
Interactive Papers with International Focus

International Wildfire Emergencies: Management in the 21st Century¹

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Abstract: The U.S. Government, through the U.S. Agency for International Development's Office of U.S. Foreign Disaster Assistance (OFDA), responds to a wide variety of disasters throughout the world every year. These disasters range from "slow-moving" events like prolonged drought or plagues of grasshoppers and locusts to "fast-moving" threats to human populations resulting from fires, hurricanes, earthquakes and volcanoes. Although disaster types vary considerably, there is a recurring theme of disaster assistance elements that constitutes a meaningful and effective response. Critically evaluating the "lessons learned" from recent responses to world-wide natural disasters will prepare the disaster management specialist to develop an improved international assistance program for the 21st century. Details of natural disasters, the response process and "lessons learned" are given and future developments that will strengthen disaster assistance are discussed. A case example of the 1987 wildfires in southern Argentina illustrates disaster management requirements and needs.

The U.S. Congress made its first foreign aid appropriation in 1812, when \$50,000 worth of food and other supplies were delivered to victims of a massive earthquake in Venezuela (U.S. Agency for Int. Dev. 1984). But it wasn't until 1964 that the need for one central office to coordinate all U.S. Government (USG) assistance was identified. In that year the U.S. Agency for International Development (USAID) named its first Disaster Relief Coordinator. It is the Office of U.S. Foreign Disaster Assistance (OFDA) in USAID that coordinates the USG response to foreign disasters. As mandated by Congress, OFDA provides assistance not only for international disaster relief and rehabilitation, but also for disaster preparedness, early warning and mitigation. The Director of OFDA reports directly to the USAID Administrator, who is the President's special coordinator for international disaster assistance. OFDA's three geographic divisions--Africa and Europe, Asia and the Pacific, and Latin America and the Caribbean--provide country-specific expertise to respond to relief and preparedness needs in each region. OFDA also has an Operations Support Division which is responsible for coordinating relief activities during a major disaster. This Division is staffed by an Assistant Director, Fiscal Officer, Logistics Officer, Medical Officer, and Administrative Officer.

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OFDA responds to requests for emergency assistance in an average of 37 disasters a year and monitors another 40 situations which could become disasters (USAID 1983). When disaster strikes, OFDA mobilizes USG resources and coordinates the USG response with that of voluntary agencies, international organizations, and other donors. To rapidly deliver emergency relief to the disaster site, OFDA maintains

stockpiles of disaster supplies at five regional locations worldwide. The beneficiaries of this relief are primarily those in developing countries who are least able to survive without outside assistance.

Although disaster types vary from slow-moving events like prolonged drought to fast-moving threats like fires and hurricanes, there is a recurring theme of disaster assistance elements that constitutes a meaningful and effective response. A critical evaluation of the "lessons learned" from recent responses to world-wide natural disasters will prepare the disaster management specialist to develop an improved international assistance program for the 21st century. The "lessons learned" from past responses will be reviewed and recommendations will be made to strengthen disaster assistance in the future.

NATURAL DISASTERS AND THE RESPONSE PROCESS

Fiscal year 1985 was one of the worst years in OFDA's history in terms of the number of people killed and affected by disasters (USAID 1985). Drought and famine ravaged two-thirds of the African continent, causing the deaths of hundreds of thousands of people and threatening the lives of millions more. The world's worst industrial accident occurred in the town of Bhopal, India, when toxic gas leaked from a pesticide manufacturing plant and killed an estimated 2500 people. In Mexico, two high-magnitude earthquakes caused billions of dollars worth of property damage and claimed the lives of thousands. Table 1 summarizes the number of people killed by declared disasters for the 6 year period from 1980 through 1985. These data reveal that drought-induced famine, earthquakes, and severe storms have posed the greatest threat to human populations in recent times.

Includes data on all non-U.S. disasters to which the USG provided assistance. Source: OFDA 1985.

Other types of natural disasters have included volcanic eruptions, floods, and wildfires. OFDA also has provided assistance when people's lives were threatened by accidental or person-caused catastrophes, such as toxic waste spills, fires, explosions, air crashes, or civil strife. One of the more insidious recent natural disasters was the sudden, catastrophic release of gas from Lake Nyos on August 21, 1986, that caused the deaths of about 1700 people and 3000 cattle in the northwest area of Cameroon, West Africa (Kling and others 1987). Evidence collected at the disaster site indicated that the bulk of the gas released was carbon dioxide stored in the lake's hypolimnion and that the victims exposed to the gas cloud died of carbon dioxide asphyxiation.

