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AND RECOVERY**

Louise K. Comfort
Graduate School of Public and
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Louise K. Comfort

**Graduate School of Public and International Affairs
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August 7, 1991

**Prepared for submission to the National Research Council, National
Academy of Sciences, Washington, DC for the Reconnaissance Report
on the March 5, 1987 Ecuadorian Earthquakes.**

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ORGANIZATIONAL INTERACTION IN RESPONSE AND RECOVERY

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INTRODUCTION

This chapter will examine the organizational interaction that occurred in the response and recovery phases of the Ecuadorian earthquake disaster of March 5, 1987. The organizational interaction is particularly interesting in this event, given the multiple geographic locations of damage from the disaster, the multiple jurisdictional levels involved in disaster response and recovery activities and the multiple perspectives required for timely and appropriate disaster assistance to the affected populations. Further, the complexity of organizational requirements in some aspects of the disaster operations process increased cumulatively over time, as problems not resolved early in the response phase generated more serious secondary and tertiary effects in the recovery and reconstruction phase.

An organizational perspective offers both value and limitations in a reconnaissance study of disaster operations. Its principal value lies in the presentation of an overview of the disaster operations process, identifying both macro and micro level processes in response and recovery. This perspective enables practicing managers and researchers to map the actions that were taken in response to an actual disaster and to examine strengths and weaknesses in these organizational systems in order to improve the design and implementation of future disaster response and recovery programs. The limitations are that organizational interaction in disaster is inherently complex, and this chapter is based upon data that, for reasons of time and resources, may be incomplete.

This chapter presents an initial profile of human systems in action that illustrates the essential integration of administrative jurisdictions, organizational forms, and scientific disciplines in

response and recovery operations in disaster. Researchers from other disciplines may find the organizational perspective useful in assessing how information from their respective disciplines affects and extends the capacity of a community to respond to disaster.

This report serves four objectives:

- 1) to provide a succinct, descriptive account of the major types of organizations involved in disaster response and recovery activities by geographic location, jurisdictional level, type of authority or funding source and decision perspective
- 2) to present a brief profile of the major organizational networks that evolved into a broadly defined disaster management system in response to the multiple needs generated by the disaster, indicating the problem focus of the respective networks and the kinds of information needed to support timely, appropriate action
- 3) to identify areas of strong performance and areas in need of further development in the set of organizational networks that formed the disaster response and recovery system in operation following the March 5, 1987 earthquakes, and
- 4) to offer recommendations for further research to improve interorganizational coordination and capacity for action in disaster management systems

The Ecuadorian earthquakes of March 5, 1987 produced an unusual set of events that, cumulatively, resulted in a major disaster for the nation.¹ This disaster is an important case for study because it illustrates the interaction between the physical environment, social organizations, economic costs and human experience. The ensuing set of complex interactions reveals both the opportunities and costs in the development of an integrated disaster management system, as well as the cumulative effects of problems generated by the disaster across disciplinary fields of expertise and jurisdictional levels.

ASSUMPTIONS

Since disaster operations are very complex, it is necessary to limit this study to aspects that are central to the task of

organizing action for disaster response and recovery. This inquiry focuses particularly on the content and exchange of information in facilitating or inhibiting organizational interaction. It is based on a set of assumptions regarding the role of organizations in disaster response and recovery activities, and it is useful to make these assumptions explicit. Briefly, these assumptions are:

1. Disasters are complex events, generating multiple physical, technical, social, economic, and psychological needs for the affected populations
2. Organizations constitute the mechanisms for matching resources and action to needs in disaster response and recovery activities
3. Effective organizational action depends upon the timeliness, accuracy, and comprehensiveness of information available to decision-makers engaged in disaster response and recovery activities
4. Information requirements for effective organizational action vary with the decision perspectives and time phases of the disaster management process
5. Three functions of the information process -- information search, information transfer and organizational learning -- are central to an organization's capacity to take appropriate action in disaster response and recovery activities
6. Identification of the critical points for information search, information transfer, and organizational learning within and between organizations engaged in disaster response and recovery activities is essential to increasing efficiency and effectiveness in the disaster management process

This set of assumptions guided the selection of issues for study as well as the organization and presentation of findings for this chapter. Other issues may be explored in disaster response and recovery operations, but fall outside the scope of this chapter.

ORGANIZATIONAL INTERDEPENDENCE IN THE CONSEQUENCES OF DISASTER

The March 5, 1987 Ecuadorian earthquakes initiated a complex set of events that vividly demonstrate the interdependence of

organizational action in response to, and recovery from, the consequences of disaster. Critical problems generated by the earthquakes and associated landslides and floods illustrate important points of choice for informed design of an interorganizational disaster management process. Further, interaction between the problems triggered subsequent conditions that produced the extraordinary impact of this natural disaster upon Ecuadorian society, as well as the international political economy, through the requirements of technical reconstruction of the TransEcuadorian oil pipeline and economic recovery from the prolonged effects of massive loss of gross national income.⁴ Interdependence in organizational action in disaster response and recovery derives from the complexity of the problems, and the sequence of consequences that follow from disruption of major systems such as transportation, economic production and distribution in the Ecuadorian society.

Domains of Organizational Action

Given the magnitude of the impact of this disaster upon the economic, social and technical systems of the nation, it is useful to consider the total set of disaster operations as a macro system, composed of interacting subsets or micro systems. This step acknowledges the conceptual framework of a nascent disaster management system that encompasses all response and recovery operations undertaken to assist the affected groups in the Ecuadorian society, while reporting specific projects and programs that were initiated by multiple agencies at various field sites. Within this managerial perspective of the total set of disaster operations, organizational action occurred within three distinct domains or fields of action: 1) geographic location; 2) administrative jurisdiction; and 3) decision perspective. Additionally, organizations as mechanisms of action in disaster operations may be classified by their

authorizing structure or mission and funding source into three basic categories: 1) public organizations with legal responsibility for disaster response and recovery; 2) private organizations with responsibility for, and/or interest in, restoring economic activity; and 3) voluntary (private non-profit) organizations with a mission of humanitarian assistance and social service. This section identifies major problems generated by the disaster by domains of organizational action and illustrates the evolving concept of a disaster management system driven by interacting events and interdependent processes.

Geographic Location

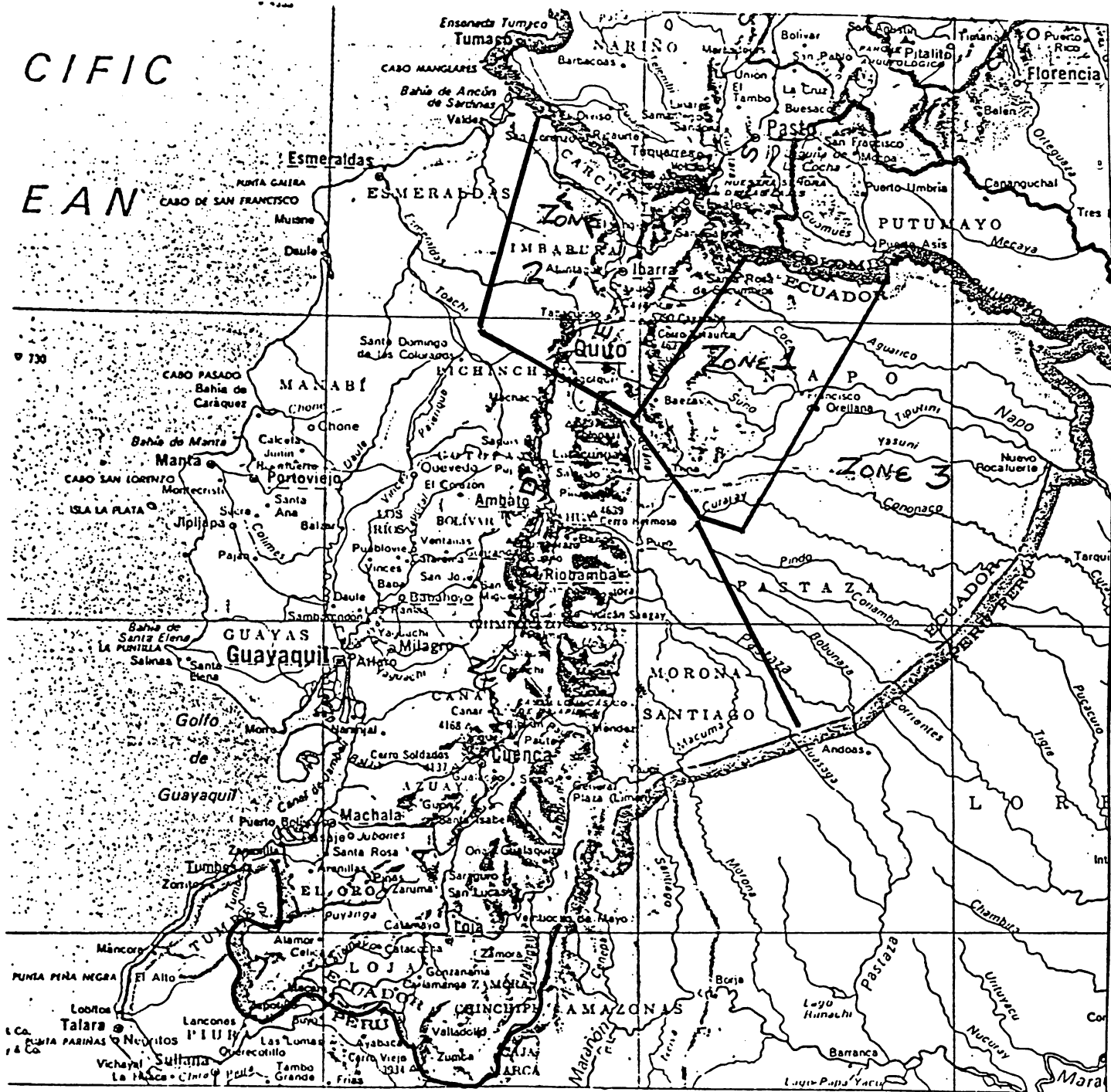
The earthquakes generated consequences of differing types and magnitudes in three geographic locations of Ecuador, as shown in Figure 1.

