Community Disaster Resilience

A Summary of the March 20, 2006 Workshop of the Disasters Roundtable

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NATIONAL RESEARCH COUNCIL
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THE NATIONAL ACADEMIES PRESS
Washington, D.C.
www.nap.edu

THE NATIONAL ACADEMIES PRESS 500 Fifth Street, N.W. Washington, DC 20001

This summary is funded in part by the National Oceanic and Atmospheric Administration (Task order 56-DKNA-0-95111); National Aeronautic and Space Administration (W-24245); the U.S. Geological Survey, Department of the Interior (under Assistance Award No. 00HQAAG0004); the Department of Homeland Security (DHS-HSHQ DC-06-P-00019); Pacific Gas and Electric; and PB Alltech, Inc. The views expressed herein are those of the authors and do not necessarily reflect the views, official policies, either expressed or implied, of NOAA or any of its subagencies, or DHS, NASA, or USGS.

This material is based upon work supported by the National Science Foundation under Grant No. CMS-0533530. Any opinions, findings, and conclusions or recommendations expressed in the material are those of the author and do not reflect the views of the National Science Foundation.

This summary is available on the internet from the National Academies Press, 500 Fifth Street, N.W., Lockbox 285, Washington, D.C. 20055, (800) 624-6242 or (202) 334-3313 (in the Washington metropolitan area); internet <http://www.nap.edu>.

Printed in the United States of America.

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FOREWORD

The Disasters Roundtable (DR) seeks to facilitate and enhance communication and the exchange of ideas among scientists, practitioners, and policymakers concerned with urgent and important issues related to natural, technological, and other disasters. Roundtable workshops are held three times a year in Washington, D.C. Each workshop is an open forum focused on a specific topic or issue selected by the DR Steering Committee. For upcoming meetings, please visit http://www.nationalacademies.org/disasters.

The Disasters Roundtable Steering Committee is composed of five appointed members and sponsoring ex-officio members. The appointed members at the time of the workshop were William H. Hooke, chair, American Meteorological Society; Ronald T. Eguchi, ImageCat, Inc; John R. Harrald, The George Washington University; Juan M. Ortiz, Tarrant County Office of Emergency Management; Havidán Rodríguez, University of Delaware; Monica Schoch-Spana, University of Pittsburgh Medical Center; and David Simpson, University of Louisville. The ex-officio members were Stephen Ambrose, National Aeronautics and Space Administration; Frank Best, PB Alltech, Inc.; Thomas Birkland, National Science Foundation; Lloyd Cluff, Pacific Gas & Electric; Timothy A. Cohn, U.S. Geological Survey; and Helen Wood, National Oceanic and Atmospheric Administration. The DR staff includes William A. Anderson, director, and Byron Mason, program associate.

This document presents the rapporteur's summary of the forum discussions and does not necessarily reflect the views of the roundtable members or other participants. For more information on the Roundtable visit our website: http://dels.nas.edu/dr or contact us at the address below.

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This summary has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the NRC's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published summary as sound as possible and to ensure that the summary meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their review of this summary: Alice Fothergill, University of Vermont, and Joyce Levine, Florida Atlantic University.

Responsibility for the final content of this summary rests entirely with the author and the institution.

Community Disaster Resilience

At the outset of the March 20, 2006 *Community Disaster Resilience* workshop of the Disasters Roundtable, the 16th in the series, roundtable chair William Hooke asked workshop participants to consider a scenario wherein residents of the U.S. Gulf Coast were successfully evacuated in advance of Hurricane Katrina, and suggested that tens of thousands of people would still be unemployed and hundreds of thousands of people would still have been displaced—many permanently. Noting that the United States faces future disasters, Hooke stressed the importance of building and enhancing community resilience—the ability to reduce the impacts of a disaster, as well as to effectively respond and recover following a disaster—as a matter of both physical and social engineering. Session I moderator and roundtable member Monica Schoch-Spana helped frame the day's discussions in terms of the complementary roles of an informed and involved citizenry, academic centers and community-based organizations, and disaster response professionals (e.g., health officials, emergency managers, state and local governments) in disaster mitigation, response, and recovery. Following each panel, audience members were encouraged to participate in open discussions of the day's topics.