Although OFDA has provided assistance to wildfire disasters in Argentina, Australia, Costa Rica, Dominican Republic, Ecuador, and Italy since 1983, it is clear from past data that other types of disasters pose a more prevalent threat to human populations. A May 1987 wildfire in northeastern China, however, has added a new perspective regarding the serious impact forest fires may have on human lives, property, and natural resources. This fire reportedly has burned more than 1 million acres, killed about 200 people, damaged 12,000 houses, and forced over 60,000 people to evacuate their homes--obviously a disaster of major proportions! Fires at the wildland-urban interface have been striking the international homefront in increasing numbers recently. For example, the Ash Wednesday Fire disaster in 1983, burned more than 840,000 acres of urban, forested, and pastoral lands in Victoria and South Australia, killing 77 people, injuring 3500, and destroying 2528 homes (Tokle and

Table 1--Number of people killed by declared disasters (FY 1980-85)

Disaster Type	FY80	FY81	FY82	FY83	FY84	FY85
Accidents	113	38	60	46	0	1,889
Droughts	N/A	N/A	N/A	N/A	N/A	403,000
Earthquakes	469	7,660	30	1,758	1,621	8,962
Epidemics	485	853	655	N/A	N/A	2,284
Floods	51	1,490	2,477	1,820	256	9
Severe Storms	338	113	209	542	1,489	10,929
Volcanic Eruptions	0	0	130	N/A	N/A	0
Total	1,456	10,154	3,551	4,166	3,376	427,073

Marker 1987). A new international focus on wildfire prevention and preparedness programs clearly will be a high priority to reduce the threat of fires to people, property, natural resources, and agriculture.

Once OFDA has been notified that a formal disaster has been declared by the Ambassador, it will immediately provide funding and guidance to the U.S. Ambassador or the U.S. Mission. Following a disaster declaration, OFDA approval is required for any assistance or expenditure over \$25,000. Based on needs identified by OFDA-funded assessment teams and other available information. OFDA furnishes relief in the form of technical specialists, commodities, services, or transportation. OFDA can usually deliver relief supplies in 24 to 72 hours after the disaster strikes from its five stockpiles located around the world. Commodities may either be granted or loaned, and the host government is urged to recover and maintain reusable items, such as tents.

International Disaster Assistance funds also may be used for rehabilitation during a 90 day period, which begins as soon as plans are developed and funds become available. The rehabilitation period does not extend beyond 90-days unless approved by the director of OFDA. Rehabilitation provides material and technical assistance towards restoration of essential community facilities and services, including shelter, water supply, sanitation, agriculture, and health. Short term rehabilitation efforts are not intended to supplement long-term development or technical assistance projects.

DISASTER ASSISTANCE SUPPORT PROGRAM

Since the early 1980's there have been increasing cooperative efforts between OFDA and the Forest Service, U.S. Department of Agriculture (USDA). The cooperation has included wildfire assistance in the Dominican Republic, on the Galapagos Islands and in Costa Rica. Emergency personnel were dispatched to the earthquake disaster site in Mexico City in 1985. The Forest Service also has administered three OFDA-funded Spanish-speaking fire suppression course for Latin America since 1983. This cooperation between OFDA and the Forest Service was formalized in August 1985, when a Resources Support Services Agreement between USAID and USDA's Office of International Cooperation and Development established a

Disaster Assistance Support Program (DASP) within International Forestry of the Forest Service. DASP is funded by OFDA and provides that office with disaster prevention, preparedness, technical assistance, and emergency relief support. Program objectives include:

1. Provides support in prevention, preparedness, and operational planning for natural resources-related disasters.
2. Strengthens disaster planning and training for OFDA, U.S. Embassies/USAID missions and host countries.
3. Provides OFDA with the capability to identify and access natural disaster related technical experts and disaster management specialists.
4. Assists in the planning and coordination of workshops, conferences, studies, and publications that promote effective disaster prevention, disaster preparedness, and disaster management.
5. Augments the disaster relief efforts of OFDA, U.S. Embassies/USAID Missions, and host countries with technical experts and disaster management specialists on a short-term basis.