Zone One: Central Napo Province

The area of primary impact, which included the epicenter of the earthquake near the Volcano Reventador, was located in central Napo Province.⁵ In this zone, two major problems were generated by the earthquakes. First, central Napo Province suffered the greatest loss of life, due to flash floods generated by massive landslides and debris flows. Official estimates placed the death toll for all three zones of the disaster at 1,000, with 5,000 left homeless or in need of resettlement.⁶ Other estimates ranged from 300 to 1,000 dead.⁷ While informed sources vary, all experts agree that it is not possible to determine precisely the number of dead, because no reliable census of persons living in the area existed prior to the earthquakes.⁸ This observation is particularly relevant for central Napo Province, as it is largely undeveloped territory recently opened to colonists for settlement and cultivation.

Second, major damage occurred to the infrastructure, including destruction of approximately 30 kilometers of the TransEcuadorian Pipeline, as well as destruction of approximately 40 kilometers of the main highway from Quito to Lago Agrio, secondary roads, the oil pumping station at El Salado and seven bridges.⁹ These conditions

Figure 1



Three Zones of Disaster Operations,
March 5, 1987 Earthquakes in Ecuador

- Zone 1: Western Napo Province
- Zone 2: Carchi, Imbabura, and Pichincha Provinces, Highlands
- Zone 3: Eastern Napo Provinces

have been described in detail in earlier chapters and will not be repeated here.

These problems precipitated different types of organizational response. At the local level, the first response of the local organizations -- the Municipal Councils, Civil Defense Committees, and parish churches -- was directed toward meeting the human needs of shelter, food and medical care for survivors of the disaster.¹⁰

After the initial trauma of coping with loss of life and dislocation of families had lessened, a second set of problems centered around the destruction of major infrastructure at the national level. These problems included: (1) reconstruction of the oil pipeline in geologically unstable territory; (2) loss of oil revenues and its consequent impact upon the national economy; (3) loss of the highway, bridges, and secondary roads for safe travel and economic activity of the resident population; and 4) reorientation and, if needed, resettlement of local residents, severely shaken emotionally and economically by the disaster and struggling to cope with questions regarding an uncertain future in a zone of high seismic risk.¹¹ The size and scope of this second set of problems necessarily shifted organizational action to national and international levels of operations. The consequences of these operations, in turn, affected the capacity of small communities to sustain their residential populations.

Zone Two: Sierra

The zone of secondary impact from the disaster was the Sierra, specifically the Andean highlands of Imbabura, Carchi and Pichincha Provinces. In this zone, the principal problem was housing. There were no reports of lives lost in the immediate occurrence of the earthquakes, but approximately 60,000 homes were damaged or rendered uninhabitable. The earthquakes produced differential effects for residents of differing economic status. It was an "earthquake for the poor,"¹² as the houses most severely damaged were those made of blocks of sun-dried mud, with no reinforcement or flexibility to withstand seismic movements. Since this is the

predominant form of housing construction for the poor residents of the area, the most severe damage from the earthquakes fell on that group within the population already living at a marginal level of economic existence and, therefore, least able to cope with the increased physical, economic and psychological costs generated by the event. What appeared to be a moderately severe event to other economic groups in this zone proved indeed to be a disaster for those at the lowest economic level, with homes vulnerable to seismic risk and few resources for rebuilding.

A secondary set of problems emerged in these Sierran towns and villages from earthquake damage to the basic infrastructure for community life. Schools, hospitals, churches and other public buildings suffered structural damage, as did rudimentary infrastructure for water supplies and sewage.¹³ Most severely damaged was the mountain city of Ibarra in Imbabura Province, with structural damage to its basilica, schools, and commercial buildings in the town square.¹⁴ Also heavily damaged were municipalities in the cantons of Cayambe and Pedro Moncayo, and neighboring communities in northern Pichincha Province.¹⁵ These types of structural damage affected adversely the capacity of these communities to carry out the normal functions of social and economic life -- education, agriculture and commerce, health care, and religious services. Consequently, the burden on individual families to meet daily needs of nutrition, shelter and physical care was magnified. For those already in marginal circumstances, these needs could not be met by the local systems of economic and social support alone.

Each parish, the administrative unit of local government in these provinces prepared a summary of the assessed damage from the earthquakes and estimated costs of repair. The parishes, with limited resources, required external assistance to meet these needs and, in turn, referred them to upper jurisdictional levels of government -- cantonal, provincial and national.¹⁶ Requests to upper levels of government for resources and assistance for housing and community infrastructure in Zone Two occurred simultaneously

with the demands for assistance from the heavily damaged communities and national infrastructure in Zone One. Reconstruction needs, experienced first at the local level, escalated to national and international levels of organizational action as managers at successive levels of administrative jurisdiction sought economic and technical assistance for rebuilding their communities.

Zone Three: Eastern Napo Province

The third zone of impact from the disaster included the city of Lago Agrio and adjacent communities in eastern Napo Province. These communities suffered little structural damage and had no loss of life. The major problem generated by the earthquakes in this zone was isolation and economic deprivation, resulting from the destruction of the oil pipeline and the major route of land transportation, the highway from Quito to Lago Agrio.¹⁷ These communities survived the initial event of the earthquakes without severe consequences, but the cumulative effects of long-term isolation, unemployment and lack of access to markets and supplies worsened with the prolonged period of time required for reconstructing the infrastructure needed to support the local economy based upon oil production and agriculture.

Especially vulnerable were the Indian communities along the Coca, Aguarico, Due, Salado and Papallacta rivers. Dependent upon the rivers for drinking water, nutrition -- fish are an important staple in their diet -- and transportation, these communities suffered serious deprivation in the loss of vital health and economic resources due to the pollution and obstruction of the rivers.¹⁸ The disruption of economic, social and transportation systems caused by the earthquakes produced, over the succeeding months, a cumulative economic and social disaster for the residents of this zone. It was an interactive set of conditions that, unresolved, steadily worsened and overwhelmed the local resources of the residents and communities of this zone. The local communities could not cope with the conditions generated by the earthquakes without external assistance, and the need for organizational

action escalated to provincial, national and international levels of operation.

Reviewing the consequences of the disaster by geographic location, the earthquakes generated differing types of physical effects in three geographic zones which, in turn, escalated the impact of the disaster for the nation as a whole. Each type of problem required specific kinds of organizational action for appropriate and timely response. The simultaneous needs of the disaster-affected populations in the three zones and the massive impact on the national economy from the combined loss of oil export revenues and costs of rebuilding the pipeline and transportation routes required resources beyond Ecuador's capacity alone.

The interaction of differing needs between¹⁹ the three zones of the disaster, each with its own degree of urgency, compounded the difficulties imposed by scarcity of resources and trained response personnel within this complex organizational environment. The process was dynamic, and in the early phase of disaster response, operating parameters of needs, resources, personnel, and, therefore, action were uncertain. Under these conditions, any nationwide action in disaster management becomes an important measure of capacity. The fact that problems were reported in the coordination and delivery of disaster assistance is not surprising.²⁰ Rather, the complexity of this situation merits particular attention in understanding the design and dynamics of interorganizational coordination in disaster management.

Administrative Jurisdictions

Jurisdictional involvement in disaster response and recovery activities in the three zones of the disaster reflected the interdependent characteristics of organizational response. Damage from the earthquakes elicited organizational response at five levels of administrative jurisdiction: parochial, cantonal, provincial, national and international. Although each level served specific functions in disaster response, no single level was able to meet all of the needs generated by the earthquakes alone. Unmet needs at one level pushed the demand for action to the next

administrative level, in an escalating search for resources and skills that ranged outside the formal disaster management system. This section will present briefly the response of the formal disaster management system as well as the informal response from the private and voluntary organizations committed to humanitarian goals.

In Ecuador, the mission responsibility for disaster management on the national level lies with Civil Defense. This is a developing organization, first established in 1962.²¹ The structure for a nationwide Civil Defense system exists at all jurisdictional levels of administration in Ecuador -- parochial, cantonal, provincial, and national. At the local levels, however, Civil Defense functions are performed largely as an added responsibility for the existing parochial or cantonal councils. The presidents of the Municipal Councils are, for the most part, also the local directors of Civil Defense. At the cantonal level, the director's position may be held by an officer in the Ecuadorian Army, as in Lago Agrio where the Commander of the Battalion de Selva is also the director of canton's Civil Defense Council.²² At both parochial and cantonal levels of administrative jurisdiction, the national Civil Defense organization seeks links to existing agencies within the communities, for it has few resources of its own. Local governmental units, in particular, assume these responsibilities with little equipment and less training in disaster mitigation and preparedness.

