RISK AND DISASTER: ARGUMENTS FOR A COMMUNITY-BASED PLANNING APPROACH

David M. Simpson

Abstract

Using recent natural disasters in the San Francisco Bay Area as illustrative examples, this paper examines the general nature of disaster planning and traditional approaches that emphasize response and recovery aspects. For strategies focused on preparation, this process is for the most part centralized, located within structured government or organizational response networks, and neglects the individual and neighborhood levels.

The author argues that planners must go beyond a focus on the traditional land-use mitigation strategies in pre-disaster planning stages, and give equal attention to the value of a bottom-up planning process. A model for this type of planning, using community and neighborhood-level groups as the primary vehicle for disaster preparedness activity, is briefly described. Examples of this process emerging in the Bay Area are also identified. Finally, given the scant attention to community-based models of disaster preparedness, an agenda for further research is proposed.

Introduction: Disaster in the San Francisco Bay Area

Within a span of two short years, the San Francisco Bay Area has experienced two significant natural disasters. On October 17, 1989, as the nation was tuned to a World Series game between the Oakland A's and the San Francisco Giants, the area was rocked by a magnitude 7.1 earthquake. Almost two years later to the day, on Sunday, October 20, 1991, the cities of Oakland and Berkeley experienced one of the worst urban-wildland fires in U.S. history (now commonly referred to as the East Bay Firestorm). The Firestorm also received its first television coverage from a sports event, as ashes from the fire eerily fell onto the football field across the bay in Candlestick park during a San Francisco Forty-Niners game.

Perhaps the most serious realization these two events produce is not the recognition of the loss of property or lives, but rather that these two events will happen again – and again. The San Francisco Bay Area is located in an active fault region, and conditions still exist in many parts of the Bay Area that invite a repeat of a similar firestorm. The tremendous forces of nature are oblivious to human settlements, and thus there are certain unavoidable consequences associated with the urbanization of high-risk disaster-prone areas.

Following a disaster, the historical trend is to rebuild – both quickly, and, for the most part, in a similar manner and location (Rubin 1985). There are a variety of possible explanations for this phenomenon – some psychological, political, social, and cultural. Perhaps some of the strongest are the political and social pressures that drive rebuilding efforts, reflecting a strong desire to

return to normalcy. There are, without question, arguments to be made that the safest approach, in terms of protecting lives and property, is not to build in these areas. Barring this politically untenable no-build option, however, the task remains as how to best cope with recurring disasters. Planners, perhaps to a greater degree than other professions, are more appropriate agents to prepare and plan for the destructive power of natural disasters. The tools and processes of land-use planning, emergency preparedness planning, and disaster-response planning can all play an important role in the reduction of life-threatening hazards.

The following essay argues that what is needed and missing is a bottom-up, community-based approach to disaster preparedness. Such an approach is in contrast to the traditional planning approach to disasters found in the literature, which tends to focus on structural and regulatory processes as the primary means of mitigating natural hazards. The traditional focus is, for the most part, top-down and hierarchical, and neglects the positive role that community-based planning and preparation can play in overall disaster planning. With this perspective in mind, the essay will explore planning issues associated with natural disasters, using the recent earthquake and fire in the Bay Area as examples. The planning "gap" between the event and the first available public response will be examined, and examples of recently formed community organizations in the San Francisco Bay Area are offered as possible models for other communities. Finally, a research agenda is proposed to address these issues.

The Price of Disaster

The cost of catastrophic natural disasters can be staggering, both in terms of lives lost and property damage. And although it might be unnecessary to state the costs associated with disasters as an argument for better planning, the sheer magnitude of disasters experienced in the Bay Area are worth examining. The East Bay Firestorm and the Loma Prieta Earthquake are representative examples of the type of large-scale natural disasters that continue to pose a significant risk to residents in the area. The most recent disaster, the Firestorm, is described first followed by a brief description of the Loma Prieta Earthquake. A map of the region, including earthquake faults, is shown in Figure 1.

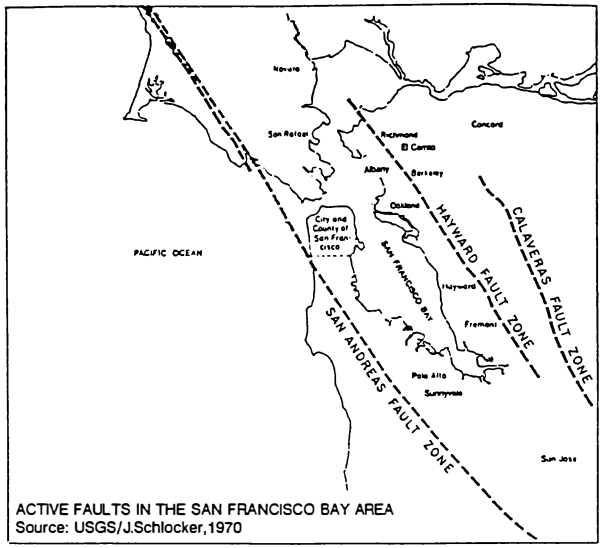
The East Bay Firestorm

In the case of the East Bay Firestorm, an ember from a thought-to-be extinguished brush fire suddenly ignited on a Sunday morning. Aided by hot, gusting "Diablo Winds,"[1] the fire exploded into an inferno that reached up to 2,000 degrees Fahrenheit, incinerating almost everything in its path. Figure 2 is indicative of the total devastation of structures in the burn area.

The intense heat melted cars, and in some cases melted gold kept in "fireproof"[2] home safes. The fire burned for three days, destroying three square miles of Oakland and Berkeley neighborhoods. Twenty-five people lost their lives, many while fleeing the blaze. Over 3,000 homes were destroyed, and the damage has been estimated at roughly 1.7 billion dollars.[3] The area received a federal disaster declaration from President Bush on Monday, October 21, 1991, before the last flames were extinguished.

Figure 1

Map of Bay Area



ACTIVE FAULTS IN THE SAN FRANCISCO BAY AREA
Source: USGS/J.Schlocker,1970

In the months following this disaster there were many instances of finger-pointing and attempts to place blame. While there were numerous response problems and arguably legitimate mistakes made by public agencies, the fact remains that this type of fire is becoming more common as we begin to urbanize into wildland areas (Lopez 1991). Called by some experts "the fire of the future," the fire risk is compounded in areas where the development expands into rugged hill terrain, where roads are narrow and winding, and where many houses have wood shingle roofs.

