CARRI Research Report 6

DISASTER RESPONSE: RESEARCH FINDINGS AND THEIR IMPLICATIONS FOR RESILIENCE MEASURES

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RESEARCH FINDINGS ABOUT COMMUNITY AND REGIONAL RESILIENCE

One of the commitments of the Community and Regional Resilience Initiative (CARRI) is to understand what resilience is and how to get there, based on research evidence.

As one resource for this effort, CARRI has commissioned a number of summaries of existing knowledge about resilience, arising from a number of different research traditions. This report is one in a series of such summaries, which will be integrated with new resilience explorations in several CARRI partner cities and with further discussions with the research community and other stakeholders to serve as the knowledge base for the initiative.

For further information about CARRI's research component, contact Thomas J. Wilbanks, wilbankstj@ornl.gov, or Sherry B. Wright, wrightsb@ornl.gov.

COMMUNITY AND REGIONAL RESILIENCE INITIATIVE

Oak Ridge National Laboratory's (ORNL) Community and Regional Resilience Initiative (CARRI) is a program of the Congressionally funded Southeast Region Research Initiative. CARRI is a regional program with national implications for how communities and regions prepare for, respond to, and recover from catastrophic events. CARRI will develop the processes and tools with which communities and regions can better prepare to withstand the effects of natural and human-made disasters by collaboratively developing an understanding of community resilience that is accurate, defensible, welcomed, and applicable to communities across the region and the nation.

CARRI is presently working with three partner communities in the Southeast: Gulfport, Mississippi; Charleston/Low Country, South Carolina; and the Memphis, Tennessee, urban area. These partner communities will help CARRI define community resilience and test it at the community level. Using input from the partner communities, lessons learned from around the nation, and the guidance of ORNL-convened researchers who are experts in the diverse disciplines that comprise resilience, CARRI will develop a community resilience framework that outlines processes and tools that communities can use to become more resilient. Of critical importance, CARRI will demonstrate that resilient communities gain economically from resilience investments.

From its beginning, CARRI was designed to combine community engagement activities with research activities. Resilient communities are the objective, but research is critical to ensure that CARRI's understanding is based on knowledge-based evidence and not just ad hoc ideas—we want to get it right. To help with this, CARRI has commissioned a series of summaries on the current state of resilience knowledge by leading experts in the field. This kind of interactive linkage between research and practice is very rare.

In addition to its partner communities and national and local research teams, CARRI has established a robust social network of private businesses, government agencies, and non-governmental associations. This network is critical to the CARRI research and engagement process and provides CARRI the valuable information necessary to ensure that we remain on the right path. Frequent conversation with business leaders, government officials, and volunteer organizations provide a bottom-up knowledge from practitioners and stakeholders with real-world, on-the-ground, experience. We accept that this program cannot truly understand community resilience based only on studies in a laboratory or university. CARRI seeks to expand this social network at every opportunity and gains from each new contact.

www.resilientUS.org

LIST OF RESEARCH REPORTS BY NUMBER

CARRI Report 1: Susan L. Cutter, Lindsey Barnes, Melissa Berry, Christopher Burton, Elijah Evans, Eric Tate, and Jennifer Webb, *Community and Regional Resilience: Perspectives from Hazards, Disasters, and Emergency Management*, September 2008.

CARRI Report 2: Susanne C. Moser, *Resilience in the Face of Global Environmental Change*, September 2008.

CARRI Report 3: Craig Colten, Robert Kates, and Shirley Laska, *Community Resilience: Lessons from New Orleans and Hurricane Katrina*, September 2008.

CARRI Report 4: Betty Hearn Morrow, *Community Resilience: A Social Justice Perspective*, September 2008.

CARRI Report 5: Lance Gunderson, *Comparing Ecological and Human Community Resilience*, January 2009.

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LIST OF ACRONYMS

CART	Community Assessment of Resilience Tool
CERT	Community Emergency Response Team
DHHS	Department of Health and Human Services
DHS	Department of Homeland Security
DRC	Disaster Research Center
EERC	Earthquake Engineering and Education Center
EMAC	Emergency Management Assistance Compact
EOC	Emergency Operations Center
ESF	Emergency Support Function
EMONS	Emergent Multi-Organizational Networks
FEMA	Federal Emergency Management Agency
FRP	Federal Response Plan
ICS	Incident Management System
ICT	Information and Communications Technologies
IRB	Institutional Review Board
MCEER	Multidisciplinary Center for Earthquake Engineering Research
MOU	Memorandum of Understanding
MMRS	Metropolitan Medical Response System
NIMS	National Incident Management System
NIMH	National Institute of Mental Health
NRF	National Response Framework
NRP	National Response Plan
NSF	National Science Foundation
NVOAD	National Voluntary Organizations Active in Disaster
NHC	Natural Hazards Center
ORNL	Oak Ridge National Laboratory
PETS	Pets Evacuation and Transportation Standards Act
SGER	Small Grants for Exploratory Research
SEMS	Standardized Emergency Management System
START	Study of Terrorism and Responses to Terrorism
UASI	Urban Areas Security Initiative
WTC	World Trade Center

1. INTRODUCTION

The post-disaster response period is the disaster phase that has been best studied in the field of disaster research. Systematic research on disasters in the United States originated in the late 1940s out of Cold War concerns about how the public, organizations, and communities might react under conditions of nuclear attack. Addressing these concerns required the collection of data immediately before (when warning was possible), during, and immediately after disasters. There is a long tradition of quick response research in the field of disaster studies, with the vast majority of that work focused on individual, group, organizational, and community responses in the context of specific disaster events. In contrast, other phases of the disaster cycle, including in particular the post-disaster recovery period, are much less well understood.

This report provides an overview of research on disaster response. The report first discusses issues of disaster scale and provides information on the disaster response research tradition. It then discusses the concept of resilience and its applicability to the response phase of disasters. The report then turns to summarizing what is known about how the public responds before, during, and immediately after disasters. Next, research findings on organizational responses are reviewed, andintegrated within these research reviews are suggestions regarding resilience indicators that are specific to the post-disaster response period.

2. RESEARCH ON DISASTER RESPONSE: ISSUES OF SCALE AND METHODOLOGICAL APPROACHES

2.1 Apples, Oranges, and Disaster Response

Hurricane Katrina was a wake-up call for the United States, in that the hurricane revealed very significant deficiencies in the nation's ability to manage catastrophic events. Equally important, Katrina was also a wake-up call for those who study responses to disasters, for several reasons.

First, Katrina was one of a handful of true catastrophes (as opposed to disasters) in U.S. history and the only catastrophe to strike on U.S. soil in contemporary times and after the development of the social-scientific field of disaster research. Compared to other societies around the world, the list of catastrophic events experienced by U.S. society is short. Only the 1900 Galveston Hurricane, the San Francisco earthquake of 1906, and the Great Mississippi floods of 1927 are comparable to Katrina in terms of loss of life, physical devastation, and disruption of the social order.

These differences are by no means trivial ones. Disaster researchers have long pointed out that disasters are not merely large emergencies and that distinctions between disasters and emergencies are qualitative, rather than quantitative. Katrina reminded researchers that the same is the case for even large-scale disasters and truly catastrophic events. Public and organizational behavior and response challenges differ significantly across the three types of events (Quarantelli 1996; 2005). As shown in Table 1, key differences include the severity and scale of impacts; complexity of the organizational and governmental response; the applicability of standard operating procedures and disaster plans; the extent to which the resources needed to launch an effective response are themselves compromised or destroyed; the extent to which the public becomes directly involved in the response; and the nature of the challenges communities face following the different types of events.

Table 1. Some key ways in which emergencies, disasters, and catastrophes differ

Emergencies	Disasters	Catastrophes
Impacts localized	Impacts widespread, severe	Extremely large physical and social impacts
Response mainly local	Response multi-jurisdictional, intergovernmental, but bottom-up	Response requires federal initiative, proactive mobilization
Standard operating procedures used	Disaster plans put into effect—but challenges remain	Massive challenges exceed those envisioned in pre-existing plans
Vast majority of response resources are unaffected	Extensive damage to, disruption of, key emergency services	Emergency response system paralyzed at local and even state levels
Public generally not involved in response	Public extensively involved in response	Public extensively involved in response, with long-term mass convergence
No significant recovery challenges	Major recovery challenges	Cascading long-term effects, with massive recovery challenges

One implication of these comparisons is that just as it is not prudent to scale up insights on disaster responses from research on everyday emergencies to disaster events, caution must also be used in generalizing social, behavioral, and organizational research findings based on the study of disasters to much more complex catastrophic events. Whether or not findings based on the study of disasters are also applicable to catastrophes is a question for empirical examination and not something that can be taken for granted a priori. Response-related behaviors may indeed be consistent across different levels of event severity, but that consistency (or lack of it) must be documented, rather than assumed.

Similarly, it is important to recognize that the extent of a community's disaster resilience can be expected to vary as a function of event severity. As the scale of impacts and disruption increases, there is also an increasing need for resilient responses—yet the ability to respond in a resilient fashion is increasingly compromised. Everyday emergencies typically do not severely strain or disrupt community response capabilities; communities typically are sufficiently resilient to contain the relatively small-scale impacts emergencies create. In disasters, the difficulties associated with responding in a resilient fashion loom larger. Those difficulties are further compounded in near catastrophes and catastrophes. Resilience must thus be judged in relation to the magnitude and severity of disaster impacts.

Third, the Katrina experience validated new theoretical perspectives in disaster research, including in particular the social vulnerability approach to the study of disasters (Blaikie et al. 1994; Cutter, Boruff, and Shirley 2003; Tierney 2005b; Cutter and Emrich 2006; Bolin 2007). Early social science research on disasters paid little attention to the ways in which broader social structural factors such as social and economic inequality and political power shape disaster vulnerability. It was not until the 1990s that researchers began to seriously explore the ways in which different sub-groups within affected populations experience and respond to disasters, or the ways in which official responses may themselves be shaped by those differences (see, for example, Peacock et al. 1997; Bolin and Stanford 1998).

Katrina was an illustration of the vulnerability perspective writ large. Although the effects of diversity and inequality on the fates of disaster victims had been documented in other U.S. disasters, notably the Loma Prieta earthquake, Hurricane Andrew, and the Northridge earthquake, these effects were highlighted in Katrina.

Last, because it occurred in the context of newly adopted post-September 11 policies, plans, and programs, the Katrina disaster highlighted the extent to which various dimensions of disaster response can be influenced by the broader political and policy context. Responses to disasters are shaped in important ways by the policy contexts in which they take place, which include the laws, institutional arrangements, and forms of governance around which emergency response activities are organized. Although there has been very little cross-national comparative research on disaster responses, disaster researchers have been aware for quite some time that such factors are important for the analysis of disaster management activities. Equally important are changes in the management of disasters that take place over time within societies.

Experts on U.S. emergency management policies have traced such changes, including the creation of the Federal Emergency Management Agency, the Stafford Act and its amendments, post-September 11 laws and policies, the creation of the Department of Homeland Security, and other changes that had a substantial impact on response activities following Hurricane Katrina. Disasters themselves are recognized as "focusing events" that engender a range of policy responses (Birkland 1997; 2006; Rubin et al. 2006a; 2006b).

Policy contexts are important to take into account in assessing the resilience of intergovernmental systems responding to disasters. As a consequence of disaster policies, emergency management systems vary in attributes such as centralization of authority and resources, degree of structure, formalization, openness to new participants, tolerance for deviations from official plans, and other characteristics that make for more or less resilient responses when disasters strike (Comfort 1999).

The foregoing discussions are meant to counter the idea that the research community already knows the answers to all key questions regarding responses to disasters. Many findings on disaster response behaviors and activities are strongly grounded empirically and very robust—meaning that they have been shown to be valid across different societal contexts and across events that vary in scale and severity. In other cases, the limitations of previous research must be acknowledged. Social, economic, and political changes clearly have an impact on disaster response activities, both among members of the public and among responding organizations, and researchers need to keep such changes in mind in order to avoid over-generalizing across events. For example, as noted earlier, the diffusion of ICTs has changed the manner in which information is collected and disseminated during crises, challenging traditional models of crisis communications. Recent policy changes, such as Homeland Security Presidential Directives and the National Response Plan (and now the National Response Framework), have altered the manner in which federal, state, and local governmental entities organize themselves for disaster response. What these and other changes imply is that researchers must be judicious in how they generalize from earlier studies. While many patterns of disaster response persist across both space and time, others may not. It is important to avoid the pitfalls of "apples and oranges" comparisons in the study of disaster events and the measurement of resilience.