Civil Defense has undergone numerous changes of leadership and direction as it sought to meet the successive challenges of disaster management posed to the nation by the severe earthquake of 1976, the coastal floods of 1982-1983 and the Galapagos fire of 1984.²³ Legal responsibilities are now defined and a clear organizational structure exists, but the capacity of this relatively new organization to take action is limited by the scarcity of resources and trained personnel throughout the intergovernmental system. Although a nation of high seismic risk, disaster management in Ecuador has been limited by the scarcity of resources

available for equipment and preparedness training.²⁴

The March 5, 1987 disaster, involving three geographic locations with differing requirements for assistance, placed greater demands upon the national Civil Defense organization than its capacity for delivery of services. Recognizing the magnitude of the disaster and its impact upon the nation, President Leon Febres Cordero declared a national emergency in the provinces of Carchi, Imbabura, Napo and Pastaza under the provisions of Article 101 of the Law of National Security.²⁵ He also called a meeting of the ministers of Health, Finance, Public Works, Energy, Social Welfare, Environment, the director general of the Ecuadorian State Petroleum Consortium (CEPE), the national director of Civil Defense, the commander-in-chief of the Armed Forces, and the director of the military Corps of Engineers to evaluate the damage and to plan the emergency response.²⁶ By this action, the president mobilized the highest officers of the Ecuadorian government in response to the disaster, giving it first priority in national affairs. Further, he constituted this group as a national Emergency Committee to direct the disaster operations and to work in conjunction with Civil Defense in the assessment of damage and delivery of disaster assistance. The president appointed General German Ruiz, secretary of the National Security Council and officer of the Ecuadorian Army, as director of the national disaster operations.²⁷ General Ruiz served both as chair of the national Emergency Committee and the National Center of Emergency Operations. He worked directly with the director of the National Civil Defense Authority, General Antonio Moral Moral. In establishing the National Emergency Committee, President Cordero directly or indirectly engaged virtually all organizations in the Ecuadorian society in response and recovery activities.²⁸

Given the limited capacity of the nation and the massive losses generated by this disaster, President Cordero also appealed to the international community for assistance to Ecuador in meeting the technical and economic needs for response and recovery.²⁹ Some 22 nations responded to this call. The ensuing requirements for

coordination and communication between participating nations and between the Ecuadorian levels of governmental jurisdiction in the simultaneous delivery of services to the three disaster zones escalated the complexity of organizational interaction still further.

When the resources and capacity of the respective governmental jurisdictions were unable to meet the urgent needs of the affected communities, responsible citizens turned to private and voluntary sources for assistance. For example, communication is crucial in disaster management, especially in a complex situation involving three geographic areas. Yet, the Civil Defense organizations at the parochial and cantonal levels in Quijos did not have radios to report the news of the disaster and the extent of the damage to the national Civil Defense office in Quito. Telephone communications were disrupted by the disaster, and it took several days for the full extent of the damage to become known at the national level.³⁰ The only radio available for communication was a station operated by the Evangelical Mission in Quijos, which voluntarily served this important function by relaying messages to and from national offices in Quito.³¹

Voluntary, religious and communal organizations with appropriate resources and skills responded to humanitarian needs through an informal network of personal and organizational contacts. These agencies sought to provide what assistance they could, but their capacity to do so was limited by lack of resources, equipment, and training for operation in actual disaster environments. Nonetheless, voluntary organizations played an important role in disaster response and recovery, particularly at the community level. In-country organizations joined in a national campaign to offer voluntary contributions to disaster assistance in a remarkable demonstration of 'solidarity' with the disaster victims.³² Links to the international community provided resources that were not immediately available in country to initiate the design and implementation of disaster assistance activities. The International Red Cross, Catholic Relief Services, World Vision, and other organizations were important sources of technical expertise, resources and

personnel in the labor-intensive tasks of community assistance to disaster victims. These activities will be described in more detail in the next section.

In principle, international and voluntary organizations coordinated their activities with the national Emergency Committee in the conduct of disaster operations. In practice, the complexity of disaster operations and the lack of communications facilities between national offices and provincial and cantonal field sites compelled much of the actual work to be done locally with limited contributions from the national level.

In summary, public organizations with legal authority for disaster response at parochial, cantonal, provincial, national and international levels of jurisdiction engaged in disaster response and recovery activities in the three affected zones. The consequences of the disaster, however, overwhelmed the limited capacity of these organizations, leaving the stricken communities with substantial areas of unmet needs. Private and voluntary organizations at each jurisdictional level offered assistance in disaster operations, supplementing and strengthening the capacity of these communities for recovery. International organizations provided resources and skills that enabled local communities to rebuild homes and infrastructure, and the nation to reconstruct the oil pipeline and major transportation routes. The meshing of organizations, across jurisdictions and types of mission, contributed to a developing concept of an integrated disaster management system.

Decision Perspectives

In order to carry out an effective program of assistance and recovery in any given zone affected by the disaster, response organizations required knowledge and skills from multiple scientific disciplines. The immediate needs of survivors from the stricken communities required medical assistance. The assessment of needs in the damaged communities required knowledge of structural engineering and social welfare. The procurement and distribution of supplies to the affected communities required skills in organiza-

tion, logistics, and management. The reconstruction of the pipeline, roads and bridges required technical skills in engineering, geology and geomorphology. The design and implementation of reconstruction projects required financial, managerial and political skills and knowledge. Re-establishing households and community services meant matching available resources to immediate needs as appropriately as possible, requiring knowledge of social and economic conditions and organizational skills on a community scale. The jarring instability of the seismic zones left psychological tremors among the population, and a program of recovery to assist residents in overcoming these fears required skills in counseling and psychological assessment. Given the range of problems involved in response and recovery, disaster managers needed expert knowledge and skills from at least five decision perspectives: medicine, engineering, public health, economics and public policy and management.

In the evolving design of a disaster management system, the primary organizational task in response and recovery is to connect the elements within each domain of action and to integrate the domains in a coherent, effective program of operations. The objective is to weave a productive network of organizations, drawing resources and skills from relevant jurisdictional levels to meet the needs of the disaster-affected communities. This task requires flexibility and resourcefulness at all levels. Information and resources from one domain of action may be helpful - even crucial - to another domain. Rapid, accurate communication between elements of a domain and between domains is critical. This integrative task is demonstrated vividly by the use of 'mingas' in community work. The 'minga' is a cooperative organization of local residents formed to carry out specific tasks in their communities. It is an organizational form dating from the Incas, and it is well-known and accepted in Ecuadorian culture. The needs generated by the disaster, shared by most community residents, created an appropriate opportunity to organize mingas in the affected communities. When provided with limited resources from the

national Civil Defense organization, such as a machine for making cement blocks, and supplies from international charitable organizations, such as sacks of cement from the Norwegian Red Cross, residents of communities in the Andean highlands worked in mingas to produce cement blocks for reconstructing houses for all families in the village.³³ Scarcity of resources and urgency of needs compelled innovative means of organizing action in disaster-affected communities, where responsible managers integrated elements from separate domains to solve a shared problem.

In summary, organizational action in disaster response and recovery activities was directed from the national level by an Emergency Committee established by the President of Ecuador. By creating a separate national committee that had direct access to the experience, expertise and facilities of the major ministries of the nation, President Cordero in effect distinguished the function of disaster operations from the function of disaster planning and coordination performed by the Civil Defense Authority. The two entities worked in close collaboration during the period of disaster operations, but the National Emergency Committee was established as a temporary entity with specific responsibility for the March 5, 1987 earthquakes. The Civil Defense Authority has the continuing legal responsibility for disaster preparedness and prevention activities in the nation. Limited public resources for disaster assistance were supplemented by voluntary contributions of time, expertise and material from local, national and international organizations committed to providing humanitarian assistance to the stricken communities. Financial resources for reconstructing the oil and gas pipelines, bridges, and the highway, and relief from external debt obligations exacerbated by the loss of oil revenues were solicited from international sources. Obtaining international monetary credit required interorganizational coordination between nations, a problem that will be discussed more fully in the next section.

The striking characteristic of this disaster was the complexity of problems generated by the earthquakes and the interaction

among them. The organizational action required to address these problems simultaneously was correspondingly complex. Equally interesting is the degree of innovation with which practical action was developed to use scarce resources at the local level. In the parrochias of the Sierra and the settlements of Napo Province, the disaster created a policy-making situation, engaging most elements of the community in response to the shared need. For residents living at marginal economic levels, the disaster threatened their basic existence and presented choices for either rebuilding in stronger ways or relocating in more stable territory.

ORGANIZATIONAL NETWORKS IN DISASTER RESPONSE AND RECOVERY OPERATIONS

Reviewing the extent, form, and outcomes of organizational action in disaster response and recovery operations following the Ecuadorian earthquakes of March 5, 1987, a pattern emerges of interacting networks operating simultaneously in reference to particular problems. The degree of communication and coordination within and between these networks varied, with direct effects upon the outcomes of actions taken in the disaster operations process.

In some instances, especially in the rural parishes, communication and coordination between the local, national and international networks of organizations appeared almost absent.³⁴ In other instances, as in the emergency housing construction projects undertaken by individual relief organizations in the damaged communities of the Sierra, communication and coordination functioned very well between the local, national and international levels of operation for a particular project, but failed between projects and between other types of organizations -- public, private, or voluntary.³⁵ In still other cases, communication and coordination between types of organizations and levels of operation developed around problems addressed in common, but failed between sets of problems.³⁶ In each set of cases, the organizations involved were encountering the limits of time, facilities, and preparedness training essential to achieve effective communication and coordination in the complex, dynamic disaster environment.