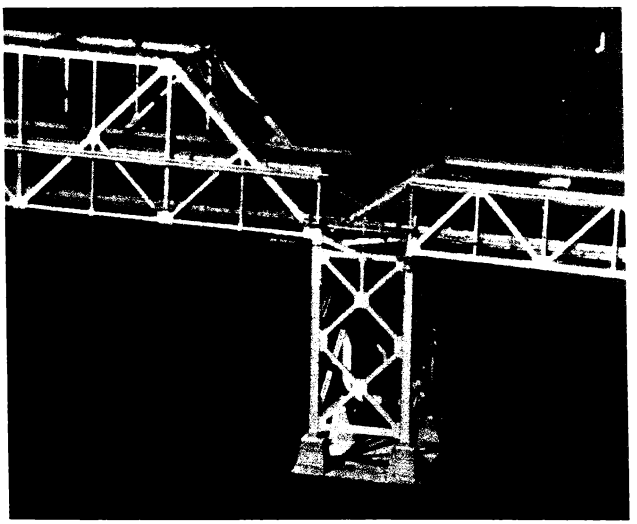
Historical records of the region demonstrate that this type of fire is not an uncommon occurrence. In the area of the East Bay Hills there have been 14 fires since the devastating Berkeley fire of 1923.[4] As recently as 1970, a fire in the Oakland hills destroyed 37 homes. As a result of that incident, a Blue Ribbon Commission issued a series of recommendations to deal with the fire hazards, most of which were either ignored or implemented in a watered-down form (Staats and Cutler 1991: 51). The fire risk is still present in surrounding hill communities, where there is over 60 years of fuel accumulation in some areas. Continuing drought and the presence of uncleared brush and "duff," the accumulation of dead surface vegetation, mean that the area remains vulnerable to the risk of a similar fire in the future.

Figure 2

Fire Destroyed All but Foundations in Burn Area
(Matt Kondolf photo, 1991)

Figure 3

Collapsed Section of Bay Bridge
(BAREPP Photo, 1989)



The Loma Prieta Earthquake

Immediately following the Loma Prieta Earthquake on October 17, 1991, the media showed the world graphic images of destruction. A section of the Bay Bridge had collapsed; a large part of the Marina District in San Francisco was in flames; and the upper deck of the Cypress Freeway in Oakland had collapsed onto traffic below (see Figure 3, previous page, and Figures 4 and 5).

In some ways these images may have exaggerated the initial perception of the severity of the earthquake to those outside of the area. Not all areas in the region experienced the same extent of damage. This is not to say, however, that the earthquake did not exact a toll on the Bay Area. After approximately 15 seconds of seismic activity, 62 people lost their lives and an additional 3,757 were injured. More than 12,000 became instantly homeless. Private property damage was estimated at $3.3 billion, and damage to public facilities was estimated at over $2.3 billion. Over 1,000 homes and apartments were destroyed, and an additional 23,000 were damaged (BAREPP 1990: 5).

As with the East Bay Firestorm, perhaps the most disturbing aspect of the Loma Prieta earthquake is that, as destructive as it was, it was not "the big one" that is still anticipated in the East Bay area. The damage caused by this earthquake came from an epicenter located 65 miles southeast of San Francisco, in the Santa Cruz Mountains. An earthquake with an epicenter closer to areas of higher urban density is highly probable in the near future of the San Francisco Bay Area. The Hayward Fault (see Figure 1) runs underneath the heavily populated cities in the East Bay, from south of Hayward north through the cities of Oakland, Berkeley, and Richmond, and has been predicted as the faultline most likely to produce a major earthquake in Northern California (a 67 percent probability of a major earthquake within the next 30 years). A 7.5 magnitude earthquake on the Hayward Fault has some overwhelming implications, with estimates of property damage in excess of $40 billion, casualties in excess of 4,000, and the number of injured ranging from 13,000 (requiring hospitalization) to over 100,000 (non-hospitalized) (CDC 1987: 75-78).

The combined damage of the East Bay Firestorm and the Loma Prieta earthquake for the region are significant: over $7.0 billion in directly measured damage, with immeasurable amounts of economic disruption and psychological trauma. There were also 87 lives lost, over 4,300 homes destroyed, and an additional 23,000 homes damaged, all within a two-year period.[5]

The actual damage associated with these disasters, and the potential costs of future recurring events, offers compelling reasons for putting measures and processes in place to mitigate these hazards. Before looking at the more traditional mitigation methods, the following sections address the concepts of risk and disaster planning.

Risk Perception

How do individuals and communities respond to natural risks in the environment? The construction and conceptualization of risk is a difficult thing to quantify. At best, risk assessment and quantification can only be a general guide to public policy and planning. As several recent works in the field of risk have described, risk is fundamentally a socially constructed concept (see, for example, Douglas and Wildavsky 1983, and Priest 1988). Its meaning remains depen-

Figure 4

First Story of Marina Complex is near Collapse
(BAREPP Photo, 1989)

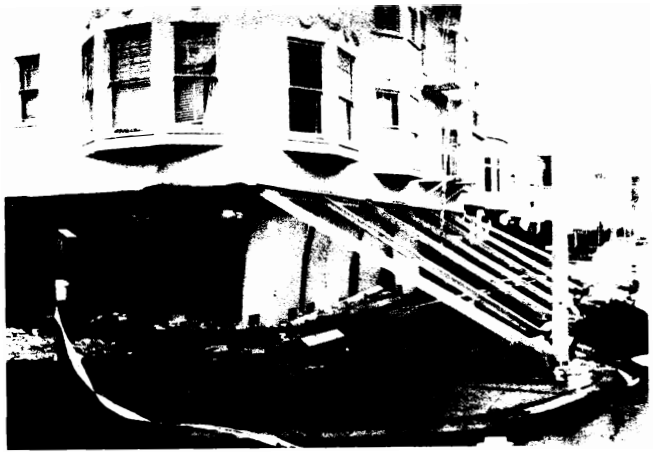


Figure 5

Upper Deck of the Cypress Collapsed onto Traffic Below
(BAREPP Photo, 1989)

dent upon the cultural and political formulations of what risk is, what it means to mitigate for certain risks, and ultimately what value is placed on the legitimacy of that risk, which in turn determines the pressure for action to be taken.

Risk evaluation then becomes the balancing of one risk against others in the community. The perception of vulnerability, the political salience of mitigation activity, and the willingness to commit funds all play a part in the evaluation process. Depending on a community's experience with a particular hazard, action taken with regard to a specific risk is typically done by a planning department or elected public officials. The local level of perceived and actual risk will largely influence the associated amount of preparation undertaken by a community.

The destructive forces of nature are nothing new, but they have become increasingly hazardous as urbanization continues into these high-risk areas throughout the United States. More and more people are populating areas susceptible to natural disasters, including such areas as the seismically active San Francisco Bay Area and Coastal California, the hurricane-prone Atlantic and Gulf coasts, and areas with an urban-wildland interface. For a variety of reasons, people have chosen to either accept or ignore the risks posed by the natural environment.

