

tendations have been set forth by the committee, primarily because traditional topics within, respectively, hazards and disaster research necessarily are interrelated. The committee also wishes to ensure that stakeholders have the flexibility to consider the broad range of research and application issues specified in its statement of task.

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Societal Changes Influencing the
Context of Research

The explosion in Halifax harbor on December 6, 1917 precipitated social science interest in disasters, hazards, and their associated risks. The SS Mont Blanc was laden with munitions that completely leveled approximately two square kilometers of northern Halifax when they exploded. More than 2,000 people were killed in the blast or lost to the subsequent tsunami, which inundated a Native American encampment in an upstream cove. Thousands more were injured. This singular event inspired a sociology doctoral student, Samuel Prince, to write his dissertation on the collective behavior of the community in response to the disaster (Prince, 1920).

Elsewhere, geographer Harlan Barrows suggested that his discipline was particularly well-suited to examine the relationship between natural environmental processes (e.g., hazards) and societal responses to them. Paralleling developments in the biological sciences toward integrative approaches to understanding organisms and their environment (the nascent field of ecology), Barrows took the occasion of his presidential address to the Association of American Geographers to argue for a new view of geography as human ecology—understanding the interaction between natural events and human agency and response (Barrows, 1923). His ideas resonated with one of his students, Gilbert F. White, and the social scientific study of natural hazards began in earnest.

World War II and, in particular, the United States Strategic Bombing Surveys (Fritz, 1961) had a strong influence on sociology and to a lesser extent on psychology with respect to the types of events studied in the

ensuing decades (e.g., rapid-onset, big-bang types of natural and human-induced disasters that roughly parallel the effects of explosions). World War II and Cold War public policy concerns about nuclear weapons had a profound effect on the directions of these two disciplines. Thus, parallel development of the hazards field in geography before, during, and after the war was absolutely critical for achieving a balanced perspective, as was Gilbert White's leadership in natural hazards, generally, and flood hazards, more specifically, in terms of public policy.

It is not coincident then that hazards and disaster research coevolved at roughly the same time. Studies of disasters, hazards, and their associated risks have always been grounded in the everyday and guided by the prevailing social, economic, and political conditions in specific historical periods. The context within which disasters, hazards, and risks are studied and the ways in which society responds to them are often a function of demographic, economic, and political changes not only in the United States, but throughout the world (see Chapter 6). The nature of the subject matter addressed by social scientists—whether events that arise from the interaction of natural systems and human systems, willful or human-induced threats, or technological failures—means that it is impossible to understand the human response without understanding the larger context within which that response takes place. Thus, to understand the types of events studied and the substantive topics addressed by hazards and disaster researchers, some of the macro- and meso-level societal changes that have influenced social science research on hazards, disasters, and risk must be reviewed.

Accordingly, this chapter provides an overview of societal changes that influence how and what hazards and disaster researchers study. The chapter begins with discussions of basic demographic shifts and economic developments in the post-World War II era. A general discussion follows on geopolitics at home and abroad and its implications for hazards and disaster management policies and practices. The reactive nature of these policies and practices in the United States is then characterized as are subtleties related to the enactment of specific mitigation, preparedness, and response initiatives. Settlement patterns are given specific attention in this regard because of their direct and highly complex relationships to hazard vulnerability as well as land-use planning and other forms of hazard mitigation. A discussion of the influences of societal changes would not be complete without a consideration of quality-of-life and social equity patterns and issues as they relate to social vulnerability. To complete its context-setting function for the report, this chapter closes with discussions of technological change and global environmental patterns. The questions that are raised in the conclusion illustrate the uncertainties and continuing importance of societal change for hazards and disaster research.

DEMOGRAPHIC SHIFTS

The demographic character of the United States and the world has changed significantly during the past 50 years. The basic composition of American society, as viewed by its age structure, increasing ethnic and linguistic diversity, and disparities in socioeconomic status creates regional patterns of demands for housing, employment, and quality of life. Not surprisingly, large-scale population shifts experienced during the past 50 years, such as the out-migration from the industrial Northeast to the Sun Belt cities in the South and West, and the movement of people from rural to suburban and urban places and to coastal areas, has exacerbated the vulnerability of many of the nation's citizens to environmental hazards (see Chapter 6). Changes in the age structure of the American population, its racial and ethnic diversity, and patterns of socioeconomic status also provide an important context for social science research in the field.

Life expectancy has increased dramatically over the past 50 years. In 1950, for example, a person born in the United States had a life expectancy of 68 years. By 2000, that life expectancy had increased to 77 years, leading to an increasingly large portion of the population who are over the age of 65—many of them women whose life expectancy is 5.4 years longer than that of men. By the year 2020, it is expected that 20 percent of the U.S. population will be over 65. This demographic transition is common among industrialized nations, especially those that experienced a baby boom immediately after World War II, but a generation later, fewer births occur. Unlike most countries in Western Europe, the United States has maintained birth-rates near the replacement level of 2.1 children per woman of childbearing age. Despite this, the U.S. population continues to grow, largely due to immigration.

As the population ages, more demands are placed on health care services, affordable housing, and the special needs of the elderly population during disasters. The impacts of Hurricane Charley in August 2004 (see Box 2.1) illustrate how the changing age structure of Americans affects what hazards and disaster researchers study.

There is greater diversity in terms of race, ethnicity, and culture (including language) in the United States at present than at any other time in its history. In 1950, for example, the U.S. population was approximately 150 million, with 89 percent racially classified as white and 11 percent non-white. The faces of America continue to diversify, as the 2000 Census confirms: With a population of 291 million people, 80 percent were classified as white; 13 percent African American; 4 percent Asian; 1 percent American Indian and Alaska Native or Native Hawaiian and Other Pacific Islander; and 1 percent claiming to be of one or more races. Among the white population, 17 percent claim Hispanic or Latino origin (U.S. Census,

BOX 2.1 Hurricane Charley in Punta Gorda, FL

Charlotte County, located on Florida's southwest coast between Fort Myers to the south and Sarasota to the north, is an ideal location for retirees. The calmer waters of the Gulf of Mexico, less development, and a good quality of life appealed to many snowbirds as they sought retirement communities. In fact, Charlotte County has the highest median age of any county in the mainland United States—54.6 years.

For many of the county's new residents, affordable housing meant manufactured housing. After selling homes in the north, retirees moved to the Sunshine State and put their nest eggs in mobile homes. Because the homes were purchased with equity from the previous home rather than through a mortgage, some of the elderly chose not to carry hazard insurance on their homes (a mandated requirement if the home was financed through a bank). The home became the nest egg for the elderly, but on August 9-14, 2004 much of that changed as Hurricane Charley, a category 4 storm, slammed into the Punta Gorda area, catching many residents off-guard because the storm was predicted to make landfall 100 miles to the north. The mobile homes (especially those purchased prior to 1992) did not weather the hurricane force winds and were totally destroyed.

Not only have the elderly lost their life savings, but the longer-term impact on their physical and mental health is uncertain as they try to recover from the devastating effects of Hurricane Charley.

2004:Table 21). As the nation has become more racially and ethnically diverse, the race and ethnic classifications employed by the decennial census have changed as well—posing significant challenges for the research community, especially those interested in longitudinal studies. In the 2000 Census, for example, six racial categories were used: white; black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and Other Pacific Islander; and One or more races. Also, two ethnicity categories were used: Hispanic or Latino and Not Hispanic or Latino (Brewer and Suchan, 2001).

These demographic changes present important challenges for disaster mitigation, preparedness, response and recovery, in part because they often result in differential impacts on various social groups as Box 2.2 illustrates. The geographic distribution of this racially and ethnically diverse population has also influenced the kinds of research that hazards and disaster researchers pursue. For example, there is increasing research interest in racial and ethnic disparities in disaster impacts as well as differences in coping responses and longer term recovery capabilities based on race and ethnicity (Bolin and Bolton, 1986; Bolin and Klenow, 1988; Peacock et al.,

BOX 2.2 Response to Crisis: Linguistic Diversity and the Northridge Earthquake

Southern California is one of the most ethnically diverse metropolitan areas in the nation and one of the most racially differentiated. The vulnerability of Los Angeles has been shaped by the post-war patterns of immigration, urbanization, and environmental transformations that have reshaped the natural landscape. Disasters are no longer unusual events, but are embedded in the region's psyche (Davis, 1998; Ulin, 2004). Despite this, there remain some interesting challenges in warning residents of dangers and in assisting them following a natural, technological, or willful disaster event. For example, there are more than 224 identified spoken languages and dialects in the Los Angeles region, and 180 different language publications. Within the Los Angeles Unified School District, there are 92 recognized languages (Los Angeles Almanac, 2004). This linguistic diversity poses severe problems in communicating warning information and ways to protect themselves to the residents. It may impede rescue, relief, and recovery efforts in the aftermath of a disaster as was seen in the 1994 Northridge earthquake (Bolin and Stanford, 1998). Finally, interesting questions arise from the differential use of foreign language media by emergency managers and the receptivity of different language media to disseminate warning messages.