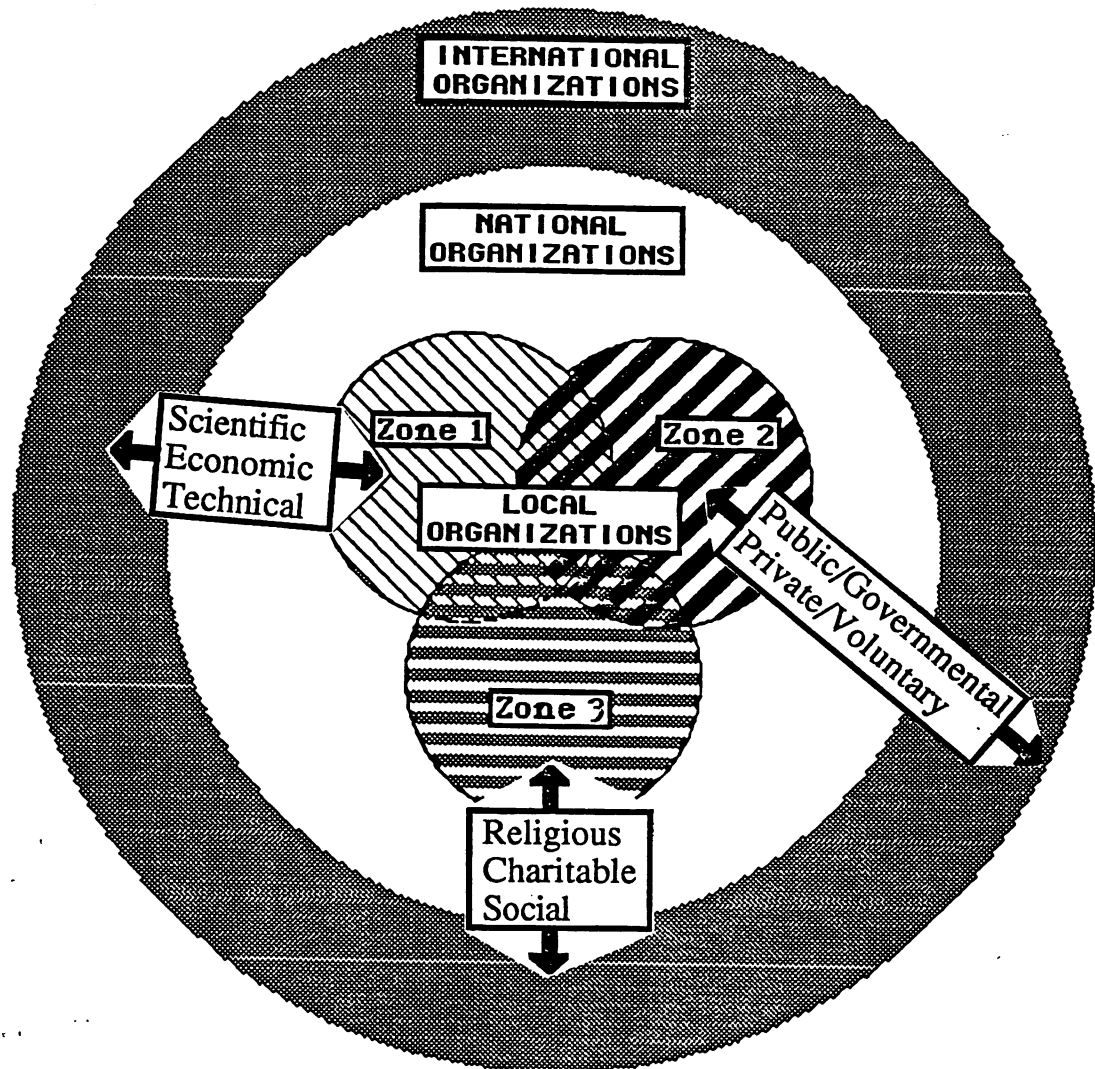
The resulting pattern of organizational network performance, at times overlapping, at times operating independently, appears to be a function of at least four factors: (1) overall complexity of the disaster environment; (2) differing requirements of technology and resources for the problems addressed; (3) number and diversity of participating organizations; and (4) limited facilities, staff, and training for communication/coordination in disaster management.





Networks of organizational action centered on the three zones of the disaster, differing in geographic location, physical and climatic conditions, and type of impact upon national, communal, and family life. From the immediate families and communities that suffered physical, personal, and property losses, networks of assistance extended to the parochial and cantonal jurisdictions of public or governmental organizations, but included religious, charitable, and voluntary organizations within the distinct communities. This network of community organizations, in turn, nested within a set of provincial organizations. The provincial organizations served as the linkage between the set of national organizations -- public, private, and voluntary -- that mobilized resources on the national level and directed them to the problems, communities, and families in the three disaster zones. The network of national organizations responding to the needs generated by the disaster, in turn, functioned within the set of international organizations that contributed financial, technical, material, and organizational assistance to the disaster operations. This overlapping set of networks that characterized the disaster response and recovery operations is represented in the organizational diagram presented in Figure 2.

The patterns of organizational action and interaction both overlapped and needed coordination in at least three directions: (1) between local, national and international levels of jurisdiction and/or disaster operations; (2) between public, private and voluntary sources of funding and direction at each operational level; and (3) between technical, social, and economic functions served by differing sets of organizations at differing levels of

Figure 2

Networks of Organizational Action in Disaster Operations:
The March 5, 1987 Ecuadorian Earthquakes



-  = Scientific, Technical, Economic Organizations
-  = Public/Governmental, Private/Voluntary Organizations
-  = Religious, Charitable, Social Organizations
-  = All Organizations

- Zone 1: Western Napo Province
- Zone 2: Carchi, Imbabura, and Pichincha Provinces, Highlands
- Zone 3: Eastern Napo Provinces

While all types of organizations played some role in each disaster zone, the dominant pattern of organizational interaction is indicated for the respective zones. The overlap in patterns represents the coordinative processes between jurisdictional levels.

disaster operations. Although breakdowns occurred within categories of organizational operation, performance was reported to be significantly better within a given network than between networks.³⁷

Through the national framework for disaster management established by President Cordero to meet the needs generated by the March 5, 1987, earthquakes, the major ministries of the nation were involved in fashioning and implementing appropriate policies for response and recovery, as stated above (p. 7). Eleven ministries and ten national institutes or administrative units were included in this National Emergency Committee. Key public officials were also invited to participate in the Emergency Committee, including the President of the National Congress and the President of the Supreme Court. A complete list of the ministries, institutes and officials participating in this Committee is included in the Appendix.

In constituting this Emergency Committee and establishing a National Center of Emergency Operations, President Cordero was, in effect, signaling to the nation that the extraordinary needs generated by the disaster could only be met by a nationwide response and that the response required the cooperation and contribution of all organizations and citizens to do so. By involving all elements of the nation's political and economic leadership in the directing body for the disaster operations, the President took steps to provide credibility to the concept of a nationwide network of emergency response.

The effectiveness of this network of emergency operations in serving the needs for organizational coordination in disaster management is a question for further study. There is evidence of both success and failure of this system, assembled under stress of disaster, to achieve coordination in response and recovery activities. This report serves only to state the problem and to offer an initial account of its operation in the overall disaster management process. Clearer insight into the problem of interorganizational coordination in disaster response and recovery

activities can be illustrated by a brief profile of organizational activities undertaken to meet the major problems identified in the three disaster zones.

Disaster Operations Network 1: Central Napo Province

In central Napo Province, the zone of primary impact, three major problems generated by the disaster required urgent, simultaneous response and assistance. Moreover, the three problems, each separately traumatic, interacted to escalate rapidly the demands for organizational response.

The most urgent need was for food, clothing, shelter, and medical care for the victims of the disaster, those families who had suffered physical damage and/or lost their homes and property in the chain of destructive events generated by the earthquakes. Given the undeveloped state of the territory, the lack of communications facilities, and the marginal economic conditions of the resident population, the task of meeting basic human needs for the victims required outside assistance. This task, however, was made more difficult by the rudimentary state of public services within the communities and the lack of equipment, training, or experience with disaster management. In most communities, the local churches had established stronger relationships with the citizens than had the Civil Defense councils, which were relatively new and still in the process of development. Individual members of community Civil Defense councils were willing to participate in disaster response activities, but the responsibilities had not been clearly defined at the local level and there were few resources or experienced personnel to guide the process.³⁸ Consequently, citizens looked to trusted religious leaders for practical as well as spiritual guidance.

Bringing assistance into the local communities from national and international sources generated all of the problems of unplanned action in complex, dynamic environments. Local managers reported a series of dilemmas as they sought to assess needs and

distribute relief goods appropriately in their respective communities. National and international organizations contributed supplies, but how was this assistance to be distributed and to whom? Was it ethical to make distinctions between levels of economic misery, as some families who had not lost their homes in the disaster suffered just as acutely from the ensuing loss of employment or income from agricultural products? How did one serve the intangible needs of the people in the wider community for emotional security in a geologically unstable environment? The immediate needs for physical care and basic family support for the disaster victims were compounded by the economic needs of all members of the community, as well as increased difficulty in communication and transportation.³⁹ These questions involved the National Civil Defense Authority, the ministries of Health, Social Welfare, Agriculture and Livestock, the Ecuadorian Institute of Children and Families, the Ecuadorian Institute of Agrarian Reform and Colonization as well as the Ecuadorian Red Cross, Catholic Relief Services, Hoy Christus Jesus Benedece - the service organization of the Evangelical Church, U.S. Peace Corps volunteers and other international organizations that contributed disaster assistance.⁴⁰

Basic needs for the disaster victims in central Napo Province were overshadowed by the stunning blow to the national economy from the destruction of the TransEcuadorian oil pipeline and the consequent lapse in oil exports. The second problem, reconstruction of the pipeline and highway in a geologically unstable area, required involvement of a different set of organizations -- national and international -- to address the scientific questions of probability of seismic risk, the landslide and flood hazards, engineering questions of feasibility and design, and economic questions of costs and credit for the project. This problem drew the attention, involvement and cooperation of a number of national and international organizations to determine the financial and technical feasibilities of reconstructing the pipeline and highway, the implications for national economic performance of alternative

routes, and the costs associated with each alternative. These organizations included those with scientific expertise, such as INEMIN (Ecuadorian Institute of Mining), the Institute of Geophysics of the National Polytechnic School, the Italian Mission, with its team of geophysics experts, and the U.S. Geological Survey, as well as those with access to financial credit, such as the World Bank, the Interamerican Development Bank, the Andean Development Corporation (CAF), and the International Monetary Fund.

