



## Disaster Resilience: A National Imperative

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## Summary

No person or place is immune from disasters or disaster-related losses. Infectious disease outbreaks, acts of terrorism, social unrest, or financial disasters in addition to natural hazards can all lead to large-scale consequences for the nation and its communities. Communities and the nation thus face difficult fiscal, social, cultural, and environmental choices about the best ways to ensure basic security and quality of life against hazards, deliberate attacks, and disasters. Beyond the unquantifiable costs of injury and loss of life from disasters, statistics for 2011 alone indicate economic damages from natural disasters in the United States exceeded \$55 billion, with 14 events costing more than a billion dollars in damages each.

One way to reduce the impacts of disasters on the nation and its communities is to invest in enhancing resilience. As defined in this report, resilience is *the ability to prepare and plan for, absorb, recover from and more successfully adapt to adverse events*. Enhanced resilience allows better anticipation of disasters and better planning to reduce disaster losses—rather than waiting for an event to occur and paying for it afterward.

However, building the culture and practice of disaster resilience is not simple or inexpensive. Decisions about how and when to invest in increasing resilience involve short- and long-term planning and investments of time and resources prior to an event. Although the resilience of individuals and communities may be readily recognized after a disaster, resilience is currently rarely acknowledged *before* a disaster takes place, making the “payoff” for resilience investments challenging for individuals, communities, the private sector, and all levels of government to demonstrate.

The challenge of increasing national resilience has been recognized by the federal government, including eight federal agencies and one community resilience group affiliated with a National Laboratory who asked the National Research Council (NRC) to address the broad issue of increasing the nation’s resilience to disasters. These agencies asked the NRC study committee to (1) define “national resilience” and frame the main issues related to increasing resilience in the United States; (2) provide goals, baseline conditions, or performance metrics for national resilience; (3) describe the state of knowledge about resilience to hazards and disasters; and (4) outline additional information, data, gaps, and/or obstacles that need to be addressed to increase the nation’s resilience to disasters. The committee was also asked for recommendations about the necessary approaches to elevate national resilience to disasters in the United States.

This report confronts the topic of how to increase the nation’s resilience to disasters through a vision of the characteristics of a resilient nation in the year 2030. The characteristics describe a more resilient nation in which

- Every individual and community in the nation has access to the risk and vulnerability information they need to make their communities more resilient.

- All levels of government, communities, and the private sector have designed resilience strategies and operation plans based on this information.
- Proactive investments and policy decisions have reduced loss of lives, costs, and socioeconomic impacts of future disasters.
- Community coalitions are widely organized, recognized, and supported to provide essential services before and after disasters occur.
- Recovery after disasters is rapid and the per capita federal cost of responding to disasters has been declining for a decade.
- Nationwide, the public is universally safer, healthier, and better educated.

The alternative, the status quo, in which the nation's approaches to increasing disaster resilience remain unchanged, is a future in which disasters will continue to be very costly in terms of injury, loss of lives, homes and jobs, business interruption, and other damages.

Building resilience toward the 2030 future vision requires a paradigm shift and a new national "culture of disaster resilience" that includes components of

- (1) Taking responsibility for disaster risk;
- (2) Addressing the challenge of establishing the core value of resilience in communities, including the use of disaster loss data to foster long-term commitments to enhancing resilience;
- (3) Developing and deploying tools or metrics for monitoring progress toward resilience;
- (4) Building local, community capacity, since decisions and the ultimate resilience of a community are driven from the bottom-up;
- (5) Understanding the landscape of government policies and practices to help communities increase resilience; and
- (6) Identifying and communicating the roles and responsibilities of communities *and* all levels of government in building resilience.

A set of six actionable recommendations (see Box S-1 at the close of the Summary) are described that will help guide the nation toward increasing national resilience from the local community through to state and federal levels. The report has been informed by published information, the committee's own expertise, and importantly, by experiences shared by communities in New Orleans and the Mississippi Gulf Coast; Cedar Rapids and Iowa City, Iowa; and Southern California where the committee held open meetings.