DASP consists of a Program Manager, Disaster Management Specialist, and a Program Secretary based in Washington, D.C. The DASP staff develops an annual plan of work to achieve OFDA's objectives in prevention, preparedness, technical assistance, training and disaster relief. Project activities are accomplished by DASP staff and other specialists who are recruited for short term assignments in the United States or overseas. In addition to Forest Service personnel, recent assignments have included representatives from the Bureau of Land Management, National Park Service and National Weather Service. Other agencies, consultants, private individuals and companies, and university personnel with disaster management experience also may be recruited for assignments.

As the objectives indicate, DASP may provide individuals to OFDA for technical assistance or emergency assignments. Because time generally is not a critical factor in notifying people for technical assistance assignments, these are filled through normal administrative channels. An operating plan, however, has been prepared to define the emergency response process whereby decisions are made and individuals are mobilized quickly to assist OFDA on international disasters. Roles and responsibilities must be

clearly understood so that the right people are informed in a timely, manner, insuring an effective, efficient response (fig. 1).

After a formal request for emergency assistance has been received by DASP from OFDA, DASP prepares a situation assessment report that includes a summary of the personnel, equipment, and supplies being requested. This assessment is transmitted to Fire and Aviation Management, who contacts the Deputy Chief for State and Private Forestry. Once the Deputy Chief determines that the Forest Service will respond to the emergency request, OFDA and the Boise Interagency Fire Center (BIFC) communicate directly on resource orders. Mobilization of personnel, equipment, and supplies is accomplished through BIFC using established incident mobilization procedures. Identifying personnel to respond to an international emergency is accomplished from a disaster management skill file (roster), fire qualification red card system, pre-identified teams, or a selection based on requested skills.

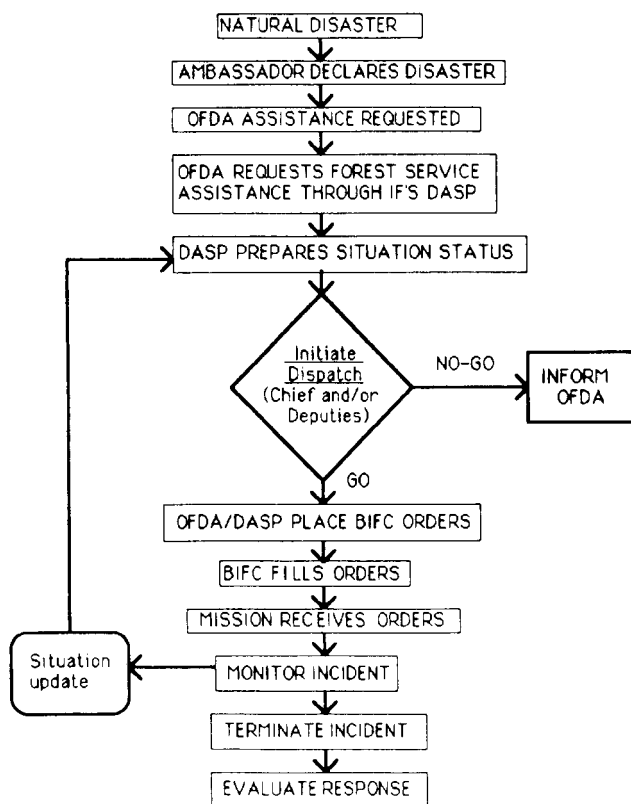


Figure 1--Stages of Forest Service assistance in an international disaster.

1987 ARGENTINA WILDFIRES

Especially dry conditions in southern Argentina in early 1987 established a severe wildfire situation along the foothills of the Andes between 39° and 42° south latitude. The general weather pattern leading up to the Lanin and Lago Puelo Fires was characterized by an absence of precipitation, temperatures that ranged from 85-95° F, and 30-50 mph maximum winds from the south, southwest, and west (Perkins and Benavidez 1987). The priority fire was the one at Lago Puelo, since it threatened isolated houses, a tract of commercial forest, and the small villages of Lago Puelo and El Hoyo.

The Lago Puelo Fire started on January 11, 1987, from an escaped campfire. The fire was within the jurisdiction of the National Forest Service and had burned approximately 10,000 acres by January 26. The Lanin Fire, under the jurisdiction of the National Park Service, reportedly was started by poachers on January 2, 1987, and immediately became a large, difficult fire. By January 27 this fire also was over 10,000 acres in size.

