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NATURAL HAZARDS AND DISASTERS

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The consequences of the impacts of natural disaster events on societies are dramatic. For example, over the last 20 years earthquakes, tidal waves, floods, hurricanes, tornadoes, landslides, and wildfires have claimed over 2.8 million lives worldwide. Over a dozen of these events have killed more than 10,000 people each. The accompanying economic losses to the built environment--commercial and municipal buildings, homes, bridges and dams, water and power systems, and communication networks--are staggering. During the past two decades, natural disaster events have resulted in an estimated loss of $25-100 billion in property damage, and this figure does not include losses due to economic disruption of commercial and governmental activities (National Research Council 1987). The United Nations declared the 1990's as the International Decade for Natural Disaster Reduction when it was realized that these losses were not only continuing but escalating worldwide.

Although the above description focuses on the magnitude of

the consequences of natural disaster events, it is not always

true that disaster consequences are in proportion to the

magnitude (or the physical properties) of the disaster agent

itself. In other words, the relationship between the "physical"

damage and the "social" damage in a natural disaster is often

quite tenuous (Dynes 1970); natural disaster events that have

similar physical characteristics may not have similar social

consequences. Take, for example, two recent earthquakes--the

1988 earthquake in Armenia and the 1989 Loma Prieta earthquake

in California. The earthquake in Armenia, which was 6.9

magnitude on the Richter scale, killed approximately 25,000,

injured more than 31,000, and left 514,000 homeless. By

contrast, the slightly larger (7.1) magnitude Loma Prieta

earthquake in the San Francisco Bay area killed only 62 people, injured 3,800 people, and left approximately 12,000 people homeless. Because of this inconsistency, research on natural disasters has focused on characteristics of individuals and social systems that make them more or less vulnerable to the impacts of disaster agents.

The existence of a natural hazard--a river capable of flooding, an earthquake fault, or a weather system capable of generating a tornado or hurricane--is necessary for a natural disaster to occur, but it is not sufficient. Natural hazards may be present in the physical environment for extremely long periods of time without a disaster occurring. Even if a river floods, a hurricane develops, or an earthquake fault moves, a disaster--in its **social** sense, may still not result. In order for a natural disaster to occur, human beings, their social systems, and their built environments (their homes, buildings, dams, utility systems, etc.) must be dramatically affected, causing widespread damage, social disruption, and economic interruption.

Because of this linkage between the natural and social worlds, there are obvious linkages between natural disaster research and environmental sociology. Current research efforts

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in the field of natural hazards and disasters bridge the two prevailing emphases in environmental sociology. One approach emphasizes the **built environment**, while the other focuses on the **natural environment**. Traditionally, "natural hazards" concerns have been included within the natural environment area of environmental sociology, along with other issues such as social impact assessment, outdoor recreation, resource management, and energy (Dunlap and Catton 1983: 114). While natural disaster agents <u>do</u> derive from the physical forces of nature (particularly geophysical and atmospheric conditions), their societal consequences are directly related to the extent to which social systems and the built environment are disrupted. The vulnerability of any community to the impact of a disaster event is directly related to the complexity and condition of the built environment and to the extent that effected social systems are able to prepare for, cope with, and respond to the agent itself. The study of natural hazards and disasters, therefore, tends to bridge the gaps between the built and natural environments.

This chapter provides a brief overview of the history of natural hazards and disaster research in the United States, the formulation of a sociological definition of disaster, and major

historical and current themes in disaster research.

THE DEVELOPMENT OF DISASTER RESEARCH

Early sociological work focused primarily on the social consequences of disasters, a topic that was rigorously studied by social scientists beginning in the late 1940s (e.g., Fritz and Marks 1954; Barton 1969; Kreps 1981; Quarantelli 1987a). Almost all of this early research (1950-1962) was conducted by sociologists affiliated with one of three research programs--the National Opinion Research Center (NORC) of the University of Chicago; the University of Oklahoma; and the National Academy of Sciences' National Research Council--that focused on behavioral responses to disaster events. In the course of their work, these groups studied a variety of natural and industrial disaster events in order to better understand human behavior in response to extreme, and often unexpected, situations; that is, situations that created a great amount of disturbance for communities and social systems. Some of the incidents studied by these groups included response to such diverse events as: the 1952 Bakersfield, California earthquake; three airplane crashes in Elizabeth, New Jersey; tornadoes in Arkansas and Texas; hurricanes along the Gulf Coast; a coal mine disaster; and a ship explosion in Texas City.

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The early research topics addressed by these three groups were strongly influenced by their principal funding agencies, all of which were part of the United States military. During this post-World War II period, the military was quite concerned about the extent to which unexpected nuclear attacks on United States' cities would disrupt military as well as civilian populations. The military wanted to be able to train soldiers to function according to plans following a nuclear strike as well as to be able to anticipate what problems might result from civilian behavioral responses to such attacks. Large-scale, rapid onset, peacetime disasters and industrial accidents, such as those mentioned above, were seen as providing comparable situations within which such issues could be studied.

There was an implicit assumption made by the funding agencies that underlay this early work--the basic problems in disasters (and, by extrapolation, in wartime situations) are found in the reactions of individuals to danger, loss, and deprivation. For this reason, much of the early research effort focused on victims and their responses to disaster events during the early emergency (or immediate post-impact) period. For example, the emphasis in the early NORC studies was on problems associated with individual behavior, as well as on the

attitudes and opinions of those involved in the disaster.