The problem also involved substantive negotiations between national representatives, such as the President of Ecuador and the Vice President of the United States, in securing financial credit. Further, it involved negotiations between the Presidents and appropriate ministers of Ecuador and Venezuela, as well as representatives of the Organization of Petroleum Exporting Countries, to arrange Venezuela's assumption of Ecuador's oil production quota and export obligations, between Ecuador and Colombia to arrange Ecuador's use of the Colombian pipeline to maintain partial production and shipment of oil during the reconstruction period, and between Ecuador and Mexico to arrange for technical and material assistance in the reconstruction of the pipeline.⁴¹

Negotiations also occurred between particular organizations, such as between CEPE (Ecuadorian State Petroleum Corporation) and Will Bros., the U.S. engineering firm that built the original pipeline; CEPE and Texaco Oil Co., the U.S. company involved with the Ecuadorian national corporation in the production and shipment of oil, as well as the maintenance of the related facilities. This network of scientific, financial, business, and governmental organizations working on the questions of reconstruction of the pipeline in order to resume oil production and exports operated largely independently of the set of organizations involved in humanitarian disaster assistance. Yet, the consequences of their actions affected the residents of the communities through the loss or generation of jobs, access to transportation, and the benefits of remaining in the region.

A third major problem generated by the disaster in central Napo Province concerned policy decisions for future economic and agricultural activity in the zone. The question of reconstructing the infrastructure -- pipeline, roads, and bridges -- was tied to scientific information regarding the geological stability and probability of future seismic and/or volcanic activity in the zone. The feasibility of resettling the colonists living in the zone into areas of lower seismic risk involved judgments of economic costs vs. social responsibility. The cost of the ecological damage to the rivers and the short- and long-term effects of this damage upon human populations in the region also required multidisciplinary study and design for action. These questions, dealing with the viability of continuing economic and social activity in the region, were the most difficult and most problematic in terms of policy design and implementation. Decisions made regarding infrastructure in the early stages of disaster response and recovery shaped the formulation of future options and policies for development of the region.

Organizations involved in the process of determining the future development of the zone, and alternatives for its current residents, were the scientific organizations -- INEMIN; Institute of Geophysics of the National Polytechnic School; the Italian Mission, with its team of experts in geophysics and volcanology; the U.S. Geological Survey; the ministries of Agriculture and Livestock, Social Welfare, Health, Environment, Transportation; IERAC (Institute of Agrarian Reform and Colonization); the Ecuadorian Institute of Children and Families; as well as the private and voluntary organizations -- Catholic Relief Services/CATEC (Corporation of Support to Technology and Communication), environmental groups, and the provincial and national Indian associations (CONFENAIE or Confederation of Napo Associations of Ecuadorian Indians and CONAIE or National Confederation of Ecuadorian Indians.)

In summary, three problems generated by the disaster in central Napo Province interacted with one another to produce an

even more complex and difficult set of policy questions for organizations engaged in disaster response and recovery. These were the needs for: (1) immediate humanitarian assistance to the victims and their families; (2) reconstruction of the infrastructure required to resume production and export of oil for the national economy; and (3) review and redesign of future economic and social activities for the zone, taking into account continued seismic risk. Sorting out constructive alternatives for appropriate action was clearly an interorganizational task. No single agency or entity could manage it alone, and the evolving pattern of actions included local, national, and international agencies; public, private, and voluntary efforts; and scientific, technical, administrative, economic, and social concerns. The complexity of tasks in disaster response and recovery greatly increased the difficulties of designing coordinated organizational action.

Disaster Operations Network 2: The Sierra - Pichincha, Imbabura, and Carchi Provinces

The major problem generated by the earthquakes in the Andean highlands of Carchi, Imbabura, and Pichincha provinces was the loss of housing, exacerbated by the prevalence of poverty (see pp. 141-142). In Canton Cayambe of Pichincha Province alone, nearly 3,000 houses were damaged or destroyed, leaving 15,000 people with minimal shelter in cold, rainy weather.⁴² In all three Andean provinces, approximately 60,000 homes were reported destroyed or damaged, or 81.8% of the total number of 73,261 houses affected in all zones of the disaster.⁴³ Damage ranged from total destruction to small cracks. In this zone, approximately 9,566 homes needed to be wholly reconstructed, the largest proportion of the total number of houses, 11,694, reported in need of complete reconstruction for the entire disaster. Approximately 47,828 people, residents of the damaged houses, were left homeless in this zone, out of the 58,470 persons reported homeless for the total disaster. In addition, some 33,947 persons in this zone suffered the cost and incon-

venience of repairing damage to their homes, out of the 41,500 persons reporting repairs for the entire disaster.

In sum, over 80% of the damage to housing generated by the disaster was reported in the Andean highlands, affecting some 81,755 people, out of the approximately 100,000 people who reported damage to their homes for all zones of the disaster.⁴⁴ The extensive need for housing in this zone generated organizational response at the local, national and international levels and involved public, private and voluntary organizations. Technical, economic and cultural perspectives influenced the design of specific programs of action to meet housing needs of the disaster victims, as well as the acceptance and implementation of the various programs.

Local organizations initiated the response to housing needs for community residents who either lost their homes or who suffered serious damage to their homes in the earthquakes. While the extent and efficiency of the response varied by community, local councils in most communities undertook the census of homes, identifying those families who had suffered damage in the earthquakes.⁴⁵ Many communities, however, did not have the resources to rebuild or repair the damaged homes. Consequently, they turned to provincial and national sources for assistance, which in turn requested assistance from international sources.⁴⁶

International organizations played a major role in the reconstruction of housing in this zone. First, housing was an obvious and tangible need which they could meet by providing materials for shelter and for design and reconstruction for the residents of these rural communities. While there was an initial effort to communicate with one another and to coordinate their assistance programs, the various international organizations proceeded to carry out their work, for the most part, independently. The USAID/Office of Foreign Disaster Assistance distributed plastic sheeting widely in the area as an immediate and temporary protection to families sleeping outside.⁴⁷ The British government sent tents. The Norwegian Red Cross sent construction

materials. The International Committee of the Red Cross, working in conjunction with the Ecuadorian Red Cross, designed and constructed a sizable housing project near Ibarra. The German and Italian governments selected certain communities and met housing needs in those communities. Other governments and other international voluntary organizations contributed construction materials, technical assistance in architectural design, and money to assist in the rebuilding or repair of housing in these mountain communities. In Cayambe, for example, all housing construction and repair was committed for construction and financed by international or national sources by June 30, 1987.⁴⁸

Disaster assistance from foreign governments was sent to the Ecuadorian government and transmitted to COEN, the National Center for Emergency Operations. The Civil Defense organization, working with COEN, was responsible for distribution of international assistance from foreign governments to needy communities in the disaster zones. Assistance from international voluntary organizations such as World Vision, Friends of America, and Save the Children, were transmitted to a committee established by the national government specifically to receive international disaster assistance. This committee was chaired by the First Lady of Ecuador, Senora Eugenia Febres Cordero. The International League of Red Cross Societies and foreign national Red Cross societies worked directly with the Ecuadorian Red Cross to conduct its extensive housing program. Other international organizations, such as Catholic Relief Services and the Evangelical Brotherhood, transmitted money, technical assistance and materials for housing through their respective in-country organizations.

At the community level of disaster operations, the local churches were frequently the primary vehicle for distribution of supplies or mobilization of services to assist the disaster victims. Long established in the communities and trusted by community residents, religious leaders from local orders served a very important function in linking the needs of the residents to the sources of assistance from the international community.⁴⁹ In

the process, they served the equally vital function of providing reassurance and hope for rebuilding their lives to community residents, badly shaken emotionally by the sudden experience of destruction in their lives.⁵⁰

In summary, organizational interaction was important in addressing the major problem of housing in the disaster zone of secondary impact. Although international organizations played a major role in the reconstruction projects initiated to meet this need, they operated largely independently with little communication and coordination between projects. Questions of design, cost, and appropriateness of housing for the local needs of community residents, involvement of residents in the actual development of the projects, and work of reconstructing their own homes were recognized by local leaders but were not addressed systematically among the set of participating organizations.⁵¹

The difficulty of establishing a viable means of coordination during the actual operations was also recognized by participants in the process who had tried to do so.⁵² The opportunity to use the reconstruction process to serve other community needs was very apparent in the housing projects of the Andean highlands. Important initiatives were taken, but other problems surfaced in the process. The appropriate role of communities in designing and building their own housing needs to be carefully examined. The linkage between the destructive consequences of disaster and constructive opportunities for fostering community development in the reconstruction phase are clearly illustrated in the housing projects undertaken in this zone of secondary impact.

Disaster Operations Network 3: Eastern Napo Province

In eastern Napo Province, the major problems generated by the disaster were the interaction of isolation and unemployment resulting from the destruction of infrastructure -- the highway and the oil and gas pipelines -- and the pollution of the rivers, with its consequent impact upon health and agriculture. These problems

were especially difficult because they deepened with time and were compounded by decisions made in reference to other aspects of disaster recovery and reconstruction. Destruction of the oil and gas pipelines meant unemployment for many of the residents of these eastern communities, dependent directly and indirectly upon petroleum production as the primary local industry. Further, decisions made in reference to long-term development for Zone 1 and the reconstruction of the highway and bridges in geologically unstable territory adversely affected access to markets and supplies for the population in the eastern provincial cities and settlements. The primary means of transportation between the eastern cities of Lago Agrio and Coca and the metropolitan markets of Quito were by air, which was expensive, or by water through a network of rivers that led to roads, which was time-consuming.