## UNDERSTANDING, MANAGING, AND REDUCING DISASTER RISK

Understanding, managing, and reducing disaster risks provide a foundation for building resilience to disasters. Risk represents the potential for hazards to cause adverse effects on our life; health; economic well-being; social, environmental, and cultural assets; infrastructure; and the services expected from institutions and the environment. Risk management is a continuous process that identifies the hazard(s) facing a community, assesses the risk from these hazards, develops and implements risk strategies, re-evaluates and reviews these strategies, and develops and adjusts risk policies. The choice of risk management strategies requires regular re-evaluation in the context of new data and models on the hazards and risk facing a community, and changes in the socioeconomic and demographic characteristics of a community, as well as the community's goals. Although some residual risk will always be present, risk management strategies can help build capacity for communities to become more resilient to disasters.

A variety of tools exist to manage disaster risk including tangible structural (construction-related) measures such as levees and dams, disaster-resistant construction, and well-enforced building codes nonstructural (nonconstruction-related) measures such as natural defenses, insurance, zoning ordinances, and economic incentives. Structural and nonstructural measures are complementary and can be used in conjunction with one another. Importantly, some tools or actions that can reduce short-term risk can potentially increase long-term risk, requiring careful evaluation of the risk management strategies employed. Risk management is at its foundation a community decision and the risk management approach will only be effective if community members commit to use the risk management tools and measures made available to them.

## **THE CHALLENGE OF MAKING INVESTMENTS IN RESILIENCE**

Demonstrating that community investments in resilience will yield measurable short- and long-term benefits that balance or exceed the costs is critical for sustained commitment to increasing resilience. The total value of a community's assets—both the high-value structural assets and those with high social, cultural, and/or environmental value—call for a decision-making framework for disaster resilience that addresses both quantitative data and qualitative value assessments. Ownership of a community's assets is also important; ownership establishes the responsibility for an asset and, therefore, the need to make appropriate resilience investments to prepare and plan for hazards and risks. Presently, little guidance exists for communities to understand how to place meaningful value on all of their assets. Particularly during times of economic hardship, competing demand for many societally relevant resources (education, social services) can be a major barrier to making progress in building resilience in communities.

Assessing and understanding the historical spatial and temporal patterns of economic and human disaster losses on communities in the United States are ways for communities to understand the full extent of the impact of disasters and thereby motivate community efforts to increase resilience. Historic patterns of disaster losses provide some sense of the magnitude of the need to become more disaster resilient. The geographic patterns of disaster losses—e.g., human fatalities, property losses, and crop loss—illustrate where the impacts are the greatest, what challenges exist in responding to and recovering from disasters, and what factors drive exposure and vulnerability to hazards and disasters. Although existing loss databases in the United States are useful for certain kinds of analyses, improvement in measurements, accuracy, and consistency are needed. Furthermore, the nation lacks a national repository for all-hazard event and loss data, compromising the ability of communities to make informed decisions about where and how to prioritize their resilience investments.

## **MEASURING PROGRESS TOWARD RESILIENCE**

Without some numerical means of assessing resilience it would be impossible to identify the priority needs for improvement, to monitor changes, to show that resilience had improved, or to compare the benefits of increasing resilience with the associated costs. The measurement of a concept such as resilience is difficult, requiring not only an agreed-upon metric, but also the data and algorithms needed to compute it. The very act of defining a resilience metric, and the discussions that ensue about its structure, help a community to clarify and formalize what it

means by the concept of resilience, thereby raising the quality of debate. The principles that resilience metrics can entail are illustrated by some existing national and international indicators or frameworks that address measuring the resilience of different aspects of community systems. The Leadership in Energy and Environmental Design (LEED) for developers, owners, and operators of buildings is one example. Comparison of the strengths and challenges of a variety of different frameworks for measuring resilience suggests that the critical dimensions of an encompassing and consistent resilience measurement system are

- Indicators of the ability of critical infrastructure to recover rapidly from impacts;
- Social factors that enhance or limit a community's ability to recover, including social capital, language, health, and socioeconomic status;
- Indicators of the ability of buildings and other structures to withstand earthquakes, floods, severe storms, and other disasters; and
- Factors that capture the special needs of individuals and groups, related to minority status, mobility, or health status.

