Disaster Resilience

A NATIONAL IMPERATIVE

SUMMARY

Committee on Increasing National Resilience
to Hazards and Disasters

Committee on Science, Engineering, and Public Policy

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Disasters are becoming more destructive in the United States and around the world. Blizzards, tornadoes, droughts, floods, hurricanes, wildfires, heat waves, ice storms, earthquakes, and other natural hazards collectively kill and injure thousands of Americans every year and affect the lives of many more. Disasters destroy homes and businesses, displace people, interrupt economic activity, disrupt transportation, and place heavy demands on public and private resources. And human-induced disasters, such as acts of terrorism, financial crises, or social unrest can be as destructive as natural disasters.

No one is immune from disasters and disaster-related losses. Even people who are not directly affected by a disaster may be members of communities that respond to disasters, from local to national and international levels. Creating a culture of disaster resilience for the nation is a proactive, rather than a reactive, approach to the problems caused by disasters. Such a culture can provide a pathway for reducing vulnerability and the impacts of disasters before they occur, with the potential to decrease the costs of disasters at all levels.

Concerned about the nation's increasing vulnerability to disasters, eight federal agencies and a community resilience group asked the National Research Council to examine ways to increase disaster resilience in the United States. A committee of experts with a wide range of backgrounds and expertise met over the course of more than a year to discuss the many issues associated with disaster resilience and to develop a plan of action. Committee members drew on their own experiences, on published information, and on open meetings and field visits in New Orleans and along the Mississippi Gulf Coast; in Cedar Rapids and Iowa City, Iowa; and in Southern California. The committee focused on natural disasters, but its conclusions apply equally well to human-induced disasters.

THE MEANING OF RESILIENCE

Many people have heard and used the term "resilience," often in reference to people or communities who show strength under adversity or bounce back after a tragedy. In considering ways to increase resilience, it is first important to articulate what is meant by the term.

Resilience is the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events.

The committee's definition reflects the many facets of resilience and its relevance before, during, and after a disaster. While resilience is rooted in the local communities affected by disasters, it involves a wide variety of stakeholders, including families, the private sector, governments, academia, nonprofit groups, and faith-based groups—on local, state, and national scales.

"Adverse events" can include a range of natural and human-caused disasters, and it is important to recognize that planning for one kind of disaster can increase a community's resilience in the face of a different kind of event. This "all hazards" approach is a condition to which all communities and the nation can aspire.

A VISION OF THE FUTURE

To guide its work, the committee also adopted a vision of the future—a vision of a more disaster-resilient America in the year 2030. In this future vision for the nation, everyone has access to the information needed to make communities more resilient. Individuals and communities invest in their own capacity for resilience, since resilience ultimately is driven from the bottom up. And all parts of society—citizens, communities, private companies, and all levels of government—design strategies, make investments, and implement policies to enhance resilience and reduce vulnerability to future disasters.

This vision of the future requires a new national culture of disaster resilience in which everyone takes responsibility for resilience to both natural and human-induced disasters. All communities and levels of government know their roles and responsibilities in building resilience, and they act on them.

In its full report, the committee recommends six actions to achieve this vision of the future. This summary describes these six recommendations and offers specific examples of the positive difference resilience can make to the nation's communities.

Recommendation

A national resource of disaster-related data should be established that documents injuries, loss of life, property loss, and impacts on economic activity.

The available evidence indicates that disaster losses in the United States have grown dramatically and are continuing to increase. In 2011 alone, economic damages exceeded $55 billion, with 14 disasters costing more than a billion dollars each in damages. Worldwide, 2011 was the costliest year on record for natural disasters with more than $380 billion in losses, of which only $105 billion was insured.

Looking forward, changing patterns of hazards and vulnerability may affect potential losses. For example, population growth or decline affects the number of people exposed to hazards. Today, more than 50 percent of the U.S. population lives within 50 miles of a coastline, and this proportion is expected to increase in the future.

To justify investments in enhanced disaster resilience in communities, the potential short-term and long-term benefits of those investments need to balance or exceed the costs. This kind of cost-benefit analysis requires that communities have information about the costs of both past disasters and potential future disasters and the value of the assets in their communities. Without this kind of information, commitment to enhanced resilience is difficult to maintain.

The nation currently lacks a national repository for information about disasters that occur and the losses they cause. In addition, existing data are often incomplete, incompatible with each other, and inadequate to reveal in detail the geographic impact of losses. This lack of information leaves communities unable to make informed decisions about where and how to prioritize their investments in resilience.

A national data inventory would reconcile and integrate the fragmented data sets on disasters. It would serve as a national archive for data on historical disasters and the losses they caused. It would assist in the development of better loss measurements and measures against which communities could begin to assess their resilience. And it would provide an evidence base for evaluating the effectiveness of interventions and investments to build resilience. Collaboration among federal agencies, private actors, and the research community would improve the collection of loss data after disaster events.