Session I: Local Perspectives

Community Disaster Resilience: The Berkeley Experience

The City of Berkeley, California, which spans 10.5 square miles, is situated between the San Andreas and Hayward Fault lines and is at risk from hazards such as urban and wildland fires, flooding, earthquakes, and landslides. The devastation caused by the 1989 Loma Prieta earthquake and the 1991 firestorm in the East Bay Hills of San Francisco Bay signaled a need to address community disaster resiliency issues in Berkeley. Moreover, the experience of these two disasters demonstrated that local governments cannot do the job alone. Arrieta Chakos, City of Berkeley chief of staff, highlighted the importance of community members' involvement in hazard mitigation and the strengthening of community resiliency.

Following the Loma Prieta earthquake of 1989, the City of Berkeley's Board of Education and its City Council convened several forums to engage community members and state and regional agencies in discussions about engineering standards and retrofitting needs. The result was a holistic approach that focused not only on earthquake hazards, but included risks from fires, flooding, and landslides. Chakos stated that the knowledge and tools needed to establish disaster resilient communities are available, but a "fabric of political will" is needed to implement them. She suggested that Berkeley's level of local involvement in disaster mitigation distinguishes it from other communities in the United States. Berkeley's commitment is evidenced by the passing of six special tax bills concerned with risk reduction and community resilience since 1992. According to Chakos these tax measures, totaling nearly $386 million in revenue, were overwhelmingly approved by Berkeley citizens. The funds raised by these measures have been used to retrofit all of the city's public schools, fire stations, and major city buildings. Chakos reported that Berkeley has also enacted tax incentives to encourage retrofitting in the private sector. Berkeley administers a tax-rebate program that grants homeowners an allowance of up to $2,000, at point-of-sale, to cover retrofitting costs. According to the Northern California Chapter

of the Earthquake Engineering Research Institute the cost of retrofitting a house in California's Bay Area ranges from $2,000 to $5,000. Chakos estimated that 65 percent of Berkeley's single-family homes have been retrofitted under this program.

The City of Berkeley has also participated in state and federal programs to advance its resiliency goals. In 2000, Berkeley became a member of Project Impact, a community disaster resiliency program formally sponsored by the Federal Emergency Management Agency (FEMA). According to Chakos, Berkeley's membership in Project Impact encouraged its business sector to engage in disaster preparation and mitigation activities. Chakos also noted that with the adoption of its July 2004 comprehensive mitigation plan Berkeley became the first city in California to comply with the requirements of the 2000 Disaster Mitigation Act (PL 106-390).

The University of California, Berkeley (UCB) has been instrumental in enhancing the city's disaster resiliency. Sarah Nathe, coordinator of UCB's Disaster-Resistant University Project, stated that the university's building retrofit program began in the late 1970s, but lessons learned from the 1994 Northridge and 1995 Kobe earthquakes about the seismic performance of buildings prompted UCB engineers and earth scientists to call for a reevaluation of campus buildings in 1997, resulting in the establishment of the Seismic Action Plan for Facilities Enhancement and Renewal Program (SAFER) in 1998. According to Nathe, FEMA recognized UCB as the first disaster-resistant university in the United States and began applying the concepts of Project Impact to other large research universities through its Disaster Resistant Universities Initiative program in 2000. Nathe remarked that universities like UCB receive substantial federal funds to conduct research and house special collections in libraries; and these vulnerable facilities are worth protecting.

Leveraging university resources with funds from FEMA, UCB conducted loss-estimation studies and produced a strategic risk-management plan, which was included in FEMA's guidelines on becoming a disaster-resistant university. According to Nathe, UCB initially focused on understanding the potential threats to lives and health posed by campus structures in the advent of an earthquake. As the program evolved, concerns about the impacts of a disaster on the university's ability to teach and conduct research highlighted the importance of business-resumption planning. Nathe remarked that a U.S. university had never halted its operations for more than 30 days in response to a disaster prior to hurricanes Katrina and Rita.