1997; Fothergill et al. 1999). Changes in the racial and ethnic identities of Americans as well as modifications in the way we measure them, have affected hazards and disasters research. For example, prior to 1970 there was no Census variable for Hispanic populations, so tracking regional or local changes in this ethnic population can only occur for the past 30 years.

The gap between the rich and privileged and the poor and disadvantaged has widened in the past 50 years. The key measures of socioeconomic status (education, occupation, and income) all have changed dramatically. In 1950, only 6 percent of the population over the age of 25 had completed 4 or more years of college; by 1970 this had risen to 11 percent; and by 2000, nearly 25 percent of the population over 25 had a college degree. In 1950, almost half (47 percent) of the population had completed eight or fewer years of formal education, but by 2000, most Americans graduate from high school (80 percent). However, seven percent of Americans still only have eight or fewer years of formal educational training. There is significant variability in educational achievement by race, ethnicity, and gender. High school completion rates are highest among white females and lowest among Hispanic females. Regionally, Texas, Louisiana, Alabama, and West Virginia have had the lowest percentage of high school graduates (less than 80 percent), while the Great Plains states (especially Wyoming,

Minnesota, Nebraska, and Montana) along with Alaska and New Hampshire have the highest (around 90 percent) (U.S. Census, 2004: Tables 213 and 216).

The poverty rate has also improved since the 1950s, when approximately 30 percent of the population lived below the poverty level. By 1970, only 12.6 percent of the American population lived below the poverty level. However, despite the economic growth over the past 30 years, the percentage of Americans living below the poverty level (12.4 percent) in 2000 was the same as in 1970. Given the increase in overall population, this means that there were 16 million more people living in poverty in 2000 than there were in 1970. Again, there is variability in poverty levels based on age (20 percent of all children under 18 live in poverty as do 10 percent of the elderly persons over 65) and race (where more than 50 percent of black and Hispanic populations live in poverty). Geographically, the highest levels of poverty are found in the District of Columbia and New Mexico, while the lowest levels are found in Wisconsin and Colorado.

Although the socioeconomic status picture has improved generally, these improvements are not consistent across all portions of the population or by geographic region. Such differences are important to hazards and disaster researchers, because they can lead to an understanding of how communities and their diverse residents prepare for, respond to, and recover from disasters (see Chapters 3 and 4). For example, there is a disproportionate relationship between death rates and economic costs when comparing developing (see Chapter 6) to developed societies. Deaths following disasters are higher in the former and economic losses are greater in the latter. In the United States, death rates related to disasters have declined over time, while economic losses have increased (Cutter, 2001).

U.S. ECONOMIC CONDITIONS AND PROSPERITY IN THE POST-WAR ERA

Unparalleled economic growth and prosperity have characterized the past half-century in the United States. The effects of changing economic conditions not only influence our understanding of the economics and social dimensions of disasters, but also fundamentally alter the social science research agenda, offering challenges, opportunities, and constraints regarding what hazards and disaster researchers study.

The post-World War II era was characterized by increasing economic growth fueled by technological innovations, world dominance as an economic power, and increased demand by American consumers for goods and services. For example, per capita gross national product (GNP) in the United States in 1960 was \$2,929 (current dollars), but it has nearly doubled in every decade since then. At present, GNP per capita is \$33,898 (U.S. Census,

2004: Table 648). Personal incomes have risen as well, but as noted earlier, this trend is not evident in all regions or among all social groups.

The shift from primary sector employment (extractive industries such as agriculture, mining, fisheries) to secondary sector employment (manufacturing) helped fuel the economic engine of the United States. However, in the past several decades, more and more of the economy became service sector based. For example, in 1970, one-third of all employees in the United States were producing goods, but by the end of the century, this had fallen to around 20 percent. This means that the United States relies more on consumer spending and the provision of services as the basis of economic growth than on manufacturing or extractive industries. This shift to a service economy has resulted in the closure of manufacturing plants throughout the industrialized Northeast and Great Lakes Rust Belt and helped fuel the explosive growth in the Sun Belt states—growth predicated on service, not manufacturing jobs. Not only are there regional variations in these patterns, but they also affect workers differently. Generally speaking, the majority of service sector jobs that are low wage often fall to racial and ethnic minorities and women. At the same time, manufacturing jobs (particularly those insured by strong labor unions) are found in the traditional manufacturing belt in the Northeast and Midwest, but not in “right-to-work” states in the South where unions have less traction. Thus, the changing economic structure in which employment and output in services has expanded faster than manufacturing or agriculture influences hazard vulnerability, although some of the effect is likely due to the change in location of economic activity that has accompanied these sectoral shifts, rather than to fluctuations in the size of the sectors themselves (Berry et al., 1996; Clark et al., 2000).

The rise of multinational corporations and their diversification through mergers and acquisitions in the 1970s and 1980s paved the way for exploitative practices (domestically and globally) and a situation in which markets for goods and services are controlled by world supply and demand rather than at the national level (Cutter and Renwick, 2004). The general trend of rising interregional trade in intermediate products has made producers in one region more dependent on inputs from other regions. This could have two very different implications for the effects of disasters. On the one hand, it could mean that disasters in one region have greater effects on output in other regions because of growing global interdependence. Alternatively, greater interregional trade could mean that producers in one region can be supplied from multiple regions. Disasters might interrupt supply from one region, but substitute suppliers would be available so that the overall effects on production in undamaged regions would be mitigated.

During the 1980s and 1990s, deregulation of business, especially the deregulation of transportation and power production, introduced competi-

tion, lowered prices, and raised efficiency. However, part of the increase in efficiency has been achieved by eliminating "redundant" capacity (Cutter and Renwick, 2004). Should average load factors rise, then there is less of a margin between "normal" production and maximum capacity production. Accordingly, the impacts of disasters that damage a portion of the capital stock are more likely to reduce available capacity below normal operating levels and hence to force cutbacks in production. Put another way, what is considered redundant during normal operations may be essential when disaster strikes.

Domestically, consumer confidence still plays a big role in the economic growth of the United States, especially given the shift from a manufacturing to a service sector economy. At the same time, reductions in consumer confidence such as those fostered by the savings and loan crisis of the 1980s and by corporate malfeasance (such as Enron) slow economic growth and often result in periods of economic decline. Well-paying jobs or affordable housing—once the American dream—are beyond the attainment of many. Recessionary periods often hit those at the lower ends of the economic ladder the hardest, so that when disasters occur there is no economic cushion or savings for victims to draw upon during the hard times. Recovery from disasters often takes much longer, especially among those who were barely meeting their basic needs prior to the event.

In addition to the broad trends noted above, there have been changes in the economy that are having and will continue to have significant implications for future disaster problems. In general, these changes have been given little formal analysis. First, the rising spatial concentration of population and economic activity in large urbanized areas places more buildings and infrastructure at risk with a greater potential for catastrophic losses should a natural, technological, or terrorist event occur in a major metropolitan area.

Second, the rising rate of homeownership and ownership of second or vacation homes produces a context in which decisions about location, mitigation, insurance, and other types of disaster preparedness measures are being made by individuals with little expertise in real estate and management. Moreover, the rise of the second (vacation) home has put more real estate in harm's way because such development tends to be concentrated along shorelines where flood and wind damage are more likely or in woodlands where fire hazard is likely. There is evidence that owner-occupants fail to renew National Flood Insurance Program (NFIP) insurance even when there is a significant subsidy in the pricing of that insurance.