Due to the serious situation, the Government of Argentina requested U.S. assistance through the American Embassy in Buenos Aires on January 21, 1987. Upon receiving this request from the Embassy, OFDA asked DASP to provide a two-person wildfire team to advise Argentina officials and to provide an assessment on the fire situation to OFDA. The two individuals sent to Argentina were Jay Perkins, Klamath National Forest, California, and Gary Benavidez, Aviation and Fire Management, Southwestern Region of the Forest Service. Both individuals have been instructors at the International Fire Suppression Courses in Latin America since 1983. A briefing at OFDA in Washington, D.C., on January 23 prior to the team's departure included the following assessment objectives:

1. Size up situation and provide close technical consultation, advice, and assistance to agencies and organizations in Argentina to immediately help them in doing their job more effectively.
2. Prepare a situation status report on fire activity.
3. Evaluate adequacy of fire communication network.

4. Assess effectiveness of current air operations and determine future air operations needs.
5. Evaluate fireline and public safety situations.
6. Recommend appropriate types of technical assistance or equipment to U.S. Embassy and OFDA.
7. Evaluate the applied results of previous Latin American fire training courses as they related to suppression actions in Argentina at the time (several course graduates were in overhead positions on the wildfires).

The assessment by Perkins and Benavidez (1987) concluded that although a local "Fire Management Presuppression Plan" was in place when the fires started, it did not adequately address required actions during a multiple fire situation. The lack of a regional or national mobilization plan precluded a rapid response to multiple fire starts. There also was a serious absence of trained people, with the deficiency most significant at the crew level. Communication equipment was minimal, fire equipment failures occurred, and the heavy hand tools were intended for agriculture purposes and not firefighting.

The U.S. Ambassador in Buenos Aires formally declared the fire situation a disaster on January 30 and requested assistance in the form of fire equipment from OFDA. Fire equipment ordered through the Boise Interagency Fire Center included handtools, backpack pumps, headlamps, Mark III pumps, and hose. The equipment order was shipped from Los Angeles to Buenos Aires by the Argentina commercial airline, arriving on February 2. Burning conditions remained very active throughout February, with new fires breaking out in the vicinity of the town of Bariloche. The assessment team's specific long term recommendations will be covered under "lessons learned."

LESSONS LEARNED

OFDA responds to an extremely diverse array of disasters every year. Although disaster types vary considerably, there is a recurring theme of disaster assistance elements that constitutes a meaningful and effective response. Carefully evaluating the "lessons

learned" from recent responses to world-wide disasters will better prepare the disaster management specialist to develop an improved international assistance program for the next century. Whether responding to an earthquake, severe storm, or forest fire, many common elements must be implemented to provide a timely and effective disaster relief effort. Lessons learned and recommendations from the October 10, 1986, earthquake response in El Salvador and two recent wildfire assessments in Argentina provide a basis for changes in international disaster assistance programs towards the year 2000 and beyond.

Two strong earthquakes struck the capital city of San Salvador in El Salvador on October 10, 1986. The first tremor registered 5.4 on the Richter Scale at 11:49 a.m. local time and was centered about 10 miles northwest of the capital. The second tremor registered 4.5 at 12:04 p.m. in the same vicinity. The earthquakes were felt in the neighboring countries of Honduras and Guatemala.

Major damage was centered primarily in a 20-square block area in downtown San Salvador. Major structural damage also was reported southeast of the capital, including the residential neighborhoods of San Jacinto, San Marcos, Modelo. The quake killed approximately 1000 people, injured an estimated 10,000 people, and left about 150,000 people homeless. Government buildings, the U.S. Embassy, hospitals, schools, and houses suffered severe and extensive damage.

On October 10, 1986, OFDA convened a 24-hour El Salvador Earthquake Working Group to coordinate assistance for disaster victims in El Salvador. The State Department established a Task Force to respond to the needs of U.S. Embassy and USAID personnel in El Salvador.

OFDA dispatched the following personnel to assist with disaster assessment and search and rescue efforts:

1. Five member assessment team from Costa Rica.
2. Four dog teams plus coordinator from the east coast.
3. Post-incident stress expert from University of Maryland.
4. Five member rescue team from Metro Dade Fire Department. Florida.