The 1997 evaluation of the campus revealed that nearly 30 percent of UCB's facilities were in poor or very poor condition in relation to seismic resistance. Since then, having focused on large, heavily occupied buildings, UCB has retrofitted two-thirds of its poor and very poor space. Nathe reported that in cases where the cost of retrofitting was too high, buildings were torn down and rebuilt. UCB's retrofitting plan also included the creation of an Office of Emergency Preparedness that involves the faculty and works with the City of Berkeley and its municipal utilities to further mitigate the earthquake hazard.

Disaster Preparedness Challenges to Public Health Infrastructure

Elin Gursky, an epidemiologist and principal deputy for biodefense strategies at (Advancing National Strategies and Enabling Results) ANSER/Analytic Services, broadened the scope of the workshop with an examination of the U.S. public health system's inability to provide emergency

information to the public in a timely manner. Gursky stated that the United States has not established an electronic, interoperable health intelligence, or infrastructure that links the medical and public health sectors and provides accurate, real-time situational awareness regarding threatening contagions. Public health systems in the United States are fragmented and range widely in their organization within and between states. Gursky reported that public health departments are run by governors and mayors, not federal authorities, and often there is uncertainty about leadership and chain-of-command. According to Gursky, many health secretaries and commissioners do not have direct contact with their state's governor. Gursky reported that there are 3,000 local health departments in the United States, with a median of only 13 fulltime employees. She noted that the public health workforce also faces challenges due to dwindling numbers and a lack of universal training. For example, as senior nurses retire, their positions are being deleted rather than filled with new staff. Gursky reported that she has identified 24 different occupational categories in public health departments across the country. She stated that such diversity precludes universal training and coherent command-and-control within and across public health departments. In response to this issue, programs like Project Public Health Ready, a partnership of the National Association of City and County Health Officials and the Center for Disease Control and Prevention (CDC), and the CDC's Cities Readiness Initiative (CRI) are aimed at preparing public health agencies for disaster events.

Gursky noted that the United States has not experienced a pandemic disease event since the 1918 Spanish flu. The traditional responsibilities of public health departments, such as low-birth weight, diabetes, obesity, and other ailments have challenged limited resources to incorporate disaster planning for catastrophic outbreaks into their daily operations. Preparedness has not become a core mission of the public health sector. Moreover, much of disaster preparedness in public health is based on untested assumptions on public response, highlighting the importance of conveying accurate and timely information via the media.

In the discussions that followed the panel, participants noted that the experience of Hurricane Katrina in 2005 raised the issue of continuity of government during a disaster and stressed the need to promote individual preparedness of the public as an important component of community preparedness and resiliency.[1]

Session II: Citizens and Demographic Groups

Encouraging Citizen Disaster Preparedness

Michael Barnett, a physician and adviser in the office of U.S. Representative Patrick J. Kennedy, traced his interest in community disaster resilience to a 2003 review of the Substance Abuse Mental Health Services Administration (SAMHSA) and his conclusion that communities are better served by funding resiliency efforts rather than focusing solely on disaster response. His conclusion resulted in the National Resilience Development Act (H.R. 2370), introduced by Representative Kennedy in June 2003. H.R. 2370 would have required the Department of Health and Human Services (DHHS) and FEMA to engage in efforts to increase communities'

[1] These section summaries are based on the participants' discussions and do not necessarily reflect what was presented by the speakers.

resilience to potential terrorist attacks on the United States. Although the bill never made it through committee, according to Barnett, H.R. 2370 had a significant impact in raising the topic of resilience within several federal agencies, such as DHHS and the Department of Homeland Security (DHS). In July 2005, Representative Kennedy introduced the Ready, Willing, and Able Act (H.R. 3565), aimed at promoting the development of disaster plans that actively involve U.S. citizens in disaster preparedness, mitigation, response, and recovery.