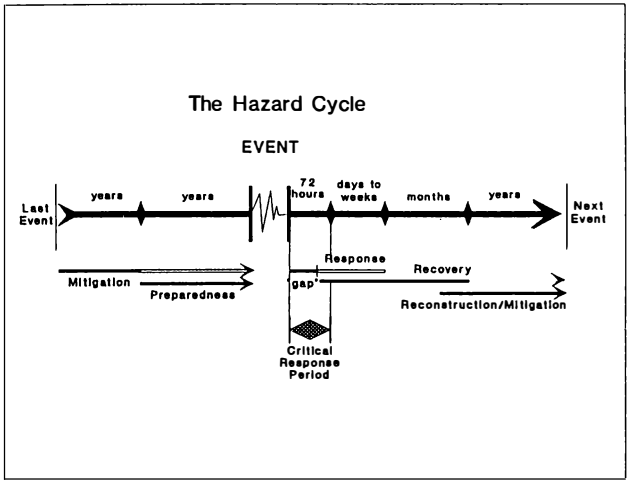
General Disaster Planning

As identified in the disaster planning literature (Foster 1980, Drabek 1981, Quarantelli 1978, Rubin et al. 1985, and others), a community that experiences any kind of disaster will go through a series of identifiable stages. The following four categories, while not exclusive, represent the types of activity that take place at various stages:

> **Mitigation:** activities to prevent or reduce impacts of a catastrophic event prior to its occurrence; may include restrictive building codes, insurance, or public education efforts.
>
> **Preparedness:** includes warning systems, hazard plans, maintaining resource inventories, storing emergency supplies, or making structural changes (such as building retrofits).
>
> **Response:** search and rescue efforts; debris removal; and provision of essential resources, meaning food, shelter, and medical aid.
>
> **Recovery:** restoration and reconstruction of the community to approximate pre-disaster conditions. Emergency repairs are first, followed by restoration of repairable and restorable structures. Emphasis turns to replacing capital stock. Lastly, major construction contributing to the improvement of the community is often undertaken (see Rubin 1979: 2-3).

Thus the process of planning for natural disasters may be thought of as a "hazard cycle," as indicated in Figure 6. Each of the stages above (mitigation, preparedness, response, and recovery) is shown in relation to the approximate time the activity takes place. For areas with recurring phenomena, the cycle is more appropriately thought of as a closed loop, with recovery preceding the next event.

Figure 6
Hazard Cycle



The critical area often neglected by planners is the gap between preparedness and response. Particularly in relation to catastrophic events, this is perhaps a function of being "unwilling to plan for the unthinkable," meaning that initial chaos in such an event will be unmanageable, and therefore unplannable. In the case of a catastrophic event, the likelihood is that due to the overwhelming demands on the structured public response system, individuals and families will have to be self-sufficient for up to 72 hours (during Hurricane Andrew the need for individual stockpiles of supplies exceeded this 72-hour period). It is during this chaotic period immediately following a large-scale disaster that community-based neighborhood planning and preparedness demonstrates its potential usefulness.

Structured Response and Hierarchy

For earthquakes and fires, there are a multitude of activities that take place in the hazard cycle mentioned above. Although space does not permit detailed comment on each of these activities, there are two general approaches to disaster mitigation taken by governmental institutions. The first approach to mitigation is structural and legislative. By requiring certain kinds of activity (such as density limitations, zoning and subdivision regulations, adherence to seismic or fire safety building codes, or other requirements), hazards can be mitigated. These types of activity will be discussed briefly below.

The second approach to mitigation of natural disasters emphasizes response plans. Much of current disaster planning focuses on how to best respond to a

disaster with an emphasis on advance planning – creating plans and checklists to be followed once a disaster takes place. The evolution and establishment of this approach is available in other sources (see, for example, Drabek et al. 1991), so it is not discussed here. It is clear, however, that this process, while valued and necessary for most small-scale emergency events, breaks down in the case of larger-scale catastrophic events, and the top-down response-oriented approach is not the optimal mitigation strategy in the immediate post-event stages.

Comments on the Top-Down Planning Method

The focus of disaster planning within state and local government institutions tends to be on the response and recovery aspects of an event. Emphasis is placed on being able to effectively respond once an event has occurred – to put out the fires, to rescue those in need, and to provide essential shelter and relief to area residents. Other activities focus on longer-term mitigation, which are discussed below, but are given a lower priority.

The use of lengthy plans and checklists, a mainstay of disaster planning, are often written to satisfy regulatory requirements. Most have not had a significant test or simulation of a larger-scale disaster (many local emergency officials recognize these plans are "boilerplate," meaning large sections are taken from existing plans, and are only slightly modified for local circumstances). It may be that the Multi-Hazard Functional Plan, as it is called, may look good on paper, but in the middle of a disaster such bulky plans are less likely to be used.

Experience and the practice-oriented literature on disaster response also point to the possible problems of an "over-planned" response (see, for example, Lewis 1988: 169-172). By initiating too much structure and procedure, the response plan may not be followed simply because it is not possible to predict all the needs and circumstances in a disaster. People will devise systems that get the job done, inventing new systems if necessary. Some flexibility must be maintained in the response process.

Another significant problem in disaster planning by government institutions is the separation between "official" activity and the activity of individuals and volunteers. Relatively few communities have made any attempt to integrate the role of community-based organizations or volunteer groups into a broader official city response plan. Yet disaster research has shown there is a great propensity on the part of individuals to help out in the time of a crisis.[6]

For these and other reasons, the top-down approach is only marginally effective in the pre-disaster stages, and perhaps most useful in later stages for funding resources and longer-term recovery activity. At the immediate response level, however, the system usually fails to work as planned, and the need for community-based planning and other mitigation measures becomes quickly apparent.

Characteristics of Earthquake and Fire Disaster

As disaster phenomena, there are some important differences that distinguish earthquakes and massive fires from other natural disasters such as flooding or hurricanes. These characteristics make planning difficult and political support sporadic and difficult to sustain. While some of these elements are true in different ways for other disasters, those listed below are particularly true for

catastrophic earthquakes and fires such as the East Bay Firestorm. The more significant characteristics are summarized below:

- There is a low frequency of events;
- They are large-scale events, with high probability for extensive damage;
- The timing is unpredictable – an event may occur at different times of the day when population densities are distributed differently;
- The damage occurs almost instantaneously for earthquakes, and almost as fast in a firestorm; and
- There is difficulty in warning a community during a large-scale fire, and it is currently impossible during an earthquake.