On November 18, 1986, a "San Salvador Lessons Learned" meeting was held at the Office of U.S. Foreign Disaster Assistance, Washington, D.C., to:

1. Identify opportunities and issues related to the earthquake that occurred in El Salvador on October 10, 1986.
2. Recommend actions that will strengthen future search and rescue relief responses.

Participants at the meeting included on-site disaster assistance personnel and representatives of OFDA, Federal Emergency Management Agency, U.S. Department of Agriculture, and the National Association of Search and Rescue.

Participants identified 28 opportunities and issues that were grouped under four major headings. The major headings included mobilization, emergency management, incident support and training. Many of the same issues that were identified following the earthquake in Mexico City also became problems in San Salvador. The key opportunities and issues identified at the San Salvador meetings can be grouped in this manner:

Mobilization

- Provide advance briefings
- Dispatch sufficient personnel
- Pre-position support equipment for relief personnel
- Provide for the timely dispatch of personnel

Emergency Management

- Implement an emergency management system
- Provide a communication team
- Establish an effective demobilization process
- Help facilitate the relief efforts of international donors
- Fulfill public relations role at disaster site

Incident Support

- Develop a uniform for relief personnel
- Dispatch communication equipment (satellite system and radios)
- Provide adequate rescue equipment
- Inform Embassies/Missions of emergency roles and responsibilities

Training

- Identify and train people to implement an emergency management system

- Train Embassy/Mission personnel to make effective assessments of disasters
- Orient search dog handlers on OFDA policies and procedures

Most of these issues are self-explanatory, but a few require additional clarification. It is important that emergency relief personnel are well briefed on their assignments prior to undertaking disaster assistance actions. People will be better prepared to provide disaster assistance, if they are well informed and understand specific objectives of their response. Ideally, personnel should be briefed by OFDA prior to leaving the United States and again upon arriving in the host country.

The five issues listed under emergency management included implementation of an emergency management system, providing a communication team, establishing a demobilization process, facilitating relief efforts and fulfilling the public relations role at the disaster site. Carrying out the first issue, implementing an emergency management system, is the most direct way to assure that the other four issues also are resolved. When an emergency management system like the Incident Command System is activated, the functions of communications, demobilization, coordination, and public relations automatically are accommodated as integral parts of the system. So in addition to sending search and rescue teams and heavy rescue teams, it is also important to dispatch an emergency management team that has the ability to organize all of the planning, logistic, and operational requirements related to the disaster. This type of emergency management organization allows the search and rescue teams to concentrate primarily on finding survivors.

Wildfire recommendations for Argentina made by Roby and Partido (1985) and Perkins and Benavidez (1987) can also be grouped under the four major categories established at the San Salvador earthquake meeting:

Mobilization

- 0 Develop national and regional mobilization plans

Emergency Management

- 0 Improve overall effectiveness of emergency management organizations

Incident Support

- 0 Do not invest heavily in an air tanker program until there is a significant increase in ground attack capability and better communications

- 0 Investigate opportunities to implement a helicopter program to transport people, equipment, and water
- 0 Continue to strengthen roles and responsibilities of National Coordination Committee
 - Acquire and deploy firefighting equipment at strategic locations
 - Develop a fire weather forecasting capability
 - Develop a basic fire danger rating system
 - Implement a fire prevention program through schools and the media
 - Consider using a single engine aircraft for fire detection patrols during periods of very high and extreme fire danger

Training

- Produce training programs for basic firefighters and crew bosses
- Develop a natural fire management seminar for decision makers
- Furnish opportunities for specialized on-the-job fire training for selected individuals in the United States
- Develop a prescribed fire training course for hazard reduction

DISASTER MANAGEMENT IN THE 21ST CENTURY

Elements of an appropriate disaster response include early warning of a pending problem, identifying the right respondents, mobilizing rapidly, making thorough briefings, providing accurate and complete assessments, implementing an effective emergency management system, establishing clear lines of communication for voice and data, providing humanitarian assistance, supporting disaster personnel, monitoring relief efforts, demobilizing personnel in an orderly manner, and evaluating results. We know what needs to be done, but what should the disaster response of the 21st century look like? What is our vision of a meaningful and effective disaster assistance program in terms of mobilization, emergency management, incident support, and training? As we highlight the future of these four areas, we recognize that prevention and preparedness measures will assume increasing prominence. Simply making a reflex response to a disaster will no longer be adequate.