Third, there has been a general trend for inventory-to-output ratios to fall over time, particularly in the past decade. This trend extends over a broad range of industries. The change in the inventory-to-output rate reflects changing manufacturing practices, such as just-in-time materials manage-

ment, which necessitates considerable coordination between suppliers and end users or sellers. The benefit of this coordination is lower costs of warehousing and managing inventory. However, it is not clear what effect this lower ratio of inventory to output has on disaster losses and business disruption. On the one hand, there may be fewer goods to suffer damage, but the potential vulnerability of economic activity to disasters in other locations may arise. If inventories of inputs are low, supply interruptions will have more dramatic effects on output.

Finally, the economic repercussions from willful events such as terrorist acts have impacts not only at the local level, but nationally and internationally. The 2001 attacks on the World Trade Center had enormous economic impacts locally, but more importantly, the ripple effects throughout the United States and global economies are being felt years later (Bram et al., 2002; Hughes and Nelson, 2002; Hewings and Okuyama, 2003). In highly industrialized nations such as the United States, there is more capacity in the economic system to absorb short-term direct impacts from hazards and disasters than there is in the developing world, although this is a researchable question. We know little about many aspects of the economics of natural hazards, especially the role of indirect impacts and information effects from disasters on local, state, regional, and national economies (Kunreuther and Rose, 2004). Moreover, the existing research is often at the aggregate level (state or nation) so less is known about disruptions in the supply chain (or spatial nodes) that could interrupt the flow of materials and goods (Park et al., 2005). The economic consequences and disruptions caused by terrorist activity and other unexpected extreme events constitute an important avenue of research for the hazards and disaster research community.

GEOPOLITICS AT HOME AND ABROAD

Like all public policy issues, hazards and disaster policies influence and are influenced by national and international trends and events. In the United States, there have been substantial shifts in national priorities and the "national mood" (Kingdon, 1995) since the 1950s, and these shifts have influenced the nature of social science research on hazards and disasters. The national priorities are a function of changes in the administration and political leadership. Moreover, these macro trends have influenced the evolution of the emergency management system in the United States.

The emergency management system in the United States evolved from preparations taken during World War II and postwar concerns about nuclear weapons (Kreps, 1990). The Federal Civil Defense Act of 1950 was enacted when foreign policy, national security, and civil defense policies were made under the "Cold War consensus" that the Soviet Union was the

most important threat to the nation. The first Soviet nuclear (fission) weapon test in 1949 led to the realization that nuclear war with the USSR was a possibility, and fears of nuclear attack increased with the development of a Soviet hydrogen (fusion) weapon in 1955 and the launch of *Sputnik* in 1957. The Cuban missile crisis in 1962 further raised fears of nuclear war. The organization of federal efforts to address and alleviate the harms done by hazards and disasters reflects broader civil security concerns at the time, as indicated in Figure 2.1. This timeline reflects the fact that for much of the last 50 years, federal policy dealing with natural hazards has been part of broader civil security or, today, “homeland security” functions. The organization of federal disaster policy often subordinated natural and technological hazards preparedness and mitigation to broader national security goals. This is how the system was developed in the early 1950s, although in the Kennedy administration two hurricanes—Donna in Florida in 1960 and Carla in Texas in 1961—led to the establishment of the civilian Office of Emergency Planning (later Office of Emergency Preparedness) in the White House.

Great Society Programs and Hazard and Disaster Policy

The 1960s were a period of substantial social change. The Great Society programs of the Johnson administration sought to revitalize cities and to relieve poverty. Greater efforts to provide federal disaster relief were consistent with the intent of these programs. In the mid-1960s, greater attention was beginning to be paid to natural disasters, including the 1964 Alaska earthquake and Hurricane Camille in 1969 (Waugh, 2000). Camille led to the Disaster Relief Act of 1969 while Hurricane Agnes (1972), which resulted in substantial inland flooding in Pennsylvania and New York, led to the Disaster Relief Act of 1974, which provided for relief assistance to local governments and to individuals (May, 1985).

By 1976, after the souring of some Great Society programs and the Watergate scandal, the national mood had turned against what some called “big government.” The election of President Jimmy Carter began a period of deregulation and government contraction that continued under the Reagan administration. This contraction was generally on domestic spending; after the Soviet invasion of Afghanistan in 1979, the United States began to spend more on defense after the substantial cuts in defense spending following the Vietnam War. By the mid-1970s, it was clear that multiple agencies shared and had overlapping disaster management responsibilities. There were more than 100 federal agencies with responsibility for some aspect of hazards and risks and at least five federal agencies with direct responsibility for emergency management response functions (Haddow and Bullock,

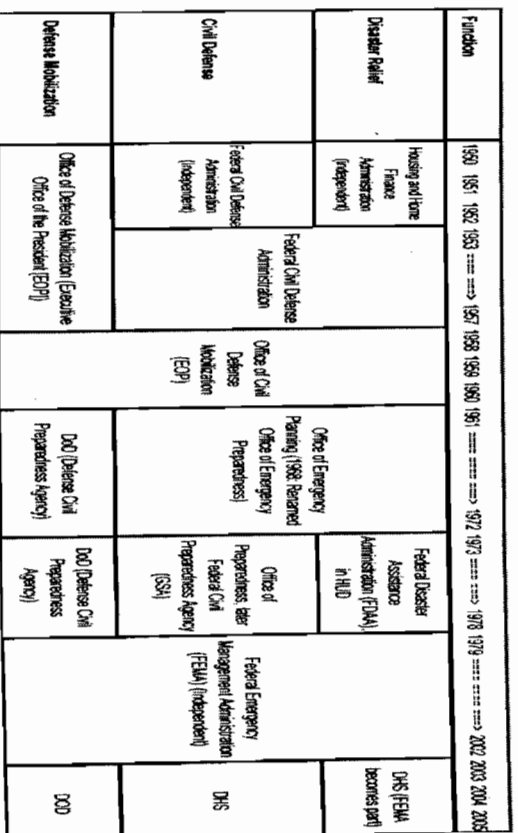


FIGURE 2.1 Organization of federal disaster, civil defense, and defense mobilization functions, 1950-present. NOTE: DHS = Department of Homeland Security; DoD = Department of Defense; GSA = General Service Administration; HUD = Department of Housing and Urban Development.

2003). The creation of the Federal Emergency Management Agency (FEMA) was intended to address some of this overlap (Figure 2.1).

The Reagan administration rejected the policy of détente with the Soviet Union in favor of a more confrontational approach; defense spending increased; and administration officials began to speak of nuclear war survivability (Leaning, 1984). FEMA was not focused very intensively on natural disasters during this time period because there were relatively few of them. Instead, FEMA’s leadership reflected Reagan era commitments to civil defense and preparedness for limited as well as full-scale nuclear war. By the late 1980s, relations with the Soviet Union had improved somewhat, and emergency management moved from a civil defense mentality to again focus attention on natural hazards. Moral problems and charges of political misbehavior at FEMA led to “an agency in trouble” from 1989 to 1992, as the agency was unable to effectively respond to the Loma Prieta earthquake, Hurricane Hugo, and Hurricane Andrew (GAO, 1992, 1993a, b; NAPA, 1993; Haddow and Bullock, 2003).

The collapse of the Soviet Union in 1991 removed, to a considerable extent, the threat of nuclear war. FEMA needed a change of leadership and direction, which came in the form of what Haddow and Bullock (2003) call

the "Witt Revolution," named for the leadership of James Lee Witt, FEMA director from 1993 to 2001. Witt, an emergency management professional in Arkansas, was familiar with state concerns at a time when FEMA had lost its credibility with its state partners. He also enjoyed the confidence of President Clinton. The agency became transformed from a haven of political patronage to a modern, professional government organization.

The late 1990s and early 2000s continued to be marked by considerable political polarization and the influence of this polarization on hazards and disaster policy is still not entirely clear. While the distribution of relief in the name of either compassion or of constituent service was generally not ideologically based, changes in the emergency management system itself have become part of partisan politics. Singular events such as the September 11, 2001 attacks can profoundly alter the organization of emergency management in the United States (Box 2.3). The absorption of FEMA within the Department of Homeland Security (DHS) is a notable case in point.