The above aspects of these two types of disaster have important planning implications for both pre-event and post-event activity. In terms of preparation and hazard mitigation, there are other problems that are listed here briefly:

- In community-risk-perception terms, the infrequency of events creates low level of interest and lack of institutional memory;
- Preparedness has low political saliency and few organized constituencies;
- More organized constituencies pressure against mitigation than for it (particularly when the cost of mitigation is placed upon the owners and developers);
- The general community tends to think the government will take care of them, possibly evidenced by generalized apathy (see Jaffe, Butler, and Thurow 1981);
- The cost of maximum structural mitigation in many cases outweighs the benefits (in a calculus that discounts over a structure's lifespan); and
- Public policy formation tends to be reactive, reaching implementation when an issue has reached a crisis level, or if a disaster has already occurred.[7]

These circumstances inhibit proactive planning and aggressive preparation strategies. The case of preparation apathy on the part of the public is not likely to be solved by governmental pressure. There are, however, some mandated activities that can aid in the mitigation of hazards in a community.

Earthquakes, Fires, and Traditional Land-Use Planning

Given the geophysical aspects of earthquakes and urban-wildland fires, land-use planning is an essential element in the minimization of risk of damage and injury. In recent years there has been an increasing body of literature focusing on land-use planning as one means of mitigating the hazards of an earthquake (see Jaffe et al. 1981, Mader et al. 1988, Blair and Spangle 1979, Nichols and Buchanan-Banks 1974, among others). One particular problem has been the inability to measure the effectiveness of these approaches, due to the infrequency of events and the difficulty in defining relative success (May and Bolton 1986, and Jaffe et al. 1981). Although this remains a debated issue, the general assumption can be made that land-use planning controls can be effective for a variety of natural disasters, if implemented strategically and with adequate political support.

Ideally a land-use planning approach should seek to mitigate two types of hazards: those associated with the event itself, and those associated with the secondary effects caused by the event. The primary geophysical hazards for which an earthquake is responsible are briefly summarized as being:

- Fault displacement
- Ground shaking
- Ground failure (liquefaction)
- Landslides
- Flooding (by tsunamis or seiches)
- Disruption of critical facilities.

Those hazards associated with large-scale fires may also be summarized as the following:

- Complete burning and destruction of existing structures
- Loss of utilities (water, gas, and electric)
- Burning and destruction of landscape and vegetative cover
- Possible loss of habitats
- Secondary hazards such as erosion and landslides.

Each risk requires different considerations in the land-use planning process. Different areas of a community will be more or less susceptible to the variety of geophysical hazards a disaster can produce. Once these risks have been identified, there are a variety of approaches that a community can use to try to mitigate the effects of an earthquake or fire. These approaches are briefly outlined below.

Land-Use Controls and Disaster Mitigation

There are a number of land-use planning techniques that have the potential to reduce damage from a natural disaster. These controls exist in different forms in many states, and the application of these tools will vary from community to community. The following land-use controls are discussed within the context of available methods in California, where the two recent disasters occurred. The role of community-based planning is not restricted by any particular legislation, and therefore the model proposed later in this essay is transferrable to other communities outside of California.

Although California has passed a number of state initiatives imposing certain requirements for earthquake hazard mitigation,[8] most of the responsibility rests with the local government. The same is true for fire ordinances, most of which fall under local jurisdictional control. Thus municipalities have a number of land-use tools at their disposal to control the development and redevelopment of land within their jurisdiction. This section briefly outlines available mitigation methods a community may undertake for fire and earthquake risk.

The General Plan

One of the most basic tools available for mitigation is the general plan. As part of state legislated requirements in 1972, each municipality must include a "seismic safety" element as part of its General Plan.[9] This requirement was later changed to the "public safety" element, to be more inclusive of other haz-

ards. The public safety element requires the identification of risks posed to the community and requires that development goals and long-range plans be linked accordingly. The element also recommends actions assisting in the prevention or alleviation of hazardous conditions. A community might therefore have long-range goals limiting development in seismically active or other high-risk areas.

Zoning

Zoning ordinances allow a community to restrict the development of areas near fault zones. State law (1972 Alquist-Priolo Act) places restrictions on development within one-eighth of a mile on either side of an active fault. But zoning has been more fully utilized by other communities to mitigate not only the problems of rupture along the fault itself, but also the secondary effects of liquefaction, landslides, and other risks (see, for example, the zoning ordinances of Portola Valley, California). Thus, zoning can also be used to control densities on slopes and can also control the types of land use, (e.g., open-space designation or low-density residential development).

It is important to realize that the behavior of structures on different types of soils and conditions will vary during an earthquake and should be reflected in the planning and zoning. Zoning ordinances must be developed that recognize the hazards that will affect populations not directly located at the site of the natural hazard. An example might be the restriction of high-rise residential uses on susceptible alluvial soils. Other related techniques which might be considered are:

- *Transfer of Development Rights (TDR):* allow a developer to transfer densities from a high- to a low-risk area; and
- *Height and Bulk Provisions:* these may help keep building failure within the lot area, and may prevent the blockage of the streets from debris (also true for fires).

In high-fire-risk areas, many of the same considerations discussed above are equally applicable. Zoning ordinances can limit densities in designated fire-risk areas. More importantly, zoning can control some of the hazardous conditions that assist in the spread of a fire once it has started. Vegetative zoning can restrict the amount of accumulated undercover, as well as the type of vegetation that is permitted to grow.[10] Zoning ordinances may also be used to restrict the use of certain fire-prone materials in housing. The use of wood shingles in wooded areas are an increased risk because embers are spread by the wind onto surrounding rooftops. Other zoning strategies might be:

- *Setback standards:* allows for fire breaks; for earthquakes, may be applied to high-rise structures so that they do not sway into one another; and
- *Open Space and Conservation Areas:* may also be used as area-wide firebreaks; for earthquake areas, may be designated to prevent high-density development in floodplain, landslide, and other high-risk areas.

Subdivision Review

Subdivision layouts may be reviewed for susceptibility to hazards, and developers required to redesign them if there are risks that have not been addressed. Adequate water supplies and hydrants, the design of streets (cul-de-sacs are particularly troublesome for large fire-fighting vehicles), and emergency access and egress must be taken into consideration for fire risks. For

earthquakes, land dedication requirements might also be used, such as open-space dedication along a fault trace, or requiring alternative water sources for post-earthquake fire control.

Capital Improvement Planning and Construction

The siting of public facilities and the planning of new infrastructure offer another instance where planning can mitigate natural hazards. Critical facilities such as police, fire, and hospital operations should be located away from earthquake hazard areas. For fire response, stations should be located so that firefighters can reach a fire before it becomes unmanageable, which may mean having additional units stationed in places with terrain and conditions similar to the East Bay Hills. For both earthquakes and massive fires, the building and siting of critical emergency response facilities should be decentralized and planned with an awareness of alternative routes for response in the event of road failures or blockage.