Mobilization

Pre-identified specialty teams with the necessary training, equipment, language skills, immunizations, and passports for immediate mobilization to the disaster site have become common in the next century. Emergency management, communications, water purification, and fire management assessment teams are fully prepared for a dispatch within 24 hours or less. These teams are culturally sensitive to local conditions, allowing them to work effectively with host country counterparts.

In addition to these pre-identified teams, a computer based skills file, or roster, is used to quickly identify the right individuals with the technical expertise, language capability, and experience to fulfill a variety of technical assistance or disaster management requests. The roster, with thousands of individual entries, is comprised of applicants from federal, state, and local agencies, consultants, private individuals, and universities who possess in-depth international assistance capabilities.

By the year 2000 disaster management specialists are provided more detailed briefings prior to dispatch through such technologies as telecommunications, satellite weather data, and remote sensing imagery. In this manner specialists are prepared in advance to better understand conditions that prevail at the disaster site, contributing to more thorough and comprehensive assessments. The technology is available today to transfer a large variety of information to the disaster management specialist, even for remote parts of the world. For example, the Joint Agricultural Weather Facility (JAWF), a cooperative effort between the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of Agriculture, focuses on weather anomalies and their effects on the crop yield potential in major international crop areas (Moths and Heddinghaus 1986). Since JAWF can monitor and evaluate near-real-time operational weather data from the global station network, as well as satellite-derived meteorological data, the meteorological assessments can be just as available for fire purposes. Weather observations and analyses were provided by JAWF for forest fires in Argentina, China and Guatemala in early 1987. Others are investigating opportunities today to relay video images of natural disasters to experts at other

locations for early evaluations. What remains to be done is the meaningful integration of all remote sensing capabilities into a comprehensive and coordinated system.

Emergency Management

In addition to dispatching search and rescue teams to the disaster site, it also has become a standard operating procedure in the 21st century to send an all risk emergency management team to organize the planning, logistic, and operational requirements related to the disaster. Besides allowing search and rescue teams to concentrate primarily on finding survivors, staffing an emergency management organization helps accomplish such key functions as communications, planning strategy and tactics of the response, facilitating other assistance, public relations, and demobilization. A leadership role may have to be assumed initially to demonstrate by example to the international community the important advantages of establishing an emergency management system at the disaster site comprised of trained and experienced emergency management specialists. Ideally the emergency management organization is staffed by specialists representing both the host country and international donors.

Incident Support

OFDA presently receives early warnings from several agencies regarding potentially serious natural threats to human populations around the world. NOAA monitors drought conditions that can contribute to food shortages, hunger, and famine. An earthquake monitoring network is tracked by the U.S. Geological Survey. Severe storm monitoring is conducted by the U.S. Navy, National Aeronautical and Space Administration, and NOAA. Provisions also have been made for tsunami warning and volcano monitoring.

An early warning system for international wildfires has not been as readily available. For example, a series of large wildfires totaling almost 11 million acres occurred in Borneo and Kalimantan in 1982 and 1983. These major fires were not "discovered" by the rest of the world until months later. After the turn of the next century a remotely sensed international fire danger rating system provides an index to potential burning conditions anywhere in the world. This information coupled with real-time imagery of emerging fires furnishes the disaster

management specialist with new insights about pending problem areas. New advances are realized in fire prevention programs as well, since countries are better able to coordinate prevention efforts and messages with the new system for measuring fire danger potential.

Direct support to the disaster management specialist at the disaster site includes the latest advances in voice, data, and video communications. Portable satellite communication and telecommunication systems commonly are used for assessment, decisionmaking, information, and relief ordering purposes. The two-way electronic transfer of data, pictures, and hard copies provides a level of rapid and accurate information not previously available. The specialist also is the recipient of individualized support equipment that makes the relief assignment safer, more efficient, and more productive.