Recommendation

The public and private sectors in a community should work cooperatively to encourage commitment to and investment in a risk management strategy that includes complementary structural and nonstructural risk-reduction and risk-spreading measures or tools.

Understanding and managing disaster risk is critical to increase resilience to disasters. Risk represents the potential for disasters to affect people in harmful ways. Risk management is a process that identifies the hazards facing a community, assesses the risks from these hazards, develops and implements strategies to counter those risks, and adjusts those strategies based on experience and further study.

Disaster risks cannot be completely eliminated, even with the best risk management strategies. But such strategies can help communities become more resilient. For example, disaster-related fatalities in the United States and other developed countries have, on average, been steady or declining in recent years, attesting to the success of measures to decrease vulnerability to disasters, thereby increasing resilience.

Tools to manage disaster risk include both structural and nonstructural measures and approaches, which are complementary and can be used together. Examples of structural measures are levees and floodways, disaster-resistant construction, retrofitting of existing buildings, and securing of building components. Well-enforced building codes also can result in more resilient physical structures. Nonstructural measures and approaches include a wide range of options, such as wetlands that act as natural defenses, timely forecasts and warning systems, changes in zoning and land use, improved risk communication, economic and tax incentives, and insurance.

A diverse portfolio of measures to manage disaster risks provides choices for decision makers and communities before, during, and after disasters. Such a portfolio can promote more efficient use of resources and more effective risk management.

In examining measures that could be helpful to communities, the committee devoted particular attention to insurance and to building codes and standards. The public and private sectors are encouraged to invest in risk-based pricing of insurance, which imposes higher premiums on those in areas of higher risk to one or more hazards. Risk-based pricing can help communicate to those in hazard-prone areas the level of risk that they face. It can also reduce the need for public subsidies of disaster insurance and can encourage residences and businesses to relocate to safer areas.

Building codes and standards have been shown repeatedly to be effective in reducing property damage, preserving human life, and increasing resilience. However, codes and standards vary among communities and are unevenly enforced and publicized. Federal agencies, together with local and regional partners, researchers, professional groups, and the private sector, should develop an essential framework of codes, standards, and guidelines that will increase the resilience of the structural elements of homes, businesses, utilities, and communication and transportation systems so important to the function of any community before, during, and after a disaster. This framework should include national standards for infrastructure resilience and guidelines for land use and structural mitigation, especially in known hazard areas such as floodplains.

Recommendation

Federal, state, and local governments should support the creation and maintenance of broad-based community resilience coalitions at local and regional levels.

National resilience emerges, in large part, from the local level. But communities across the United States vary greatly in their history, geography, demography, culture, and infrastructure, as well as in the hazards they face. Plans to enhance resilience in one locale may not be a good fit for the assets and needs of another.

Nevertheless, some basic premises for resilience apply to all communities:

- Essential services, such as health, education, and public and private infrastructure need to be robust.
- Individuals and groups need to know about risks and how to reduce them.
- Communities, neighborhoods, and families need to be organized to prepare for disasters.
- Land-use planning needs to be sound.
- Building codes and standards need to be adopted and enforced.

Achieving this level of resilience is a shared responsibility, requiring the engagement of the entire community, not just part of it. Government, the private sector, and nongovernmental and faith-based organizations all have important roles to play in building resilience.

Broad-based public-private coalitions provide a way to unify all parts of a community around the goals of resilience. Such coalitions can assess a community's vulnerability, educate and communicate about risk, and evaluate and expand a community's capacity to handle risk.

Coalitions are also key to improving the resilience of a community's critical infrastructure and systems—such as power and water systems, health care services, and transportation systems—which are often dispersed across the public and private sectors. Resilience requires that public and private leaders come together to assess the vulnerabilities of these systems and plan ways to help them withstand a disaster. For example, coalitions of private and public health services can provide cohesive and coherent medical responses during a disaster.

Coalitions can also help to foster public communication and education. These are essential to increasing resilience because they result in a populace that knows what hazards it faces, has the social cohesion to help it endure, understands how to protect its safety and well-being, and sees itself as capable and self-sufficient.

A robust coalition needs strong leadership and governance, with a person or persons who have the time, skills, and dedication to develop and maintain relationships among all partners. It also requires participation from people representing the full spectrum of a community's members, including minorities, the disenfranchised, people with disabilities, children, senior citizens, and other subgroups that are potentially vulnerable to the impact of disasters.

CARPENTERS ALL
The Vietnamese Community in New Orleans East

When Hurricane Katrina devastated New Orleans East, which is home to about 8,000 of the 40,000 Vietnamese residents who live on the Gulf Coast, the Vietnamese community saw the storm as an opportunity to rebuild their community to be even stronger than it was before. This spirit of hope and community is a critical aspect of resilience in any locality.