THE REACTIVE NATURE OF HAZARDS AND DISASTER POLICY

Federal policy in hazards and disaster management is reactive in nature and responsive to singular disaster events. This was particularly true through the 1970s when individual disaster events prompted post-event legislative responses. The establishment of the National Earthquake Hazards Reduction Program (NEHRP) in the wake of the 1964 Alaska and 1971 San Fernando Valley earthquakes is one example, the passage of the National Oil and Hazardous Substances Pollution Contingency Plan in the aftermath of the 1967 *Torrey Canyon* tanker spill is another. Cutter (1993), Platt (1994), Godschalk et al. (1999), Rubin (1999), and Rubin et al. (2003) provide examples of hazardous conditions and disasters and policy responses to them. However, policy responses are often more nuanced than this simple reaction suggests.

For example, some legislation has often been event specific and, as typifies distributive policy (Ripley and Franklin, 1984) characterized by "logrolling" (i.e., pledges to support each other's preferred legislation) and accommodation of particular areas' needs. May (1985) notes that not only was such logrolling predicated on potential future disasters, but it was also based on past disasters. Legislation may have been languishing without the requisite political support to make its way through Congress, and the particular hazard event or disaster provided the impetus to "push the legislation" through. Moreover, federal governmental efforts to alleviate suffering in the wake of disasters traditionally concentrated on disaster relief. Aid provisions retroactive to prior disasters were often written into new relief measures to ensure broader support. The Disaster Relief Act of 1950 (P.L. 81-875), coincident with severe flooding on the lower Missouri River, re-

BOX 2.3 Reinventing Government Redux

Events that led to the creation of federal agencies provide the focal point for their activities. The Federal Emergency Management Agency (FEMA) was created in 1978 as the result of years of federal experience with disaster preparedness and response that suggested reorganization would more clearly focus federal efforts in one place. FEMA combined about five functions into one agency: functions previously performed in the Departments of Defense, Commerce, and Housing and Urban Development, as well as programs located in the Executive Office of the President. The Department of Homeland Security (DHS) was created by the Homeland Security Act of 2002, which was passed in response to the terrorist attacks of September 11, 2001. DHS encompasses no fewer than 22 functions, including such disparate functions as the United States Coast Guard, FEMA, the Transportation Security Administration (TSA), border patrol functions, and former U.S. Department of Agriculture (USDA) responsibilities for managing plant and animal diseases. The fact that DHS was created in response to the event was as much a response to political demands as it was a careful consideration of the organization of government to meet homeland security challenges. This is reflected in the fact that important homeland security functions, such as intelligence gathering, remain in the Department of Defense, the Federal Bureau of Investigations (FBI), and the Central Intelligence Agency (CIA), even as experts on homeland security, and the September 11 Commission, concluded that the integration and dissemination of information is key to homeland security (National Commission on Terrorist Attacks upon the United States, 2004).

The key question for social science is whether the Department of Homeland Security will be able to address the new homeland security challenges while still attending to the "traditional" role in disasters that FEMA assumed, with some success, in the 1990s. Regardless of FEMA's location in the federal bureaucracy, its response to disasters will be under careful scrutiny from victims, their elected officials, the news media, and researchers. Social science research is needed to address a number of issues about the new organizational structure. For example, have FEMA's programs on hazard mitigation been compromised by its new administrative structure? Has the organizational culture changed the focus of the agency away from older, known threats to the identification of newer, unknown threats, and how does this affect preparedness programs? Would the nation be better off if FEMA had not been absorbed within DHS, but had maintained its independent agency status? These are testable questions that the committee believes should be addressed by social scientists.

placed ad hoc, event-specific aid packages with a general disaster relief law.

FEMA's shift away from preparedness for nuclear war and toward a disaster relief and hazard mitigation orientation was foreshadowed by the enactment, in 1988, of the Robert T. Stafford Disaster Relief and Emer-

gency Assistance Act (hereinafter the Stafford Act). Indeed, the passage of the Stafford Act was an important milestone in American disaster policy for several reasons. First, the Stafford Act essentially served as FEMA's enabling statute. Second, the Stafford Act created a routine system of disaster declaration and relief, which, while still not perfect, is more predictable than the ad hoc policies that had preceded it. Third, the Stafford Act was extremely important because it provided much more attention to mitigation.

Mitigation has traditionally received less attention because of the routine pressures on government officials and citizens to deal with many other problems that are much more salient until there is a catastrophic disaster (Rossi et al., 1982; May, 1985; Kreps and Drabek, 1996; Waugh, 2000). It is simply easier to declare a Presidential Disaster and provide relief. Hazard mitigation, according to scientific and technical consensus, should be a pre-disaster program to reduce the ultimate costs of relief and recovery.

The original Stafford Act provided a new program for hazard mitigation, which allowed the federal government to allocate 10 percent of federal moneys granted to states after disasters on "repair and restoration of facilities" (Section 406). The mitigation funds, under a program called the Hazard Mitigation Grant Program (HMGP), could be granted to states only if they had prepared a mitigation plan. The results of these mitigation programs were not as promising as their proponents had hoped. There were some positive developments; in particular, FEMA created a Mitigation Directorate to manage the HMGP and promote the idea of mitigation among state and local governments. Yet mitigation has not become an important part of broader natural hazards policy (Godschalk et al., 1999) and remains a post-event program. Little changed in the Hazard Mitigation and Relocation Assistance Act of 1993, legislation passed in direct response to the 1993 Midwest floods. The 1993 act did contain policy improvements by providing the means by which property owners in flood-prone areas could sell their property to state governments, which would mitigate flood hazards. However the act—even with an increase in HMGP moneys from 10 to 15 percent of federal disaster relief per disaster—remained a post-disaster program, not the sort of proactive, pre-disaster program for which experts had argued.

The continued shortcomings of the Stafford Act led to the enactment of the first explicit pre-disaster all-hazards mitigation program. The Disaster Mitigation Act of 2000 (DMA 2000) created the National Pre-disaster Mitigation Fund; states and localities would be eligible to apply for funds through a proposal process. According to the legislation, funds were to "(1) support effective public-private partnerships; (2) improve the assessment of a community's natural hazards vulnerabilities; or (3) establish a community's mitigation priorities." Where mitigation planning and implementation are taken seriously, they yield mitigation benefits and involve

states and localities (Burby, 1994, 1998). DMA 2000 also required local governments to develop local mitigation plans to complement the state mitigation plans (Srinivasan, 2003). This is particularly important if localities wish to receive pre-disaster mitigation funds made available through DMA 2000. In 2002, FEMA extended the deadline for preparation of these plans to December 2004. Such plans are required if a community wishes to be eligible to receive post-disaster HMGP funds provided under the Stafford Act. However, considerable challenges confront policy makers who seek to change individual and community behaviors to mitigate disasters. Some political constituencies deny the need for more disaster mitigation efforts (Rossi et al., 1982; Alesch and Petak, 1986; Brieche, 1999) or believe that traditional mitigation policies, such as levees or other engineered solutions, are as effective as land-use planning mitigation in protecting lives and property.

Many of the activities called for in DMA 2000 were consistent with FEMA's now defunct Project Impact, which was created in 1997 to build public-private partnerships and broad levels of local commitment to hazard mitigation. However, there have been very few disasters that have tested the effectiveness of Project Impact. The most often cited example was the 2001 Nisqually earthquake that struck near Olympia, Washington, and was widely felt in western Washington, British Columbia, and Oregon. The relatively low level of damage done in Seattle (a Project Impact community) was attributed by Project Impact advocates as an example of the success of the program (Akaka, 2001; Chang and Fall-Baiamonte, 2002; Chang, 2003). Yet others cited the characteristics of the event and seismic building codes as reasons for the low level of damage. Despite making some headway in encouraging local action to mitigate disasters, in 2001 the Project Impact program was terminated, because the new administration had other priorities. However, despite discontinuation of the Project Impact initiative at the federal level, many local communities have continued with projects originally undertaken with federal Project Impact support. Tulsa Partners in Tulsa, Oklahoma, is an example of a relatively large-scale effort that is continuing with community mitigation and preparedness activities that were begun as part of Project Impact. Research on both Project Impact and its spin-off programs is needed to assess their effectiveness.