Training

OFDA has supported and funded an international fire suppression course for Latin America since 1983. The course, taught entirely in Spanish by Latin American, Spanish, and U.S. instructors, was designed to teach basic fire suppression skills and reduce the threat of wildfires to people, property, and natural resources. Secondary benefits have included a new spirit of self reliance as countries later have sponsored their own courses; and new expressions of international cooperation have occurred within the region on wildfires. For example, Chile sent 58 trained and equipped firefighters to help neighboring Argentina during that country's wildfire emergency in February 1987. That type of response, the first of its kind in the history of the two countries, was facilitated by the friendship and cooperation that grew out of the international fire courses. OFDA now is supporting a similar "train the trainers" bushfire suppression course in Ghana in West Africa that is scheduled for November 1987. This pilot program hopefully will serve as a precedent setting mechanism for fire training on the regional level in Africa as well. There also have been several successful examples where fire service personnel from other countries have been integrated within on-the-job training assignments with U.S. crews. This is a means of providing valuable and practical follow-up to the classroom experience.

The design, development, and implementation of an emergency management course for participants worldwide has similar positive implications for the future of disaster relief efforts. The course will use emergency management principles, case examples, and simulations to improve the coordination and management of disaster relief efforts. This training opportunity will be shared among U.S. participants, host country counterparts, and other international donors. Such training needs to be designed with sufficient cultural sensitivity so that training results may be readily assimilated and applied.

The 21st century also will see increasing opportunities for prescribed fire training that prepares people to minimize future disasters by skillfully using fire to reduce wildland fuel hazards in priority areas. Such training can help improve the in-country understanding of the relationship of fire management to ecological and environmental principles, as well as to fire protection and economic issues. An expanded effort should be made to translate more publications, training materials, and fire safety brochures to augment all training programs.

The training needs of U.S. personnel should be identified to improve international response capabilities and language abilities.

CONCLUSIONS

The data base of disaster statistics (OFDA 1985) makes it painfully obvious that no society in the world is exempt from the threat of person caused or natural disasters. Prevention, preparedness, disaster relief, and rehabilitation measures must be integral parts of a disaster management program aimed at minimizing the effects of disasters and reducing human suffering. In assessing the lessons learned from recent disasters, we have stratified recommendations in terms of mobilization, emergency management, incident support, and training requirements. The future of these four areas was highlighted to help prepare the disaster management specialist to develop an improved international assistance program for the 21st century.

Implementing the changes embodied in the lessons learned will strengthen OFDA's and host countries' capabilities in mobilization.

emergency management. incident support, and training. But the fact remains that disasters know no timetable and one could occur tomorrow. It is important to translate the lessons learned and recommendations into action plans that implement feasible alternatives in a timely manner. We know the types of improvements needed today--the year 2000 could be too late for many people.

REFERENCES

- Kling, George W.; Clark, Michael A.; Compton, Harry R.; and others. 1987. The 1986 Lake Nyos Gas Disaster in Cameroon, West Africa. *Science* 236: 169-175.
- Motha, Raymond P.; Heddinghaus, Thomas R. 1986. The Joint Agricultural Weather Facility's Operational Assessment Program. *Bulletin of the American Meteorological Society* 67(9): 1114-1122.
- Office of U.S. Foreign Disaster Assistance. 1985. *Disaster History: Significant Data on Major Disasters Worldwide 1900-1985*. Washington, DC: Office of U.S. Foreign Disaster Assistance.
- Perkins, James H.; Benavidez, Gary V. 1987. Argentina. January 22-February 4, 1987, Lago Puelo and Lanin Fire Assessment. Washington DC: U.S. Department of Agriculture, Forest Service; 32 p.
- Roby, George; Partido, Bob. 1985. Assessment of the Wildfire Situation in Argentina. Washington DC: U.S. Department of Agriculture, Forest Service; 34 p.
- Tokle, Gary O.; Marker, John. 1987. *Wildfire Strikes Home!* Laughlin, Jerry; Page, Cynthia, eds. National Wildland/Urban Fire Protection Conference, Boston, MA. U.S. Department of Agriculture, Forest Service; National Fire Protection Association: U.S. Fire Administration; 89 p.
- U.S. Agency for International Development. Office of U.S. Foreign Disaster Assistance. 1983. Annual report FY 1983. Washington, DC. 132 p.
- U.S. Agency for International Development, Office of U.S. Foreign Disaster Assistance. 1984. Annual report FY 1984. Washington, DC. 95 p.
- U.S. Agency for International Development. Office of U.S. Foreign Disaster Assistance. 1985. Annual report FY 1985. Washington, DC. 141 p.