New utility infrastructure should be planned to direct associated growth away from the highest hazard-prone areas. Infrastructure should also be designed to be more earthquake-resistant. This includes making connections more flexible, strengthening the lines where they cross faults, or creating redundant systems to allow for expected line failures, which is also important for fire-fighting. Placing all utility lines underground is another method of reducing hazards from large-scale fires (e.g., falling power lines from burning poles). Backup generators for water-pumping stations and alternative water routing are possible approaches to assure water capacity.

Building Codes

Codes are a structural approach, focusing on engineering and design rather than land use. Local governments in California can either enforce the state Uniform Building Code for their seismic risk area (Zones 1 through 4), or seek more stringent requirements. Fire codes can be used to require such things as interior sprinklers and smoke detectors. In either case, inspections are a crucial component of this process.

Public Notification

This process is more reliant on the private market to achieve effectiveness. Although its usefulness has been questioned, it remains as a possible alternative (see Palm 1981). Municipalities can require the notification of owners of the seismic and fire risks as part of the real estate transaction process. The Alquist-Priolo Act requires realtors to inform buyers of the seismic risks of properties within the zone areas. The same could be done with fire-prone areas. The environmental review process can also alert developers and municipalities to the seismic risk and secondary hazards that would either be caused by the development, or which would place the project at risk.

Effectiveness of Traditional Approaches

The effectiveness of the land-use planning approach is largely dependent upon when the ordinances took effect and whether the local community is willing to make the investment to enact them, both in time and capital. If there is new construction, or if there is redevelopment, then these techniques can be effective in minimizing damage. In older, urbanized and predominantly built-out communities, however, where there is already substantial construction in hazardous areas or there is construction that pre-dates newer fire- and earth-

quake-resistant building codes, mitigation techniques are more costly and more difficult to implement.

Mitigation techniques in these communities may involve the retrofit or reinforcement of existing buildings, taking action on properties at the point of sale (to require reinforcement, to reduce densities near a fault zone, or to purchase properties to remain as open space), or require renovation as a prerequisite for rezoning or other permit processes.

There is ongoing debate in the disaster-planning literature as to how effective many of the mitigative techniques are in the event of a large-scale disaster (see, as one example, May and Bolton 1986). The general assumption, lacking good causal relationship data, is that mitigation attempts are beneficial to some degree, and that this is better than no attempt at all. Further debate results when trying to attach specific cost-benefit analysis to different mitigation strategies.

Regardless of the effectiveness of any one particular mitigation measure, it is clear that no one technique or set of techniques will prevent the damage resulting from a catastrophic event. The magnitude of these larger-scale disasters requires a re-thinking of how we plan for the immediate post-disaster stages of a catastrophic event, as described in the next section.

Arguing for a Community-Based Approach[11]

As previously discussed, the typical disaster planning paradigm has two primary components: pre-event planning, and post-event response. The pre-event planning includes those mitigation techniques described in the land-use approach sections. Pre-event planning also includes the creation of response plans and procedures to be implemented in the event of a disaster, such as the multi-hazard functional plan. Post-event response includes the ability to carry out the multi-hazard functional plans, and the ability to provide immediate search and rescue activity, medical services, and relief services such as food and shelter.

Referring once more to the Hazard Cycle in Figure 6, there is a gap between preparedness planning and response planning. In the event of an earthquake, it is generally assumed that individuals and neighborhoods must be prepared to support themselves for up to 72 hours. This is because essential services will not be available (phone, water, power) for an unknown period time. Local governments will be overloaded, and it may take several days to mobilize and respond to all of the areas that require assistance.

For the additional reasons described in previous sections, the top-down approaches are susceptible to breakdown because of "over planning," system overload or collapse, and the fact that new systems will be invented on the spot to take care of immediate needs. Key personnel may be at home and may not be able to reach the command center.

To meet community needs during this 72-hour period, an alternative planning framework must be considered. The emphasis should be on the individual, neighborhood, and community-based organizations to provide the "first-responder" capability during this crucial period. Without a guarantee of governmental assistance within a specified period of time, the local community must be prepared to meet their own needs.

The use of community-based organizations and local neighborhood groups as the focus of initial response makes sense from a number of perspectives. The first is simply cultural. Local organizations are able to communicate with residents who might not be proficient in English. Communication with non-English-speaking populations was found to be a problem by disaster assistance teams following the Loma Prieta earthquake. Information can be more effectively communicated using the speaker's first language in an appropriate cultural context.

The second is local awareness. Neighborhood groups are more likely to be aware of who in their area has special needs, such as residents who are hearing- or sight-impaired, physically disabled, or otherwise might require assistance. Neighborhood groups can assist in the evacuation of these residents, or identify their location if a rescue is needed. Awareness also means knowing where the resources are in their area (who in the group has tools, or medical training), and familiarity with the buildings so that utilities can be shut off for people who are away from their homes.

Finally, there is the ability and necessity for these neighborhood groups to be effective first-responders. Residents in a neighborhood are logically closest to the local needs. With basic training in emergency first aid, fire suppression techniques, and simple search-and-rescue procedures, the local residents can accomplish vital response activities in the initial phase of the disaster. As an example, in the Firestorm there were cases of residents who stayed in the area and fought smaller brush fires or hosed down structures while firefighters concentrated on the major fires.

Proposing a New Framework

A new disaster-planning paradigm should incorporate a more comprehensive, integrated approach to the preparation for and response to a disaster, while recognizing the vital role of neighborhood and community organizations in all stages. At the present, most of the literature and research is focused on either long-term mitigative strategies (land-use approaches), or more effective response planning (multi-hazard functional plans and similar response activity).

These two approaches are driven by governmental institutions, and have deficiencies associated with the political processes – for example, decisions on the allocation of resources under pressure from various interest groups. The existing disaster-planning paradigm also neglects the immediate needs of individuals and neighborhoods in the critical gap between the event and response. This is where the greatest need will be, and also where the community and neighborhood groups can provide immediate assistance.

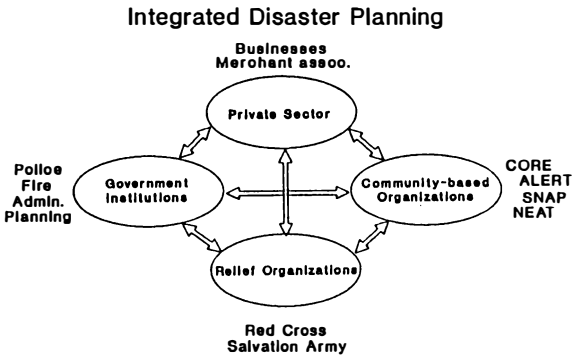
A new paradigm should emphasize and link the role of community groups and individuals in a fully integrated approach (see Figure 7) that incorporates community and neighborhood organizations together with the traditional governmental institutions and responses, private sector response, and existing relief organizations that will typically respond to a disaster.