Federal policies can also unintentionally undermine local support for mitigation (Platt, 1999, 2004), even those done unintentionally. Prudent planning for and regulation of urban development often take a secondary role when the federal government pays for protection of private property from loss by building hazard control structures and offering disaster relief expenses that cover losses when they occur (Burby et al., 1999). Local governments, as the regulators of land use and building construction, are politically susceptible to blame for restricting land development and requir-

ing flood control or earthquake resistance measures that increase local development costs. States have attempted to support local governments while meeting federal requirements in many different ways, including traditional land use requirements, but also by mandating or encouraging local governments to use capital investment policies and land-use planning for hazard mitigation purposes (Burby et al., 1997; Berke, 1998).

As the costs of disasters have risen, the private sector has become increasingly interested in hazard mitigation and preparedness. Some insurers have pulled out of particular hazard-prone areas, and the industry as a whole has begun to promote mitigation for households and businesses, as well as disaster planning for business functioning after disasters. The Institute for Business and Home Safety (IBHS), an insurance industry coordinating organization, has been a leader in this effort through its Showcase Community Program and Public Private Partnerships 2000. Despite these efforts, hazard mitigation faces important legal challenges in the United States (Box 2.4). Social scientists have a major role to play in providing information on the tradeoffs and costs and benefits of various mitigation options, including takings, available to decision makers.

Finally, the September 11, 2001 terrorist attacks on the United States led to a wide range of policy changes that may affect all phases of emergency management. In addition to the newly created DHS (see Box 2.3), the

BOX 2.4 Takings: Good or Bad for Hazard Mitigation?

Public interest versus private property rights has long been a controversial topic among planners, environmental managers, and local residents. Several "regulatory takings" cases have been heard in the U.S. Supreme Court, the first of which was *Lucas v. South Carolina Coastal Council* (112 S.Ct., at 2886, 1992). These cases sought to clarify the conditions under which localities can regulate the use of private property in order to accomplish a public purpose and when governments must provide compensation for "taking" the value of property. The net effect of these cases has been to limit, but not eliminate, the ability of local governments to regulate land use for hazard mitigation. Governments must not remove all value of a property (total taking) without compensation, regardless of the purpose of the law. *Dolan v. City of Tigard, Oregon* (114 S.Ct. at 2309, 1994) established a "rough proportionality" between the burden on the property owner and the benefit to the public. More recently, the U.S. Supreme Court's decision in *Tahoe-Sierra Preservation Council, Inc. v. Tahoe Regional Planning Agency* (122 S.Ct. at 1465, 2002) reversed a two-decade-long trend that favored private property rights over the public interest. Consequently, there now is some uncertainty about the way in which public benefits can be balanced against private property rights.

U.S. Patriot Act (broad law enforcement powers to monitor terrorist activity), the Aviation and Transportation Security Act (which created the Transportation Security Administration to assist in aviation security), and the issuance of a series of Homeland Security Presidential Directives (HSPDs), which created the Homeland Security Advisory System and the National Incident Management System are of considerable concern to social scientists (see Chapter 8). In the aftermath of the inadequate response to Hurricane Katrina, Congress is considering new organizational changes to improve the nation's ability to cope with future threats (Congressional Research Service, 2006). Such proposed changes will also be of interest to social scientists.

SETTLEMENT PATTERNS AND LAND USE

The United States as well as most of the world has become increasingly urban over the last five decades. By 1950 roughly two-thirds of the population of the United States lived in an urban area and by 2000 that proportion was close to 79 percent. In addition to increasing urbanization, there is a marked tendency toward settlement in coastal counties throughout the United States where 53 percent of the nation's population currently resides (U.S. Census, 2004:Table 23). Human settlements are subject to continuous change in response to trends in land use, advances in technology, and appearance of new urban design innovations. Trends at the beginning of the twenty-first century continue and extend those of the recent past. Conventional low-density development patterns (or sprawl) have dominated the landscape, while the concepts of Smart Growth and New Urbanism have emerged to counter the impacts of sprawl. The trends and new visions have important implications in coping with and responding to future threats of hazards and disasters.

The Dominant Pattern of Twentieth Century Development

Metropolitan areas throughout the country are increasing their vulnerability to disasters because development continues unabated in many hazard-prone areas. Most of the vulnerability is associated with sprawling low-density development patterns caused by the outward expansion of suburban development on the urban fringe and commercial strip development along highways leading into and out of cities and suburbs. For example, between 1982 and 1997, the percentage increase in urban land dramatically outpaced the increase in population growth in all regions of the country. These land consumption rates place intense pressure on environmentally sensitive lands, including floodplains, earthquake fault zones, and unstable slopes.

This twentieth century model of the sprawling American metropolis has fostered a massive buildup of development in hazard-prone areas. Data on the buildup and subsequent disaster losses are abundant. Natural hazards cause average annual economic losses of about \$25 billion to \$30 billion in the United States, and losses have been rising rather than falling relative to increases in population and gross national product (Mileri, 1999b; Cutter, 2001; Cutter and Emrich, 2005). This model of sprawl has fostered the exposure of development to hazards in several ways. First, urban planning approaches to hazard mitigation are viewed by economic interests and local governments pursuing economic growth as a "good" to be fostered rather than a "bad" to be avoided. Hazard areas tend to be viewed as sufficiently safe, profitable places for development, especially by many players in the real estate market (appraisers, developers, and real estate investors) who are increasingly syndicated nationally and internationally. They have little stake in the local consequences of their actions. Community values aimed at creating safe, affordable, and livable places often have a lower priority for investors than protecting property values and profit gains.

Second, federal policies that facilitate the consumer-based model of city space are designed to stimulate investment in hazardous areas. Federal mitigation policies generally ignore risk avoidance (public land acquisition in hazardous areas or relocation from hazard areas) and, instead, have focused on risk reduction (building codes, seawalls) and risk sharing (disaster relief, tax write-offs, and flood insurance) (Burby et al., 1999). This approach makes sense if the goal is to foster development in hazardous areas. In the process of pursuing this goal, the federal government has severely limited the range of land-use options for local governments. In particular, it has crippled their ability to pursue risk avoidance policy goals. The ease of securing federal intervention to aid in the development of areas exposed to hazards establishes disincentives for local governments to plan for the most appropriate uses of these areas and to develop risk elimination programs to reduce losses of existing development. This situation cries out for more social science research to provide policy guidance to decision makers.

Unfortunately, the economic organization of the nation and the globalization of the economy constitute major impediments to the construction of safe places to live and work. Locations of urban land uses are arranged for maximizing property values, not as habitations that meet civic values such as avoidance of risk from hazards as noted earlier. While the trend is to create communities that are safe economic spaces, this does not always translate into creating safe living spaces (Box 2.5).

Two concepts prevalent in contemporary planning—New Urbanism and Smart Growth—are increasingly receiving attention as ways of coun-

BOX 2.5 Living Too Close to the Edge

In many parts of the West, suburban sprawl and the desire to live closer to nature have led to the development of residential areas in wildfire-prone regions. Fire is part of the natural ecosystem functioning and helps to regenerate the forest and rangelands. On the other hand, when people encroach into forested lands, these wildfires can cause tremendous damage to residential property and result in lives lost. The increasing movement of subdivisions into these fire-prone mountainous areas will increase the losses in these urban-wildland interfaces. Experiences in the last decade show that this pattern is increasing not decreasing: the Oakland Hills fire in 1991 that destroyed 2,900 structures and killed 25 people; the Flagler, Florida, fire in 1998 where thousands were evacuated; the Cerro Grande fire, which destroyed portions of the Los Alamos National Lab in 2000 (www.nrlc.gov/stats/); and the multiple fires in Southern California in 2003, where seven people died, more than 5,000 buildings were destroyed, and 3,700 vehicles were destroyed or damaged. Insured losses exceed \$2 billion (Guy Carpenter, 2004). Continued expansion of the urban fringe into forested areas will exacerbate the wildfire hazard in the United States not only in the West, but in the Southeast as well.

tering the societal ills associated with sprawl. Both have important implications for the way society copes with future threats posed by environmental hazards and the types of needed research from the social science community.