2.2 Studying Responses to Disaster

Substantive findings from research on disaster response are perhaps best understood in the context of the research methods used in the development of those findings (for more detailed discussions, see Stallings 2002; 2007). Since its inception, the field of disaster research has placed primary emphasis on collecting perishable data on response-related activities through *direct observation* of those activities. In disaster field work, trained teams of observers are dispatched on a quick-response basis with the goal of obtaining access to sites and settings in which response activities are taking place. Where possible (e.g., in hurricanes), field workers may be mobilized to collect data even before the disaster actually strikes. Field workers use a variety of techniques and technologies for collecting data during disasters, including recording detailed observational field notes; collecting and analyzing documents produced by responding agencies, the mass media, and other sources; and the use of photography, video, and other visual methods. Observations during disasters are supplemented by *informal interviews* with a variety of types of informants, including emergency workers, personnel from other crisis-relevant organizations, and victims.

When the emergency period had has passed, researchers can obtain more detailed information on various aspects of disaster responses through structured, semi-structured, and unstructured *interviews*. To achieve maximum validity, such interviews must be conducted as soon as possible after the disaster event. Interviews can take place on a face-to-face basis, by telephone, or through other means, such as e-mail. *Surveys* are also used to study responses to disasters; typical approaches involve telephone and mail surveys. Examples include surveys of the public concerning evacuation behavior during hurricanes, surveys conducted in the aftermath of earthquakes that are designed to yield data on behavioral responses to earthquake events and aftershocks, and mail surveys on the business impacts of disasters.

Recent years have witnessed an explosion of *virtual data sources* that yield an almost bewilderingly complex variety of data that can be mined to explore disaster response activities. The internet constitutes a vast data source, and the collection and analysis of data available through the internet and other forms of information and communications technologies (ICT) raise significant challenges—as well as possibilities for significant scientific advances—that researchers are only beginning to address. Research on the virtual dimension of disaster response, which encompasses studies on the use of ICT to support activities such as emergent peer-to-peer communication, information sharing, situation assessment, collective sense-making, and agency-public interactions during disaster events, constitutes a new frontier in the study of disasters (Palen and Liu 2007; Palen et al. 2007).

Because disasters are by their very nature "unscheduled events," special procedures are needed for the collection, storage, and analysis of data on emergency response activities. This need was recognized more than 55 years ago, when the first teams of standby disaster field workers were organized in the late 1940s. The Disaster Research Center (DRC), which was founded at the Ohio State University in 1963, carried on this tradition. Prior to disasters and based on information on the frequency of disaster events, DRC submitted proposals to agencies such as the Defense Civil Preparedness Agency, the Health Resources Administration, the National Institute of Mental Health (NIMH), and the National Science Foundation (NSF), which enabled the center to maintain a standby field research capability and to send research teams into the field to study events that fell within the parameters of proposed research projects. Examples of topics studied include inter-organizational and intergovernmental coordination during disaster events, the delivery of emergency medical and mental health services in

disasters, and organizational responses to chemical disasters. In addition to studying disaster events, DRC also conducted research on urban civil disturbances and campus unrest during the 1960s and 1970s.

The Natural Hazards Center, which was founded in 1976 at the University of Colorado at Boulder, provides small grants for researchers wishing to go into the field during and immediately after disasters to collect perishable data, identify topics for future research, and document lessons learned in specific disaster events. The center's quick-response research program is funded by the NSF. To qualify for funding, researchers must submit proposals to the center, which are reviewed and, if approved, are filed for potential activation. If a disaster occurs that seems to offer appropriate research opportunities for an investigator with an approved proposal, he or she has the option of activating the project at that time. Over 200 such projects have been funded to date. The two largest mobilizations in the history of the center were for post-disaster research following the 9/11 terrorist attacks and Hurricane Katrina. Both cases led to over two dozen field studies (Natural Hazards Center 2003; 2006).

The NSF also provides quick-response research opportunities through its Grants for Rapid Response Research (RAPID) program—a program that is designed specifically to fund high-risk projects that involve the collection of perishable data following disasters and other rapidly developing crises. (The RAPID program has now superceded NSF's Small Grants for Exploratory Research [SGER] program.) RAPID research proposals are reviewed and funded on an expedited basis specifically because data that are not collected rapidly are likely to disappear.

The NSF has other mechanisms that provide support for quick-response research. In response to the occurrence of an extreme event that the foundation and the research community deem worthy of intensive study, NSF has the ability to launch special initiatives for rapid-response research. Following the catastrophic Indian Ocean earthquake and tsunami of 2004, for example, NSF offered substantial funding for the collection of perishable data. Recipients of NSF disaster research grants also have the ability to apply for supplementary funding to study events that fall within the scope of existing awards.

In some cases, quick-response research funding is provided for specific types of disasters. For example, NSF funds the Earthquake Engineering Research Institute's Learning from Earthquakes program, which supports the mobilization of multi-disciplinary teams that collect data on earthquake impacts and responses worldwide. Three NSF-funded earthquake engineering and education centers (EERCs)—the Pacific Earthquake Engineering Center (Berkeley), the Mid America Earthquake Center (Illinois), and the Multidisciplinary Center for Earthquake Engineering Research, or MCEER (SUNY at Buffalo)—have also conducted quick-response research in the aftermath of significant earthquake events.

Quick-response research on disaster response activities often raises special challenges with respect to institutional rules regarding the protection of human subjects. The Common Rule regulations that all researchers are expected to follow were originally developed for situations involving routine, pre-planned research for which investigators could provide detailed documentation prior to initiating their studies. University institutional review boards (IRBs) may understandably find the research approval process difficult for "no-notice" events such as disasters. Additionally, some review boards may consider populations affected by disasters as especially vulnerable on an a priori basis, without an understanding of the actual risks to such populations. Over the years, disaster researchers have worked constructively with IRBs on procedures that enable rapid mobilization into the field that complies with all Common Rule requirements, such as pre-approval of research protocols for activation in the event of a disaster,

procedures for exempt and expedited reviews, and the sharing of research-based findings on the relative vulnerability of different types of research subjects in the context of disasters.

2.3 Toward Measures of Resilience for Disaster Response Activities

The term *resilience* as applied to disasters has been conceptualized in many ways (Paton and Johnston 2006; Norris et al. 2007). Reviewing that literature is beyond the scope of this paper; instead, three different frameworks will be discussed briefly. The framework developed by researchers from the MCEER characterized resilience as encompassing four attributes—robustness, redundancy, resourcefulness, and rapidity—each of which can be applied to different units of analysis (organizations, communities) and associated with different organizational and community dimensions, defined as technical, organizational, social, and economic. Within each dimension, robustness refers to the ability to resist disruption and failure and continue functioning effectively; redundancy refers to the extent to which other alternative systems can continue to provide services when primary systems fail or are disrupted; resourcefulness refers to the ability to mobilize resources in a timely manner to address problems in technical, organizational, social, and economic systems.* Rapidity, or timely resolution of disaster-related challenges, is the end product of the other three attributes of resilience (for a brief discussion of the MCEER perspective, see Tierney and Bruneau 2007).

Economist Adam Rose (2004), who was a member of the MCEER team that initially developed measures of resilience, distinguishes between what he terms *inherent* and *adaptive* resilience. Inherent resilience, which resembles robustness in the MCEER framework, refers to characteristics of different social units (households, businesses, communities, local economies) that serve as sources of strength when the social order is disrupted. For households, for example, inherent resilience may be based on household income, savings, and other sources of wealth, as well as household disaster plans. For businesses, inherent resilience may be rooted in large corporate assets, market diversification, and pre-event mutual aid agreements. For communities, indicators of inherent resilience can include extensive pre-event collaborative preparedness efforts and the existence of rich networks of community-based organizations.

Adaptive resilience, which is manifested when a disaster event occurs, refers to the capacity of social units to overcome crisis-related problems through effort and ingenuity. Following the MCEER framework, the elements of overall resilience most closely associated with adaptive resilience are redundancy and resourcefulness. Communities facing disasters must find substitutes for resources that are destroyed or are no longer available; identify and mobilize personnel, material, and financial resources; and exercise creativity in areas in which plans fall short.† In contrast with the other MCEER researchers discussed above, Rose does not consider

*For example, the decision to lower interest rates along with the recently enacted economic stimulus package, brought about by the subprime mortgage market failure and other systemic economic disruptions, is an example of an effort to inject additional resilience into the U.S. economic system.

†Many examples can be cited. After the 1989 Loma Prieta earthquake, fires broke out in the city of San Francisco. However, both the primary water system and a backup source of water for fire suppression were unavailable to fire fighters owing to severe earthquake damage. Fortunately, the city had other redundant firefighting resources, including fire boats and a portable fire suppression system consisting of large above-ground hoses, pumps, and other components, which made it possible to obtain water directly from the Pacific Ocean. The reconstitution of New York City's emergency operations center (EOC) following the destruction of WTC Building 7 on the day of the 9/11 terrorist attacks is a textbook example of adaptive resilience.

robustness or resistance to external stressors as an element in resilience. Rather, for Rose, resilience encompasses efforts to rebound following disruptive events.

In a recent paper entitled "Community Resilience as a Metaphor, Theory, Set of Capacities, and Strategy for Disaster Readiness," Norris et al. (2008) provide a comprehensive, wide-ranging review and analysis of how disaster resilience can be conceptualized and measured. The paper reviews definitions of resilience from the physical, ecological, and social sciences and discusses the concept in terms of different social units to which it has been applied (e.g., individuals and communities). It also presents a model characterizing the process through which communities (and community sectors) adapt following disaster events—a process that, depending upon levels of resistance and resilience, can result either in post-event adaptation or continued dysfunction. Unlike Rose, Norris et al. do view robustness as a component of resilience. They incorporate into their model the concept of resistance, conceptualized as a condition in which resources are sufficient to buffer the immediate impacts of a disaster and to encourage recovery.

In the Norris et al. formulation, community resilience flows from a set of resource-based and networked adaptive capacities in four primary domains: information and communication, community competence, social capital, and economic development. These adaptive capacities are related in turn to other community attributes. For example, social capital includes attributes and indicators such as supportive social networks, attachment to place, and citizen participation. Community competence is related to such attributes as capacity for collective action and decision-making and community empowerment.

It is important to note that, while quite abstract, the elements in the Norris et al. model do yield empirical measures. Norris and her colleagues are currently testing the Community Assessment of Resilience Tool (CART), a methodology based on their conceptual framework, which communities can use to assess their resilience.

As suggested earlier, measures of social vulnerability can also provide insights into the extent to which communities will be resilient in the face of disasters. High levels of social vulnerability do not automatically translate to low levels of resilience; even very vulnerable populations can be well organized and can possess significant social and cultural capital, as indicated by close-knit community ties, active social support networks, and vibrant community institutions, such as churches. However, other things being equal, populations that score high on measures of social vulnerability can be thought of as possessing less inherent and adaptive resilience capacity than those that are less vulnerable. This is the case because resilience is linked to the ability to identify and exercise options during crisis situations. For some segments of the population, options abound, while for others, options are very limited. Diverse groups thus possess different levels of resilience in disaster situations.

2.4 Research on Disaster Response

The discussion now turns to findings from research on disaster response within the public and among responding organizations. The research review that follows highlights both strongly supported findings and areas in which more research is required. It covers both topics that have been studied for decades, as well as areas that researchers have only begun to investigate systematically. Following discussions on research findings on different aspects of disaster response, candidate measures of resilience are listed.

3. PUBLIC RESPONSES TO DISASTERS

This section focuses on ways in which members of at-risk populations respond during disasters, as well as on why such responses occur. Topics addressed include factors influencing evacuation behavior; sheltering and housing arrangements following disasters; and crisis-related collective behavior, such as emergent pro-social behavior and information-seeking. Also discussed are two common concerns regarding the behavior of those affected by disasters: panic and anti-social behavior. Suggested measures of resilience accompany the discussions that follow.

3.1 Pre-Event Public Responses: Evacuation and Other Self-Protective Measures

Individual and group responses to impending threats have been studied for more than three decades and across a variety of contexts, and much more is known about these behaviors than about other response-related activities. The state of knowledge regarding warning response and evacuation has been summarized in Sorensen (2000) and Sorensen and Sorensen (2007). Both these publications contain summaries of findings regarding the impact of a range of social, psychological, technological, message-related, and situational factors on evacuation processes.

Processes involved in warning response behavior are very well understood, well-tested models exist, and a number of comprehensive research reviews have been compiled. One frequently used model, the Protective Action Decision Model, was developed by Lindell and Perry (for recent discussions, see Lindell and Perry 2004) and validated through extensive study. The model is based on the emergent norm theory of collective behavior (Turner and Killian 1987), which provides a framework for understanding collective decision making and action under conditions of uncertainty and urgency in which there is a perceived need to act. Collective behavior theory is based on the notion that people in society generally take the social world for granted, assuming that their social environment is operating normally. When that taken-for-granted environment is disrupted or undergoes rapid change, and when problems develop that do not fit accepted explanations, people become more sensitive to environmental cues and begin a recursive search for information that can become the basis for new understandings and behavioral norms.