Presently, the nation does not have a consistent basis for measuring resilience that includes all of these dimensions. Until a community experiences a disaster and has to respond and recover from it, demonstrating the complexity, volume of issues, conflicts and lack of ownership are difficult. A national resilience scorecard, from which communities can then develop their own, tailored scorecards, will make it easier for communities to see the issues they will face prior to an event and can support necessary work in anticipation of an appropriate resilience-building strategy. A scorecard will also allow communities to ask the right questions in advance of a disaster.

### **BUILDING LOCAL CAPACITY AND ACCELERATING PROGRESS FROM THE BOTTOM-UP**

National resilience emerges, in large part, from the ability of local communities with support from all levels of government and the private sector to plan and prepare for, absorb, respond to, and recover from disasters and adapt to new conditions. Bottom-up interventions—the engagement of communities in increasing their resilience—are essential because local conditions vary greatly across the country; the nation's communities are unique in their history, geography, demography, culture, and infrastructure; and the risks faced by every community vary according to local hazards. Some universal steps can aid local communities in making progress to increase their resilience and include:

- Engaging the whole community in disaster policymaking and planning;
- Linking public and private infrastructure performance and interests to resilience goals;
- Improving public and private infrastructure and essential services (such as health and education);
- Communicating risks, connecting community networks, and promoting a culture of resilience;
- Organizing communities, neighborhoods, and families to prepare for disasters;
- Adopting sound land-use planning practices; and
- Adopting and enforcing building codes and standards appropriate to existing hazards.

Community coalitions of local leaders from public and private sectors, with ties to and support from federal and state governments, and with input from the local citizenry, become very important in this regard. Such coalitions can be charged to assess the community's exposure and vulnerability to risk, to educate and communicate risk, and to evaluate and expand the community's capacity to handle such risk. A truly robust coalition would have at its core a strong leadership and governance structure, and people with adequate time, skill, and dedication necessary for the development and maintenance of relationships among all partners in the community.

### **THE LANDSCAPE OF RESILIENCE POLICY— RESILIENCE FROM THE TOP-DOWN**

Strong governance at all levels is a key element of resilience and includes the making of consistent and complementary local, state, and federal policies. Although resilience at its core has to be carried forward by communities, communities do not exist under a single authority in the United States, and function instead under a mix of policies and practices implemented and enforced by different levels of government. Policies that make the nation more resilient are important in every aspect of American life and economy, and not just during times of stress or trauma. A key role of policies 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.

Certain policies of the federal Executive Branch, including Presidential Directives and Executive Orders, policies initiated by federal agencies, and policies of the Legislative Branch can and do function to help strengthen resilience. Presidential Policy Directive-8 (PPD-8) calls upon the Department of Homeland Security to embrace systematic preparation against all types of threats, including catastrophic natural disasters. Because the scope of resilience is sometimes not fully appreciated, some who contemplate national resilience policy think first of the Stafford Act and its role in disaster response and recovery. Although the Stafford Act does provide guidance for certain responsibilities and actions in responding to a disaster incident, national resilience transcends the immediate impact and disaster response and, therefore, grows from a broader set of policies. Many of the critical policies and actions required for improved national resilience are also enacted and implemented at the state and local levels.

Although policies at all levels of governance do exist to enhance resilience, some government policies and practices can also have unintended consequences that negatively impact resilience. Furthermore, gaps in policies and programs among federal agencies exist for all parts of the resilience process—including disaster preparedness, response, recovery, mitigation, and adaptation, as well as research, planning, and community assistance. Although some of these gaps are the result of the legislative authorization within which agencies are directed to operate, the roles and responsibilities for building resilience are not effectively coordinated by the federal government, either through a single agency or authority, or through a unified vision.