New Urbanism

The urban design concept of New Urbanism is intended to counter the adverse effects of sprawl. This pattern of development is designed to create compact, mixed-use urban forms to foster social communities by enhancing civic engagement and interactions between public and private spaces, as well as to increase pedestrian (not auto) movement through use of a grid layout to shorten trip lengths, in contrast to the looped cul de sac pattern of conventional suburban developments. Linkages are created among commercial, office, residential, and transit facilities (as opposed to the spatial segregation of land uses under sprawl), and each development pattern is designed at the half-mile-wide "village scale." Individual New Urban developments are conceived as fundamental building blocks of New Urbanism at the regional scale (Calthorpe and Fulton, 2001; Duany and Talen, 2002). They form an interconnected network of mixed-use, high-density nodes of development linked by transit corridors. Within this network, regional open

spaces create landscape-scale commons that serve as parks, act as barriers to limit outward expansion of urban development, and protect farmlands and environmentally sensitive areas. The New Urban version of metropolises builds on a long tradition of planning promulgated most prominently by the British planners Patrick Geddes and Ebenezer Howard in the late-nineteenth century, and the Regional Planning Association of America in the 1920s.

New Urban developments have the potential to further compound the growing risk to hazards by adding more higher-density development than in the past. High-density developments associated with New Urban forms can place more people, residential and commercial buildings, and infrastructure at risk than conventional development on an equivalent land unit exposed to hazards. This pattern of development also potentially exacerbates evacuation and emergency shelter needs for populations in hazard-prone areas. Future losses from New Urban developments due to natural disasters can be reduced if hazards are recognized in advance of exposure and appropriate disaster preparedness, structural, site design, and land-use planning practices are taken. Emergency preparedness and hazard mitigation practices are costly, however, and they are not likely to be applied to individual development projects without ample evidence of the threat from New Urban developments (Box 2.6). This evidence from individual cases, of course, is circumstantial absent the ability to control for other factors that can contribute to risks of hazards. On the other hand, New Urbanism can cluster development on safer lands, keeping those parcels most at risk in parks or in open space. The human-scale neighborhoods could actually reduce vulnerability, especially as communities rebuild in the aftermath of disasters such as Hurricane Katrina. Instead of the rush to rebuild in a hodge-podge fashion, New Urbanism principles of social interaction and environmental sustainability are now being considered in the rebuilding of the Mississippi coast (www.mississippi renewal.com).

Research is needed to examine the effect of New Urban design as a compact urban form on the disaster resiliency of urban development. For example, how well do the New Urban developments integrate hazard mitigation practices compared to the dominant mode of urbanization in the United States—the conventional low-density sprawl developments? Because New Urban communities are typically designed to be large, high-density developments, project reviews generate much higher levels of citizen reaction and opposition compared to project reviews of conventional developments. Does this high level of participation generate increased opportunity for public awareness of hazards and hazards mitigation practices? These are but a few of the questions that social science perspectives can contribute.

BOX 2.6 The New Urbanism: Risk Amplification or Risk Reduction?

Since its inception in the mid-1980s, the New Urbanism movement has been expanding rapidly. Data from the Congress of New Urbanism indicate that local governments in 41 states are currently experimenting with specific plans, policies, codes, and development standards that promote New Urban projects (Congress of New Urbanism, 2004). The data further indicate that between 1986 and 2002, about 474 New Urban projects that include 571,262 dwelling units housing more than 1.47 million residents have been completed or are under construction (estimates of residents are based on the national average household size of 2.59 people taken from the 2000 U.S. Census). Anecdotal evidence about various New Urban development projects supports the potential severity of the risk impacts. Consider the following examples.

Envision Utah. This regional planning effort covers the 100 mile long Wasatch region that contains a widespread presence of earthquake faults; liquefaction, and landslides (Berke and Beatty, 1992). The region currently holds 1.7 million people (including Salt Lake City) and has experienced rapid expansion of conventional low-density development patterns to accommodate explosive population growth. The Envision Utah initiative channels future growth into a series of New Urban developments along the entire region, which are denser than conventional developments (Calthorpe and Fulton, 2001). However, given the higher densities, these New Urban developments may be at higher risk. Only 12 of the 24 major local governments in this region currently use U.S. Geological Survey maps that delineate fault, liquefaction, and landslide hazards in their land-use regulations, with the remainder not accounting for the threat in their land regulatory framework (Interview with Gary Christensen, Geologic Manager, Utah Geologic Survey, September 26, 2003).

Birkdale Village, North Carolina. This New Urban project is a case of locating a major stormwater pollution treatment and sediment control facility in the floodplain. It is moderately small by New Urban standards, consisting of 320 dwelling units, but the commercial core is designed to be a regional center with a large amount of commercial and office space (about 500,000 square feet). Since the stormwater treatment pond system is built in the main channel of the McDowell Creek floodplain, it is subject to floods that could flush out pollutants and sediment, which places a nearby downstream drinking water supply reservoir at risk.

Smart Growth

Compared to New Urbanism, Smart Growth is based on land-use and development guidance policy frameworks but is less architecturally prescriptive and detailed in specifying the physical layout of a community. Since the early-1990s, 10 states have adopted “smart growth” legislation

that requires or encourages local governments to adopt community planning programs to alter development practices dominated by conventional low-density patterns of urbanization and create more compact urban forms (Godschalk, 2000).

Smart Growth programs seek to identify a common ground where communities can explore ways to accommodate growth based on consensus on development decisions through inclusive and participatory processes. Smart Growth promotes compact, mixed-use development that encourage choices among different travel modes (walking, cycling, transit, and autos) by coordinating transportation and land use, requires less open space, and gives priority to maintaining and revitalizing existing neighborhoods and business centers. State and local Smart Growth initiatives include incentives and requirements to direct public and private investment away from the creation of new infrastructure and development that spreads out from existing areas. While Smart Growth's central concern has been to reform state growth management legislation, its concepts have also influenced local plans and been endorsed in the policy statements of professional and business interest groups, such as the American Planning Association, the International City County Management Association, the National Association of Homebuilders, and the Urban Land Institute.

Similar to New Urbanism, Smart Growth projects can lead to greater risks than low-density sprawl. The higher densities promoted by Smart Growth, state and local plans, and legislation can place more people and property at risk unless advanced planning is put in place. State Smart Growth legislation has to date offered limited guidance on how to integrate emergency management and hazard mitigation practices into local land-use plans and development ordinances that promote Smart Growth.

WELL-BEING AND QUALITY OF LIFE

The health of populations and the provision of health care have both changed significantly in the past 50 years. By the 1950s the United States and Western Europe had both benefited from the public health advances in sanitation and nutrition that had begun in the late nineteenth century. Most developed nations had already undergone the epidemiologic shift (similar to and contributing to the demographic shift described previously) and now found that the leading causes of death and morbidity were "life-style" diseases (i.e., stroke, heart disease, cancer) instead of infectious diseases. This shift was furthered by the introduction of antibiotics in the 1940s to treat bacterial diseases and by the widespread use of vaccines to prevent viral diseases such as polio and measles beginning in the 1950s. Today in virtually all developed nations and many developing countries, the leading

causes of childhood mortality and morbidity are unintentional injuries and life-style-related diseases such as obesity.

The provision of health care in the United States has also changed dramatically in the past 50 years. Previously, the practice of medicine was primarily under the direction of general practitioners. In 1950 there were 142 physicians per 100,000 people. Changes in training and health care began shortly thereafter, so that by 1965 there were equal numbers of generalists and specialists. By 1995, there were almost twice the number of specialists as generalists and 274 physicians per 100,000 people. While there are now more physicians per population, most of them are specialists, and they are geographically concentrated. Furthermore, most physicians practice in large metropolitan areas leaving the smaller cities and rural areas drastically underserved by health care workers. Likewise, inner-city areas also suffer from physician shortages.

One of the new "specialties" that began around 1970 was emergency medicine. This specialty area of medicine has contributed to the practice of disaster medicine as well. The World Association of Disaster and Emergency Medicine began in the 1970s as a gathering of physicians (primarily anesthesiologists) who were interested in bringing the lifesaving and resuscitation techniques of the surgical suite to the field in post-disaster situations (Frey, 1978).

The growth of specialty areas has benefited from the tremendous scientific and technological advances that have occurred in the past 50 years. Many of the standards of medicine that we take for granted today, such as MRI's (magnetic resonance imaging) and CATscans (computerized axial tomography) are relatively new advances. Likewise, the ability to quickly characterize infectious disease agents such as SARS (sudden acute respiratory syndrome) is the result of scientific advances made in the last decade (Marra et al., 2003).