Cues are sought from a variety of sources, including physical cues (smoke, fire, an explosion), official warnings, media reports, other organizational sources such as superiors in the work place, rumors, family and informal friendship networks, and observation of the behavior of others. Deliberation takes place in groups, and while some decisions are made rapidly, others may take hours or even days. Lengthy deliberation and decision making can end up increasing the risk for those who eventually decide to heed warnings.

Interactions leading to decisions regarding evacuation and self-protective actions are shaped by a variety of factors. These factors include characteristics of those receiving warning information, such as their prior experience with particular hazards; situational factors, such sights, sounds, and other cues of danger, which enhance the believability of the warning information; and the social contexts in which decisions are made. Those social contexts can include such factors as household authority patterns, the presence (or absence) of resources that can facilitate recommended behaviors, and conflicting obligations that prevent those at risk from acting on warnings.

Over 20 years ago, Mileti and Sorensen (1988) developed another useful framework for understanding the decision processes that precede the initiation of self-protective behavior. In

order to move through the self-protective cycle, people must receive warnings and information about danger—typically from multiple sources; understand that information; understand that the information is meant for them, rather than others; develop personal feelings of being at risk; interact with others to confirm those feelings and understandings; know what to do in order to be safe and when to carry out those actions; have the resources available to do so; make a decision to act; and then engage in the recommended actions. Warning recipients also need as much information as possible on how long the danger is likely to last and when they might be able return. Each step in this process is crucial, which is why stimulating actions under conditions of danger is so difficult.

Recent work by Kuligowski and Mileti confirms that models that explain large-scale community evacuations do an equally good job of explaining evacuation decisions and processes in individual structures and in groups of structures, such as the World Trade Center (WTC) buildings in the aftermath of the September 11, 2001, terrorist attack. This is an important development that underscores the robustness of existing knowledge on human responses to danger. Kuligowski's in-depth qualitative study of decision-making within the WTC towers at the time of the attack also calls attention to persistent patterns in evacuation. One such pattern is the tendency to delay departure even after making a decision to evacuate. Once that decision had been made, workers in the towers then proceeded to go through a "mental checklist" of activities that had to be accomplished before leaving, such as backing up computer files, packing up computers and work materials, looking for co-workers to make sure they were safe, and even backtracking during the evacuation itself to aid other victims. The same processes are known to occur on during household evacuations, for example when evacuation is delayed until all family members are able to leave together. Time spent in extensive pre-evacuation behavior reduces further the margin of safety. Here again, more research is needed to better understand those processes and find ways of shortening the time between deciding to evacuate and actually doing so.*

In some cases, those who evacuate don't actually deliberate extensively among themselves; instead, decisions are made for them. This occurs, for example, when hospital and nursing home personnel decide that patients must leave a facility for a safer location—or, conversely, when they decide it is not necessary to evacuate residents, as occurred in the tragic St. Rita's nursing home incident during Hurricane Katrina. Authorities make decisions concerning the evacuation of children in schools and institutionalized populations. Drabek (1994) has documented protective procedures in the tourism industry, in which hotel and resort operators take responsibility for guests who may be completely unfamiliar with hazards and disaster response plans in areas they are visiting. In an unusual example of official intervention, following the Katrina disaster, victims who were left stranded in the impact area were relocated by authorities to both near and distant communities around the United States, and many remain displaced in those locations. These special situations are not as well understood as other forms of evacuation activity and merit future study.

While evacuating endangered areas is often considered the best way of reducing life safety hazards during disasters, there are cases in which sheltering in place is a safer option, particularly when attempting to flee can expose those at risk to even greater danger. This form

*These preliminary findings, which have not yet appeared in peer-reviewed sources, are based on research conducted by Dennis Mileti and Erica Kuligowski with funding from the START Homeland Security Center and the National Institute of Standards and Technology. Findings should not be quoted or cited without the permission of Erica Kuligowski, Building and Fire Research Laboratory, NIST.

of self-protective action is generating more attention and discussion with respect to hazards such as toxic chemical releases, accidents at weapons storage facilities, and intentional terrorist attacks, as well as in areas that are difficult if not impossible to evacuate in a timely manner. Sheltering in place is even being advocated for wildfires in Australia (Rhodes and Handmer 2008). Sheltering in place can involve "vertical evacuation," movement to safe areas within structures, and the use of protective materials such as duct tape or plastic sheeting. For example, for bombing attacks, Israel has developed an extensive system for population protection that involves the distribution of gas masks, the use of alerting technologies, and the utilization of "safe rooms" in single- and multi-family dwellings.

It is important to emphasize that the same decision processes and the same behavioral models apply regardless of whether recommended activities center on evacuation or sheltering in place. At the same time, however, the knowledge and skills needed to successfully carry out various types of protective actions do differ (Sorensen et al. 2004).

Research on warning responses and evacuation has also considered the impact of false alarms or the "cry wolf" effect (Breznitz 1984) on subsequent evacuation behavior. Here the research is somewhat equivocal. Research provides little support for the "cry wolf" effect in disasters, noting that populations that evacuated in situations that turned out to be false alarms still evacuated when later asked to do so (Dow and Cutter 1998). Researchers hypothesize that even unnecessary evacuations have a positive effect on subsequent behavior, because they give those involved in evacuation an opportunity to "rehearse" and learn what to expect in those situations.

At the same time, as observed in Hurricane Katrina, previous experience with similar disasters may lead residents of at-risk areas to conclude that evacuation is not necessary. After Katrina, older residents indicated they had felt safe in their homes because those structures had survived Betsy and Camille. As early as the 1960s, researchers noted the existence of "disaster subcultures" in areas subject to repetitive disaster impacts (e.g., flooding). Such occurrences can become normalized within local cultures, leading community residents to become complacent. One reason why disaster experience is often a poor predictor of subsequent behavior is that people interpret experiences in different ways. Near misses, minor impacts, and even major ones do not necessarily result in learning and behavior change but may lead instead to complacency and overconfidence (Tierney, Lindell, and Perry 2001). For example, a Gallup Poll/Red Cross survey of Katrina survivors taken 1 month after the hurricane indicated that among those who did not evacuate (Haney, Elliott, and Fusel 2007: 82), nearly half stated that they did not evacuate because they did not believe that the storm would be as bad as it turned out to be. In fact, non-evacuees were more likely to cite this reason than a lack of money or transportation, and 5 percent cited a lack of proper warning for failure to evacuate.*

Consistent with the social vulnerability paradigm, evacuation researchers have documented interrelationships that exist among socio-economic status, race, ethnicity, English-language ability, and evacuation behavior. Examples of the impact of these factors include the 1987 Saragossa, Texas, tornado, in which warnings released in English did not reach the residents of that Spanish-speaking community in time, resulting in severe loss of life (Aguirre et al. 1991). Latinos in the United States have larger families than whites and value extended family ties. It

*Other factors that had a significant effect on decisions concerning whether to stay or go were gender (with men opting to stay behind more often than women) and lack of economic resources. Race was also important: white households were more likely to evacuate "in unison," while blacks were more likely to evacuate part of the household, while other members stayed behind, or not to evacuate at all.

therefore takes families longer to make decisions concerning evacuation owing to the number of family members who need to be consulted. Racial and ethnic differences shape groups' perceptions of the credibility and trustworthiness of different information sources; for this reason, members of some groups may take longer than others to seek information and confirm and act on warnings.

The presence of elderly and disabled family members in the home also has major implications for evacuation behavior. Evacuation decisions are collective decisions, not individual ones. In cases where risks to elderly, ill, or mobility impaired household members are seen as high, entire households may remain behind to care for those family members, rather than evacuating in the face of danger.

Having pets in the home also complicates evacuation decision making. Household members may elect not to evacuate in order to provide for their animals, knowing that official shelters do not accept pets. This issue became very evident in the aftermath of Hurricane Katrina; 2006 saw the passage of the Pets Evacuation and Transportation Standards Act (PETS Act), which requires improvements in planning for the evacuation and sheltering of animals in disasters.

Income and other economic factors are important as well. Relatively speaking, it is more financially burdensome for poor households to take on the challenges of evacuation than it is for more well-off households. Evacuation involves obtaining access to transportation; having money for gas, for those with private vehicles; the ability to take advantage of free sheltering services or to pay for a place to stay; and the ability to absorb lost wages and deal with disrupted cash flows. Poor people may lack the ability to handle the financial burdens of evacuation, and better-off households have many more evacuation options than their low-income counterparts. Poor people may lack the ability to handle the financial burdens of evacuation, and better-off households have many more evacuation options than their low-income counterparts. Elderly persons are also more likely than the general population to be transportation disadvantaged, because they tend to have lower incomes and more problems with disabilities that can restrict driving ability. They are less likely to own cars, and also more likely to elect not to drive for safety or financial reasons (Government Accountability Office 2006). (For more discussions on social factors in evacuation, see Sorensen 2000; Tierney, Lindell, and Perry 2001; Lindell and Perry 2004; Sorensen and Sorensen 2007.)

One key lesson from the Katrina experience is that older frameworks that only take into account household- and private vehicle–based evacuation are a thing of the past in U.S. urban settings. It is more evident than ever before that warning strategies and evacuation planning must cease to rely on "one-size-fits-all" approaches and instead design diverse strategies for the diverse needs of the public. Such strategies must aim at building local community capacity and resources and at providing transportation and sheltering assistance that is appropriate to at-risk subgroups when and where it is needed. Much more attention has to be paid to the use of public and mass transit for moving large numbers of people out of harm's way. The mix of evacuation strategies must also include efforts to provide refuges of last resort within disaster-threatened communities—complexes that can support sheltering in place—for those who cannot or will not evacuate.

Examples of resilience indicators for the pre-impact warning phase of disasters include the following:

- Prevalence of household evacuation/reunification plans
- Household knowledge of evacuation routes
- Household understanding of warning messages and technologies

- Household pre-identification and storage of items to take when evacuating
- Comprehensiveness of community warning plans and procedures
- Extent of evacuation plans and drills for high-occupancy structures and critical facilities
- Extent and quality of community-focused evacuation education programs
- Community provision of multi-modal evacuation options
- Extent and quality of community planning for the evacuation of institutionalized, hospitalized, and other dependent populations
- Existence of community plans targeting transportation-disadvantaged populations

3.2 Pre- and Post-Impact Public Responses: Sheltering Arrangements

Sociologist E. L. Quarantelli (1982) was the first disaster researcher to develop a typology of evacuee housing and sheltering arrangements, which is based on both temporal phases of disasters and the types of amenities offered to those displaced by disaster. *Emergency shelter* consists of expedient arrangements that protect victims when disasters strike but offer little or no supportive resources. For residents of flood-prone Bangladesh, emergency shelter may consist of "evacuation towers" to which victims can flee to avoid drowning in rising waters. In tornadoes, emergency shelter could involve sheltering in an evacuation center or in a neighbor's basement. Emergency shelter is a crucial means for saving lives during disasters. However, typical emergency sheltering arrangements do not provide the resources needed to support victims' survival beyond a few hours or days. Many evacuees who shelter on an emergency basis return to their homes without needing additional shelter and housing support, while others move on to access temporary shelter.

Temporary sheltering arrangements go well beyond the provision of immediate life-safety protection. Victims who seek temporary shelter are typically those who are unable to return to their homes because their homes have been destroyed, damaged, or rendered uninhabitable because of ongoing threats or because of community-wide infrastructure damage. In some cases, authorities may restrict re-entry to damaged areas, causing relocated victims to remain in temporary shelter situations pending approval of re-entry.

In the United States, most disaster victims are offered temporary shelter by family members, other relatives, friends, and even strangers. Victims may also seek temporary shelter in hotels or improvise their own sheltering strategies (e.g., outdoor encampments or use of resources provided by faith-based and community-based organizations). Typical temporary sheltering arrangements give victims access to reasonably comfortable accommodations, meals, and basic hygiene. Government-operated shelters, such as those staffed by the Red Cross in the United States, also offer victims information on sources of disaster aid, counseling, and assistance with finding more personal housing. Temporary shelters provide an important source of assistance for displaced victims, but in the United States they generally do not meet victims' expectations regarding privacy, personal space, and the resumption of pre-disaster activities, nor are they used by a representative cross section of the victimized public. Peacock et al. (2007: 261) note the following:

> While considerable attention by emergency responders is given to public sheltering such as the use of the Superdome during Hurricane Katrina or public schools during other types of events…the majority of those seeking temporary shelter use public shelter as a refuge of last resort…less than a quarter of those seeking sheltering use large-scale public facilities…and those who do are more

likely to have lower socioeconomic statuses, live in rental housing, own homes in disrepair (prior to the hazard), and have few familial resources.