However, because most of these research efforts were administered or conducted by sociologists, the emphasis was not psychological but sociological in orientation. For example, implications of the consequences for victims from different and identifiable social groups--the elderly, children, people living in poorer areas--within the context of the overall community affected by the disaster became important concerns.

Since many of these early sociological researchers were also trained in the substantive area of collective behavior (especially from a symbolic interactionist perspective), these studies also focused on the emergence of group phenomenon following the onset of the disaster (e.g., the emergence of volunteer search-and-rescue groups before "official" emergency organizations could respond) and on the functions that rumoring served during the warning and early response periods. (For a more complete discussion of the theoretical and substantive approaches that shaped these early disaster research efforts, see Quarantelli 1992 and Nigg 1994.)

The significance of this early work was in the rejection of the popularly-accepted notions that societies affected by a disaster experience some disintegration, and that individuals in

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such situations engage in irrational and anti-social behavior. Instead of discovering support for this "disorganization" model of societal reaction to disaster events, these early sociological researchers argued that disaster-stricken communities resolve disaster problems through collective approaches, and these approaches allow them to rebound with some degree of resilience (Nigg and Perry 1988). Although these notions were refuted over 40 years ago, we still see examples of this type of expectation, especially in the formal plans of some emergency management organizations. One only needs to remember the use of thousands of National Guard and federal troops during Hurricane Andrew to protect private property from looters rather than to provide direct relief assistance to victims. The magnitude of looting (even its very existence) in the wake of many natural disasters has been grossly exaggerated, often resulting in a misuse of resources during the disaster response and early recovery periods.

The effect of the initial emphases in these early studies had two major consequences for the development of disaster research (Quarantelli 1987a). First, the prototypic disaster was a rapid onset event with little warning, where the impact was experienced over a wide geographic area. In fact, the

problems and impacts generated by a large magnitude earthquake

were believed to be good approximations for those likely to

accompany a nuclear attack. This perspective led to the

development of a definition of disaster that guided much of

disaster research during the next couple of decades:

> an event, **concentrated in time and space** (emphasis added),
> in which a society, or a relatively self-sufficient
> subdivision of a society, undergoes severe danger and
> incurs such losses to its members and physical
> appurtenances that the social structure is disrupted and
> the fulfillment of all or some of the essential functions
> of the society is prevented. (Fritz 1961: 655)

One result of this early emphasis on rapid onset disasters

was a lack of attention to other types of disaster events that

were not necessarily concentrated in space or time. Slowly

developing disasters such as long-lasting droughts (like the

Sahail drought in Africa) or geographically widespread climate

changes (like those produced by the El Nino and La Nina

phenomena) have not typically been studied by sociologists as

"disasters" despite the devastating impacts they have on human

populations.

Attempts were made to account for the different levels of

systemic disruption (that is, the <u>social impacts</u> of such

events), suggested by Fritz's definition for different types of

disaster events; however, the primary emphasis remained on

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immediate onset events. Researchers identified several aspects

of disasters that need to be taken into account to explain this

variation: the predictability of an event's occurrence; the

controllability of the event or its agent; the probability that

the event could occur; the agent itself (e.g., whether it is

natural or technological in origin); the speed of onset; the

scope of impact; the destructive potential of the event; the

frequency of the event's occurrence in a particular location;

the length of possible forewarning; and the duration of impact

(e.g., Fritz 1961; Dynes 1970).

Given this approach, the features of the disaster agent

were depicted as variable, but their significance was

exclusively social in nature. In other words, these features

are not viewed as deterministic in and of themselves; rather,

their impact on any specific community was directly related to

the disruption of the social systems and the built environment

in that community. As emphasized in the introductory section of

this chapter, disaster events with similar characteristics--

despite the type of agent that creates the disaster--may have

different impacts in different communities. Given this

attention to the variability across the features of disaster

events, more recent work in the field of natural disasters has

begun to apply this approach to other than rapid onset disasters (e.g, Nigg 1993; Quarantelli 1996).

A second emphasis in the early work that had long-lasting consequences for the field was a focus on the "impact" and immediate "post-impact" periods, especially investigations of emergency response efforts (Nigg and Tierney 1993). Disaster response studies have focused on the extent to which organizations and communities are systematically disrupted and the factors which are associated with differential levels of disruption. While these studies have primarily been concerned with the response of victims and their communities to the disaster, they have also investigated the extent to which communities were prepared to respond to disaster events (e.g., Kartez and Lindell 1987; Gillespie, Colignon, Banerjee, Murty, and Rogge 1993). Ostensibly, those communities that were better prepared would be less seriously disrupted or, at least, better able to manage the consequences following the disaster impact. While these studies have looked at impacts on communities of all sizes, greater attention is currently being given to the impact of disasters in major metropolitan areas since increasing urbanization and increasing population density is a worldwide phenomenon. For example, extensive research since the mid-1970s

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has been conducted by sociologists and other social scientists on the ability of both the Los Angeles and San Francisco metropolitan areas' preparedness for and ability to respond to a catastrophic earthquake (e.g., Mileti, Hutton, and Sorenson 1981; Turner, Nigg, and Paz 1986).