While many of the changes in health care have been either positive or mixed in their effects, one significant change that has universally had a detrimental effect on both the population and the system has been the cost of health care. In the last 20 years, the costs of health care have skyrocketed. It is estimated that in 1950, per capita spending on health care was \$497; by 2002, that amount (in constant dollars) was \$5,241 (U.S. Census, 2004:Table 117). While some of the increase in costs can be attributed to the aging of the population, most of these costs are attributed to innovations in health care. Increasing costs of new pharmaceuticals contribute the lion's share of these increasing costs of innovation. Between 1992 and 2002, the share of health care dollars spent on prescription drugs rose from 5.8 to 10.5 percent. Most of this increase is due to new pharmaceuticals, but more importantly, most of these costs are borne by a small

portion of the population. Five percent of the population accounts for more than half of the health care spending.

There are also changes in the trends of who pays for these increasing costs. The share of health care costs covered by government sources has increased during the last decades. Out-of-pocket expenses for health care have diminished, but the costs of private insurance coverage have increased greatly, with much of the increase taking place within the last 10 years. The rising costs of health care and health insurance to both individuals and employers have led to an increasingly large portion of the population being uninsured. Over the past 20 years, the percentage of uninsured grew from 11.8 percent to 17.3 percent. Some states (especially in the Southwest) have rates of uninsured that exceed 20 percent of the population. This puts an extraordinary burden on health care providers, especially those in hospital emergency departments, to provide essential medical care that is uncompensated (Henry J. Kaiser Family Foundation, 2002).

There are significant implications of these health care trends for the hazards and disaster research community. First, a moribund and aging Public Health Service will be unable to meet the emergency preparedness needs in the future, especially those involving willful acts such as bioterrorism, despite efforts such as the national network of Centers for Public Health Preparedness (funded by the Centers for Disease Control and Prevention); DHS-initiated projects such as the urban surveillance and monitoring of atmospheric pathogens and biothreats (Project BioWatch); centralized information depositories and rapid decision making (Project BioSense); and the development of the next generation of medical countermeasures (Project BioShield). Second, health care capacity (e.g., hospitals, extended care facilities) is growing at a slower rate than the population and, during times of crises, may be severely overextended. Finally, the emergence of new infectious diseases and the reappearance of older strains necessitate additional understanding of the origin and diffusion of diseases especially among high-risk populations.

The implications of these changes in health care and its cost directly influence the availability of services to highly diverse population groups, as noted earlier in the chapter. The differential in access to emergency services between urban and rural places, among different racial or ethnic groups, or based on socioeconomic status portends significant emergency preparedness and disaster response problems for the future.

SOCIAL JUSTICE AND EQUITY

The historical evolution of the Civil Rights Movement, the Great Society programs, the War on Poverty, women's liberation, the environmental

movement, and U.S. involvement in Vietnam gave rise to societal concern and actions for social and environmental justice during the 1960s and 1970s. These broader based social movements occurred at a time when the vast majority of hazards and disaster researchers were beginning their research careers and thus provided the context for the ways in which research problems were defined and studied. Not only did the subject matter change (expansion of hazards from natural hazards to technological events), but so too did the subjects of analyses. For example, hazards and disaster researchers have determined that women and members of racial and ethnic minorities sometimes suffer disproportionately from disasters (Beady and Bolin, 1986; Schroeder, 1987; Cannon, 2002; Cutter, 1995; Fothergill, 2003), particularly given the relationships between race, gender, poverty, and community vulnerability.

This is understandable given that hazards and their associated risks are embedded in our political, economic, and social institutions. Disasters are not only "acts of God," but also "acts of people." Two key issues that arise from social activism govern contemporary hazards and disaster research. First, hazards and their associated risks are social constructs. As such, they are the products of failures in technological, political, social, and economic systems that govern the use of technology, on the one hand, and influence response to disasters, on the other. This social construction leads to different perceptions of the "nature of the problem" and thus a politicized response, especially in the area of human-induced or technological hazards and risks. The driving forces behind the environmental stressors (e.g., materialism, poverty) that place people at risk are rarely considered in the policy world where there is often a preference for resolving the immediate impact, not the longer-term causes (Cutter, 1993).

Second, hazards and risks of disasters place uneven burdens and risks on people and the places in which they live. Concern about the distributional impacts of risks has a long tradition both in academe and within the federal government (NRC, 1999c). For example, the pioneering empirical work on distributional impacts focused on pollution in cities (Kruvant, 1974; Berry, 1977). This work was followed by claims focusing on environmental injustices based on the disproportionate burden of toxic waste on minority communities that were offered by the landmark General Accounting Office (GAO, 1983) and United Church of Christ (UCC, 1987) reports and social science research (Ballard, 1990; Lester et al., 2001). Most of the recent literature (1993-present) on inequity and environmental justice focused on activism and advocacy, on the legal and civil rights aspects of the environmental justice movement, or on more theoretically based discussions on the meaning of equity (Szasz and Meuser, 1997; Bowen, 2001, 2002; Liu, 2001; Rhodes, 2003; English, 2004).

What empirical research exists is fragmented, inconclusive, and inconsistent in its results. While there has been a marked increase in the number of methodologically sophisticated articles, especially those employing spatial analytical techniques (Stockwell et al., 1993; Chakraborty and Armstrong, 1997; McMaster et al., 1997; Cutter et al., 2001; Mennis, 2002; Pine et al., 2002), or historical demographic methods for measuring the evolution of inequities (Oakes et al., 1996; Yandle and Burton, 1996; Been and Gupta, 1997; Mitchell et al., 1999), the science of measurement and modeling is still in its infancy. There are also fundamental questions regarding the appropriate geographic scale for proving the existence of inequity (Greenberg, 1993; Zimmerman, 1994; Cutter et al., 1996; Sexton et al., 2002), as well as the role of environmental justice in the larger context of public policy decision making (Sexton and Adgate, 1999; Bowen, 2001; Margai, 2001; Bowen and Wells, 2002; Miranda et al., 2002).

As a partial federal response to the disproportionate impact of hazardous waste on poor and minority communities, Executive Order 12898 (signed February 11, 1994) was implemented. The language of Executive Order 12898 states:

To the greatest extent practicable and permitted by law, and consistent with the principles set forth in the report on the National Performance Review, each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands.

This order forces the federal government to examine all of its policies and their implementation to ensure that they do not affect one social or economic group more than others. While largely focused on toxic releases and hazardous waste, all federal agencies are required to examine their programs in this light. Whether disaster assistance has been equally distributed to all affected communities, or whether such assistance is also a reflection of environmental injustice, is an important and understudied area in the hazards and disaster community. Moreover, what is the relationship between the county-level pattern of direct losses and the demography of counties and has this changed over time or across space? Are poor minority communities disproportionately affected (e.g. incur a greater relative loss) than wealthier nonminority communities (whose capacity to absorb losses is greater)? These are a few questions that will challenge social science research on hazards and disasters in the future.

TECHNOLOGICAL CHANGE

During the past 50 years there have been tremendous technological advancements that have profoundly influenced our daily lives. We live in an age with complex and tightly coupled systems that govern the water we drink, the food we eat, the energy we use, and how we commute to and from work (Perrow, 1984). While the technological advances illustrated below certainly support hazards and disaster research (see Chapter 7), the technologies themselves may prove to be hazards (Perrow, 1984; Cutter, 1993). The 2003 electrical grid failure in the eastern United States is a recent example of how a failure in technology can lead to potentially disastrous situations. Thus, technologies can make societies both less and more vulnerable to environmental threats and willful acts. For example, in terms of the latter, as technology advances, societies may be particularly vulnerable to terrorism for a number of reasons (NRC, 2002b). One reason is that technological systems are so closely connected that disruptions in one system can spread to others, causing catastrophic failures. Furthermore, the means of mass destruction are potentially more available due to technological advancements. Thus, nation-states or small terrorists groups—either locally or internationally based—may gain access to materials used to produce nuclear, chemical, and biological weapons. The openness of countries, like the United States, also makes them more vulnerable to attacks because terrorist groups have easier access to potential targets, and they have relatively free use of communication technologies that can be used in planning and carrying out attacks.