Before the storm, the community established evacuation plans coordinated through the local Catholic church, where many of the Vietnamese residents attend services, and a local radio station. Immediately after the storm, the leader of the church took a boat through flooded neighborhoods to check on community members, and community volunteers later called and checked on everyone in the community. This tight community cohesion helped limit fatalities to just one elderly resident. About 30 percent of the Vietnamese community consists of elders, so they needed special care to evacuate or to stay in place. More than 90 percent of the Vietnamese community has returned to New Orleans East—a higher percentage than for most other groups in the area.

After the storm, the community worked together to rebuild, drawing on carpentry skills that some community members brought from Vietnam and others learned in America. As one resident said, "We are all carpenters now." Many community members are involved in the fishing industry, and they helped each other repair their boats, with little help from federal or other government sources. When federal funds did become available for repairs, community members expressed surprise and gratitude for the additional support.

In 2009 the Deepwater Horizon blowout and subsequent oil spill again severely affected New Orleans East, including the Vietnamese community. The seafood industry was initially shut down and later plagued by uncertainty, and anticipated income from the industry was put into doubt.

The shared experience of immigrating to the United States following the Vietnam War created a strong sense of community among many of the Vietnamese residents of New Orleans East. But all communities share common experiences and concerns. The resulting internal ties can help communities prepare for and rebound from disasters.

Recommendation

Federal government agencies should incorporate national resilience as an organizing principle to inform and guide the mission and actions of the federal government and the programs it supports at all levels.

Although many critical processes to improve resilience occur at the state and local levels, the federal government plays a central role in providing guidance and assistance to local communities. Currently, however, the federal government lacks an overall vision and coordinating strategy for resilience; policies, practices, and decisions affecting resilience are not effectively communicated or coordinated among and within the branches of the federal government.

In the short term—the next one to two years—the federal government should take steps to incorporate national resilience as an organizing principle. For example, federal agency leaders should work with state, local, and private-sector stakeholders to develop a vision of national resilience. A process should be developed to help agencies effectively coordinate their work on resilience and collaborate with one another. And federal agencies should collectively conduct an analysis of federal, state, and local funding for disaster preparedness and response and develop a cost-effective strategy for investing in resilience.

Additional measures are needed over the long term—three to ten years from now. For example, federal agencies should collectively establish a process for dialogue, planning, and coordination among local, state, and national government leaders and agency heads that can be used to develop a long-term national strategy for improving resilience. Federal agencies should also develop short-term incentives and guideposts for achieving its long-term goals. And they should develop a consistent and coordinated communication and outreach strategy to the general public around the national vision for resilience.

Because communities vary so much in their risks, cultures, and development patterns, policymakers and government leaders need to build flexibility into their mechanisms to enhance communities' resilience. Government policies that attempt to mandate resilience would imply that perfect resilience can be defined and achieved, which is not possible. Similarly, resilience is too broad and complex to incorporate into a single comprehensive law. Instead, the principles of resilience need to be infused into the routine functions of government at all levels.

COMMUNITY TIES
Cedar Rapids and the 2008 Flood

Cedar Rapids, a city of about 125,000 people in eastern Iowa, sits on the banks of the Cedar River, which drains agricultural lands to the northwest of the city. In the spring of 2008, heavier-than-average rains had fallen onto land already saturated by snowmelt, and in June residents and local leaders monitored the potential for flooding along the river. But having endured record-breaking floods in 1993—when the river crested at 22.5 feet—most people did not expect another "100-year flood" so soon.

What they ultimately faced was far worse: When the Cedar River crested at more than 31 feet on June 13, it was well above what would characterize a "500-year" flood. Water inundated about 1,300 city blocks, including nearly all of the downtown business district, and nearly 18,000 people were displaced

But despite the devastation, accounts of the flood reveal strong cooperation among groups and individuals that helped mitigate damage. For example, when the city's last remaining water well was threatened by the flood, over 1,000 volunteers responded to a media call for help and sandbagged the area around the well, saving it and preserving some clean water for immediate use. When similar volunteer efforts could not save Mercy Hospital from flooding, a coordinated effort evacuated the patients to other area hospitals.

Medical facilities and nonprofit organizations continued to assist each other with patient care as cleanup and rebuilding began. NGOs also coordinated relief services—offering food, water, shelter, and physical and mental health services—for vulnerable and displaced people. And in the immediate recovery period after the flood, the police and fire departments reported little crime and no civil unrest.

What mobilized the community? Though it's hard to know all of the tangible and intangible factors that build a cooperative community, the city had taken practical steps before the flood that made a collective response easier. In particular, health care workers and emergency responders point to drills the city had conducted to mitigate the risk posed by another potential hazard—a nearby nuclear power plant. Four times a year, emergency planners, hospital personnel, and citizens practiced responding to a nuclear accident—including evacuating along established routes and relocating essential medical facilities to safer areas.