Integrated Disaster Planning

The planning and activity of these groups should be coordinated and integrated into a comprehensive response strategy. That does not mean a cumbersome, fixed-response plan, but rather an overall strategy that recognizes the

Figure 7

Integrated Disaster Planning Framework



flexible nature of response in a disaster, and highlights the key communication and coordination functions. Each of the four groups must play an active and coordinated role in preparedness and initial-response planning. The inclusion of a community-based response function in the planning process is a relatively new concept for earthquake response, and could be equally applied to other disasters such as fires, floods, and hurricanes. The manner in which this community-based preparation might take place is discussed below. These community organizations are then integrated with the city's response plan, assisting as first responders, assessing damage, and taking care of the immediate local needs.

Models for Community-Based Disaster Response

Given the trauma that has taken place in the San Francisco Bay Area, it is perhaps not surprising that solutions for the response-planning gap have already begun to emerge. Several of the Bay Area communities and neighborhoods realize that they will be responsible for their own needs immediately following a disaster. These groups offer a model for other communities, and also reinforce the idea that research and planning should begin to address this type of bottom-up organization strategy as being equally important in the disaster-planning process.

The community groups that are briefly described in this context have several common elements. There were initiated by proactive and concerned individuals

and neighborhoods, and were not created by the local governments, although many have gained some support and staff time to assist their efforts. The groups were organized in order to respond to disaster needs in their own neighborhood and local area. Finally, they were initially organized without local financial support, although in some cases groups were given funds to expand a pilot project. The next section describes a sample of these organizations.

SNAP, CORE, ALERT, and NEAT

Another common element among these groups is an easily recognizable acronym to describe their organization. "SNAP" stands for "Sunnyvale Neighborhoods Are Prepared." Sunnyvale is a medium-sized city in the South Bay. The community organized itself into 12 sections, with neighborhood section boundaries defined by relative proximity to a local elementary school. Each section conducts a workshop on response, and inventories the skills and resources of the members in the section (for example, who has chainsaws, ladders, medical training, or other skills or equipment). Each section is also integrated into a communication network with the other sections and with the city (CB or ham radio contact).

In the city of Oakland, groups were formed around existing neighborhood crime watch associations. The organization is called CORE, or "Citizens of Oakland Respond to Emergencies." The original effort was designed to train individuals in the city's 26 neighborhood associations and ten city departments. This first effort, a pilot program, was called Neighborhoods and Employee Earthquake Selfhelp Program (NEESP). Coordination of the program is now based in the Oakland Office of Emergency Services.

Training for the CORE groups is divided into three modules that are offered sequentially. The first module is "Individual and Family Survival."[12] The module focuses on preparation, identifying home hazards, the stockpiling of supplies, and evacuation procedures. The second module, "Organizing Response Teams," explains how to organize local volunteer response teams, how to select an operations center, and how to assess the group's needs and available resources. The final module is called "Advanced Citizen Response," and deals with the more advanced training needed for first aid, fire suppression, and light search and rescue procedures. CORE offers the module training not only to neighborhood groups, but also to community organizations and individuals.

In the nearby city of Albany, citizens have formed "ALERT," which stands for "Albany Local Emergency Response Teams." The format is similar to SNAP, with groups organized at the neighborhood level. Neighborhood areas have team leaders and each area maintains an inventory of resources and contacts. ALERT is less than a year old, but intends to expand into more intensive training for the neighborhood groups. The impetus for the organization was in response to the threat of earthquakes, and this serves as the focus of the groups.

North of Albany is the city of El Cerrito, which has formed a program called "NEAT." NEAT, which stands for "Neighborhood Emergency Assistance Teams," is organized much like the CORE program in that it is an attempt to coordinate neighborhood action for a range of emergencies, including earthquakes and fires. Due to topography and vegetation, El Cerrito has fire risk similar to that in the Oakland Hills area.

Education is an essential element in these neighborhood programs. Members in these groups are made aware of the risks in their community and neighborhood, and are instructed in ways to prepare for their own home and family first. These activities include making sure the entire household understands evacuation procedures, has food and water stockpiled, and takes individual action to improve the safety of their home – including activities such as brush-clearing or structural modifications.

Each city and community has different needs and will design its program to meet those needs. Generically, however, under a community-based response model, a neighborhood response organization should:

1. **Develop organizational units along existing boundaries.** These boundaries might be defined by crime watch groups, neighborhood associations, or tied to local elementary schools, which are often the local designated shelter in a disaster.
2. **Focus on educational and preparedness programs using a bottom-up approach.** This is accomplished by educating and preparing the indi vidual first, then the family, the block, and the neighborhood.
3. **Provide basic emergency response skills.** At a minimum, training should be made available for disaster first aid, basic fire suppression, and light search and rescue. Cities might sponsor "train the trainer" programs, training individuals to return and train the members in their own neighborhood groups.
4. **Have local groups inventory their block needs and their available resources.** This will identify those individuals with special needs and will also indicate where additional resources might be located (e.g., who has tools, such as a chainsaw or ladder, or specialized experience and training).
5. **Establish alternative communication networks.** Alternative communication links will need to be established (either by CB or Ham Radio) in the likelihood that phone service will not be available.
6. **Integrate groups into a city-wide response plan.** These groups will be a valuable asset in the event of a disaster, and thus should be integrated into the city's official response plan so that officials can make use of trained volunteers, and have contact points within each neighborhood block.

The key to community-level response planning is the development of realistic response strategies that can be carried out under adverse conditions. They should be basic, easy to understand, and clearly understood by all participants prior to a disaster. The confusion and panic that will follow immediately after a disaster will not permit "on-the-job" learning of the response plan. If it is not understood or followed, then there is the probability it will be dropped altogether, and an ad hoc system will develop in its place. If some degree of flexibility is not planned into the response system, then any ad hoc response has the potential to be wasteful of both resources and manpower.

Areas for Future Research

Given the disasters described above, and considering the damage caused by the most recent Hurricanes Andrew and Iniki, the need for additional research into these areas is readily apparent. There is a need for planning-oriented research in a wide variety of contexts. Considering a model that focuses more on community-based preparedness and neighborhood groups, there are four main topics deserving of more thorough research. These are briefly described below. These topics should be considered to be part of a larger research agenda, one that has an overall goal of creating more integrative and community-inclusive models for disaster planning, along the lines expressed in this paper.

Community-Level Risk Perception

The first research area is the perception of risk at a community level, or, in other words, to what degree is a community aware of the natural hazards in its area, and what is the community's willingness to organize or pay for mitigation and preparedness planning? Current risk literature focuses almost solely on the individual and the individual's willingness to pay (Fisher et al. 1989).