Again, because of the potential application to military situations, early disaster research focused on reaction, not prevention. This initial constraint resulted in the majority of research efforts investigating disaster planning and response activities rather than mitigation strategies or recovery efforts (Drabek 1986). Dynes (1993; 1994) also points out, however, how this early usage of emergencies as extensions of "enemy attack" scenarios focused attention on command-and-control capabilities--ostensibly needed because of the chaos that would follow such an event--which developed a set of false assumptions that have been used as the basis of emergency planning for community disasters.

More recently, Quarantelli (1987b), among others in the field of disaster research, has called for a reformulation of the term "disaster" in order to overcome the limitations of earlier conceptualizations. His suggestions to guide this reformulation include:

1. An emphasis on "disaster" as a <u>sensitizing concept</u>, in Blumer's use of the term, rather than as an empirical determinant.

This would allow the concept to be applied to a wider range of

situations that have similar consequences for human communities.

2. A definition that is exclusively <u>social</u>.

References to the physical characteristics would be important only

insofar as they influenced the social dimensions of an agent's

impact on a community.

3. Their characterization as <u>occasions</u>, in Goffman's terms, rather than events.

In this way, disasters could be seen as social occasions that

provide multiple possibilities for development rather than as a

singular type of outcome that results along a linear path.

4. Their characterization as <u>crisis occasions</u> in order to differentiate between agent- and response-generated demands.

By focusing on response-generated demands, crisis occasions

would

need to be contextualized within the social parameters of the

effected community and would become part of the cycle of social

stability and social change that typifies the dynamic properties

of all social organization.

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ADJUSTMENTS TO NATURAL HAZARDS

The relationship between human populations and the natural environment has been a subject of investigation by social scientists for a long time. Early efforts (Park 1936) viewed human

collectives as adaptive units that respond to the natural world. Others like Hawley (1950) have emphasized the study of the mechanisms through which adjustment occurs and specification of the physical-social relationships that define human-environment interaction (Duncan 1964). The general field is known as human ecology, and investigations seek the causes of human behavior in the natural environment and the processes that facilitate human adjustment to the physical world through social organization (Duncan and Schnore 1959).

Extremes in routine natural processes, when they impact a human collective, can cause disaster. Extremes in physical systems become disasters when the social systems they impact have only partially taken such extremes into account when adjusting to the physical world; that is, when human beings don't anticipate how natural hazards might effect their communities. Human collectives typically emphasize adjustment to physical systems on the basis of the probable routine of nature

rather than its equally predictable, although less frequent, extremes.

The environmentally routine in a hydrological--water-- system, for example, is the presence of a river, lake, average annual rainfall and other factors to which the human aggregate adjusts and on which it often depends. When extremes in this same physical system occur, for example as a flood or drought, they can result in a disaster. Environmental extremes are commonplace. Although they are of lesser probability in the short-term than is the environmentally routine, they are certain to occur over the long-term. For example, a river is likely to continue to flow within its "normal" banks over a period of years; but, at sometime, it will overflow its banks and flood nearby areas. If the river runs through a community, this could result in a disaster.

The balance of this chapter will focus on human **adjustment** to living with natural hazards--the environmental extremes of nature. Historically, this approach derived from human or social ecology (Faupel 1985) which places a major emphasis on the "human-environment" system; that is, the character and magnitude of a hazard is affected by human action. In other words, disaster impacts are a consequence of both physical and

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social systems that have been constructed by human effort. This

trend in natural hazards and disaster research has shifted

attention from studies of disaster response to investigations of

how humans have created situations that endanger their

communities and how human action can lessen the potentially

disruptive effects of natural hazard agents through various

means.

From the perspective of environmental sociology, natural

hazards research attempts to explain the choice of collective

adjustment to some possible future disaster event. Given this

objective, our focus in the remainder of this chapter is to

review what is known about adjustment decision-making; that is,

about the selection of types of adjustment during the non-

emergency period before a disaster occurs.

There are two general types of adjustments to environmental

hazards--cognitive and behavioral. **Cognitive adjustments** refer

to ways of thinking about the hazard. Such cognitions would

include: ideas; understandings; feelings; expectations of the

frequency, causation and intensity of the occurrence of the

event; and perceptions of the potential impacts of a disaster

agent. Such cognitive processes routinely involve some

assessment of risk to which individuals and their social systems

are exposed. Risk, for purposes of this discussion, is defined

as the expectation of certain harms or damages to social,

political, or economic systems as well as to the built

environment.

Developing understandings of people's cognitive adjustments

to a hazard provides insight into why people are willing to live

with a threat or to do something to reduce the risk to which

they believe they are exposed; that is, why some people

undertake **behavioral adjustment**--individually or collectively--

to reduce risk while others do not. According to Mileti and his

colleagues (1981), risk reduction is the consequence of

adjustment policies which intensify efforts to lower the

potential for loss from future environmentally extreme events.