Barnett suggested that resilience should not be conceived as a technical concept and that the approach to developing resilience is misguided. Suggesting that humans are innately resilient, Barnett proposed removing social obstacles that interfere with its expression rather than developing resilience as a technical concept. He stated that our culture's master narrative defines behaviors and responses, and in the United States the top-down command-and-control paradigm of emergency management is predicated on the myth – social narrative – of panic. Barnett stated that panic rarely occurs in response to a disaster event and is short-lived if and when it occurs. He also suggested that poor word choice promotes a false perception of human disaster response. According to Barnett, terms like "first responder," generally used to describe emergency personnel, are misleading as individual citizens are often the first to respond and engage in search-and-rescue and other efforts after a disaster occurs.

In terms of resilience, Barnett believes our reaction to a disaster event is contingent on the meaning we ascribe to it, and that meaning is informed by cultural norms and expectations. Barnett concluded by remarking that communities are the primary problem-solving tools of a nation. Social bonds and the norms of reciprocity persist during and after a disaster. These bonds prevent panic responses and should be incorporated in disaster preparedness, mitigation, and response planning to promote resilient communities.

Community Diversity, Vulnerability, and Resilience: What's the Connection?

Disaster resilience is an ongoing process, rather than an outcome, that requires multiple levels of analysis. Focusing her attention on social groups at the neighborhood level, Elaine Enarson, assistant professor of applied disaster and emergency studies at Brandon University in Manitoba, Canada, noted that resiliency is not a function of discrete identifiers (e.g., race, ethnicity, gender, income, education). According to Enarson many of these identifiers intersect, and focusing on them individually may provide an inadequate assessment of resiliency. Often, those most at risk have multiple identifiers. Noting that impoverished women were disproportionately impacted by Hurricane Katrina, Enarson challenged the public policy community to develop integrated analyses of age, economic, ethnic, gender, and other social factors.

Enarson stated that national trends such as increased immigration and an aging population are changing the demographic makeup of communities and presenting challenges to community disaster resilience. Increased mobility throughout the United States has resulted in growing numbers of "newcomers" and transients that are not connected to the networks of people around them. Enarson remarked that migrants, sexual and religious minorities, and other individuals isolated from the social networks of their communities are among the least resilient groups. She suggested that when assessing resiliency, an understanding of the demographic makeup of the least resilient is important. Enarson also reminded participants that vulnerable groups and

individuals are not necessarily helpless and stated that a low-resilient community is not a community of victims. She concluded that advancing community resilience requires community member involvement.

In the discussions that followed the panel, concerns were raised about the role of the military in the evacuation of Gulf Coast residents following Hurricane Katrina in 2005. Some feared that the top-down command-and-control approach of the military discourages community involvement in response and recovery actions.

Session III: Perspectives from Research and Analysis

Research Initiatives at MCEER to Advance Earthquake Resilient Communities

The goal of the Multidisciplinary Center for Earthquake Engineering Research (MCEER) is to enhance the seismic resiliency of communities through improved engineering and management tools for critical infrastructure systems (e.g., power systems, pipeline distribution systems, water and gas distribution, highways). MCEER defines seismic resilience by the reduced probability of system failures following an earthquake, reduced consequences due to system failures, and reduced time for system restoration. Director Michel Bruneau commented that the tools necessary to make such predictions have yet to be developed, but reported that MCEER is working to develop them. Bruneau stated that a socioeconomically viable national strategy for earthquake loss-reduction can be developed by coupling efficient response and recovery strategies with a focus on protecting critical and essential facilities. A holistic approach reveals that nonstructural systems are also important components of critical infrastructure. Bruneau remarked that a hospital that withstands an earthquake is of little value to a community if its equipment is destroyed during the event.

MCEER is also committed to coupling research to education and outreach. Bruneau stated that a two-year window of opportunity follows a disaster, wherein disaster researchers are able to push for changes in disaster mitigation and response policies. He noted that the federal response to Hurricane Katrina has received substantial public attention and scrutiny, but cautioned that disaster mitigation is of equal importance. Bruneau stated that focusing solely on response will reduce some losses, but will not produce the results that mitigation offers in enhancing the robustness and resilience of critical infrastructure systems.