Temporary housing consists of arrangements that at least in theory help normalize ongoing social life for those affected by disasters and that afford privacy and the ability to restore household routines. Examples include housing programs and vouchers provided by the Federal Emergency Management Agency (FEMA), FEMA mobile homes, and apartment rentals and "doubling-up" arrangements with relatives that are understood to be temporary.

Permanent post-disaster housing, the last phase of the cycle, refers to situations in which disaster victims return to their original homes or establish new homes on a permanent basis. Victims may relocate elsewhere within their own communities or in different communities. Where options are available, they may also choose different types of living arrangements. For example, more than a decade after the 1995 Kobe earthquake, many elder residents of heavily damaged areas now live in communal or co-housing facilities, rather than in family-centered dwellings.

In a chapter in the *Handbook of Disaster Research,* Peacock et al. (2007) take a detailed look at sheltering and housing issues throughout the four phases first identified by Quarantelli. This review, along with other studies on emergency and temporary shelter and temporary and permanent housing (see Tierney, Lindell, and Perry 2001), has yielded a number of important findings. First, within societies, social groups do not move through these four phases at the same rate. Factors such as insurance, household savings, household access to aid programs, social capital and resources that enable victims to take advantage of emerging housing opportunities, and the ability of disaster-stricken communities to advocate for victims' needs help to determine how rapidly victims complete the cycle. Put another way, if resilience involves the ability to rebound, adapt, and restore living arrangements, some groups within disaster-affected populations are more resilient than others.

Second, in many disasters, temporary housing may become permanent housing on a *de facto* basis, particularly in cases where those in charge of managing recovery fail to develop and implement permanent housing plans. Third, certain forms of sheltering and housing strategies can actually make the recovery process more difficult for those affected. For example, temporary housing support may be withdrawn before households have the opportunity to make arrangements for permanent living arrangements—as is currently occurring with victims of Hurricane Katrina. In the United States, FEMA-funded high-density mobile home camps can become sites for domestic violence and crime (Enarson and Morrow 1998). In some cases, proper hazard mitigation and safety measures are not implemented in post-disaster housing facilities, as seen most recently in the case of formaldehyde in FEMA trailers in the Gulf region.

In sum, rather than integration and continuity, what exists in the United States is a lack of connectedness among the different phases of disaster sheltering and housing, making for a less resilient post-disaster sheltering and housing response. Different phases of the housing cycle are organized, managed, and financed by different entities. No entity exists to manage the process that moves those who have lost their homes into new housing arrangements. While many disaster victims have the resources (e.g., insurance, personal savings, help from family members) to respond resiliently throughout the housing recovery process, others lack those resources. Moreover, funding streams are not consistent across the housing cycle. Victims can avail themselves of different types of aid at different times (emergency shelters, temporary housing vouchers, insurance payouts), but the housing recovery process is delayed for many owing to a lack of financial resources and adequate programs. Initiatives such as the Road

Home program for victims who were forced to relocate following Hurricane Katrina are an example of attempts to compensate for the lack of continuity in post-disaster sheltering and housing programs. In many senses, this lack of coordination and absence of attention to household recovery is an extension of the nation's general inattention to a comprehensive housing policy (Comerio 1998).

Candidate indicators of resilience with respect to the need for and provision of shelter and housing following disasters include the following:

- Proportion of housing stock not rated as substandard or hazardous
- Community pre-identification of post-disaster housing needs
- Adequacy of plans for inspecting damaged buildings following disasters
- Adequacy of post-disaster sheltering plans (e.g., Red Cross shelters)
- Capacity to anticipate the needs of diverse shelter populations
- Vacancy rates for rental housing
- Community understanding of the range post-disaster sheltering and housing programs and sources of assistance
- Extent of provisions for continuity in the provision of shelter and housing
- Extent of pre-disaster planning for post-disaster residential reconstruction and recovery

3.3 Pre- and Post-Impact Public Responses: Collective Behavior in the Context of Disasters

As noted earlier, the concept of collective behavior refers to activities that are carried out by individuals and groups in situations that are so unusual that conventional norms and everyday practices seem no longer to apply (Turner and Killian 1987; Marx and McAdam 1994; Miller 2000). Under conditions of threat, stress, and uncertainty in which there is a collectively defined need to act, new patterns of behavior and new forms of social organization emerge. Discussed below are forms of collective behavior that are common during disasters.

It should be noted at the outset that while most manifestations of collective behavior under crisis conditions are positive and pro-social, and while others simply constitute extensions of normal, everyday patterns of social behavior, these positive behavior patterns nonetheless can raise significant challenges for members of the public and for officials charged with responding to disaster events. Forms of crisis-related anti-social behavior, while quite rare, may also present major challenges.

Any discussion of public behavior during crisis events must begin by re-emphasizing that such behavior has been a fundamental concern since the inception of the field of disaster research. It was important both to researchers and to those funding research that disaster studies should yield solid empirical information on how endangered publics would react under extreme stress. Among the first products of early field studies was a compilation of myths and erroneous beliefs about public behavior that were contradicted by empirical research, such as the myth of the panicky public and the notion that public order breaks down during crisis events. Remarkably, many such myths persist today—or have been resurrected in the post-September 11 era—despite continuing evidence of their lack of validity (Fischer 1998).

The discussions that follow will briefly summarize social science findings on public behaviors during disasters. Topics covered include patterns of pro-social behavior; behaviors indicating a lack of panic responses within the public; information-seeking and confirmation behaviors; and extremely rare occurrences of behaviors such as looting.

3.3.1 Helping Behavior in Disasters

Both classic and contemporary research on disasters provides overwhelming evidence that members of the public cope well before, during, and after disasters. Research consistently shows that behavioral patterns within populations under stress are pro-social, as indicated by increases in large-scale helping behavior and volunteerism. Alan Barton's classic study on disaster response (1969) referred to a post-impact period of "mass assault," in which community energies were overwhelmingly devoted to addressing the needs of victims. Dynes (1970) and others wrote about what they termed "the expansion of the citizenship role" to describe how community residents, including those not normally concerned with public affairs, feel compelled to help their communities when disasters strike.

Pro-social behavior takes various forms during disasters (National Research Council 2006). The least organized and most emergent forms consist of spontaneous actions undertaken by family members, friends, and neighbors in the immediate disaster impact area: providing assistance with evacuation; sheltering and protecting those at risk; fire suppression and other efforts to contain both primary and secondary disaster impacts; search and rescue; the administration of first-aid measures; transportation of victims to health care facilities; and other tasks. During the immediate post-impact period, helping activities carried out by ordinary community residents far outweigh those undertaken by official "first responders." Indeed, members of the public are the true first responders in all disasters.

During and after disaster impact, spontaneous helping behavior becomes more organized, as indicated by the presence of emergent groups that take responsibility for a wide range of disaster response activities (for discussions of emergent groups and emergence in disasters, see Stallings and Quarantelli 1985; Drabek and McEntire 2002). Examples of such groups include search and rescue and debris-removal teams that formed following the 1985 Mexico City earthquake; volunteer groups that emerged to provide a range of supportive services for emergency responders at respite centers following the World Trade Center attacks; organized groups of residents who used bicycles to navigate debris-clogged roads in order to provide medical care, disseminate information, and offer other services to the victims of Hurricane Katrina in New Orleans; and the more than 1.2 million volunteers who took part in groups providing a broad spectrum of services to victims of the 1995 Kobe earthquake.

These forms of emergent responses within the public constitute a major source of resilience during disasters. Disaster volunteers greatly enhance the capacity to respond, complementing and in many cases superseding official organizational responses.

As emergent groups coalesce into networks, their contributions to disaster resilience expand. Two recent examples illustrate the accomplishments of community-based public responder networks. Following the September 11 attack on the World Trade Center, owners of ferries, boats, and other watercraft spontaneously organized a network of vessels that transported tens of thousands of persons who were stranded in Lower Manhattan, while also providing transportation for emergency workers from neighboring jurisdictions who were mobilizing to the disaster site (Kendra, Wachtendorf, and Quarantelli 2002; 2003).

Water transport for victims was also of critical importance following Hurricane Katrina. In this case, loosely organized emergent groups consisting of hundreds of volunteers with boats, later labeled the "Cajun Navy," searched for and rescued thousands of stranded victims of the hurricane and set up and supplied a shelter known as "Camp Katrina" in a warehouse near the Mississippi River. While some agencies and branches of government coordinated well with the

Cajun Navy, others turned the volunteers away, indicating that their assistance was not needed (Hennessy 2007). This latter pattern, which is common in disasters, illustrates the ambivalent attitudes official agencies often hold regarding grassroots emergency assistance efforts.

The public's pro-social impulses also find expression through involvement with formal volunteer organizations, such as the Red Cross and networks such as National Voluntary Organizations Active in Disaster (NVOAD). Such organizations are designed to expand in order to take advantage of the upsurge in volunteering that inevitably takes place during disasters. Community emergency response teams (CERTs) also constitute an example of pre-planned disaster helping behavior. Originally developed in Los Angeles in the 1980s, the CERT concept was widely adopted throughout the United States in the aftermath of the 9-11 attacks. From a research point of view, the CERT concept is a sound one, in that it recognizes the primacy of local knowledge and rapid local response in disasters, acknowledges the role of planning and training in improving community residents' ability to respond, and takes advantage of the public's need to be of service in disaster situations.

Studies show not only that community members become involved in disaster response in large numbers but also that their efforts can in many cases be more efficient and effective than those of entitles that are more farther removed from everyday community life. An often-cited study by Aguirre and his colleagues (Aguirre et al. 1995), on the 1993 Guadalajara gas explosion, describes how local residents were very effective in locating and aiding victims, because residents knew how many people lived in different households, who was accounted for and who was not, and locations at which their neighbors were active during different times of the day—information that greatly facilitated search and rescue. By going door-to-door and visiting debris piles in search of buried victims, residents were able to locate victims and identify those who were trapped, based on their local knowledge of daily rounds of activity in their communities. Studies on post-disaster search and rescue activities indicate that early search and rescue efforts—that is, those most likely to result in live rescues—are almost always dominated by local community residents, rather than official search and rescue teams (Poteyeva et al. 2007). Here again, emergent community groups enhance community resilience by increasing response efficiency and effectiveness.

Research regarding both the widespread nature and the effectiveness of public involvement in disaster response has clear implications for official approaches to disaster management. First, it is important to recognize and engage local communities and groups that emerge in the context of disasters as full partners in disaster response activities. Second, official response agencies must avoid taking actions that undermine the ability of residents of disaster-stricken communities to engage in self-help activities in the aftermath of disasters. One unfortunate aspect of the official Katrina response in Louisiana (when it was finally launched) was the extent to which it interfered with grassroots efforts to aid victims that were already under way.

Major disasters also trigger massive increases in donations of money, material goods, and services, which means that donations management can become a major challenge in its own right. Often the material goods and services that are offered are not needed—even though donors insist on providing them. Large-scale fundraising, which can greatly benefit disaster victims, can at the same time raise questions regarding accountability, transparency, qualifications for assistance, and the manner in which aid is distributed. In recent years, the Red Cross in particular has come under criticism for its longstanding practice of using disaster events to raise money both for victims of those particular events and for its general disaster programs. Donors are increasingly demanding that the funds they donate to the Red Cross and

other aid providers be distributed according to their own wishes—even when they might be put to better use elsewhere.

The forms of collective behavior discussed above are all examples of *convergence*, a pattern that has been consistently documented during disasters (for early discussions of this phenomenon, see Fritz and Mathewson 1957). Disasters invariably generate convergence, and (other things being equal) the larger the disaster event, the greater the convergence. Convergers include members of the public who mobilize to disaster sites to provide assistance; emergency workers who "self-dispatch" to disaster sites, even when told that they should not do so; people who travel to disaster impact areas out of sheer curiosity; representatives of the mass media; those wishing to donate resources—again, whether those resources are needed or not; and other newly identified types of convergers, such as those wishing to memorialize victims, "fans" whose main objective is to cheer for and support emergency workers, and "disaster tourists" (Kendra and Wachtendorf 2003).

Globalized communication and expanded access to means of transportation have broadened opportunities for those wishing to converge when disasters strike. Convergence contributes to resilience by rapidly expanding disaster response resources. At the same time, convergence also presents significant management challenges, such as how to best utilize the energies and skills of converging volunteers; assess skills; provide whatever training may be needed for volunteers; implement credentialing systems; provide for the safety of convergers; manage staging areas; allow legitimate public expressions of concern and grief without allowing those expressions to compromise emergency operations; and assess and manage liability risks associated with convergence.