Sociological researchers conducting studies on natural

disaster reduction policy and planning investigate collective

attempts (formal and informal, public and private) to reduce

vulnerability and risk, especially those that are associated

with the threat of natural hazards to urban environments. These

efforts have involved both structural (in terms of improving the

physical integrity of the built environment as well as the

structural relationships among social systems) and non-

structural solutions (for example, land use planning and zoning

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policies) to disaster-related problems. Disaster reduction

efforts are undertaken to reduce the consequences of the

disaster impact both before impact (through the use of

mitigation measures) or after impact (through disaster

preparedness and response planning efforts). Especially

important in these studies is the identification of the social,

political, and economic factors that both facilitate and impede

the adoption of disaster reduction efforts by organizations,

professional associations, and governments.

Concerns about adjustment to natural hazards raise two

basic questions. First, what factors account for the emergence

of, interest in, awareness of, and concern about an

environmental hazard? In other words, when do natural hazards

begin to receive a sufficient level of attention, during non-

emergency periods, to motivate people to consider or reconsider

the level of risk which they are willing to tolerate and to whom

do these assessments become important and why? Second, what

solutions (i.e., types of adjustments) are considered to be

acceptable and to whom are they acceptable?

Both of these questions focus on the understanding of

natural hazards and their meanings, implications, and

consequences for those who may be affected by them or for those

who are responsible for the safety and welfare of those who are

potentially threatened. By focusing on the social processes

through which these understandings are formulated and shared,

the importance of the communication process in the formulation

of risk perceptions and policy solutions is highlighted. Also

central to both of these questions is the concern about

differential decision making with regard to adjustment to

natural hazards, both within and across communities. When there

are competing definitions of the acceptability of risk? What

political and policy processes result in the selection of a

collective adjustment strategy or mix of strategies?

The following sections review the natural hazards and
disaster literature under three headings that shed some light on
the above questions: hazard perceptions (i.e., perceptions of
risk that facilitate adjustment); emergency preparedness and
response planning (i.e., adjustments which increase the capacity
of a social system to respond to disaster); and mitigation
(i.e., adjustments to reduce risk).

Hazard Perception

Although used in a variety of ways, **hazard perception** can

be defined as beliefs about the existence and characteristics of

a natural hazard. Hazard perception studies have been

undertaken to investigate how people come to understand the

risks from natural hazards to which they are exposed, and how

those understandings are related to their behavioral responses.

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While most of these efforts have been traditionally directed to public perceptions of natural hazards and the risks they entail, more recent research has focused on the development of risk perceptions by professionals and governmental actors who have key roles in the development of disaster reduction initiatives. Particularly important in these studies has been the identification of contextual, cultural, and historical factors that have influenced the ways in which individuals and communities adjust to the risks from a natural hazard agent.

In general, research on natural hazard perception concludes that it is a necessary but not sufficient cause of human adjustment to natural disaster, and that perception thresholds must be reached or exceeded for action to occur.

Studies of hazard perception have focused on how individuals and collectivities come to understand the character and relevance of the hazard for themselves and their community. Hazard perceptions are often influenced by the characteristics that are associated with the expected future disaster. Such characteristics include the notions of speed on onset, scope, intensity, duration, frequency, temporal spacing, casual mechanisms, and predictability (Dynes 1970). Another key component of hazard perception is the development of a **risk**

perception (that is, a belief in the seriousness of the threat)
that directly influences attitudes and dispositions about the
need to consider further adjustments through the enhancement of
preparedness and/or mitigation efforts (Mileti 1980).

Individual, collective and cultural perceptions of extreme
events, as well as hazard-reduction adjustments, are vital to
reducing the vulnerability of the built environment from the
impact of a natural disaster agent. Perception plays a vital
role in the hazard adjustment process, expanding our
understanding of the frequent mismatch between selected
adjustment options and the objectively-determined level of risk
(Parker and Harding 1979).

Although some empirical evidence has been found to support
a causal linkage between hazard perception and behavioral
adjustment (e.g., Mileti, Drabek, and Haas 1975), these linkages
have been weak (e.g., Saarinen 1982). Since the individual is
the unit of analysis in studies of perception of natural
hazards, behavioral adjustment has been defined variously as
actions which can be taken by individuals: the purchase of
insurance (Kunreuther 1978); improvements in household
preparedness (Turner et al. 1986); and mobility decisions
(Kiecolt and Nigg 1982). While awareness may be necessary for

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the eventual decision to engage in behavioral adjustment, it is not sufficient in and of itself.

However, when the hazard perception specifically includes an assessment of risk, slightly stronger relationships are found. Mileti (1980), for example, concluded that the greater the perceived damage or harm that could result from the disaster agent, the more likely hazard adjustments would be undertaken. Several researchers have posited the existence of a "hazard perception threshold" to explain this adjustment process (e.g., Kates 1962, 1970; Slovic, Fischoff, and Lichtenstein 1974; Preston, Taylor, and Hodge 1983). Only when expected losses exceed some critical value or threshold will individuals and collectivities begin to consider new adjustment options.

A larger body of literature suggests that past experience with a specific hazard agent may have consequences for behavioral adjustment; however, findings on the influence of past experience are somewhat difficult to reconcile. Simple past experience alone does not account for peoples' current behavioral adjustment (e.g., Hanson, Vitek, and Hanson 1979). However, Preston and her colleagues (1983) found that awareness of a natural hazard was influenced by the ease with which people recall or imagine the intensity and impact of an event's

occurrence, providing an explanation of why rare events (those which occur infrequently) generally do not provide sufficient motivation for adjustments to take place under "normal" (i.e., non-emergency) conditions. When the frequency of disaster events is low, people have little opportunity to become familiar with the likely consequences of experiencing disruption in their environments and how various adjustment options could reduce the extent of that disruption.