According to Bruneau, the future of disaster resilience and mitigation lies in multi- or all-hazards approaches that optimize mitigation and response for more than one type of disaster. He stated that opportunities exist to leverage the knowledge learned from earthquake engineering against a broader spectrum of hazards. Bruneau stated that developing an integrated and holistic approach would allow the hazards and disaster community to make the best use of the two-year window of opportunity that follows a disaster.

Measuring Community Emergency Preparedness

David Simpson, associate professor of urban planning at the University of Louisville and director of the Center for Hazards Research and Policy Development, suggested that better metrics would

enhance understanding of the dynamics of emergency preparedness and allow funds and resources to be allocated more efficiently. Assessing a community's preparedness level requires clear definitions of the variables measured. Simpson stated that we must begin by defining communities, disasters, and vulnerability. Simpson noted that communities may be defined as cities, counties, states, nations, and via the Internet. Using a working definition of disasters as events that exceed a community's response capacity, Simpson stated that vulnerability is often assessed at the social rather than at the community level. Hazards and disaster researchers are also faced with the challenges of determining scale and level of detail, units of measurement, and accounting for variables of time and location in their efforts to obtain reliable metrics.

According to Simpson, reliable indicators are needed to accurately measure community vulnerability. Yet, Simpson cautioned that all indicators are not equal and noted that indicators are not value-free; selecting one variable to measure often means not measuring others. In terms of emergency preparedness policy, indicators that merely describe the symptoms of the event are not as useful as those that demonstrate causation. This is particularly important because disasters are usually one-time events in a community's history that preclude establishing baseline measurements that would allow comparison between current and previous disaster response efforts in the same location.

Simpson noted that the hazards and disaster research community now possesses improved tools and increasingly powerful computers with better loss-estimation software (e.g., geocoding, geographic information systems [GIS], HAZUS®MH) that can allow for better data collection and metrics. He cited the work of Susan Cutter on disaster vulnerability at the University of South Carolina; Stephanie Chang on seismic resilience, at the University of Washington; and risk index programs at the United Nations Development Programme (UNDP), the Inter-American Development Bank, and Munich Re as evidence of efforts to improve the metrics of hazards. Simpson cautioned against the narrow use of these tools and metrics to advance a particular agenda. He commented on the development of the Department of Homeland Security's Urban Area Security Initiative risk assessment model, which he characterized as terrorist-centric despite its all-hazards claims to the contrary. Simpson championed a move towards finding consensus-based metrics that can be generally agreed upon as fairly objective. He stated that these metrics must then be institutionalized and incorporated in state and local hazard-mitigation plans.

The Costs and Benefits of FEMA Mitigation Programs

In the fall of 2000, the U.S. Senate Appropriations Committee's Subcommittee for Veterans Administration, Department of Housing and Urban Development, and Independent Agencies issued a report that acknowledged the benefits of disaster mitigation and charged FEMA to fund an evaluation of the actual extent of such efforts in future monetary savings to the United States (Senate Report 106-161). To carry out this mandate, FEMA contracted the Multihazard Mitigation Council (MMC) of the National Institute of Building Sciences to perform an independent assessment of FEMA's mitigation activities. MMC assembled a team of experts to review and evaluate the activities of FEMA's major mitigation programs (the Hazard Mitigation Grant Program, Flood Mitigation Assistance Program, and Project Impact) from 1993 to 2003. MMC approached its task by selecting three primary hazards (earthquakes, floods, and extreme

wind events) and evaluating FEMA's mitigation activities on both a national and community scale.

Philip Ganderton, professor and chair of the economics department at the University of New Mexico and member of the MMC Board, was involved in the national scale statistical analysis. Ganderton stated that there are two types of broad mitigation activities; project mitigation, which includes steps taken to avoid and reduce damages and loss of life, and process mitigation, efforts that increase public awareness and lead to policies (e.g., building codes, floodplain zones) to reduce risk. He noted that process mitigation is the more difficult of the two mitigation types to quantify, and less research has been done in this area.