3.3.2 Information-Seeking and Its Role in Disasters

Human beings continually search for information as they navigate through their daily routines, and especially in our technology-enabled world, information is never in short supply. In fact, typical members of the public in Western industrialized societies are more likely to complain of information overload than a lack of information. While alert to various sources of information, human beings are also "cognitive misers" who use heuristics, mental models, cognitive frames, and other cognitive strategies to organize what is already known and make sense of new information (Kahneman, Slovic, and Tversky 1982; Morgan et al. 2001).

As people receive and process new information, it is incorporated into pre-existing mental categories and concepts. Sociological scholars have long emphasized the notion that the ideas and concepts used by members of different societies in making sense of their social world are *socially constructed* (Berger and Luckmann 1967). As a consequence of social construction practices, social attitudes, beliefs, and behavior take place in the context of a taken-for-granted stance toward the social world. Even in unstable societies, social life generally operates according to what has been termed the "normalcy bias" (Drabek 1986). People go about their daily lives assuming a high degree of continuity between one day and the next while integrating the new information they receive into what might be called a mental architecture that provides structure for everyday experiences. The interpretive organizing devices that make up this architecture are commonly known as frames (Goffman 1974).

In the disaster context, this tendency to take day-to-day life for granted is one reason why it is so difficult for people to assess accurately environmental cues indicating danger and to attend to, understand, personalize, and act upon warning messages. At-risk populations and groups have a natural tendency to adhere to socially constructed societal routines and to normalize

cues that may indicate danger. When confronted with signs of impending disaster, the natural tendency is for those at risk to downplay the threat and to reason that "it won't happen to me." The normalcy bias and the taken-for-granted nature of everyday life manifest themselves in the desire to continue with everyday activities, rather than change course because of an imminent threat, and to downplay guidance urging self-protective action.

As threats become more evident, as warnings become more persistent, or as a disaster or other crisis strikes without warning, the taken-for-granted nature of social life comes into question for those affected. Socially constructed views of normalcy are breached. Expectations regarding daily life—that home will always be there, that communications and transportation systems will work reliably, that electricity and water will be available, that jobs and schooling will go on as before—become problematic. Public recognition of these breaches leads to large-scale collective efforts to obtain new information that can help those at risk make sense of changing circumstances. This collective information-seeking is a fundamental process that occurs in all crisis situations—as well as in situations that are not in fact true crises but that come to be socially defined in that way. Intensified information-seeking represents an entirely normal and predictable response to socially disruptive, ambiguous, and novel social situations. During disasters and other crises, those both inside and outside the region of impact seek to identify and use any sources of information that are available. Those sources can include mass media reports, official government web sites, and government agencies. They also can include informal sources of information (families and friends), non-governmental web sites, postings on social networking sites such as FaceBook, and rumors that spread through word-of-mouth or mediated sources.

Different information sources are virtually certain to contain inconsistent and contradictory information during disasters. It is difficult to distinguish between previously released versus up-to-date reports and well-validated versus speculative information. Vague and inconsistent information and official delays in releasing information further intensify information-seeking, as the public seeks clarification on myriad complex questions. In an information-saturated society, when crises occur, managing the demand for information is a major challenge. Official agencies must pay attention to the public's stepped-up need for information during disasters and find ways of managing information inquiries that far exceed normal demand levels.

A key point that has not yet been adequately addressed in the disaster literature is that as members of the public and those involved in responding to disasters obtain more information and attempt to assess disaster situations, *pre-existing frames, mental models, and socially constructed meanings still act as organizing frameworks for new information.* Thus, in a community characterized by racial conflict, the sound of gunfire in the context of a disaster can be interpreted as indicating that members of one group are shooting at their adversaries to kill or maim. The sight of people representing particular racial or ethnic groups entering homes can be interpreted as attempts to loot, as opposed to efforts to search for victims. Actions taken by different groups (e.g., members of minority or majority groups, the police, government agencies) are interpreted in light of pre-existing cognitive frames. The fact that members of minority or disadvantaged groups are on the streets after dark may automatically be interpreted as evidence of wrongdoing. These interpretations give further impetus to the spread of rumors, as those involved attempt to make sense of the situations in which they find themselves. Information disseminated during disasters can also reflect the collective memories of different groups—as occurred when many African Americans in New Orleans, remembering what occurred during the catastrophic floods of 1927, believed that the levees had been intentionally blown up during the Katrina disaster. Seen from other socially constructed points

of view, those allegations seemed paranoid. (For additional discussion on the framing of events during the Katrina disaster, see Dynes and Rodriguez 2007.)

The point here is that even under conditions of societal disruption such as disasters, pre-existing beliefs still serve as cognitive anchors, both for members of the public and for response personnel. Everyone organizes information using existing cognitive frames. Recognizing this tendency, those caught up in the immediacy of disaster impact (including importantly government leaders and the mass media) must adopt a critical and skeptical stance regarding stereotype-driven information and must find ways of basing their actions on empirical fact, as opposed to rumors and assumptions.

3.3.3 Panic during Disasters: The Empirical Record

Returning once again to the origins of social science research on disasters in the United States, one of the earliest myths to be debunked is the notion that people panic in the face of disasters. The specter of mass panic appears repeatedly in disaster movies and media, and popular discourse on panic uses the concept loosely and invariably sees panic anywhere disasters strike. People are said to panic if they run away from danger, even though running away is often exactly what those at risk need to do. Were those who fled from the incoming waves during the Indian Ocean tsunami in a state of panic? People are also described as panicking if they momentarily freeze and are incapable of taking action, even though it is normal to take more time to make decisions and plan actions under unfamiliar and threatening conditions. Panic is equated with feelings of fear—although who would not be afraid if confronted by a storm surge, earthquake, tornado, or wildfire? Panic is even equated with the types of information-seeking described above, which constitute completely normal and understandable collective behavior responses to events that disrupt everyday norms and collectively constructed understandings. Thus members of the public who wished to obtain information on how to recognize and treat anthrax during the 2001 anthrax attacks were said to have been in a state of panic, as were those who more than a decade earlier sought to learn more about the pseudoscientific Iben Browning New Madrid earthquake "prediction" of 1990.

In social science parlance, panic—as opposed to anxiety, fear, movement away from danger, information-seeking, and other behaviors discussed here—refers to *highly individualistic, non-rational, non-social* behavior in which the bonds and social norms that unite social groups (families, friendship networks, attendees at gatherings, organizations, government agencies) break down to the extent that the well-being of others ceases to be a consideration. To the extent that it does occur—and panic is quite rare—it is not confined only to disasters. Panics in financial markets are a case in point: mass stock sell-offs, runs on banks, and other forms of financial panic are collective behavior responses that in many ways parallel the rare instances of panic that occur during disasters. (For discussions on panic and its rare occurrence, see Quarantelli 1954; Johnson 1987; Johnson et al. 1994; Feinberg and Johnson 2001; Clarke 2002.)

Several empirical points are key to an understanding of panic in crisis situations:

- The event characteristics and social conditions that give rise to panic are well understood in the social science literature
- Those conditions are almost never present in disaster situations
- When it does occur, panic behavior is typically very short lived and does not necessarily place others in danger

- Panic is a label that is used loosely in media and public discourses on how members of the public behave under stress, and fear, anxiety, and other behaviors are used interchangeably with the concept of panic
- When emergencies and disasters, particularly those in confined spaces, result in loss of life and injury, panic is often automatically assumed to have been a factor, when in actuality the occurrence and impact of panic must always be a matter of empirical investigation
- There is a substantial body of knowledge that provides guidance on how to prevent panic from emerging during crises
- Describing disaster victims and attendees at crowds and gatherings as panicking and causing danger to themselves and others often serves to deflect attention away from negligence on the part of institutions and organizations that are responsible for ensuring public safety

In the aftermath of the terrorist attacks on 9-11, and facing looming threats such as attacks using exotic explosives and biological agents, as well as the potential for pandemic flu, official emergency management and homeland security discourse has once again focused on the potential for public panic should such events occur. Here again, this "panic discourse" parallels Cold War fears concerning public responses in the event of nuclear war. Among many institutions, there appears to be a shared attitude of collective denial, indicated by the refusal to acknowledge an empirical record showing unequivocally that the vast majority of people do not panic under conditions of danger. Regarding exotic threats and highly fear-inducing situations, examples abound. No panic took place during the 1947 smallpox outbreak in New York City, the Chernobyl nuclear catastrophe of 1984, the 1995 sarin gas attack in the Tokyo subway, or the 1993 and 2001 attacks on the World Trade Center (Tierney 2004).

Common-sense reasoning would expect that panic would break out when groups of people are confined in tight spaces and must flee under conditions of extreme danger. Yet even under these conditions, pro-social norms governing behavior remain strong. On August 2, 2005, for example, an Air France jet ran off the runway and caught fire during an attempted landing at a Toronto airport. The mass media described passengers as panicking, but in fact 297 passengers and 12 crew members remained calm and evacuated the plane in approximately 3 minutes—something that could not have been accomplished had panic broken out. No one died, and there were only 43 minor injuries.* In an even more dramatic illustration of how the social order remains robust under even the most extreme conditions, on August 20, 2007, a China Airlines plane caught fire shortly after landing at an airport on Okinawa. Minutes before the plane exploded into flames, 157 passengers and 8 crew members evacuated in a rapid, orderly fashion, with no injuries to plane occupants.

In the 2003 Station Nightclub fire in Rhode Island, using video footage taken inside the club, the official investigation of the fire found no evidence of panic, but there did appear to be signs of a crowd crush as occupants attempted to exit. The crowd crush can be attributed to the fact that the club was overcrowded, that all available exit routes were not used, and that the club

*Following the Air France crash, some media outlets stated that panic had developed on board the plane. In a critical op ed piece in the *New York Times* on August 7, 2005, entitled "A Hero in Every Aisle Seat," decision scientist Baruch Fischhoff argued that such a rapid evacuation would never have been possible had panic occurred, and that in fact pro-social behavior dominated on board the plane, just as it does during other emergencies. In the concluding section of his piece, Fischhoff noted that "whatever its source, the myth of panic is a threat to our welfare…It's time to end the chatter about 'panic' and focus on ways to support public resilience in an emergency."

entrance, the main egress route used by club occupants, was poorly designed (Grosshandler, Bryner, Madrzykowski, and Kuntz 2005).

This is not to say that panic behavior never occurs during disasters. In the deadly Beverly Hills nightclub fire of 1977, there was evidence of short-lived panic in one of the rooms in the nightclub when there was a rapid flashover of fire (Johnson et al. 1994). However, panic did not break out in the other rooms as club patrons attempted to evacuate.

In considering public responses during disasters, it is critical to examine how organizations, institutions, and decision makers can amplify the potential for fear and other forms of crisis-related behaviors, such as information-seeking and rumoring, within at-risk populations. The disaster literature suggests that in many cases officials hold back information and even delay issuing warnings out of fear of creating panic—a misplaced concern—when instead they should concentrate on disseminating information rapidly and widely (Fischer 1998). Inconsistent, ill-timed, and contradictory information released by official sources is guaranteed to fuel intensified information-seeking. In cases where information is not shared with the public, rumors will arise to fill in the gaps. In his classic study of rumor, *Improvised News* (1966), the sociologist Tamotsu Shibutani highlights the manner in which secrecy, censorship, and unwillingness to share news—in particular bad news—with the public, creates the context in which rumors spread and come to be accepted as fact. Here again it is important to note that public fears and the rumors that accompany them are invariably shaped by pre-existing attitudes and beliefs concerning different social groups and social actors.

Institutions and organizations also contribute in other ways to conditions that increase the potential for harm within at-risk populations and social gatherings. For example, research following the "Who Concert Stampede" in 1979, a crowd crush that was erroneously labeled as a panic episode, revealed how the design of the concert hall—especially ingress routes—contributed the crush (Johnson 1987). Also singled out was the "festival seating" scheme, very common in concert venues at the time, that provided seating on a first-come-first-served basis, rather than on the basis of assigned seats. Festival seating arrangements encouraged competition for entry into the concert venue and contributed to overcrowding and subsequent crush behavior at inadequately-designed doors.

The Biosecurity Center of the University of Pittsburgh Medical Center, formerly the Johns Hopkins Center for Civilian Biodefense Strategies, has engaged in intensive studies of ways in which public anxiety and rumors can be mitigated during public health emergencies (e.g., pandemic flu, a bioterrorism attack) through effective leadership before and during such events (Working Group on Governance Dilemmas in Bioterrorism Response 2004). Recent Biosecurity Center work stresses the importance of public engagement in planning for all types of disaster events (Schoch-Spana et al. 2007).