Alternatively, however, researchers have also concluded that when disaster events occur **more** frequently in an area and people have more experience with that hazard agent, they begin to underestimate the threat, thereby not engaging in further behavioral adjustments. Two different lines of reasoning have been used to explain why these underestimates occur--one focuses on cognitive adjustments; the other on the development of disaster subcultures.

Cognitive adjustments. All cognitive adjustments involve changes in people's awareness of environmental hazards. These changes allow for the reduction of cognitive dissonance (i.e., the psychological discomfort) people feel when they hold two conflicting beliefs simultaneously. In hazardous environments, cognitive dissonance may arise when a person believes that a

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threat exists but still expects to continue living in that environment (Shippee, Burroughs, and Wakefield 1980).

Researchers have identified several solutions to such dissonant situations. Taylor and Hall (1976) suggest that people grow accustomed to the existence of the environmental hazard over time and their concern about the threat is diminished. Weinstein (1983) states that people are unrealistically optimistic about the future, believing that they are less likely to be negatively affected by any possible future event. The most extreme form of cognitive adjustment results in the denial of the existence of the threat from a particular hazard (Slovic et al. 1979).

Slovic and his colleagues (1974) have identified a process whereby cognitive adjustments are made. They suggest that people have "anchors"--starting points for judgments about the hazard--which are adjusted over time to accommodate new information. The worst past experience, therefore, becomes the standard against which future impacts are judged. This explanation of the hazard perception development process accounts for the differential development of adjustment patterns both within and across communities. Those who have directly experienced the impact of a past disaster have greater

familiarity with the consequences of disaster impacts and are
more willing to undertake and support preparedness and
mitigation adjustments than are those who did not have these
direct experiences. Those who did not share in these
experiences, even though they lived in the same community, may
not feel that further behavioral adjustments are warranted.
Cognitively the latter's anchors may be adjusted to reflect this
new event; however, the need to reconsider additional behavioral
adjustments may not exist since they were relatively unharmed by
this worst case experience.

Disaster subcultures. The concept of a disaster subculture
was first developed by Moore (1964) to refer to the cultural
defenses which groups develop to cope with recurrent dangers.
This includes adjustments--cognitive and behavioral, individual
and collective--that are used by residents to prepare for, cope
with, and respond to a disaster agent that has struck or that
tradition indicates will strike in the future.

Wenger and Weller (1973) suggested three factors that
facilitate the emergence of a disaster subculture. First, the
community must have experienced repetitive disaster impacts and
perceive that there is a recurrent, chronic threat from that
hazard agent again in the future. Second, the development of a

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subculture is facilitated if the disaster agent allows for a

period of forewarning, providing an opportunity to implement

hazard reduction activities to lessen the impact. Third, the

belief that damage will be widespread and could affect any part

of the community facilitates the emergence of a disaster

subculture.

Research in the area of disaster subculture has been sparse
(e.g., Turner, Nigg, Paz, and Young 1980); however, there are
indications that individuals tend to become complacent about
making behavioral adjustments to a continuing threat from a
natural hazard if the organizational component of the subculture
is strengthened. For example, Hannigan and Kueneman (1978)
discovered that as government accepts greater responsibility for
flood mitigation, individual interest in flood-related matters
is weakened. This finding suggests that individuals may be
lulled into a false sense of security and become less prepared
to cope with or respond to a disaster event because
organizational adaptations to the threat appear to be
sufficient. Underestimation of the threat, in this case,
appears to be related to a sense that the government is
responsible for reducing natural hazard threats and risks.

Emergency Preparedness and Response

Emergency preparedness refers to how and to what extent

people, organizations and communities have adjusted to natural

hazards and the disasters they cause by readying themselves to

respond to future environmental disasters. Typically, response

to natural disasters such as those caused by hurricanes,

earthquakes, tornadoes and other environmental extremes is both

more effective and efficient if emergency plans exist before a

disaster occurs. The focus of research on emergency

preparedness has been on how organizations such as fire and

police departments prepare for disasters. Additionally,

research has sought to explore how organizations interact and

network with one another to mount a coordinated community level

response to disaster. Research findings on this topic fall into

two general categories. These are organizational factors

(elements within each disaster response organization) and

community organizational factors (those pertaining to all

responding organizations in the community struck by disaster).

This section of the chapter reviews these research findings.

Organizational factors that effect disaster response. A

large number of research studies have focused on the

effectiveness of preparedness for, and organized response to,

disaster. These studies, when brought together, point out key

elements of good emergency preparedness and effective response

to disaster. The first of these is normativeness. It has been

found (Adams 1970, 1966; Anderson 1969,; Drabek and Quarantelli

1967) that the less an organization has to change from its

routine non-disaster work (that is, its everyday work tasks and

roles) to perform in a disaster, the more effective is its

actual disaster response. In essence, organizations like fire

and police departments whose daily operations can be switched to handle the emergency at hand do better than organizations who must adopt new operations that are unique to the emergency.