Risk and Hazard Communication to the Community and Individual

What are better methods for communicating the natural hazard risk in a given region? The few studies that have looked at this aspect have found that people do not trust the government in disseminating risk information, and tend to believe it more if it comes from the media, or by word of mouth (Perry and Greene 1983). There also appears to be a sense of "fatalism" in some cases, so that people feel that it is simply fate if something happens. In other cases, the fear of a risk is irrational in proportion to the actual danger (Kartez 1989). Better and more effective strategies for risk-information dissemination need to be studied, perhaps borrowing from other fields (FEMA 1986, in addition to the National Earthquake Hazard Reduction Program [NEHRP] publications).

The Use of Neighborhood and Community-based Organizations

While there is a recognition in the disaster literature that organized neighborhoods tend to perform better in disaster and crises situations, more research would assist in determining the best or most appropriate design of these groups. In what type of neighborhood will some designs work better or worse than others? Where possible, it would be helpful to conduct pre- and post-disaster research on existing community groups. How do you integrate the community groups into a comprehensive city-wide response plan? Why do some groups continue, while others fade?

Disasters and the Role of Planners

Perhaps more than any other field, the planning profession should be taking the lead on disaster planning and related issues. In general, this is not the case. The majority of disaster-related research is being conducted within the field of

sociology, while the field of psychology deals with many aspects of risk awareness and perception. Planning research has primarily focused on the variety of land-use mitigation techniques and their relative success. Planning researchers should examine the nature and role of planning in disasters from a broader and more comprehensive perspective.

Conclusion

Natural disasters are traumatic, frightening, and destructive events. Unfortunately, we must continue to contend with them, and seek ways to minimize the impacts. As we continue to urbanize high-risk areas, the damage and loss of life will increase unless we take a proactive and aggressive approach to all areas of mitigation, preparedness, and response planning. A fully integrated approach is needed, with equal emphasis being placed on a "bottom-up" preparedness strategy using a framework of neighborhood and community-based organization.

Planners and the planning profession can and should play a central part in the creation and maintenance of preparedness and response plans. Planning academicians should continue to look at the costs and benefits of alternative strategies, the role of the community, and the formulation of risk perception and its effect on planning practices. The emphasis must be turned toward a more integrative and comprehensive planning approach, yet one which incorporates some degree of flexible response.

ACKNOWLEDGEMENTS

This author wishes to thank Sarah Michaels, now at the University of Auckland, New Zealand, Ruth Steiner at U.C. Berkeley, and three anonymous reviewers for their comments and suggestions on earlier versions of this piece. It has benefitted greatly from their assistance. The author also wishes to thank the Bay Area Regional Earthquake Preparedness Project (BAREPP) and U.C. Berkeley Professor Matt Kondolf for the use of photos.

NOTES

[1]The Diablo winds are hot, dry winds associated with high-risk fire conditions, and are the Northern California equivalent of the Southern California "Santa Ana" winds.

[2]Most home safes are fire-rated for 1,5500 degrees Fahrenheit, which is not exceeded in the more typical home structural fire.

[3]Statistics taken from the Alameda County Sheriff's Department, Office of Emergency Services, "The 1991 East Bay Hills Firestorm: After Action Report," dated February 1992.

[4]The 1923 fire, aided by the Diablo Winds, burned out of control and was extinguished "only by an act of providence," burning over 130 acres and 584 homes throughout the city of Berkeley. Taken from "A Summary of Fires in the East Bay Region," draft report from the East Bay Regional Park District, undated.

[5]Prior to the recent damage from Hurricane Andrew in southern Florida, this was the highest amount of sustained damaged to a region within such a short period of time.

[6]There is an abundance of anecdotal evidence of heroics in the East Bay Firestorm and Loma Prieta earthquake by individuals who were volunteers and not part of any "official" response, yet performed lifesaving and dangerous tasks.

[7]Much of the California legislation passed immediately following an earthquake, notably in 1925 (Santa Barbara), 1933 (Long Beach), 1971 (San Fernando), 1983 and 1987 (Coalinga and Whittier Narrows), and most recently 1989 (Loma Prieta). This offers the conclusion that there is a "window of opportunity" in which to push for statewide measures in the aftermath of a disaster (see also Olsen 1980, and Blair and Spangle 1979.) The same is true following urban fires, with the passage of many ordinances in Southern California which restrict wood shingles and other vegetative zoning. There have also been ordinances implemented by the city of Berkeley following the East Bay Firestorm.

[8]Examples are the 1933 Field Act (seismic standards for public schools); the 1971 Hospital Seismic Safety Act (standards making hospitals earthquake-resistant); the 1972 Alquist-Priolo Special Studies Zone Act (projects within a bounded zone of an active fault must be accompanied by a geologic report, in addition to other local requirements); and the 1986 Unreinforced Masonry (URM) Buildings Act, which requires municipalities to identify all URMs and establish a mitigation program for them.

[9]California Government Code, Section 65302(f).

[10]In the East Bay Firestorm, it was apparent that eucalyptus trees are a fire hazard, in that they burn rapidly and contain an oily resin that gives off toxic smoke, making firefighting more difficult. The area had also experienced a freeze in the previous year that left many of the trees dead or dried out, and increased the rate at which they burned.

[11]Some elements of this framework were first presented in a conference paper by Simpson and Collignon, 1991.

[12]Descriptions of the CORE training modules are taken from a bulletin entitled "CORE: Citizens of Oakland Respond to Emergencies," published by the Oakland Office of Emergency Services, CORE program, undated.

REFERENCES

Alameda County Sheriff's Department, Office of Emergency Services. 1992. "The 1991 East Bay Hills Firestorm: After Action Report." February.

Association of Bay Area Governments (ABAG). 1987. *The San Francisco Bay Area: On Shaky Ground*. Oakland, California: ABAG. February.

Bay Area Regional Earthquake Preparedness Project (BAREPP). 1989. *Earthquake Vulnerability Analysis for Local Governments*. Oakland, California: BAREPP.

Bay Area Regional Earthquake Preparedness Project (BAREPP). 1990. "Loma Prieta and Its Lessons." In *Networks*. Oakland: Bay Area Earthquake Preparedness Project. Vol. 5, No. 1. Winter.

Blair, M. L., and W. E. Spangle. 1979. *Seismic Safety and Land-Use Planning*. Washington, D.C.: Government Printing Office.

Blair-Tyler, Martha, and Penelope A. Gregory. 1989. *Putting Seismic Safety Policies to Work*. Oakland, California: BAREPP. October.

Bolt, Bruce A. 1978. *Earthquakes: A Primer*. San Francisco: W. H. Freeman and Co.

California Department of Conservation, Division of Mines and Geology (CDC). 1987. "Earthquake Planning Scenario For a Magnitude 7.5 Earthquake on the Hayward Fault in the San Francisco Bay Area." Special Publication #78.