The measurement or acquisition of information about an object or phenomena that is not in direct contact with that object is called remote sensing. The earliest use of aerial photography, a form of remote sensing, began with a French balloonist in 1859 and then progressed to fixed winged aircraft in 1909 (NASA, 2005). Aerially photography was used extensively in both World Wars. With the invention of radar, and thermal infrared remote sensing, remote-sensing technologies greatly advanced in the 1950s and 1960s (Jensen, 2000). Coupled with the postwar space program (and its associated satellites) remote sensing moved from exclusive military applications to civilian ones in the early 1960s first with the launch of experimental weather satellites and then with the Earth Resources Technology Satellite (later renamed Landsat). Today, remote sensing is widely used in surveillance and monitoring of hazards and disasters (e.g., hurricane tracking and tornado formation on Next Generation Radar [NEXRAD] Doppler; wildfire monitoring using satellites that carry Advanced Very High Resolution Radiometers [AVHRR]), hazard zone delineations such as floodplains; assessment of post-event damages. The newest generation of nonmilitary

satellites has the ability to “see” 1 meter by 1 meter from space, greatly enabling the precise monitoring of hazards and disasters and their impacts.

In addition to satellite remote sensing, the increased use of sensors and robotics has facilitated hazard and disaster threat detection and monitoring. The in situ sensors are the most useful and have been used to monitor ground motion and tsunami waves in the open ocean and, more recently, to monitor and model offshore coastal conditions in the advance of tropical storms (Caro-Coops, 2005). In the area of willful disasters, sensor systems are now widely deployed to monitor bioterrorist agents.

Americans enjoy more modes of telecommunication today than at any other point in the nation’s history, and can watch events as they are unfolding on live television. The influence of television and round-the-clock cable news has not only affected the perceptions of risk by individuals, but also their responses to warnings. For example, the often-watched Weather Channel is now one of the primary sources of hurricane risk and warning information. Similarly, the use of advanced warning technologies (such as Doppler Weather Radar) by local weather forecasters has proven effective during tornado season.

Yet as Hurricane Katrina demonstrated, the use of advanced warning technologies alone does not guarantee an effective organizational and public response to an impending disaster, particularly when major regional impacts are possible. During times of impending disaster, along with using the technological resources that are available to them, decision makers at all levels need to consider the social, economic, and political dynamics that come into play in these situations. Social science expertise is vital at such times.

The management of disaster response has been aided by improvements in computing and computer systems. Easy to use software, laptop computers, and wireless communications are now the norm in post-event responses. Coupled with enhanced performance of pre-impact planning, computers have fundamentally altered the ways in which we study hazards and disasters and also how practitioners respond to them.

Wireless communications also have produced changes in warning and response to disasters, as well in surveys as a tool for disaster research. Two recent trends in survey research—falling response rates and emergence of new data technologies—will have longer-term consequences for disaster research. Public reactions to telemarketing (such as the Do Not Call list), aging of the U.S. population, and the rise in non-English speaking immigrants all contribute to declining survey response rates. Further, the switch from land-line phones to cellular phones as the primary contact number has significantly altered response rates among certain segments of the population. Survey research has also undergone technological changes related to the increasing use of information technologies, including Web-based data collection tools that reduce or eliminate the need for an interviewer. At the

same time, not everyone has access to the Web, so certain segments of the population may not be adequately sampled or may be impossible to reach through these new technologies.

ENVIRONMENTAL CHANGE

Local and global environmental changes and our understanding of them in chronological and social time have influenced what hazards and disaster researchers study. The earlier focus on extreme natural disasters in the early years (floods, earthquakes, severe weather, hurricanes) has been replaced by research on more common natural events such as coastal erosion, heat, and urban snow hazards. At the same time, slow-onset disasters (persistent drought cycles, deforestation) offer new perspectives on preparedness, warning, and response. Large-scale global processes such as those embodied in global climate change as well as more cyclic phenomena such as El Niño-La Niña illustrate the need for understanding the interactions of the biophysical system with human systems and how these effects manifest themselves over chronological and social time and across different regions.

The impacts of climate change are no longer hypothetical and will include temperature increases, changes in temperature regimes, changes in storm tracks and intensities, and sea level rise. The effects of global changes on local places, generally, and the uneven distributions of these impacts, especially as they relate to vulnerable populations provide an additional research context for hazards and disaster research (AAG GCLP, 2003). They also provide an opportunity to link social science hazards and disaster research to the human dimensions of the global change community in developing more robust understandings of the interactions between human systems and natural systems through advancements in sustainability science (Kates et al., 2001; Turner et al., 2003a) and vulnerability science (Cutter, 2003a).

Complex emergencies, such as the Rwandan refugee crisis, or the genocide and starvation in Darfur—which result in humanitarian crises and international relief efforts—are also important domains for pre-, trans-, and post-disaster investigations (Alexander, 2000). The precursors of these crisis occasions, such as environmentally induced changes in land use by poor and ethnically diverse populations, coupled with dysfunctional social and political systems, require more detailed analyses by hazards and disaster researchers than has hitherto been the case.

Finally, social scientists continue to study toxic substances and their production and influence on human and environmental health. Signal crisis events such as the *Torrey Canyon* tanker (1967) and later the *Exxon Valdez* (1989) spills, Three Mile Island (1979), Love Canal (mid-1970s), Bhopal (1984), and Chernobyl (1986) have resulted in both hazards and disaster

policy initiatives and considerable research within the hazards and disaster research community (Kates et al., 1985; Kleindorfer and Kunreuther, 1987; Kasperson et al., 1988; Cutter, 1993; Freudenburg and Gramling, 1994).

CONCLUSIONS

It is clear that the evolution of hazards and disaster research has taken a parallel path that parallels changes in American society and world events. The very nature of the problems that are studied and the approaches that social scientists take are set within this broader context of change. Researchers are able to respond to opportunities to extract lessons from particular disaster experiences as well as to draw theoretical, conceptual, and methodological understanding of human adjustments to hazard vulnerability.

The economic, political, and social changes during the past five decades cited above provide a rich array of researchable questions, many of which, as reflected in the following chapters, have been pursued by social scientists.

What are the vulnerabilities associated with settlement and occupant patterns, and how have these changed over time and across space? Do uneven distributions of impacts (which raise questions of equity in a much more diverse society) affect policy responses at local, state, and federal levels? What is the significance or importance of scale as we move from the local to the global, and how can we understand the cascading impacts of hazards and disasters as we move from one scale to another? How can we assist elected and appointed officials to make decisions under uncertain conditions and with incomplete information? How will the changes in American society (e.g., access to health care, greater ethnic diversity) influence disaster response in the future?

The salience of the terrorism threat following the September 11, 2001 attacks also raises a number of fundamental questions for researchers to consider. For example, in what ways are terrorist threats similar to and different from risks posed by natural and technological hazards? How has the increased salience of willful disasters shaped the emergency management system in the United States? Also how prepared are local communities and the nation as a whole for possible future attacks.

These are but a few of the questions derived from the context within which this research takes place. Many questions remain unanswered, providing opportunities for further research by current and future generations of hazards and disaster researchers in the social sciences. In some cases, this will require collaboration with colleagues from other disciplines such as earth sciences and engineering as discussed in Chapter 5 and with international colleagues as discussed in Chapter 6.

3

Social Science Research on Hazard Mitigation, Emergency Preparedness, and Recovery Preparedness

The committee's goal in Chapters 3 and 4 is to document social science contributions under the National Earthquake Hazards Reduction Program (NEHRP) to the development of knowledge about the five core topics of hazards and disaster research and their interactions (see Figure 1.1.). As an organizing tool, the conceptual model of societal response to disaster, also introduced in Chapter 1 (see Figure 1.2), is employed. Within that conceptual model the catalytic impacts of disaster events are determined by conditions of systemic vulnerability, disaster event characteristics, and the actions of what the committee has termed the hazards and disaster management system. This chapter reviews research related to hazard vulnerability, disaster event characteristics and pre-impact emergency management interventions as determinants of disaster impacts. Chapter 4 then reviews research related to planned and improvised post-impact responses as determinants of disaster impacts. Each chapter concludes with recommendations for future research within the framework provided by the conceptual model.

FURTHER COMMENTS ON THE CONCEPTUAL MODEL OF SOCIETAL RESPONSE TO DISASTER

Understanding the causal processes by which disasters affect social systems (i.e., communities, regions, societies) is important for at least four reasons. First, research on these processes is needed to identify the pre-impact conditions that render social systems vulnerable (hazard exposure,