Second is the ability of an organization to be flexible. Organizations that are better able to vary from standard operating procedures during the disaster are typically more effective than those that cannot be flexible (Drabek, Tamminga, Kilijanek, and Adams 1981; Kreps 1978; Stallings 1978). For example, an organization that has very bureaucratic work rules has a difficult time dealing with and adjusting to the uncertainty of disaster situations (Dynes 1969). The result of inflexibility is that response to the disaster suffers. Flexibility is useful in many ways, including flexibility in doing disaster work, in decision making (Drabek et al. 1981), in mobilizing the organization for disaster response, in taking on new disaster-related tasks and work, and in giving up autonomy in order to become part of the general community response to the disaster (Dynes 1969: 191).

A third major factor that affects the ability of an organization to be effective in responding to disaster is being prepared (Kreps 1978; Quarantelli 1970). Disaster preparedness

enables members to see how their organization's responsibilities fit into the general community's disaster response plan (Haas and Drabek 1973). By engaging in preparedness planning, members of an organization become aware of the internal authority structure of that organization during the disaster response process (Dynes 1969: 20); a need that is particularly acute since authority in organizations during emergencies typically changes from what it is during routine non-emergency operations. Preparedness also defines what functions organizations are expected to perform in a disaster situation (Dynes, Quarantelli, and Kreps 1972: 54). A clear definition of anticipated activities, tasks and priorities is important in emergency situations because internal as well as community demands are so numerous. Organizations that must discover their disaster-related tasks and activities during a disaster are rarely as effectively as they could have been if this planning were done before the onset of the disaster agent.

Several other aspects of emergency preparedness affect the effectiveness of organizations in responding to disasters. First, resources (staff and equipment), if adequate, enhance disaster response (Kreps 1978), as does access to important information (Quarantelli 1970). Preparedness planning typically

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pre-identifies resources that can then be allocated as the need

arises. Second, preparedness also helps organizations to

respond more effectively to disasters by legitimating the roles

and responsibilities of individual organizations, thus reducing

interorganizational conflict during disaster response (Stallings

1978). Third, preparedness helps an organization respond to

disaster by creating cohesion among the members of the

organizations included in the planning. Worker commitment

(Dynes 1970), group cohesion (Form and Nosow 1958), and an

absence of role conflict (Dynes 1969) indicate that

organizational workers can be more effective in their post-

disaster efforts.

Community factors that effect disaster response .
Individual organizations certainly do not function independently

during disasters. A rich research history has explored the

nature and character of preparedness with respect to how

different community disaster response organizations relate to

one another in emergencies and how such relations determine

disaster response effectiveness (Wenger, Dynes, and Quarantelli

1986). An overriding conclusion of this research is that inter-

organizational coordination enhances the effectiveness of

community-level response to any disaster (Quarantelli 1988,

1992).

Several factors have been identified that enhance overall effectiveness of a community's response to a disaster event. First, at the community level, there must be some agreement or consensus about what organizations are expected to perform what tasks in a disaster situation (Dynes 1978; Kreps 1978; Quarantelli and Dynes 1977). This type of specific planning facilitates organizational interaction by legitimizing the emergency roles of all organizations involved in the process (Dynes 1978, 1969; Stallings 1978). Second, it establishes lines of authority among these organizations (Drabek et al. 1981) which helps to avoid conflict and to expedite decision making across the organizations. The result is a better integrated community response to the disaster. Third, the number of organizations included in community-level plans for disaster response should not be large (Dynes 1969; Warheit 1968). If too many organizations are included in community level response plans, integration becomes difficult and effectiveness can actually decrease.

Fourth, integration of the organizations in a community plan is easier to achieve if the organizations normally interact with one another during non-disaster times (Drabek et

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al. 1981; Dynes 1978). Organizations that are used to
interacting with each other are more readily able to coordinate
in an emergency, often because of the personal contacts that
have been established by the members of the organizations made
over a longer period of time. Also, when organizational
members understand the internal operations and structure of
other organizations, it is easier to coordinate with them during
a disaster (Dynes 1978). When such integration and coordination
is absent, the gap can be filled by inter-organizational
competition, resulting in a decrease of the effectiveness of
community disaster response. Fifth, communication between
organizations is another essential ingredient for an organized
community-wide emergency response (Drabek et al. 1981; Dacy and
Kunreuther 1969). Communication is essential for the quick
dissemination of news about the changing context of the
emergency. Sixth, participation in an effective community-wide
response requires that organizations relinquish some of their
individual autonomy (Mileti et al. 1975; Dynes 1970). Although
individual organizations typically struggle against giving up
their autonomy, preparedness planning makes obvious the need to
surrender some autonomy to those who are responsible for
coordinating the overall disaster response.

Mitigation

Mitigation refers to those actions undertaken to reduce a community's vulnerability from the possible future impacts of a hazard agent, whether natural or technological. Although individuals can also undertake mitigation measures, most of the emphasis in mitigation efforts as well as in mitigation research is on professional and governmental attempts to reduce vulnerability. Mitigation activities are generally thought of as collective solutions to a threat which could have widely felt effects in a community, region, state, or country.

There are generally five ways of reducing the physical impacts of a natural hazard agent (Petak and Atkisson 1982). The first two efforts concern ways of preventing or modifying the occurrence of a hazard. First, structural protection for a geographic area can be enhanced--for example, through the construction of dams, levees, channels, and seawalls--to lessen the likelihood of flooding due to severe storms. Second, specific buildings or developments can be protected through site preparation. For example, the installation of hillside drains and debris basins can lessen the impacts of severe storms by reducing the likelihood of erosion and mud floods.