3.3.4 Looting Behavior in Disasters: How Much Should We Worry?

The research record documents that looting during disasters in the United States is quite rare. Also documented is the widespread *belief* that disasters do give rise to looting and other forms of anti-social behavior. Following disasters, the news media invariably report that forces such as the National Guard have been sent into disaster areas "to prevent looting." The media often feature photographs of signs indicating that "looters will be shot." Fear of looting appears to contribute to unwillingness to evacuate under threat conditions. However, the fact that there is a pervasive "looting frame" that shapes beliefs about how individuals and groups behavior during disasters does not mean that looting and crime are serious problems in most disasters.

Hurricane Katrina did give rise to the taking of property owned by others. That fact is inarguable. Also inarguable is the fact that, consistent with the "looting frame," the media and public officials amplified the extent to which looting occurred. However, how much these behaviors were exaggerated, and why they were, is a matter of perspective and standpoint. For example, African Americans are more likely than Whites to attribute negative media reporting to the fact that many of those who were trapped in New Orleans in the days following Katrina were black. There does seem to be considerable evidence that the media linked behaviors that took place in the Katrina aftermath with the behaviors that are typically seen in episodes of civil unrest, where looting does occur on a large scale. This linkage, along with descriptions of New Orleans as a "war zone," both reflected and shaped public views of victims' behavior (Tierney et al. 2006).

Because of the Katrina experience, looting has become something of a hot button issue both in policy circles and in the research community. As a direct consequence of Katrina, law enforcement and military functions are being given greater emphasis in the National Response Plan. It appears that from the official perspective, looting is now being seen as a likely occurrence in disasters.

Within the research community, it has long been understood that norms regarding the taking of property do shift during both episodes of rioting and during disasters. During riots, emergent norms permit looting and property damage—but still within limits. Contemporary U.S. riots are termed commodity riots because actions generally target businesses (but not all businesses equally), as opposed to private homes, schools, and government buildings. During disasters, property norms are sometimes relaxed for the good of the community—for example, when authorities commandeer private property without permission—but generally remain very strong, as indicated by public denunciations of looting (Quarantelli and Dynes 1970; Tierney 1994).

Katrina has motivated the research community to explore its own assumptions about disaster-related looting and to identify the conditions under which it occurs. To say that looting does not occur in disasters is patently incorrect. For example, new historical evidence indicates that in the 1906 San Francisco earthquake, well-off members of the community engaged in looting in Chinatown when its residents were forced to flee. The looting, which involved antiques and other high-valued items, was initially done under the eyes of the police but was short-lived (Fradkin 2006). Looting was reported following the terrorist attacks on the World Trade Center. Accusations that police officers and firefighters were involved in the looting prompted strong denials from those agencies. Following Hurricane Hugo, there was widespread looting on St. Croix in the U.S. Virgin Islands—but not, it should be noted, in other parts of the Caribbean and the U.S. mainland that were severely damaged by the hurricane.

Quarantelli, who did extensive research on the post-Hugo looting on St. Croix, suggests that St. Croix and New Orleans provide two useful data points for understanding the conditions under which tendencies to loot may be amplified (see Quarantelli 2007).* Both events involved catastrophic disaster impacts, widespread helplessness, a breakdown in conventional systems of social control, and particular types of pre-disaster conditions. Based on his analysis (see also

*Quarantelli notes that the looting on St. Croix was proportionally far more widespread that what occurred following Katrina, with very large proportions of the victim population taking part at some point. He also notes that emergent property norms still did not permit indiscriminate looting (2007: 2): "there was not a single authenticated case of the looting of private residences, schools, hotels, the one industrial complex with valuable equipment, or even resort restaurants."

Frailing 2007) it can be argued that looting may become a significant concern in U.S. disasters under the following set of conditions:

- A catastrophic disaster in which there is widespread destruction
- A breakdown in emergency services and the governmental system
- Severe lack of access to goods needed for continued survival, such as water and food
- Lack of clarity on when (or if) assistance will arrive
- Victims perceive themselves as trapped, unable to leave disaster area
- Emergence of norms signaling that victims are on their own
- Marked pre-disaster social inequality
- Pre-event conditions such as a significant organized crime presence, high crime rates, and official and police corruption

That the United States can point to at most two recent events in which significant widespread looting did take place—St. Croix and Katrina—suggests that this unfortunate confluence of conditions remains quite rare.

The St. Croix and Katrina experiences also indicate that the emergency services system itself has a responsibility for preventing the development of conditions that can give rise to looting. It is clear that much of the looting that took place following Katrina stemmed from the fact that many of those left behind in the impact zone were truly desperate and required looted items to survive (Potter 2007).

Based on knowledge of collective behavior responses during disasters, indicators of resilience in accommodating those responses include:

- Adequacy of plans for incorporating volunteers and emergent groups into official response activities
- Adequacy of donations management plans
- Extensiveness of pre-disaster citizen training programs (e.g., CERT, Citizen Corps)
- Extensiveness of efforts to engage communities in planning for future extreme events, including pandemic flu and bioterrorism
- Adequacy of procedures for communicating with the public and addressing the public's need for accurate information following disasters
- Adequacy of linkages between official and unofficial information sources
- Adequacy of ties between emergency management entities and mass media serving diverse populations
- Disaster responders' awareness of typical patterns of social behavior following disasters (e.g., research findings on panic, anti-social behavior, information seeking, convergence)
- Appropriateness of responders' strategies and resource allocations, in light of expected public responses (e.g., a balanced approach to security and social control measures, avoidance of militaristic approaches to dealing with the public in disaster situations)

4. ORGANIZATIONAL ASPECTS OF DISASTER RESPONSE: BALANCING STRUCTURE AND SPONTANEITY

The overarching principle guiding the discussion that follows is that organizations responding to disasters face the dual challenge of coordinating and structuring their activities according to pre-existing plans and agreements, while also allowing for improvisation,

creativity, and innovation as the response unfolds. While planning and training do contribute in major ways to the effectiveness of disaster response activities, because disasters always involve challenges not addressed in prior plans, effectiveness also rests on the capacity to be resilient and flexible in the face of those unexpected challenges. Put another way, to be effective, responses in disasters must successfully blend "agility and discipline" (Harrald 2006). This section reviews what is known about how organizations respond in both structured and adaptive ways in disasters and critically reviews current disaster management philosophies and frameworks. As in the previous section, discussions culminate with a listing of candidate resilience measures.

4.1 Contrasting Perspectives on Disaster Management

Disaster researchers have written often about what they see as competing views on organized responses to disasters. These approaches are commonly termed the "command and control" and "problem-solving" or "emergent human resources" perspectives (Dynes 1993; 1994). The command-and-control orientation emphasizes that official agencies hold primacy in terms of responding to disasters; that disaster operations are best managed through centralized direction and control; and that relations among responding organizations should be pre-determined, ideally in a hierarchical fashion, before disasters occur. This orientation, which favors a type of military model for disaster response, harks back to the early days of civil defense in the United States and at the same time resonates with post-September 11 thinking regarding the management of extreme events.

Alternatively, the problem-solving/emergent resources model stresses that organizational responses to disasters involve decentralized decision making and action; collaborative relationships among responding organizations; and considerable emergence with respect to organizational activity during disasters, where the term emergence refers to new collaborative arrangements and new disaster-related tasks. While the command and control approach to disaster management sees disaster response mainly in closed system terms, the problem-solving model explicitly recognizes that response activities constitute open systems whose membership can never be predicted in advance of actual events.

Early work by the Disaster Research Center (DRC) (e.g, Brouillette and Quarantelli 1971) emphasized that entities involved in responding adaptively to disasters vary both in terms of structure and the functions they undertake. *Existing* organizations maintain their pre-disaster structure (size, membership, organizational arrangements) as well as the tasks they perform. A community-based clinic that offers its regular services to both its own clients and disaster victims, without expanding its range of services or taking on additional staff, is an example of an existing organization. *Expanding* organizations change their structure, for example, by taking on new members and incorporating other organizational entities but continue to perform their normally assigned tasks. The mobilization of firefighting resources in wildfires is a clear example of organizational expansion. *Extending* organizations retain their pre-disaster structure but take on entirely new tasks. For example, following the 1995 Kobe earthquake, local schools served as both shelters and disaster morgues, tasks that were entirely new for the schools and school personnel involved. *Emergent* groups were discussed earlier, and the Cajun Navy, which performed search and rescue activities during Hurricane Katrina, was cited as an example. Emergent grassroots groups have no pre-disaster existence and come into being to solve specific problems, as identified by members.

One key insight provided by the four-fold "DRC typology" is that the composition and activities of the collection of organizations that engage in response activities cannot be anticipated in advance of actual disasters, particularly when extending and emergent organizational forms are taken into account. Another is that as the scale and severity of an event increases, response activities tilt more toward emergent forms of organization. Two decades of research by Gary Kreps and his collaborators also attests to the variation that exists in organized responses to disasters—variation ranging from the purest forms of spontaneous collective behavior, reflected in the activities of emergent groups, to the precise execution of pre-event plans (Kreps 1989; Kreps and Bosworth 1993; 2007).

This knowledge base calls into question the foundational assumptions of the command-and-control model. While the participation of officially designated organizations—local emergency management and public safety agencies, and state and federal agencies—can be anticipated in advance of disasters, the involvement and activities of many other responding organizations cannot. Except in everyday emergencies, the actual composition of disaster response networks cannot be predetermined, and indeed many participating organizations may be unaware of official response frameworks and plans.

This point has become even more evident through research on emergent multi-organizational networks (EMONS) in disasters. Key here is the idea that disaster response tasks are not handled by hierarchies or pre-designated sets of organizations but rather by networks of organizations that emerge to meet the challenges of particular disaster events. Networks consist of two essential elements: nodes (in this case, responding organizations and groups) and the ties or relationships among nodes. New nodes are added as disasters scale up in their severity and scope, and relationships among nodes also continually shift and evolve over time. The network form of organization appears during the response phase of disasters because it is the form that is best suited to the dynamic nature of the disaster environment itself; nodes or organizational actors are recruited (or recruit themselves) in response to particular problems as they arise, and relationships among organizational actors often develop on the fly.

The first EMONs studied by disaster researchers were relatively small and specialized. For example, nearly 30 years ago Thomas Drabek et al. conducted research on emergent search-and-rescue networks in disasters (1981). EMONS have not been a major focus of empirical studies since then, but recent advances in computational capabilities and network-analytic procedures have now made it possible to analyze and explore many features of EMONS, such as their structural characteristics (size, cohesiveness, existence of subnetworks addressing specific tasks), attributes of network nodes (centrality), and evolution over time (see Kapucu 2005; 2006).

Studies on the World Trade Center disaster represented a turning point in social scientific understanding of EMONS, owing in no small measure to the fact that the WTC event generated interest among specialists in network analysis. As a result of intensive research on that event by such experts, much has been learned regarding the structural features of EMONS, including their potentially enormous size and diversity; the participation in networks of all of the types of organizational entities originally identified in the DRC typology; and the ways in which diverse entities interact with one another within the disaster context. Recent research also focuses on underlying patterns that explain ties among organizations during disasters, including organizational similarity and geographic proximity (Tierney and Trainor 2004; Bevc et al. 2006).

The fact that responses to disasters are handled by emergent networks, rather than predetermined ones, has several important implications. First (and obvious even before the rise of EMON analysis), officially designated response entities, such as emergency management and other crisis-relevant organizations, will inevitably be required to interact with other entities on

an unplanned basis. Second, in many cases, those entities will be extending organizations and emergent groups formed on a grassroots basis by community residents. Third, disaster management organizations that fail to plan for the emergent nature of disaster response activities will face major challenges when disasters do occur.

The validity of the problem-solving/emergent resources model is also supported by research that views disaster response in socio-technical systems terms. In her book *Shared Risk: Complex Systems in Seismic Response,* Louise Comfort (1999) argues that key challenges facing disaster response networks include enhancing the ability to effectively manage information, to adapt in the face of changing circumstances, and to accommodate emergent organizational processes. On the basis of her extensive research on organized responses to earthquakes worldwide, she concludes that (1999: 263–264; also quoted in National Research Council 2006: 143).

> A socio-technical approach requires a shift in the conception of response systems as reactive, command-and-control driven systems to one of *inquiring systems*, activated by processes of inquiry, validation, and creative self-organization…Combining technical with organizational systems appropriately enables communities to face complex events more effectively by monitoring changing conditions and adapting its performance accordingly, increasing the efficiency of its use of limited resources.

