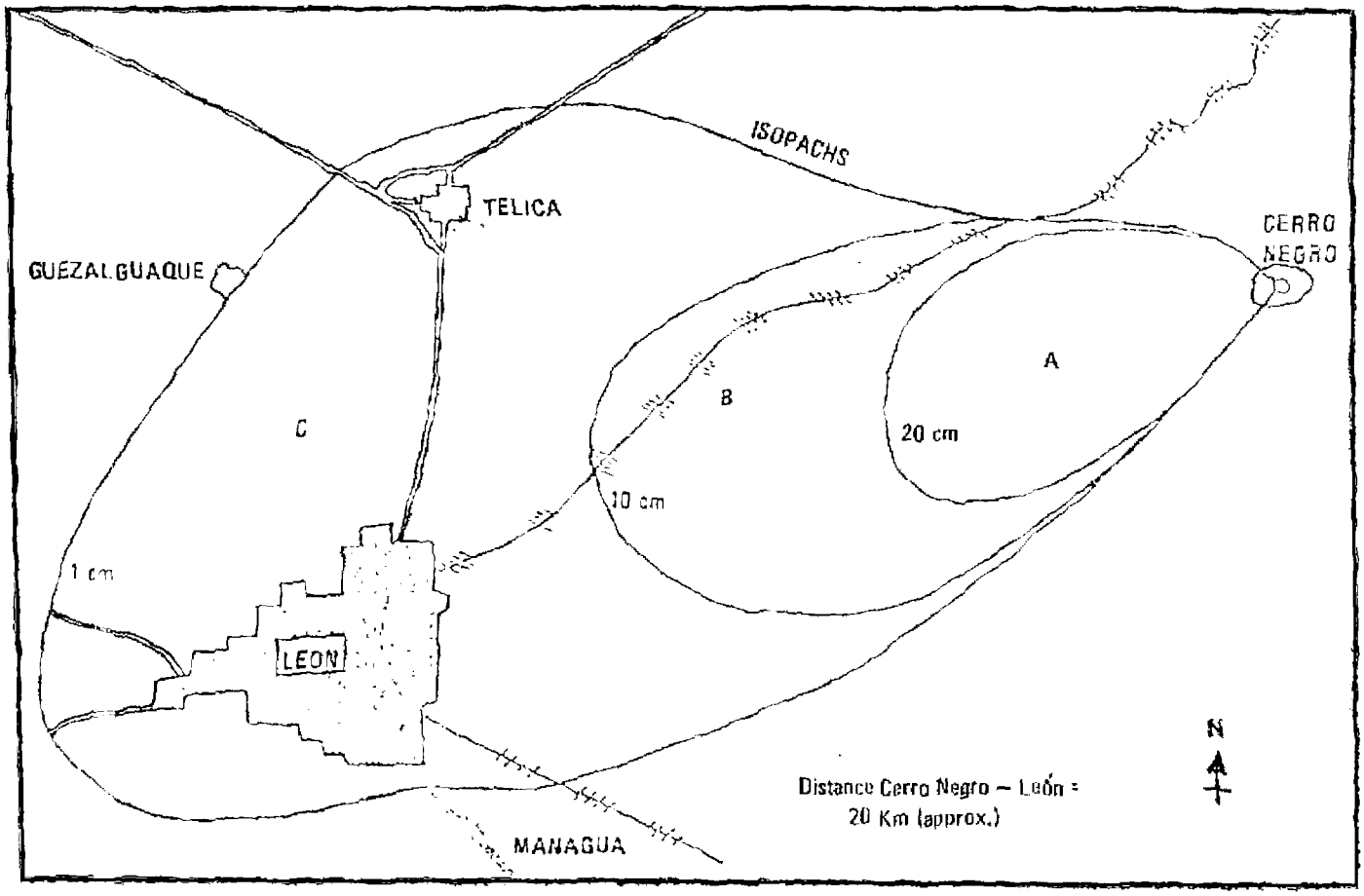
[6] A separate report is to be presented on the tasks assigned to the UNDRO mission. It is anticipated that the two reports will be included in a consolidated document issued by the United Nations system.



NICARAGUA: LOCATION OF AREA AFFECTED BY THE CERRO NEGRO VOLCANIC ERUPTION

Maps not to scale	Map No. 1

Note: The boundaries shown on this map do not imply official endorsement or acceptance by the United Nations.



	>Isopach 20	Isopachs 20-10	Isopachs 10-1	Total
Area (Km-2)	31	45	162	238
Population	618	3 960	142 448	147 026
Dwellings	103	660	23 741	24 504

NICARAGUA:
POPULATION AFFECTED BY THE CERRO NEGRO VOLCANIC ERUPTION: APRIL 1992

Map No. 2

Note: The boundaries shown on this map do not imply official endorsement or acceptance by the United Nations.