Networks of organizational assistance did develop to address these problems. However, these networks appeared to cluster even more specifically around the problems, with little coordination between them or recognition of their mutual contributions to the overall disaster response and recovery effort. First and most widely recognized was the "Punta Aerea", the aerial bridge operated by the Ecuadorian Air Force between Quito and Lago Agrio with international assistance. The governments of Great Britain, Argentina, the United States, and other nations contributed time of aircraft and crews to assist the Ecuadorian Air Force in the transport of supplies, commodities and people to and from the isolated cities.⁵³ A major factor inhibiting the use of air transportation, however, was the cost, calculated at \$600-800 per hour for a military helicopter with limited load capacity and many times that for a C-130 or similar cargo aircraft.⁵⁴ Consequently, foreign governments limited their contributions to specific periods of time or reduced their participation as the months passed. Without viable road transportation, however, the isolation worsened the economic and social conditions for the populations in these eastern communities, which were marginal even before the disaster.

A second network developed among the Indian organizations and

religious organizations that offered services to the Indian communities and colonists who lived in the rural areas or along the rivers of eastern Napo Province. These populations, largely unconnected with the national economy and structure of public service organizations, had already developed a network of relationships focusing on self-help and voluntary assistance. These organizations included: 1) the Federacion de Organizaciones Indigenas de Napo (FOIN), which has a strong membership base near Puyo; 2) the Confederacion de Nacionalidades Indigenas del Ecuador (CONAIE), the national confederation of Indian organizations; and 3) the Federacion de Comunas de Napo Ecuatoriana (FECUNAE), which has strong influence in the settlements along the Coca River.⁵⁵ The ecological effects of the disaster in the pollution and obstruction of the rivers had particularly severe consequences for these populations, dependent upon the rivers for food, water and transportation. Again, living in largely undeveloped territory on a marginal economic base, these populations were particularly vulnerable to the chain of adverse consequences generated by the earthquakes. Their limited resources to cope with disaster conditions were quickly exhausted, and they needed outside assistance for recovery and reconstruction.

The primary link between the Indian and communal organizations of eastern Napo Province and the national and international sources of disaster assistance were religious and voluntary organizations. For example, Mision Carmelita, located outside Lago Agrio along the Coca River, took an active role in contacting the Indian communities along the rivers and in organizing the distribution of supplies and assistance to them.⁵⁶ Catholic Relief Services also utilized contacts already established through a program of technical assistance to improve economic and social conditions in these undeveloped communities.⁵⁷ With long experience in the Indian communities and language capacity in Quecha, the Catholic religious leaders were able to engage in a needs assessment following the disaster and the design of strategies for self-help with the residents of these isolated communities. An Evangelical mission

near Lago Agrio played a similar role. These mission leaders were able to articulate the needs generated by the disaster in their respective communities to the national and international organizations in order to mobilize needed supplies and assistance for recovery and reconstruction activities. The religious and voluntary organizations thus served a vital role in linking the local needs with national and international sources of assistance in disaster operations in eastern Napo Province.

A third network evolved to address the problem of isolation for eastern Napo Province between the Ecuadorian Army Corps of Engineers, the Ecuadorian Ministry of Public Works, the USAID/Office of Foreign Disaster Assistance and the U.S. Military Group in Ecuador, which included U.S. military personnel from the Army, the Army Corps of Engineers, the Army Southern Command based in Panama and the Air Force. This network formed around two road construction projects to open up new southern routes from Quito to the settlements and cities of eastern Napo Province. In the first project, the Office of Foreign Disaster Assistance of the U.S. Agency for International Development agreed to purchase the materials and to task the U.S. Army Corps of Engineers to construct eleven bridges needed for a road being built by the Ecuadorian Army Corps of Engineers for the Ministry of Public Works (Ministerio de Obras Publicas, MOP). The road, already under construction when the disaster occurred, was planned as an alternative route from Quito to Coca through territory that was geologically more stable and less vulnerable to seismic risk than the Quito-Lago Agrio highway. The planned route, however, traversed rugged mountain and jungle terrain, and the estimated completion date for the road, given existing Ecuadorian resources, was three years away. The completion of the road would be shortened by at least two years with the provision of the seven bridges needed to cross the rivers in the area. As a major contribution to Ecuadorian disaster recovery and reconstruction efforts, the Office of Foreign Disaster Assistance agreed to finance the construction of the needed bridges. The construction of bridges, however, was diverted from

the MOP road built by the Ecuadorians to a second road project, still further south, named the "Blazing Trails" project, which was to be built as a training project for U.S. army reservists.

The controversial "Blazing Trails" project, conducted by the U.S. Army in cooperation with the Ecuadorian Army Corps of Engineers, was a second effort in Ecuadorian-U.S. intergovernmental cooperation in disaster assistance. The project entailed building a second road connecting the existing road system from Quito to the eastern cities of Coca and Lago Agrio in Napo Province, located further south from the MOP road. The project was designed as a U.S. military exercise in jungle training conducted under contract and with the legitimate approval of the Ecuadorian government. It would utilize the services of U.S. Army reservists to meet a civil engineering need for Ecuador. On the basis of the planned operation and the information available to them, OFDA decided to withdraw the bridges from the MOP road and install them where needed for this second road being built by U.S. reservists. This decision engendered substantial political controversy in the Ecuadorian National Congress in reference to the project.⁵⁸ Misperceptions and distrust of U.S. military purposes in bringing reservists into the country for training created an uneasy tension in Ecuadorian circles over the project. The difficulty of the construction conditions and the inexperience of the reservists working in jungle terrain caused policy makers at OFDA to reconsider their decision on the location of the bridges in terms of where they would contribute the most to reopen transportation in the area.

After reviewing the "Blazing Trails" road project and construction conditions more carefully, OFDA moved the bridges back to the MOP road to the north.⁵⁹ Given its goal of facilitating transportation to the isolated region of Eastern Napo Province, OFDA policymakers concluded, for several reasons, that the MOP road would likely be completed more quickly than the southern route. The political context of the Ecuadorian presidential elections of January, 1988, anticipated in the developing campaign strategies, may have influenced the debate,⁶⁰ but the controversy distracted

time, energy and attention that might have been put to more substantive cooperation between U.S. and Ecuadorian organizations in disaster assistance.

The project is interesting because it illustrates a critical dilemma regarding the role of information in building the basis of common understanding necessary for interorganizational coordination in the dynamic context of international disaster assistance. The controversy illustrated the dilemma of technical vs. cultural exchange of information between the two governments regarding the construction of the road, and the ensuing constraints upon organizational interaction. To inform the Ecuadorian public regarding the cultural/humanitarian objectives and means of the U.S. military road construction project in reference to the overall goal of disaster assistance takes scarce time and attention from technical work on the project. Yet, to do technical work on the project without fully informing the Ecuadorian people regarding its cultural/humanitarian intent raises questions of public trust, which inhibits the overall goal of disaster assistance. Within the complex, uncertain environment of disaster operations, the dilemma illustrates the importance of information search, information transfer and organizational learning in creating a common understanding of the goal of disaster assistance in international projects sensitive to the possibility of dependency.

This agreement demonstrates an important step in productive interorganizational coordination between Ecuador and the U.S. on a critical technical problem. Further, it demonstrates important interorganizational coordination within the U.S. Mission in Ecuador to utilize the technical capacity of the Army Corps of Engineers (Department of Defense) to meet the humanitarian goals of international disaster assistance (Department of State).

In summary, three distinct networks of organizational interaction developed in relation to the problems of isolation and transportation created by the earthquakes in eastern Napo Province. These included: 1) the network of national governments that contributed support to the Ecuadorian Air Force in its maintenance

of the 'aerial bridge' of transportation between Quito and Lago Agrio; 2) the network of religious and voluntary organizations that linked the communities of Indians and colonists to national and international sources of disaster assistance; and 3) the network of Ecuadorian and U.S. governmental organizations involved in technical assistance for road construction through remote areas of eastern Napo Province. Critical, however, from the standpoint of achieving interorganizational coordination was the relatively low degree of communication and coordination among the three networks, even though each developed in response to the common problem of isolation and transportation for inhabitants of eastern Napo Province.

Returning to the concept of an emerging disaster management system, linkages developed through both formal and informal contacts among the three Disaster Operations Networks. The set of networks evolved from the practical requirements of action in disaster response and recovery. Taken together, they offer an initial basis in experience and adaptive skills that may inform and reinforce an integrated disaster management system for Ecuador. The set of networks is represented in Figure 3.

Strengths and Needs for Further Development in the Larger Network of Disaster Response and Recovery Operations

Strengths

Many strengths emerged from the set of organizational interactions that characterized the disaster response and recovery operations following the March 5, 1987 earthquakes. Five practices, in particular, deserve mention, as they either confirm basic principles of disaster management or indicate innovative practices developed in this disaster.

(1) This disaster drew an extraordinary response in voluntary contributions from in-country organizations. An outpouring of good will is not unusual following a major disaster, but this response

**EVOLVING DISASTER MANAGEMENT SYSTEM:
MARCH 5, 1987 ECUADORIAN EARTHQUAKES**

Shared Goal: Protection of Life and Property
in Event of Disaster

Network 1: Central Napo
Subnetworks formed around problems:
1. Humanitarian Assistance
2. Reconstruction of Infrastructure
3. Economic & Social Future

Network 2: Sierra
Subnetworks formed around problems:
1. Housing
2. Community Infrastructure and Development
3. Coordination between Projects

Network 3: Eastern Napo
Subnetworks formed around problems:
1. Aerial Bridge
2. Sustenance of Indian Settlements
3. US-Ecuadorian Road Projects

Informal Communication and
Coordination in Disaster Operations

Communication Linkages:

- = Formal Contracts
- - - - = Professional Associations
- ==== = Community/Religious Bonds
- - - - = Personal Friendships

deserves mention because it was carefully mobilized and directed through the use of a nationwide television campaign with international transmission. Virtually all major organizations in Ecuador - public, private and voluntary - participated in the "Crusade for Solidarity" to raise money and contributions for disaster assistance. The appeal, carefully structured, focused not on sympathy for the victims but on the national sense of unity in meeting the unexpected hardships of disaster. Measured by commitment to action as well as contributions, the campaign was very successful.