Researchers from the fields of organization and management also emphasize importance of accurate problem identification, followed by appropriate action. Perhaps the most important strand of research in these fields focuses on processes of *collective sense-making among organizations responding to extreme events* (Weick 1995; Weick et al. 2005). Similar to Comfort's approach to disaster response, the sense-making perspective stresses the criticality of valid, shared situation assessments, as well as collective understandings of organizational roles and responsibilities as they unfold in a dynamic response environment. Organizational researcher Karl Weick showed how sense-making failures played a role in the tragic Mann Gulch fire disaster (Weick 1993). On a much larger scale, the Katrina catastrophe represented an almost incomprehensible failure of collective sense-making. Despite advanced information, communications, and warning technologies; the existence of new high-tech facilities such as the federal Homeland Security Operations Center; and pre-event scientific guidance on the likely effects of a large hurricane striking the Gulf region, the intergovernmental system failed utterly in its assessment of the hurricane's severity and the immense response demands Katrina would generate.

Among Katrina's many lessons is that effective responses cannot be launched without ground-truthed and shared organizational understandings of the problems posed by particular extreme events. The word "particular" warrants emphasis here: while all disasters have elements in common, individual disaster events almost always present unique challenges. If they did not, they would not be disasters in the true sense of the word. Here again, the fact that individual disasters are unique events that present unique sets of problems cautions against assuming that the details of organizational response can be set out and planned for *a priori.* What is true for disasters is doubly true for catastrophes. In catastrophic events, as contrasted with disasters, situation assessment is all the more essential and yet orders of magnitude more difficult to achieve.

4.2 The Role of Improvisation in Disaster Response

Another important theme in research on disaster response centers on improvisation as a strategy for dealing with the complex surprises that develop during disasters. Organizational improvisation in disasters has been studied for some time by a small multi-disciplinary group with expertise in operations research, human factors, cognitive science, emergency management, and sociology (Weick 1998; Mendonca and Wallace 2004; Wachtendorf 2004; Mendonca 2001; Webb 2002). While the command-and-control model suggests that the key to effectively responding to disasters is to ensure that responding entities adhere to pre-established roles, activities, and organizational "scripts," research on improvisation emphasizes the notion that organizations and their personnel must know when to follow such scripts and when to improvise. Tricia Wachtendorf's 2004 doctoral dissertation *Improvising 9/11* demonstrated in detail how responding organizations and EMONS were forced to improvise extensively as they encountered problems that had never been anticipated in pre-disaster plans, such as how to coordinate emergency operations during a large-scale disaster when the primary emergency operations center was completely destroyed and no adequate back-up facilities existed; how to search through, document, transport, and store rubble in an event that was simultaneously a disaster, a crime scene, and a national security emergency; and how to vet and provide credentials for thousands of converging emergency workers. For these and many other problems, solutions had to be improvised on the fly under conditions of extreme pressure. A key point stressed in this study is that while the ability to improvise in response to the unexpected challenges disaster present is critical, improvised action is discouraged by organizational cultures that stress adherence to bureaucratic rules and requirements, as contrasted with permissive ones that encourage collective problem solving and the development of "outside the box" response strategies.

Perhaps counterintuitively, research on improvisation also suggests that the organizations best able to improvise successfully are those that are already thoroughly familiar with existing scripts.* Improvisation does not mean inventing actions on the spot or deviating entirely from pre-planned arrangements but rather involves understanding why, when, and how to go beyond those arrangements as circumstances require. Put another way, pre-planned responses and improvised ones are two sides of the same coin; improvisation builds upon and leverages prior response-related knowledge while going beyond that knowledge.

4.3 Structured Responses to Disaster: The Role of Plans and Standards

Nothing stated above regarding the need for flexibility and improvisation in responding to disasters should be interpreted as arguing against pre-disaster planning, whether on a local, state, federal, or national scale. Nothing could be further from the truth; both strong planning initiatives and the ability to adapt and innovate are essential for effective disaster responses. The essence of disaster is that some aspects of events can be managed quite effectively using pre-event plans, while other aspects constitute surprises that fall outside the purview of existing plans. Critical questions center not on the necessity of planning for disasters—which is self-

*The study of organizational improvisation during disasters has benefited considerably from knowledge concerning jazz and performance. Scholars of jazz note that the ability to improvise is associated with a deep knowledge of the jazz genre itself. In improvising, artists draw upon their knowledge of jazz traditions and styles in creative ways; one cannot successfully depart from performance strategies that are not deeply understood in the first place.

evident—but rather on what constitute valid planning philosophies, assumptions, and strategies and on the relationship between plans and subsequent improvisational activities.

For decades, researchers have attempted to address those questions, and the following ideas appear throughout the preparedness literature (see, for example, Dynes, Quarantelli, and Kreps 1981; Sutton and Tierney 2006; Lindell and Perry 2007; Patton 2007; Canton 2007; McEntire and Dawson 2007):

- Planning efforts must overcome apathy and often outright resistance
- Planning is a process, not an end point
- Planning is much more than the creation of paper plans
- Plans should be developed by the entities that will be required to carry them out
- Planning must be based on knowledge concerning how people and organizations actually behave with respect to hazards and disasters
- Preparedness requires collaboration among organizations, not top-down direction—although clear guidance (e.g., from the federal government) is needed
- Plans should be based on the all-hazards approach
- Planning activities should be comprehensive and inclusive of all community sectors that will play a role in responding to particular extreme events, including the general public, non-government organizations, and the private sector
- Planners must avoid the natural tendency to "stovepipe" preparedness efforts within particular sectors and must ensure cross-sector collaboration
- Preparedness efforts should be risk and vulnerability based, but must also consider low-probability/high-consequence events and worst cases
- Preparedness activities must seek to foster resilient responses among both victims and responders through fostering the ability to adapt, improvise, and innovate
- Planning must be supported by appropriate training activities and resource mobilization
- Plans should be updated continually based on changes in the policy environment and lessons learned through disaster experiences

This research-based guidance suggests standards for assessing preparedness activities at different levels of government and among non-governmental and private-sector organizations. The National Fire Protection Association's Standard on Disaster/Emergency Management and Business Continuity Programs, known as NFPA 1600 (National Fire Protection Association 2007), constitutes a more formal preparedness standard against which organizational and community preparedness can be measured. Both the guidance and the NFPA standard can be used as a basis for resilience assessment.

Federal-level planning activities seek to ensure intergovernmental coordination during disasters. The Federal Response Plan (FRP), which was at the time of its formulation the most comprehensive effort to date to link together federal agencies responding in disasters, was initiated in the mid-1980s and formally adopted in 1992. Following its adoption, the plan was implemented in several large-scale disaster events, including the 1993 Midwest floods, the 1994 Northridge earthquake, and the September 11 terrorist attacks. Implementation did not go smoothly at first, but gradually states and local governments came to share an understanding of the plan and its emergency support functions (ESF) framework.

Following the 9/11 attacks, the federal government began to develop the National Response Plan (NRP), which was meant to encourage vertical integration of response efforts within the intergovernmental system and to supersede the FRP and other federal plans. Those efforts

generated criticism and resistance in many circles, particularly among professional emergency managers, generally because of their lack of comprehensiveness and inclusiveness. In initiating the NRP planning process, the federal government itself failed to follow many of the principles of good preparedness planning outlined above,* and the road to adoption was rocky. Finally adopted formally in December 2004, the plan saw its first major test in Hurricane Katrina. The sluggish federal response to Katrina indicated among other things that those assigned by the NRP to carry out key roles did not in fact understand the plan and its underlying assumptions (Gall and Cutter 2007).† The NRP was modified following Hurricane Katrina, and a new document, the National Response Framework (NRF), along with its 23 annexes, was released in January 2008.

The NRP remains a controversial document. One area of controversy is the National Incident Management System (NIMS) which is mandated by the NRP as a key concept of operations. NIMS is based on the incident management system (ICS), itself a subject of controversy since its inception, which was originally developed out of the FIRESCOPE program that was developed in California during the 1970s specifically for managing firefighting resources during large-scale wildfire events. Following the Oakland Hills firestorms of 1991, the state of California institutionalized ICS, renaming it the standardized emergency management system (SEMS) and requiring its use by all local jurisdictions. Belief in the effectiveness of the ICS/SEMS framework has always been widespread, particularly in the firefighting community both within and outside California. The adoption of NIMS as a key element in the NRP and NRF is yet another reflection of this belief. From a research perspective, ICS/SEMS/NIMS has both advantages and disadvantages.

On the positive side, the ICS form of organization provides standardization in both terminology and organizational arrangements for responding to disasters. Its principal elements—planning, operations, logistics, finance, and administration—are widely understood and used by many types of agencies in structuring disaster response activities. The existence of commonly understood elements of response facilitates the expansion of response networks, as well as the incorporation of new personnel as response activities scale up and as those involved in the initial response need to be rotated out. Ideally, the use of ICS-mandated organizational structures should help ensure consistency in response activities both horizontally (across local agencies and jurisdictions) and vertically within the intergovernmental system. At least this is the expectation of the federal government, which currently requires all organizations that are assigned or that expect to play a role in disaster response to adopt the ICS/NIMS framework.

*First, the notion that an entirely new federal planning effort was needed after 9/11, as opposed to a re-examination and fine-tuning of the FRP, is questionable. Second, the government's effort to assign the development plan to a consulting agency, the RAND Corporation, was ill-advised and immediately generated opposition. Third, in its overwhelming emphasis on terrorism, the NRP was inconsistent with basic principles of "all hazards" planning.

†Regarding response failures during Katrina, Gall and Cutter note that "FEMA was unfamiliar with the roles and responsibilities detailed in the new NRP and the National Incident Management System (NIMS). The emergency support functions found in the outdated federal response plan had not been realigned to fit the new NIMS management structure. Discrepancies in awareness and knowledge of the incident command system (ICS), a key component of NIMS, adversely affected the response. While firefighters generally had knowledge of and experience with the ICS, local law enforcement, health care providers, and rural emergency management officials had not yet received training" (2007:192).

By requiring the formation of a unified command structure during disaster events, ICS is also designed to prevent organizational turf battles over the direction of response activities.*

While its positive features for some organizations in some extreme event scenarios are undeniable, ICS/NIMS has its limitation. Much of the criticism of the framework centers on the fact that it does not map well onto the ways in which many crisis-relevant organizations operate during disasters—that is, its weakness in the area that emergent management expert William Waugh terms "cultural interoperability." Decades ago, ICS was embraced by the fire service community, where it proved effective. The framework also seems adaptable to other crisis-relevant organizations that are organized hierarchically. However, ICS/NIMS is far less compatible with the cultures of organizations that have relatively flat organizational structures and that use collegial, collaborative modes of decision making. Included in this category are public health organizations and non-governmental, community-based organizations. The question raised here is whether a "one size fits all" approach is the best way to approach the challenges of responding to disasters. One recent ICS overview (Waugh and Tierney 2007: 329) observed the following.

> The national emergency management system includes complex networks of public, private, and nonprofit organizations; nongovernmental organizations; and volunteers. The networks are diverse, and communication—let alone collaboration—can be very difficult. Integrating volunteer organizations, faith-based organizations, for-profit organizations, and others into one unified effort can be a monumental task. Poor cultural interoperability complicates multiorganizational, intergovernmental, and intersector operations…When the warm and fuzzy meets the lean and mean, cultures and personality types clash, and differences can be hard to overcome. The attempt to impose control can be counterproductive in a system in which resources are dispersed, authority is shared, and responsibility needs to be shared.

Equally important is the fact that the most critical decisions affecting disaster response—that is, strategic decisions, as opposed to managerial, operational, and tactical ones—do not fall within the purview of ICS/NIMS at all (Tierney 2005a; Waugh and Tierney 2007). When to declare an event an incident of national significance, when to mobilize federal resources on a proactive basis, and when to request disaster declarations from higher governmental levels are examples of such strategic decisions. Truly critical strategic decisions can only be made by elected and appointed leaders at different levels in the intergovernmental system, and when those leaders make wrong decisions or fail to take action in a timely manner, ICS/NIMS cannot be expected to make up for such failings.

Finally, referring back to discussions at the beginning of this report, local emergencies, disasters, and catastrophic events differ in significant ways. ICS-type frameworks work best for local emergencies and are least effective in large-scale disasters and catastrophic events, in which strategic decisions take precedence and in which emergence occurs on a massive scale. The constituent organizations in the massive EMONS that characterize such events are far less likely to share the "NIMS mindset" than organizational participants in smaller events.

*One high-level federal insider may have been exaggerating when the official told this writer that "NIMS was adopted to force New York City's fire and police departments to talk to one another," but this stovepiping is an example of the response challenges NIMS does seek to address.