California Seismic Safety Commission. 1986. *California at Risk*. Sacramento, California: California Seismic Safety Commission.

Cochrane, Harold C., et al. Undated. *Social Science Perspectives on the Coming San Francisco Earthquake*. Boulder, Colorado: University of Colorado, Institute of Behavioral Sciences. Working Paper #25.

Comerio, Mary C. 1989. *Seismic Costs and Policy Implications*. San Francisco: George Meier & Associates.

Doane, Charles J. "Beyond Fear: Articulating a Modern Doctrine in Anticipatory Nuisance for Enjoining Improbable Threats of Catastrophic Harm." *Boston College Environmental Affairs Review* 17: 440-472.

Douglas, Mary, and Aaron Wildavsky. 1983. *Risk and Culture: An Essay on the Selection of Technological and Environmental Dangers.* Berkeley: University of California Press.

Drabek, Thomas E., and Gerard J. Hoetmer, eds. 1991. *Emergency Management: Principle and Practice for Local Government.* Washington, D.C.: ICMA.

Drabek, Thomas E., et al. 1981. *Managing Multi-Organizational Emergency Responses.* Institute of Behavioral Science, Monograph #33. Boulder, Colorado: University of Colorado.

East Bay Regional Park District. Undated. "A Summary of Fires in the East Bay Region." Draft.

Federal Emergency Management Agency (FEMA). 1986. *A Guide to Marketing Earthquake Preparedness: Campaigns that Get Results.* Washington, D.C.: FEMA. September.

Fisher, Ann, et al. 1989. "The Value of Reducing Risks of Death: A Note on New Evidence." *Journal of Policy Analysis and Management* 8(1): 88-100.

Foster, Harold D. 1980. *Disaster Planning.* New York: Springer-Verlag.

Hadden, Susan G., ed. 1984. *Risk Analysis, Institutions, and Public Policy.* New York: Associated Faculty Press.

Healy, Richard J. 1969. *Emergency and Disaster Planning.* New York: John Wiley & Sons, Inc.

Jaffe, Martin, JoAnn Butler, and Charles Thurow. 1981. *Reducing Earthquake Risks: A Planner's Guide.* Chicago: American Planning Association.

Kartez, J.D. 1989. "Rational Arguments and Irrational Audiences" *JAPA* 55(4), Autumn: 445-456.

Kreps, Gary A., ed. 1989. *Social Structure and Disaster.* Newark: University of Delaware Press.

Lagorio, Henry J. 1985. *Seismic Performance of Critical, Emergency Service Facilities.* Berkeley, California: University of California, Center for Environmental Design Research. WP05-85.

Lewis, Ralph G. 1988. "Management Issues in Emergency Response." In *Managing Disaster,* Louise Comfort, ed., Durham, North Carolina: Duke University Press.

Lopez, Robert. 1991. "National Experts Learn Lessons on 'Fire of the Future'." In *Firestorm,* an *Oakland Tribune* Special Edition Compilation. December 2.

Mader, G. G., T. C. Vlasic, and P. A. Gregory. 1988. *Geology and Planning: The Portola Valley Experience.* Portola Valley, California: William Spangle and Associates, Inc.

May, Peter J., and Patricia A. Bolton. 1986. "Reassessing Earthquake Hazard Reduction Measures." *Journal of the American Planning Association* 52(4): 443-451.

Mileti, Dennis S., et al. 1990. *How to Issue and Manage Public Earthquake Risk Information.* Fort Collins, Colorado: Colorado State Univ.

Nichols, D. R., and J. M. Buchanan-Banks. 1974. *Seismic Hazards and Land-use Planning.* Washington: USGS. Geological Survey Circular #690.

Oakland Office of Emergency Services, CORE Program. Undated. "CORE: Citizens of Oakland Respond to Emergencies." Bulletin. Oakland, California: City of Oakland, Office of Emergency Services.

Ochoa, Phillip. 1985. *Disaster Management for Community Associations.* Community Associations Institute (CAI) Report #14. Arlington, Virginia: CAI.

Olsen, Robert A. 1980. "Technology and Public Policy for Earthquake Safety." In *Structural Engineering and Structural Mechanics,* Karl S. Pister, ed., New Jersey: Prentice Hall, Inc.

Palm, Risa. 1981. *Real Estate Agents and Special Studies Zones Disclosure: The Response of California Homebuyers to Earthquake Hazard Information.* Program on Technology, Environment, and Man: Monograph #32. Boulder, Colorado: Institute of Behavioral Science, The University of Colorado.

Perry, Ronald W., and Marjorie R. Greene. 1983. *Citizen Response to Volcanic Eruptions: The Case of Mt. St. Helens.* New York: Irvington Publishers, Inc.

Petak, William J., and Arthur A. Atkisson. 1982. *Natural Hazard Risk Assessment and Public Policy: Anticipating the Unexpected.* New York: Springer-Verlag.

Priest, W. Curtis. 1988. *Risks, Concerns, and Social Legislation.* Boulder: Westview Press.

Quarantelli, E. L. 1978. *Disasters: Theory and Research.* Beverly Hills: Sage Publications, Inc.

Raphael, Beverly. 1986. *When Disaster Strikes: How Individuals and Communities Cope with Catastrophe.* New York: Basic Books.

Rossi, Peter H., et al. 1982. *Natural Hazards and Public Choice: The State and Local Politics of Hazard Mitigation.* New York: Academic Press.

Rubin, Claire B. 1982. *Long-term Recovery from Natural Disasters: A Comparative Analysis of Six Local Experiences.* Washington, D.C.: Academy for State and Local Government.

____. 1979. *Natural Disaster Recovery Planning for Local Public Officials.* Columbus, Ohio: Academy for Contemporary Problems.

Rubin, Claire B., et al. 1985. *Community Recovery From a Natural Disaster.* Institute of Behavioral Science, Monograph #41. Boulder, Colorado: Univ. of Colorado.

Simpson, David M., and Frederick C. Collignon. 1991. "Disaster Planning and Earthquakes: A Community Approach for Preparation and Response." Presented at the ACSP/AESOP Planning Congress, Oxford U.K., July 8-11 (unpublished).

Staats, Craig, and Jacqueline Cutler. 1991. "Bitter Lessons: City Failed to Regulate Wood Roofs, Other Hazards." In *Firestorm*, an *Oakland Tribune* Special Edition Compilation. December 2.

Weeks, Ellen J., and Barclay G. Jones. 1983. *The Social and Economic Aspect of Earthquakes and Other Natural Disasters: Risk Assessment, Hazard Mitigation, Emergency Management, Reconstruction and Recovery.* Monticello, Illinois: Vance Bibliographies.