While the nuclear plant has been accident-free so far, the strategy paid off during the flood of 2008. As many emergency responders and health care workers told the committee during their visit to Cedar Rapids, the drills played a large part in the fact that no lives were lost during the flood. "Drills brought everyone together and helped people to learn their roles," wrote Linn County supervisor Linda Langston in her account of the flood. "Relationships that had been formed during these drills assisted in getting the necessary work accomplished during the flood."

SOURCE: Langston, L. (2010). Linn County and the Flood. In C.F. Mutel (Ed.), *A Watershed Year: Anatomy of the Iowa Floods of 2008.* Iowa City: University of Iowa Press.

Recommendation

All federal agencies should ensure they are promoting and coordinating national resilience in their programs and policies. A resilience policy review and self-assessment within agencies and strong communication among agencies are keys to achieving this kind of coordination.

Federal programs and activities that make the nation more resilient are important in every aspect of American life, and not just during times of stress or trauma. A key role of federal agency programs designed to improve national resilience is to take the long-term view of community resilience and to help avoid short-term expediencies that can diminish resilience. Although different agencies will take the lead for various aspects of resilience at the national level, all federal agencies are responsible for increasing disaster resilience through their programs and policies.

Many federal programs are designed explicitly to improve resilience, whereas other programs may be designed for another reason. Because of the potential for some agency policies and practices to inadvertently undermine community resilience, evaluation by government agencies of their programs and activities is important to determine their long-term impact on resilience. Furthermore, policy makers in both the legislative and executive branches can improve the resilience of communities and the nation by viewing resilience holistically and by recognizing the complex interactions of federal policies with each other.

A resilience self-assessment by each agency would help the agency examine how its mission contributes to the nation's resilience and how its programs provide guidance to state and local officials on advancing resilience. Interactions between federal agencies and with state and local governments and the public are also part of this assessment to determine the extent to which federal agencies' resilience work is available to those who need it.

Recommendation

The Department of Homeland Security—in conjunction with other federal agencies, state and local partners, and professional groups—should develop a National Resilience Scorecard.

Today, the nation does not have a consistent basis for measuring resilience. Without a good measure of resilience, it is difficult or impossible to identify priorities for improvement, determine whether resilience has improved or worsened, or compare the benefits of resilience with the associated costs.

Many organizations within the United States and internationally have tackled the problem of measuring resilience. All of these previous efforts have important lessons for the development of a National Resilience Scorecard, but none satisfies the current need.

Any approach to measuring resilience has to address multiple hazards and be adaptable to the needs and goals of specific communities that differ in size, structure, and organization. Many dimensions of resilience, from the physical resilience of the built environment to the existence of strong social networks and good governance, are important to include. The very act of defining a metric can help a community clarify and formalize what it means by the concept of resilience.

Because of the complexity of resilience, the best strategy may be to combine various factors, using appropriate weights, into a composite index or a set of indicators. The effects of particular actions and policy changes then could be monitored over time.

A National Resilience Scorecard that encompasses the many physical and social factors that determine resilience would provide an objective baseline specific to each community and would provide a tool to track improvements. Communities could use this national scorecard to develop their own tailored scorecards that allow them to ask the right questions and create a resilience-building strategy.

CONCLUSION

Disaster resilience is everyone's business and is a shared responsibility among citizens, the private sector, and government. Increasing resilience to disasters requires bold decisions and actions that may pit short-term interests against longer-term goals. Although disasters will continue to occur, actions that move the nation from reactive approaches to a proactive stance where communities vigorously engage in enhancing resilience will reduce many of the societal and economic burdens and impacts that disasters cause.

As a nation we have two choices. We can maintain the status quo or we can embark on a path that recognizes and rewards the values of resilience to the individual, household, community, and the nation.

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This summary is based on a report of the National Academies' Committee on Increasing National Resilience to Hazards and Disasters, written under the auspices of the Committee on Science, Engineering, and Public Policy (COSEPUP) and the Division of Earth and Life Studies (DELS). COSEPUP is a joint committee of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. COSEPUP's overall charge is to address cross-cutting issues in science and technology policy that affect the health of the national research enterprise. Information on COSEPUP can be found at http://www7.nationalacademies.org/cosepup. DELS is a program division of the National Research Council. Its mission is to convene committees to advise the nation on such topics as climate change, environmental health, agriculture, natural disasters, biosecurity, and many others. Information on DELS can be found at http://dels.nas.edu.

More information, including the text of the full report, *Disaster Resilience: A National Imperative*, is available from the National Academies Press at www.nap.edu or 1-800-624-6242.

NOTE:
The report upon which this summary is based was reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise in accordance with procedures approved by the National Academies' Report Review Committee. For a list of those reviewers, refer to the full report.

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