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: Western Napo Province

In western 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 rapidly escalate 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, and Agriculture and Livestock; the Ecuadorian Institute of Children and Families; and the Ecuadorian Institute of Agrarian Reform and Colonization; as well as the Ecuadorian Red Cross; Catholic Relief Services; Hoy Cristo Jésus Benedictus (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 western Napo Province were overshadowed by the stunning blow to the national economy from the destruction of the Trans-Ecuadorian 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; and 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 mainte-

nance 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 western 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 versus 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; and the ministries of Agriculture and Livestock, Social Welfare, Health, Environment, and 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 western 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 Pichincha, Imbabura, and Carchi provinces was the loss of housing, exacerbated by the prevalence of poverty. 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 percent 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 inconvenience of repairing damage to their homes, out of the 41,500 persons reporting repairs for the entire disaster.

In sum, over 80 percent 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 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 that 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, Sra. 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 Aérea*, 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 Federación de Organizaciones Indígenas de Napo (FOIN), which has a strong membership base near Puyo; (2) the Confederación de Nacionalidades Indígenas del Ecuador (CONAIE), the national confederation of Indian organizations; and (3) the Federación 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, Misión 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 (including the Corps of Engineers, and the 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 11 bridges needed for a road being built by the Ecuadorian Army Corps of Engineers for the Ministry of Public Works (Ministerio de Obras Públicas, 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 3 years away. The completion of the road would be shortened by at least 2 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 farther 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 farther 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. This decision engendered substantial political controversy in the Ecuadorian National Congress.[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 policymakers at OFDA to reconsider their decision on the location of the bridges in terms of where they would contribute the most to reopening 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 versus 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 took 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 raised questions of public trust, which inhibited the overall goal of disaster assistance. Within the complex, uncertain environment of disaster operations, the dilemma illustrates the importance of information search, information