According to Ganderton, benefits are losses avoided in a mitigation context, and one should be able to expect the cost of administering mitigation programs to be offset by reduced postdisaster costs. In evaluating FEMA's mitigation activities on a national scale, MMC relied on cost-benefit analysis methodologies to measure direct property damages, direct and indirect business interruptions, environmental damage, societal losses in terms of casualties and displaced persons, and emergency response needed. HAZUS®MH was used to estimate direct property damage from earthquakes and hurricanes, and supplemental methods were developed to estimate property losses from floods and tornadoes. Ganderton noted that evaluating the benefits of process mitigation activities are challenging, because such activities tend to indirectly produce observable results, which presents difficulty in attributing measurable benefits to process rather than project mitigation.

According to Ganderton, the national scale analysis, which sampled more than 6000 FEMA projects undertaken from 1993 to 2003, revealed that the cost-benefit ratio for projects across the three hazard types was 4 to 1. In short, for every dollar spent by FEMA on project and process mitigation four dollars were generated in terms of future avoided losses.

Eight communities were selected by MMC to evaluate the cost-benefit ratio of FEMA mitigation programs at the community level and determine if these programs stimulated additional "synergistic" mitigation activities (See Table 1). Ronald Eguchi, president and CEO of ImageCat Inc., reported that the selected communities had received FEMA grants totaling at least $500,000 between 1993 and 2003 and were at medium or high risk from earthquakes, floods, tornadoes, or hurricanes. Data from the National Emergency Management Information System (NEMIS) databases and the U.S. Census, site visits, and interviews were used to perform cost-benefit analyses. Activity chronologies were also developed to identify synergistic mitigation activities. According to Eguchi, synergistic activities occurred in communities that had already institutionalized hazard mitigation. He noted that Freeport, New York received its first FEMA mitigation grant in 1997, but the city's mitigation efforts dated back to its enrollment in the National Flood Insurance Program in 1976. Freeport had participated in a total of six such programs before 1997. FEMA funding helped strengthen and accelerate the city's mitigation efforts.

TABLE 1 Communities Selected for Analysis

Hazard	Community
Earthquake Only	Hayward, California Orange, California
Flood Only	Jamestown, North Dakota Multnomah County, Oregon
Flood and Wind	Freeport, New York Tuscola County, Michigan Jefferson County, Alabama
Flood, Earthquake, and Wind	Horry County, South Carolina

Eguchi and Ganderton agreed that the MMC study demonstrates the cost-effectiveness of hazards and disaster mitigation. They stressed the need for additional data, loss estimation tools, and methodologies to evaluate the impact of mitigation efforts and allow for better policy decisions. Detailed findings and conclusions from MMC's study are available in *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities, Volume 1 – Findings, Conclusions, and Recommendations*, available through its website at http://nibs.org/MMC/mmchome.html.

In the discussions that followed the panel, participants expressed their hopes that the findings and conclusions of MMC's assessment will be implemented. Participants also commented on the need to apply a regional perspective to hazards and disaster mitigation efforts.

Session IV: Resilience and Community Recovery

Lessons Learned About Recovery in the Business Sector

Local businesses are an important component of any community and their survival following a disaster factors into a community's resilience. Daniel Alesch, emeritus professor at the University of Wisconsin–Green Bay, has tracked the postdisaster performance of businesses in several communities in the United States for more than a decade. His work includes repeated visits to Homestead, Florida in the years following Hurricane Andrew in 1992. Alesch stated that the relationship between the amount of physical damage a business sustains during a disaster and its ability to become viable again afterwards is weak. Some businesses that sustain massive damage recover quickly, while other businesses that sustain only minor damage never recover. According to Alesch, some businesses fail after a disaster due to the loss of a critical mass of customers as disaster victims are displaced; others fail because of inadequate responses by business owners. He stated that most of the losses businesses suffer occur months and years after the disaster.