Other types of agreements and models also provide a framework for disaster response. Memoranda of understanding (MOUs) and other types of mutual aid agreements in which responding entities agree to assist one another during disasters are one such mechanism. Emergency Management Assistance Compacts (EMACs) are mutual aid agreements that are established among states. The first EMAC was developed among states in the southern region of the United States following Hurricane Andrew, and the EMAC concept of operations was endorsed by Congress in 1996. Currently all 50 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands are involved in EMACs, but these efforts are not well funded (McIntire and Dawson 2007)

Yet another framework for intergovernmental coordination, the Metropolitan Medical Response System (MMRS), is a national program that was established under the Nunn-Lugar-Dominici Act as part of the National Defense Authorization Act of 1997. The program was established specifically to provide assistance to health care systems in communities affected by terrorist attacks. Among other things, MMRS is intended to provide expert "strike teams" to support local health-care-system efforts. Initially established within the Department of Health and Human Services (DHHS), MMRS was first re-assigned to FEMA and then moved to the Department of Homeland Security, the moved back to DHHS. During these changes, the program has experienced periods of expansion and contraction and overall has not received substantial funding (Perry and Lindell 2007). A logical question regarding MMRS involves the extent to which federal funding and guidance are giving rise to stovepiped intra-sectoral preparedness efforts.

The Urban Areas Security Initiative (UASI) was established in 2003 within the Department of Homeland Security (DHS) Office for Domestic Preparedness. The objective of UASI is to establish and supply with resources preparedness and response networks in communities around the United States, in order to enhance their capacity to prepare for and respond to terrorist events. Funding levels for UASI programs nationwide have been substantial, topping $4 billion in FY 2004 alone. A key program emphasis is the provision of funding for facilities and equipment local communities may require in the event of terrorist attacks.

Like MMRS, UASI was intended from its inception to address threats associated with terrorism, as opposed to focusing on all hazards. Many local emergency managers and government officials have found ways of channeling UASI expenditures in ways that enhance all-hazards response capability, but others have had difficulty negotiating the stovepipes associated with the UASI grant process.

While *pro forma* mechanisms exist in areas such as exercise evaluation,* programs such as UASI and MMRS have not been assessed through independent evaluation efforts. With respect to UASI, disaster management experts Ronald Perry and Michael Lindell (2007:173) observed the following.

> Local emergency managers view UASI, at least in part, warily. UASI brings substantial funding to local needs and allows a degree of local choice in planning, administration, and funding allocations; however, there are complaints that the federal authorities tightly define authorized expenditures within each

*Indeed, the evaluation of homeland security-related exercises has provided substantial revenues to consulting companies such as Booz Allen, which also serves as a major DHS contractor in other arenas. Anecdotal evidence and information gleaned by the author from inside informants suggests that these evaluations tend to be descriptive, rather than analytic, and that they fall short of standards for credible program evaluation. Exercise evaluations have not been subject to rigorous analysis.

> predetermined budget category and that local governments bear a substantial financial accounting load…DHS reporting demands have substantially increased, but these demands have not been matched by funding to support the generation of required reports…[a]t present, there is little basis on which to judge the success of UASI.

Ongoing research on UASI programs conducted under the direction of this author by the University of Colorado Natural Hazards Center (NHC), with funding from the National Consortium for the Study of Terrorism and Responses to Terrorism (START), a DHS-funded academic center of excellence, is intended to lead to a better understanding of how UASI programs are being implemented in typical U.S. communities.* Interim findings suggest that (1) local interagency preparedness networks developed with UASI support vary significantly in structure, composition, and comprehensiveness; (2) public safety agencies, such as police and fire departments, are major participants in UASI networks, while many other community sectors are underrepresented; (3) UASI grant recipients are creative in their use of DHS funds and do find ways of helping UASI support meet all-hazards objectives; (4) large infusions of funds can themselves lead to higher levels of competition, for example, between cities and counties, urban and more rural areas, and communities located within "super-UASI" regions; and (5) local jurisdictions both appreciate and are confused by federal-level rules, regulations, and guidelines.

Particularly since the terrorist attacks of 9/11, the federal government has become increasingly proactive in promulgating new response frameworks and mandating particular types of training—specifically NIMS training—for states, local jurisdictions, and all other organizations wishing to take part in disaster response operations. Through initiatives such as the National Preparedness Goal, National Response Plan, and National Response Framework, the federal government has sent strong signals regarding both the types of events for which planning and training are need (as indicated in the set of scenarios for which DHS expects communities to prepare) and the nature of that planning and training. Specialists in disaster response and emergency management see the potential benefit in these changes, but they also raise questions about the unintended consequences of post 9/11 (and post-Katrina) federal initiatives. Speaking specifically about the impacts of post 9/11 planning efforts on the response to Katrina, John Harrald (2007: 180) notes the following.

> …the specification of detailed doctrine, structure, and process reduced system agility, creativity, and flexibility and increased the tendency toward bureaucratic solutions…the NIMS structure implied, but did not define, an information flow that would ensure a common situational awareness at all levels of the distributed decision network…The new structure inadvertently increased the layers between operational and political leaders…The nation entered the hurricane season of 2005 with a new, but basically untested, national response system…The system was to be the responsibility of and directed by DHS, but

*Funded for a 3-year period by START/DHS, the study focuses on five "typical" UASI programs in different regions around the United States. Data on preparedness networks and UASI implementation are collected through in-depth interviews with key personnel in UASI organizations within those communities. The project also involves the analysis of documentary sources of information on UASI programs, both nationwide and in the five study communities. Study results will be available in 2009.

> there had been little effort to define the skills, knowledge, and responsibility that, by implication, would be required of senior DHS emergency managers.*

Such observations suggest that the nation has a long way to go in order to foster system-wide awareness of continually evolving response protocols, provide the guidance and training necessary to enable actors at different levels in the intergovernmental system to perform their disaster-related tasks adequately, and foster collective sense-making and situational awareness with complex disaster response systems. The extent to which the "new FEMA" and the recently released National Response Framework will be capable of addressing these challenge can only be determined through empirical investigation (Tierney 2007b).

4.4 Management Processes in Disasters: Collaboration and Coordination

This section on organized response to disasters began with the notion that the successful management of extreme events requires a balance between pre-structured response activities and situationally required departures from structure (improvisation, innovation)—what Harrald (2006) terms the balance between agility and discipline. The notion of a disciplined multi-organizational response is closely associated with the command and control model of emergency management, while agility relates to the capacity to understand when plans provide insufficient guidance and improvise as situations require. Effective multi-organizational responses can be found at various points on this continuum; in some cases, pre-event planning successfully anticipates the challenges that emerge during specific disaster events, while in others, creativity and improvisation are essential. Related to this notion of response variation and flexibility are the concepts of coordination and collaboration, which perhaps best embody disaster response requirements.

The idea that collaborative arrangements are best suited for planning for and responding to disaster events began to be articulated during the 1990s with the advent of programs like Project Impact. The concept fell out of favor after George W. Bush took office and was even more strongly called into question following the terrorist attacks of 9/11. That event ushered in a period during which emergency management—at least at the federal level—began increasingly to emphasize command-and-control and closed-system models (Patton 2007). Despite this shift in emphasis, emergency management experts agree that collaboration, coordination, and network management strategies are best adapted to the environment in which disaster responders must operate. The concept of collaborative emergency management seeks to engage all critical community sectors in preparing for and responding to disasters, including local elected and appointed officials; subject matter experts; community-based, faith-based and other non-governmental organizations; the general public, including both community members that belong to groups such as community emergency response teams (CERTs) and spontaneous volunteers; the private sector and business networks; and the mass media (Patton 2007). Collaborative disaster management is a community-oriented approach that recognizes the role of uniformed and sworn officers in responding to disasters while at the same time recognizing that, as discussed earlier, community residents are the true first responders in all disasters. The concept stresses the role of human and social capital in fostering disaster resilience (Dynes 2005) in the same way that they encourage cohesiveness, information-sharing and collective action during non-disaster times. In their discussion of collaborative

*For a similar analysis of post-9/11 changes and their impact on response effectiveness, see Tierney 2007a.

emergency management, Waugh and Streib (2006) emphasize that collaboration is driven not by hierarchies, rank, or standard operating procedures, but rather by a compelling shared vision of how communities will go about addressing emergency management challenges and why they need to do so.*

Smooth multi-organizational coordination during disasters is the goal that collaborative emergency management seeks to achieve. Put simply, coordination refers to the ability of organizational actors to collectively comprehend the demands associated with a particular extreme event and to carry out their responsibilities accordingly—whether as individual organizational actors, collaborators with other organizational entities, or participants in crisis-focused EMONS. Terms like coordination and collaboration are useful in the analysis and design of disaster response activities because (1) much organizational action within EMONS is voluntary, rather than mandatory; (2) many participating organizations are not, strictly speaking, under the command of any central entity, and (3) effective action requires sense-making within the complex multi-organizational fields described above (organizations possessing specialized expertise, community-based organizations, the mass media, etc.) and the ability to establish new relationships and launch strategic actions under complex and changing conditions. Hierarchical organizational arrangements are not well suited to such circumstances.

Collaboration and coordination encompass both horizontal and vertical integration, in which the former refers to joint activities carried out by organizational entities at the same scale of operations (e.g., local governments and neighboring jurisdictions, federal government agencies) and the latter refers to cooperative actions involving different levels in the intergovernmental system and entities operating at different scales (McIntire and Dawson 2007).

Preparedness frameworks like the National Response Plan, UASI, MMS, and other concepts of operations discussed above are meant to encourage coordination and collaboration during disasters. Whether they in fact will do so can only be determined through empirical research.

Potential resilience indicators for organizations and groups charged with responding to disasters include the following.

In the *pre-disaster* context, entities charged with managing disaster responses:

- Collaborate on hazard and vulnerability assessments
- Share a common understanding of what hazards the community faces and what needs to be done
- Share information regarding their capabilities, shortcomings, and overall strengths and weaknesses
- Collectively identify and address gaps in capabilities
- Agree on organizational roles, responsibilities, and an overall division of labor
- Aim at inclusiveness and comprehensiveness in collaborative activities
- Engage in joint planning activities and training experiences
- Conduct realistic joint exercises
- Enter into MOUs and other types of mutual aid agreements
- Form horizontal and vertical coordinating bodies

*It should be noted that the emphasis on collaborative emergency management is consistent with broader trends in the field of public administration that emphasize collaborative public management in many other domains. The Waugh and Streib article appears in a special issue of PAR devoted exclusively to collaborative management strategies.

- Address both interoperability among communications and information technologies and issues of "cultural interoperability" among diverse responding organizations

During disasters, those entities:

- Base their activities on shared situation assessments
- Share information in ways that enhance collective sense-making
- Interact on a collegial basis
- Employ network management strategies
- Include in emergency operations centers and coordinating activities the full range of expertise required for a robust and resilient response
- Encourage creativity and improvisation when needed
- Recognize and reward innovative efforts
- Have procedures for incorporating new response-related agencies and groups as situations evolve
- Recognize and effectively address new problems that emerge over the course of the disaster event
- Coordinate across diverse community networks, including the volunteer sector

5. CONCLUSION: ACHIEVING RESILIENT COMMUNITY AND ORGANIZATIONAL RESPONSES

This report has reviewed research on public and organizational responses during disasters. Following from those reviews, candidate measures of resilience have been offered in both areas. Discussions on collective behavior processes in disasters highlighted the notion that spontaneous helping behavior, convergence, mass volunteering, and emergent groups are sources of resilience, in that they infuse resources and creativity into disaster response activities. Before official resources arrive, and even more important, when official resources are insufficient, civil society provides adaptive capacity.

At the level of organizations and networks, organizational responses during crisis are most likely to be effective—and resilient—when they successfully blend discipline and agility (Harrald 2006). Pre-existing plans, training, exercises, mutual aid agreements, and other concepts of operations help ensure disciplined and appropriate responses, but they do so not because they encourage the playing out of pre-determined scripts but rather because they facilitate collective sense-making and inspire action toward shared goals.

Flexibility, adaptability, and improvisation among responding entities make their own distinctive contributions to resilience. Organizational expansion, extension, and emergence are key bases of resilient disaster responses. At the community level, EMONS constitute the empirical manifestation of resilience, as new actors join networks and network structures evolve in response to newly identified needs. The diversity of EMONS, together with the openness of their boundaries, helps ensure that new resources are identified and that new ideas are introduced into the system.

Collaborative management, as opposed to top-down direction, is another characteristic of resilient systems. Groupthink—the tendency of people in groups to come to premature consensus and become resistant to new ideas—is always a problem during crises. Hierarchies tend to stand in the way of upward information flow, the form of communication that is most essential during disasters. Less hierarchical forms of organization work best in all types of

turbulent environments, including disasters, in part because they encourage a free flow of ideas, but also because flatter organizations and decentralized networks are more nimble in responding to those environments.

This report does not attempt to offer a definitive strategy for measuring and enhancing resilient disaster responses. Rather, it seeks to illustrate how findings from the empirical literature on disaster response can inform such efforts. The development of a complete set of resilience indicators appropriate to the disaster response context must be a longer-term interdisciplinary effort.

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