(2) Review of disaster operations demonstrates again the fundamental value of respecting local institutions, practice and knowledge in engaging local residents in the difficult tasks of rebuilding their lives. The productive work of the 'mingas' in constructing new homes, the value of family and friendship ties in overcoming the despair of sudden loss, the knowledge of local officials and field directors of development organizations in designing effective reconstruction strategies all indicate the importance of fitting the requirements of disaster management to local delivery systems.

(3) The importance of prior networks of common goals, shared work experience, and professional association in facilitating the mobilization of resources and action across jurisdictional lines was vividly demonstrated by the ease with which communication traveled and action flowed within such networks as Catholic Relief Services, USAID/OFDA, Red Cross societies, Ecuadorian and international military experience, and family and community ties. Each generates the critical factor of trust, so essential to decision making in the uncertain conditions of disaster. Conversely, the absence of common experience is illustrated in the frequent breakdown of communication and coordination between these networks, resulting in frustrating difficulties in the implementation of disaster assistance programs.

(4) Needs assessment is a time-honored technique, but how to do it promptly, accurately, and effectively to serve as a basis for urgent action constitutes a persistent problem in disaster

management. The strategy of having cash grants available to place an interdisciplinary team of experts immediately in the field worked very well for Catholic Relief Services. Prior experience in the country, prior experience in disaster, and pooled knowledge from multiple disciplinary perspectives resulted in a solid information base that enabled CRS/CATEC to design a field program of emergency assistance and rehabilitation that proved very effective in Napo Province. The model merits replication.

(5) A step-by-step approach of engaging the victims of disaster in the difficult process of rebuilding their own lives and communities was demonstrated repeatedly to be more effective than inviting dependency through continued distribution of aid without acknowledgement or return investment. The trauma of disaster is unsettling at best, and to people with marginal resources and uncertain futures, it can be devastating. A combination of care, technical assistance, and clear guidance through incremental steps worked very well in the community programs instituted in Cayambe through the community's Emergency Committee and the CRS/CATEC program in Napo Province. Conversely, the uninformed distribution of relief supplies by external organizations often had adverse effects in disaster-stricken communities, resulting in negative competition for goods and greedy distortion of personal needs.

Needs

Clear needs for further development in disaster management were also demonstrated in this set of disaster operations. They include:

(1) Improved Communication

Improving communication is the most critical need for increasing effectiveness in disaster management. Organizations cannot function well without knowing the needs, resources, limitations and time sequence for action, both within their own spheres of responsibility and between the multiple organizations engaged in the process. This process can only be accomplished through open, interactive communication among the responsible leaders engaged in disaster response

and recovery activities. Further, the process works best when it has been designed and practiced prior to the disaster event. Facilities, equipment, and training are needed to improve communication especially at the local level of operations, where the burden of responsibility is highest but resources are most limited, and between jurisdictional levels of operation.

(2) Increased Coordination of Action

Increasing coordination between the multiple organizations engaged in disaster operations is critical to improving performance. The functions of communication and coordination are complementary, and both are consistently vulnerable to failure in uncertain, complex disaster environments. A shared knowledge base of information, resources, skills and participants in the disaster management system is critical to enable specific organizations to adjust their performance, respectively, to others engaged in the process of coordinated action toward the common goal of rescue of human life and restoration of property.

(3) Advanced Information Functions

Information functions for the wider set of organizations involved in disaster management need to be developed more fully and more systematically. In this disaster, many organizations conducted separate information searches, but there was difficulty in sharing information and especially in obtaining timely, accurate information from rural disaster sites. Representation of information in a common format and transmission of information to multiple participants in a timely manner also are critical functions in improving the communication and coordination processes central to effective performance in disaster management.

(4) Revised Concept of Disaster Assistance

The allocation of disaster assistance to victims of disaster is especially sensitive in communities with marginal economic standards. The design and distribution of assistance needs to be reconsidered in terms of the opportunities it creates to rebuild lives and homes in stronger, more productive ways. Organizations that incorporate planning for a stronger future with immediate

relief from the destruction of disaster are effective in mobilizing not only individual families but wider participation in community programs to reduce vulnerability to disaster.

(5) Organizational Learning in Disaster Management

Evaluation of performance in disaster operations and constructive feedback to participating organizations is essential in developing the capacity of these organizations to mitigate conditions that may contribute to future disasters. Developing a community-wide orientation toward reduction of risk and knowledge of emergency procedures is a vital step toward fostering responsible civic action in a zone of high risk from earthquakes and other natural hazards such as landslides and floods. This feedback is essential for international organizations as well, for they play a critical role in disaster operations in developing countries. Because organizing effective participation at the international level is necessarily more complex, feedback in a careful, constructive format is especially valuable. Without design, organizations are unlikely to learn from past experience, and may repeat ineffective performance in future disasters.

Recommendations for Further Research

The fundamental problem confronting organizations in disaster operations is to design effective action in the uncertain, complex environment of disaster. Four recommendations for future research appear especially promising in developing organizational capacity to improve performance in this difficult, dynamic environment. Each focuses on information content and exchange as the most productive and least expensive means of improving capacity for organizational learning and interorganizational coordination in disaster conditions. They are:

- (1) The design and development of an interactive information system for decision support in disaster management. Such an information system would utilize an interdisciplinary knowledge base with provision for interactive communica-

tion among multiple users. This research would utilize new developments in information, radio and telecommunications technology to address recurring problems of communication and coordination.

- (2) The design of interorganizational and interjurisdictional simulated disaster operations exercises as a means to explore the limits and capacities of human decision-making processes in disaster environments. Such exercises might utilize an interactive information system to explore the linkage between information technology and organizational learning in complex environments.
- (3) Inquiry into the design and development of networks as appropriate organizational forms for the rapid mobilization, implementation and evaluation of action in disaster management. Such networks might cross disciplinary, organizational and jurisdictional lines and would be designed to facilitate action in this complex environment. The basis for each network would be shared knowledge of particular problems in disaster operations or phases of disaster management. A meta-network might organize this information in a model of disaster management which, in turn, could be incorporated into a computerized, interactive information system.
- (4) Inquiry into economies of resource management that would facilitate interorganizational participation. Resources might be allocated to solve specific problems, such as transportation, and organizations with relevant skills, equipment and capacity to address this problem could draw against the account established for designated participants in that network. A computerized information system would facilitate the monitoring of expenditures for a multiorganizational project.

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NOTES

1. President Leon Febres Cordero stated that "...this is the most serious disaster in the history of Ecuador as a nation." Hoy, Quito, Ecuador, March 10, 1987, p.1.

2. These functions are non-technical terms that describe practical activities undertaken by any manager in confronting a novel set of events that requires organizational action: searching for the best information available to assess the situation before taking action; communicating that information to the relevant persons or organizations involved in, or affected by, the proposed action; and evaluating the effects of the actions taken in order to determine the next appropriate steps. For a fuller discussion of these terms, see Chris Argyris. 1982. Reasoning, Learning and Action. San Francisco: Jossey-Bass Publishers.

3. These assumptions are drawn from previous research in disaster management, problem solving and organizational theory. They rely on the work of many authors, but especially Herbert A. Simon, The Sciences of the Artificial (Cambridge: The MIT Press, 1969, 1981); Allen Newell and Herbert A. Simon, Human Problem Solving (Englewood Cliffs, N.J.: Prentice Hall, Inc., 1972); Russell Dynes, Organized Behavior in Disaster (Columbus, Ohio: Heath-Lexington, 1974); Harold Linstone, ed., Multiple Perspectives for Decision Making: Bridging the Gap between Analysis and Action (New York: Elsevier, 1984); Anthony Debons, as presented by Isabel Cilliers, "Problems in Information Science," Information Age, Vol. 7, No. 3, (July 1985): 150-155; John Holland, Adaptation in Natural and Artificial Systems (Ann Arbor: University of Michigan Press, 1975) and Louise K. Comfort, "The San Salvador Earthquake," in Uriel Rosenthal, Michael T. Charles, and Paul t'Hart, eds., Beyond Crises (Chicago: Charles C. Thomas, forthcoming, 1989).

4. Hoy, Quito, Ecuador. Accounts of ecological, technical, economic, social, political, cultural and international impacts of the earthquakes were reported daily in the two major Quito newspapers, Hoy and El Comercio, during the month of March 1987 and continuing during the succeeding months. The author read both papers daily during the period of her field study, June 14 -July 15, 1987, and sought to obtain back issues of both papers for the month of March 1987. Regrettably, she was unable to obtain a complete set of back issues of El Comercio for this period. Consequently, the newspaper references in this analysis are drawn primarily from Hoy during March, 1987, but refer to both newspapers during June and July 1987. To counter any possible bias from a single source, the author sought to find at least two references for critical points in the analysis.

5. See maps of disaster zones presented in earlier chapters, pp.

6. United Nations Economic Commission for Latin America and the Caribbean - ECLAC, "The Natural Disaster of March 1987 in Ecuador and its Impact on Social and Economic Development," Report #87-4-406, 6 May 1987, p.1.

7. Hoy, Quito, Ecuador, March 9, 1987. Lower figures were also reported in the house-by-house censuses conducted by the municipalities. In central Napo Province, the zone of primary impact from the disaster, the assessment team of CATEC/Catholic Relief Services, also conducted a house-by-house census of need. CATEC (Corporacion de Apoyo a la Tecnologia y a la Comunicacion) joined with Catholic Relief Services in designing and conducting an emergency assistance project in Napo Province. The two organizations are voluntary relief organizations financed by contributions from Catholic parishioners and operating with an international mission of social service. However, there were no complete records of residents living in the area prior to the earthquake, leaving in doubt the actual number of persons killed in the disaster. "Summary of Relief Program," Catholic Relief Services, Quito, Ecuador, June 15, 1987. Interview, Program Director, Catholic Relief Services, Quito, Ecuador, July 12, 1987.