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Third, attempts can be made to avoid the hazard by changing where people build. Land use planning and regulation are the techniques generally used to discourage building in areas where natural hazards have the greatest impacts. Flood plain management, for example, has been used to limit the types and amount of new development in areas that are prone to riverine and coastal flooding. Fourth, the control of building practices through the adoption of building codes is one of the primary methods used to enhance the structural integrity of the built environment. Through the adoption of building codes-- particularly those incorporating wind and seismic design-- governments make attempts to change how people build, to provide a minimum life-safety standard where the existence of a natural hazard agent is known. Finally, strategies can be developed to remove buildings that are determined to be hazardous from the existing stock of buildings in use.

Numerous factors influence the adoption of these various techniques. Why do some communities adopt certain mitigation measures when other communities that have a similar objective risk do not, opting either for a different mix of techniques or none at all? What characteristics of communities and their histories of experience with the natural hazard agent are

related to the preference for some hazard reduction measures

over others? How does the political and economic climate of a

community affect the adoption of different mitigation

strategies? These questions highlight the importance of the

need to understand the decision-making process of key actors as

they consider different mitigation actions.

Mitigation is one of the newest areas of research emphasis

in the natural hazards and disaster field, only attaining

significant attention from sociologists within the past 15 years

or so. Social geographers led this field with enquiries about

the success of flood mitigation efforts (e.g., White 1964,

1975). More recently, questions have been raised by planners

and political scientists about the success of the National Flood

Insurance Program-- the federal government's primary policy tool

to reduce flood risks (e.g., Burby, French, Cigler, Kaiser,

Moreau, and Stiftel 1985).

Similar questions have also been raised about local, state,

and federal attempts to reduce community vulnerability from

earthquakes (Panel on Seismic Policy Adoption and

Implementation, 1996). Sociologists began investigating how the

public assessed earthquake threat in the mid 1970's when

geoscientists in California felt they were on the verge of being

able to predict earthquakes and governmental officials were

concerned about how the public would react to such announcements

(e.g., Mileti et al. 1980; Turner et al. 1986). Contrary to the

belief that people would become overly fearful and be likely to

engage in mass evacuation if such announcements were issued,

these research efforts concluded that the public wanted to be

kept informed, even of very low probability events, and was

positively disposed toward continued efforts to educate them

about how to respond if such announcements were made.

Subsequent assessments of how people did in fact respond to

such announcements confirmed the sociological contention (e.g.,

Nigg 1982) that people would not panic, but would instead

continue to function normally while seeking additional

information about the prediction and hazard-reduction measures

(Goltz 1984). Building on this earlier interest in how people

understand scientific assessments of earthquake risk and its

relationship to behavioral adjustment activities, more recent

research is being undertaken to assess public response to the

state of California's attempt to inform potentially affected

residents about the most recent large magnitude earthquake

prediction (Mileti and Fitzpatrick 1993).

Although substantial research attention has been focused on

California because of its considerable earthquake vulnerability,

other areas of the country are also known to be at risk from

earthquake threat--for example, the Puget Sound area of

Washington; the New Madrid area of the Central States along the

Mississippi River; Charleston, South Carolina; Alaska; and

Hawaii. Researchers are now turning their attention toward

understanding the adoption of earthquake mitigation adjustments

in these areas of objectively high seismic risk, high seismic

vulnerability (because the built environment has not been

constructed with seismic concerns in mind), but a low

probability of the occurrence of a damaging earthquake event

(e.g., Mushkatel and Nigg 1987a, 1987b; Berke and Beatley 1992).

   Research has confirmed that the adoption of adjustments is

strongly associated with the high frequency of occurrence of a

specific natural disaster agent. When such events are

infrequent--such as a damaging earthquake--but their occurrence

could result in significant life loss and economic and social

disruption to a community or region, what conditions are likely

to lead to the adoption of mitigation adjustments?

   Mileti (1980) has identified two factors which he believes

are related to the adoption of community risk mitigation

adjustments across natural hazard agents--the capacity to

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implement various policies; and the perceived costs of the
implemented policy. Capacity refers to the resources a
governmental or administrative entity has to undertake
additional adjustment-related tasks in relation to their on-
going responsibilities. The capacity to implement any new
mitigation effort is high if it does not require much change in
resource allocation and utilization from the status quo. Higher
levels of adoption are also related to the availability of both
economic resources and expertise which are necessary to
implement new programs.

Even if decision makers believe that their community is
exposed to a significant threat, they may believe that the cost
involved in attempting to mitigate that hazard is unacceptably
high. Costs are not limited to economic concerns solely, but
also include calculations of social and political costs as well.
Elected officials, especially those at the local government
level, must weigh the social costs of not taking action
(possible life loss and economic disruption) against political
costs of supporting litigation actions (unfavorable reactions by
interest groups who would be required to bear economic costs for
changing their current practices or who would not get support
for non-hazard related programs, such as social welfare

programs).