Businesses that become viable in a postdisaster context do so in part because of a community's predisaster mitigation efforts and in part because they responded appropriately to the changed needs of the community. Alesch stated that customer priorities change after a disaster to meet their new, more pressing needs. There is less discretionary spending on luxury items and businesses that supply these goods are adversely impacted by the loss of customers. Businesses

that supply staple goods also suffer if they are unable to meet their customers' surging demand. Alesch stated that the likelihood of a business becoming viable following a disaster depends heavily on its ability to recover the assets it lost. He also stated that federal disaster assistance for businesses is negligible. Small Business Administration (SBA) loans are based on a business' predisaster performance rather than on postdisaster projections. Alesch lamented that businesses that receive SBA loans, which require large amounts of collateral, often fail due to burdensome loan payments.

Ultimately, the ability of businesses to recover hinges on a community's predisaster mitigation efforts. According to Alesch, businesses are much more likely to survive a disaster if the community suffers little damage and displacement as a result of its mitigation activities. With mitigation, businesses experience less downtime. Without mitigation, business owners must rely on adaptation and serendipity.

Emerging Patterns of Rebuilding and Recovery in New Orleans

Laura Steinberg, visiting scientist at The George Washington University Institute for Crisis, Disaster and Risk Management, was displaced from New Orleans, Louisiana by Hurricane Katrina in 2005. A member of the Bring New Orleans Back Commission's Infrastructure/Data Sub-committee and its Sustainability Sub-committee, she routinely makes monthly return visits to the city. Speaking seven months after Hurricane Katrina made landfall in the Gulf Coast, Steinberg reported that New Orleans' population had dwindled from 458,393 to 156,140 residents.[2] She stated that only 18 of the city's 117 public schools and 8 of its 22 hospitals had reopened. Relaying her on-the-ground observations, Steinberg reported that traffic lights around the city were still out although Entergy Corporation had returned power to 95 percent of the city. She also noted that garbage collection now occurred every two weeks, rather than every two days, and the postal service in New Orleans is irregular. Citing the need to call local businesses ahead of time to ensure that they are open, Steinberg stated that residents now live with increased uncertainty. This uncertainty has impacted recovery and neighborhood renewal.

According to Steinberg, as of March 2, the U.S. Army Corps of Engineers had not razed any of the homes damaged by Katrina, despite the City of New Orleans' estimates that as many as 5,500 homes in the Lower Ninth ward alone are unsalvageable (Brookings Institution, 2006). Steinberg reported that 16,000 building permits had been issued, yet homeowners were not rebuilding. Many were waiting on FEMA flood elevation maps to determine flood insurance premiums and the level of flood elevation to which they must rebuild their homes. Steinberg also stated that many homeowners had refused to deposit insurance claim settlements that they deemed as too low. Others were leery of rebuilding due to the shortage of contractors and the limited workforce. Steinberg noted that rebuilding plans had been submitted by Governor Kathleen Blanco, Mayor Ray Nagin, and the Urban Land Institute, but little action had occurred.

Steinberg stated that in terms of critical infrastructure (e.g., levees, power lines, water pipes) New Orleans was not a resilient city. The desire to rebuild New Orleans and make it more resilient has arisen from the aftermath of Katrina. Steinberg concluded by asking if community

[2] These population estimates are based on data collected by the Brookings Institution, which continues to track post-Katrina recovery variables. Updated figures are available at http://www.brookings.edu/metro/katrina.htm.

resilience is tied to individuals rather than places, and what happens if resilient residents leave? Or, in the potential case of a rebuilt New Orleans, is it accurate to deem the city resilient when its less-resilient residents have been permanently displaced?

In the discussions that followed the panel, several participants questioned the sagacity of rebuilding New Orleans. Panelists remarked that recovery does not necessarily mean a return to predisaster conditions; it means becoming viable in a new postdisaster context.

Closing Remarks

William Hooke, director of the Atmospheric Policy Program at the American Meteorological Society and chair of the Disasters Roundtable, challenged workshop participants to apply the lessons learned from the Berkeley experience to communities across the nation. He remarked that there are future disaster scenarios awaiting other cities and that simply pointing out systematic weaknesses after disaster strikes, as is the case with Hurricane Katrina in New Orleans, is rarely satisfying.

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