8. General Antonio Moral Moral, National Director of the Civil Defense, cited in Hoy, Quito, Ecuador, March 9, 1987, p.1. See also the United Nations ECLAC Report #87-04-406, op. cit., p. 1.

9. Hoy, Quito, Ecuador, March 10, 1987, p. 3A.

10. Interview, Padre, parish church, Borja, Ecuador, July 8, 1987; interview, President, Municipal Council, Baeza, Ecuador, July 8, 1987.

11. Hoy, Quito, Ecuador. Also, professional interviews with local government officials in Baeza, Borja, and El Chaco, July 9, 1987 and with the Project Director, "Proyecto Emergencia in Napo Province," Catholic Relief Services/CATEC in Quito, July 12, 1987.

12. Hoy, Quito, Ecuador, March 10, 1987, p. 9. Interview, Field Representative, USAID/OFDA, Quito, Ecuador, June 28, 1987.

13. Interview, President of the Provincial Council, Imbabura, Ibarra, July 9, 1987. A census of damage to public buildings, infrastructure and private homes was conducted by the Civil Defense councils of each canton in the province of Imbabura that suffered damage from the earthquakes. These cantonal reports were then forwarded to the Provincial Council of Civil Defense, Imbabura Province. The set of damage assessment reports was reviewed by the provincial government of Imbabura, and in turn, forwarded to the National Council of Civil Defense in Quito. These reports served as the basis for planning the reconstruction projects needed for the disaster zone. Essentially this same procedure was followed in all three zones of the disaster. Damage Assessment Reports, Provincial Government of Imbabura, Ibarra, Ecuador, March 19, 1987.

14. Professional observation, visit to Ibarra, Imbabura Province, Ecuador, July 9, 1987. See also news reports in Hoy, Quito, Ecuador, March 11, 1987, p.9A.
15. Professional observation and interviews, residents of Pedro Moncayo and President of the Municipal Council, Olmedo, June 19, 1987. See also news reports in Hoy, Quito, Ecuador, March 11, 1987.
16. Interview, President of the Municipal Council, Cayambe; July 9, 1987; interview, Secretary of the Municipal Council of Olmedo, July 9, 1987.
17. Interview, Padre, Misione Carmelita, Lago Agrio, Ecuador, June 29, 1987; interview, Director of the CEPE-Texaco Consortium, Quito, Ecuador, July 3, 1987. The CEPE-Texaco Consortium was established between the Government of Ecuador and Texaco Oil Company to manage oil production and shipment from a given location in eastern Napo Province.
18. Interview, Padre, Misione Carmelita, Lago Agrio, June 29, 1987; interview, Field Director for Indian Services, Catholic Relief Services, Quito, Ecuador, July 7, 1987.
19. The term 'between' is used in a statistical sense to connote the type of variance that exists between member organizations of a given set, in contrast to the type of variance that exists 'within' each member organization. In this analysis, the set of organizations includes all organizations that participated in the Ecuadorian disaster operations. Variance 'between' organizations may be explained by distinctive characteristics or attributes of individual organizations. Variance 'within' organizations is assumed to be distributed randomly. The total variance for the set of organizations is the sum of the 'between' or explained variance and the 'within' or random variance. This analysis is seeking to identify the types of characteristics that contribute to variance between organizations that participated in the Ecuadorian disaster operations.
20. Hoy, Quito, Ecuador, March 8, 1987, p.1; March 9, 1987, p.1; March 11, 1987, p.9A. These reports were confirmed in interviews during June - July, 1987 with informed observers from both Ecuador and the United States, who had participated in disaster assistance operations in March 1987. A survey of residents of the disaster zones also confirmed difficulties and delays in the distribution of disaster assistance. It is important to identify where the difficulties exist in the process, without making judgments as to cause, before the process can be redesigned for improved performance.

21. Interview, Coordinator, COEN (National Center of Emergency Operations) Quito, Ecuador, July 7, 1987. See also Secretaria General del Consejo de Seguridad Nacional, Direccion Nacional de Defensa Civil, Ley de Seguridad Nacional, 1987, p.1.
22. Interview, Comandante de Battalon de Selva, Lago Agrio, and Director of Civil Defense, Canton of Lago Agrio, Lago Agrio, Ecuador, June 30, 1987.
23. Interview, Coordinator, National Emergency Operations Center and director, National Council of the Civil Defense Authority, Quito, Ecuador, July 7, 1987.
24. Interview, National Director of Civil Defense, Quito, Ecuador, July 7, 1987.
25. Hoy, Quito, Ecuador, March 7, 1987, p. 6A.
26. Hoy, Quito, Ecuador, March 7, 1987, p.6A.
27. Interview, Director of the national Emergency Committee and National Center for Emergency Operations; interview, national Director of Civil Defense, Quito, Ecuador, July 7, 1987.
28. Hoy, Quito, Ecuador, March 7, 1987, p. 6A.
29. Hoy, Quito, Ecuador, March 11, 1987, p. 1. Interview, United States Ambassador, Quito, Ecuador, July 6, 1987.
30. Interview, Comandadura de Defensa Civil, Province of Pichincha, Quito, Ecuador, June 17, 1987.
31. Pastor, Iglesia del Pacto Evangelica de Ecuador, Fondacion Adelanto Comunitario Ecuatoriana, Quito, Ecuador, July 13, 1987.
32. Hoy, Quito, Ecuador, March 22, 1987, p.1. Interview, professor of sociology, Universidad Catolica, Quito, Ecuador, June 22, 1987.
33. Professional observation of a 'minga' in operation, Canton Cayambe, Ecuador, June 19, 1987.
34. Interview, Director, emergency assistance project in Napo Province, Baeza, Ecuador, July 8, 1987; interview, President, Municipal Council, Baeza, Ecuador, July 8, 1987.
35. Interview, President, Municipal Council, Cayambe, Ecuador, July 2, 1987.
36. This observation was made separately by several informed observers/participants in the disaster response and recovery process. Assurances of professional confidentiality prevent citing

the sources directly. The same observations are documented in news articles published in Hoy, Quito, Ecuador, March 7-31, 1987.

37. Interviews with directors of local and provincial Civil Defense councils and directors of disaster assistance projects, Quito, Olmedo, Cayambe, Baeza, Borja, and Lago Agrio, Ecuador, June 19-July 14, 1987.

38. Interview, Vice-president, Municipal Council and Coordinator of the Municipal Civil Defense Committee, Baeza, Ecuador, July 8, 1987.

39. Interview, Director, Proyecto Emergencia, CATEC/CRS, Quito, Ecuador, July 12, 1987; interview, President, Municipal Council, Baeza, Ecuador, July 8, 1987; interview; Program Director, Peace Corps Ecuador, Quito, Ecuador, July 10, 1987.

40. Hoy, Quito, Ecuador, March 7-31, 1987; interviews, disaster assistance volunteers, Baeza, Ecuador, July 8-9, 1987 and professional observation, Baeza, Borja, El Chaco, and Tres Cruces, July 8-9, 1987.

41. Hoy, Quito, Ecuador, March 7-31, 1987.

42. Hoy, Quito, Ecuador, March 10, 1987, p.9A.

43. These figures were reported by Civil Defense Ecuador in their final report on the disaster.

44. Hoy, Quito, Ecuador, March 7-31, 1987, p. 3A. These figures were documented from several sources, including the Office of the Director of Housing for COEN, Quito, Ecuador, July 13, 1987.

45. Interviews, President of Municipal Council, Cayambe; President, Municipal Council, Olmedo; President, Provincial Council, Imbabura, July 2, 1987.

46. Hoy, Quito, Ecuador, March 11, 1987, p. 1. Interview, President, Municipal Council, Cayambe, July 2, 1987.

47. Interview, Field Representative, USAID/Office of Foreign Disaster Assistance, Quito, Ecuador, June 28, 1987.

48. Interview, President, Municipal Council, Cayambe, July 2, 1987.

49. Interview, Padre, Catholic Church, Cayambe, June 29, 1987. Interview, Madre Superiore, Catholic School, Cayambe, July 2, 1987.

50. Interview, Catholic volunteer worker, Olmedo, Ecuador, June 27, 1987.

51. Interview, President, Municipal Council, Cayambe, July 2, 1987.
52. Interview, Program Director, Catholic Relief Services, Quito, Ecuador, July 12, 1987.
53. Interview, Director, COEN (National Center of Emergency Operations), Quito, Ecuador, July 7, 1987. Hoy, Quito, Ecuador, March 21, 1987, p.9A.
54. Interview, Comandante de Battalon de Selva and Coordinator, Civil Defense Council, Canton de Lago Agrio, Lago Agrio, Ecuador, June 30, 1987. Hoy, Quito, Ecuador, March 8, 1987, p.8A.
55. Interview, Field Director for Indian Services, Catholic Relief Services, Quito, Ecuador, July 7, 1987.
56. Interview, Padre, Mision e Carmelita, Lago Agrio, Ecuador, June 29, 1987.
57. Interview, Field Director, Catholic Relief Services, Quito, Ecuador, July 7, 1987.
58. Hoy, Quito, Ecuador, July 13, 1987. Interviews, informed observers from both Ecuador and the United States, Quito, Ecuador, June 16-July 15, 1987.
59. Interview, Assistant Director for Latin America, Office of Foreign Disaster Assistance, Washington, D.C., September 1, 1988.
60. Hoy, Quito, Ecuador, July 15, 1987. Interview, professor of public administration, Universidad Catolica, Quito, Ecuador, June 22, 1987.

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