This research emphasis on mitigation adjustments to high risk-low probability natural disaster events has a great deal in common with similar concerns raised about some technological hazards, especially those associated with fixed-site facilities. Why do some communities "accept" the risk associated with a nuclear power plant or a catastrophic earthquake or volcanic eruption; while other communities become actively involved in attempting to reduce the risks associated with these hazards? While some research assessments have been conducted on the differences in the hazard perception related to natural vs. technological hazard agents (e.g., Slovic et al. 1979; Baum, Fleming, and Davidson 1983; Couch and Kroll-Smith in this volume), the question of willingness to accept risk on a collective basis--and the manner in which individuals and organizations adjust to those decisions--constitutes an important area for future study.

CROSS-CUTTING CONCLUSIONS

We have tried in this chapter to provide an overview of research directions and findings regarding the perception, mitigation of and preparedness for natural hazards and disasters. Research and theorizing on natural hazards and disasters has also suggested several insights that cut across these specific areas. In this concluding section of the chapter, we present these general cross-cutting ideas about societal adjustment to natural hazards and the disasters they can create.

Natural disasters are not acts of God, occurring randomly and having societal impacts which must be borne. Natural

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disasters are simply consequences of extremes in natural

inevitable processes; as such, they are low probability events.

These natural extremes become disasters only when they impact

the human collective and the constructed or built environment

which society has erected. The consequences of natural

environmental extremes are disaster events, therefore, only as a

consequence of human actions such as building in a floodplain,

on a landslide shoot, near an earthquake fault or along a

coastline; or using construction practices that result in

buildings not capable of withstanding natural forces like

moderate ground shaking in earthquakes or high velocity winds in

hurricanes.

Society and communities adjust to the risk of natural

disasters through a variety of mechanisms. Some of these

mechanisms have been reviewed in this chapter; they include, for

example, emergency preparedness, mitigations like building

codes, warning systems and insurance. Societal adjustment to

the risk of disaster imposed by natural hazards is not, however,

altogether rational and in proportion to the risks faced. In

fact, risk is often ignored or, in many cases, unknown until

extensive development has already taken place. Adjustment to

the risk of low probability natural events (for example, a

damaging hurricane every 60 years or a great earthquake every

140 years) is costly, and the benefits of that increased

protection may not be realized for decades. Consequently, it is

easy to understand why society has not fully adjusted to risks

posed by natural hazards and why natural disasters continue to

occur. In fact, if one could predict the future it might be a

safe bet to expect natural disasters to escalate in the

magnitude of their impacts. Societal trends, like the growth

and increasing concentration of populations in hazard-prone

areas, foretell ever increasing numbers of people and structures

at risk despite purposeful attempts at risk mitigation.

Additionally, the adjustment process is hardly proactive.

In fact, adjustment to the risk of natural disaster is typically

reactive. Society typically readies for and adjusts to the risk

of disasters already experienced rather than those which it

faces in the future. For example, the state of California has

long enforced building codes that increase seismic resistance of

structures. Those adjustments to risk largely came after

earthquakes occurred, illustrating earthquake damage: in 1932

the Long Beach Earthquake, public school buildings collapsed and

this led to legislation to enhance the design of schools; in

1971 the San Fernando Earthquake collapsed a hospital and

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subsequent legislation was passed to enhance the design of hospitals; in 1989 the Loma Prieta Earthquake caused the collapse of the I-880 freeway in Oakland, resulting in retrofit regulations for all elevated highways and bridges in California. Meanwhile, although the risk of a great earthquake in other parts of the United States is high (for example, in Memphis and Charleston), it has been difficult to alter building codes in those areas and adjust to seismic risks since a damaging earthquake has not occurred in either area for decades.

The reactive character of the adjustment process has resulted in an uneven and varied distribution of societal adjustments to natural disaster agents across the United States. The historical occurrence of disasters has facilitated adjustment where disasters have recently occurred; yet they are often ignored elsewhere despite the risk that exists. The risk of future disasters may be just as probable and in fact even more likely in some regions of the nation where they have not yet happened or where they infrequently occur. For example, the risk of a future great earthquake is lower in areas where one has recently happened and can be increasing daily in seismically prone areas where one has not occurred for decades.

Despite the innate tendency of the adjustment process for

natural hazards to be reactive rather than proactive and disproportionate to risk rather than proportional to it, advances have been recently made to enhance the adjustment process and increase its rationality. The adjustment process, which largely occurs through the adoption and implementation of mitigation and preparedness actions, continues to become more and more institutionalized into the society of the United States. There are increasingly larger and larger numbers of people who pursue careers devoted to reducing the risk of natural disasters; and there are ever increasing numbers of national, regional and state programs devoted to escalating adjustment accomplishments. It is difficult, however, to now estimate what the actual outcome will be of the efforts of this ever-increasing number of adjustment-bearers. It is tempting to hypothesize that some of them must inevitably be successful, resulting in increased societal adjustment to natural disasters. On the other hand, it is also possible that increased adjustment accomplishments and attention to natural disasters may only be a societal reaction to increased risk flowing from trends in processes like increased urbanization. The result of increased adjustment may simply be to keep risk constant or, worse, to only slow its rate of growth.

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The inevitable occurrence of extreme natural events in the physical environment insures that the study of natural hazards and disasters will remain a vital area of inquiry and a crucial arena for the study of societal-environmental interactions.

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