Gravitational forces caused the larger particles of sand and ash to be deposited in the vicinity of the volcano's crater, while the finer particles fell to earth in more distant locations. The thickness of this blanket of volcanic dust and ash ranged from over one metre in the areas closest to the volcano to less than five centimetres in the vicinity of the city of León, as is indicated in map 2, which shows lines of equal depth of the volcanic material deposits.[7]

In the uplands within the zone —which are inhabited exclusively by very low-income groups who are no doubt living in extreme poverty— the volcanic material was still hot when it fell to the ground, where it defoliated all or a large part of the area's forests and permanent plantations (eucalyptus and other fuelwood trees as well as fruit trees). Seasonal crops grown for on-farm consumption were not affected, however, since almost all such crops had been harvested prior to the eruption. The layer of volcanic ash and sand of varying depths also covered the area's limited (in terms of both their size and quality) pasture lands in the uplands. The existence of this pasture had enabled the inhabitants to maintain small herds of livestock which were used solely for domestic purposes and transportation; the eruption made it necessary to evacuate these animals, which suffered considerable weight loss as a result. In a large part of the zone, the layer of volcanic ash is so thick that it will be impossible to continue producing some of the zone's traditional farm goods.

The ash also built up on the roofs of the highland inhabitants' none-too-sturdy dwellings. In some cases the weight of this layer of ash caused these ramshackle structures to collapse, damaging many of the household goods and furniture within.[8] Many of the open wells which supplied water to the inhabitants of this zone could not be covered in time and were consequently filled with a large volume of sand and ash which will prevent their use until such time as the considerable task of cleaning them out can be accomplished. Consequently, the inhabitants' water supply is inadequate at the present time.

In the lower-lying areas of the affected zone, which are used by higher-income farmers for the intensive cultivation of staple grains, bananas, cotton, sugar cane and sesame, the volcanic material fell on bare soil, since the great majority of these crops had already been harvested, and only certain crops, including sugar cane and bananas, sustained direct damage. Furthermore, the layer of volcanic matter in this area is so much thinner than in the uplands so that, by using deep-level plowing to mix the ash into these very fertile soils, planting can proceed without incident in the immediate future.

In the urban zones of León and Telica the roofs of some dwellings and agroindustrial structures collapsed under the weight of the ash, and a large-scale clean-up programme has had to be undertaken in order to clear the roofs and city streets of ash and sand. This situation has interfered with the economic activities of the inhabitants of those urban centres.

The deposit of volcanic material has also impinged on passenger and cargo transport throughout the affected zone. Layers of varying thicknesses cover dozens of miles of many roadways. In the uplands it is proving very difficult to transport passengers and cargo by animal-drawn carts (especially since

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[7] This blanket of ash was deposited on top of other pre-existing layers left by earlier eruptions of the same volcano (which, over time, were becoming thinner as they were eroded by rainfall).

[8] Some of the inhabitants who remembered what had happened during earlier eruptions chose to remove their houses' roofing in order to prevent their collapse. In these cases, however, the ash damaged the interiors of the dwellings and what few household goods these people had.

livestock have been seriously weakened by the lack of food and the shock of the eruption itself) or even by four-wheel drive vehicles.

Natural and artificial drainage channels —including some culverts— are completely or partially blocked by volcanic material.

The onset of the next rainy season in May is expected to aggravate the above-mentioned transportation and drainage problems since it will not have been possible to clear the volcanic ash and sand from the drainage systems and roads by that time, and the resulting mudflows could well damage bridges and culverts both in the affected zone and in other areas further to the west.

On the bright side, studies conducted by a number of renowned volcanologists (some of whom took part in the mission) indicate that no other major eruption of this volcano is likely to occur in the immediate future. This means that there will probably be enough time to seek out a suitable, definitive solution for the problems affecting the inhabitants who have been the hardest hit by this most recent eruption.

3. Measures taken to deal with the emergency

Since no early warning system was in place, effective measures to aid the population in the affected zone were taken only after the volcano had initiated its eruption.

On the very night of 9 April the country's civil defense mechanisms were activated in order to help the most seriously threatened population groups to leave the area which was within range of the eruption and the "precipitation" of volcanic ash and dust. From the very outset, some of these people made use of their links with social organizations (e.g., membership in an association of agricultural or forestry producers) to evacuate the most vulnerable members of their families to safer areas.

The Civil Defense swiftly set up a number of refugee camps in nine nearby localities (León, Malpaisillo, La Paz Centro, Telica, Quezalguaque, Posoltega, Izapa, Nagarote, Chichigalpa) in which as many as 12,000 people took shelter at a given time. Refugees arriving at these camps were provided with temporary housing, food, and preventive and curative medical care, as well as shelter and feed for any livestock they had managed to bring with them.

In the days that followed, a food-for-work programme was organized which made it possible to begin the necessary clean-up work in affected urban centres, especially the city of León. Approximately two weeks after the eruption, the inhabitants of those areas which had suffered no more than moderate damage were helped to return to their homes and were provided with a one-week food supply.

At the same time, relatively long-range (from two to six months) food programmes were initiated in cooperation with the World Food Programme in order to enable the less severely affected inhabitants to repair their homes and resume their production activities. In addition, programmes are being set up to assist the zone's inhabitants to rebuild their homes and replace their most essential household goods; health and sanitation drives are also being undertaken in order to forestall outbreaks of disease or epidemics. For those inhabitants with very low incomes whose property is located in the hardest-hit areas and can therefore not be relied upon to provide even a subsistence-level livelihood (since the land is covered with volcanic dust and ash), studies have been initiated in order to analyse various alternative

sites to which these people could be relocated; meanwhile, until a decision is taken in this regard, these individuals will remain in the refugee camps.

Although the actions taken to meet the principal needs arising out of the emergency phase have been effective, there are some needs which still have to be met before the areas affected by this disaster can return to normal.