Community resilience is broad and complex, making it difficult to codify resilience in a single comprehensive law. Rather, infusing the principles of resilience into all the routine functions of the government at all levels and through a national vision is a more effective approach.

## LINKING COMMUNITY AND GOVERNANCE TO GUIDE NATIONAL RESILIENCE

Increased resilience cannot be accomplished by simply adding a cosmetic layer of policy or practice to a vulnerable community. Long-term shifts in physical approaches (new technologies, methods, materials, and infrastructure systems) and cultural approaches (the people, management processes, institutional arrangements, and legislation) are needed to advance community resilience. Resilience to disasters rests on the premise that all aspects of a community—its physical infrastructure, its socioeconomic health, the health and education of its citizens, and its natural environment—are strong. This kind of systemic strength requires that the community members work in concert and in such a way that the interdependencies among them provide strength during a disaster event.

Communities and the governance network of which they are a part are complex and dynamic systems that develop and implement resilience-building policies through combined effort and responsibility. Experience in the disaster management community suggests that linked bottom-up-top-down networks are important for managing risk and increasing resilience. Key interactions within the nation's resilience "system" of communities and governance can be used to help identify specific kinds of policies that can increase resilience and the roles and responsibilities of the actors in government, the private sector, and communities for acting on these policies. For example, to understand hazards or threats and their processes, research and science and technology policies allow federal and state agencies to coordinate efforts on detection and monitoring activities that can be used by regional and local governing bodies, the private sector, and communities to evaluate and address their hazards and risks. Identifying resilience policy areas, identifying those in community and government responsible for coordinating activities in those areas, and identifying the recipients of the information or services resulting from those activities reveal strengths and gaps in the nation's resilience "system."

Advancing resilience is a long-term process, but can be coordinated around visible, short-term goals that allow individuals and organizations to measure or mark their progress toward becoming resilient and overcoming these gaps. However, as a necessary first step to strengthen the nation's resilience and provide the leadership to establish a national "culture of resilience", a full and clear commitment to disaster resilience by the federal government is essential.

## BUILDING A MORE RESILIENT NATION: THE PATH FORWARD

No single sector or entity has ultimate responsibility for improving national resilience. No specific federal agency has all of the authority or responsibility, all of the appropriate skill sets, or adequate fiscal resources to address this growing challenge. An important responsibility for increasing national resilience lies with residents and their communities. Input, guidance, and commitment from all levels of government and from the private sector, academia, and community-based and nongovernmental organizations are needed throughout the entire process of building more resilient communities. The report frames six recommendations (Box S-1) that can help guide the nation in advancing collective, resilience-enhancing efforts in the coming decades.

**Box S-1**  
**Summary Recommendations**

**Recommendation 1:** 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.

**Recommendation 2:** 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. Such tools might include an essential framework (codes, standards, and guidelines) that drives the critical structural functions of resilience and investment in risk-based pricing of insurance.

**Recommendation 3:** A national resource of disaster-related data should be established that documents injuries, loss of life, property loss, and impacts on economic activity. Such a database will support efforts to develop more quantitative risk models and better understand structural and social vulnerability to disasters.

**Recommendation 4:** The Department of Homeland Security in conjunction with other federal agencies, state and local partners, and professional groups should develop a National Resilience Scorecard.

**Recommendation 5:** Federal, state and local governments should support the creation and maintenance of broad-based community resilience coalitions at local and regional levels.

**Recommendation 6:** 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.

Increasing disaster resilience is an imperative that requires the collective will of the nation and its communities. Although disasters will continue to occur, actions that move the nation from reactive approaches to disasters to a proactive stance where communities actively engage in enhancing resilience will reduce many of the broad societal and economic burdens that disasters can cause.



# **Disaster Resilience: A National Imperative**

**Committee on Increasing National Resilience to Hazards and Disasters**

**Committee on Science, Engineering, and Public Policy**

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## Preface

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. As a nation we have two choices. We can maintain the status quo and move along as we have for decades—addressing important, immediate issues such as the solvency of the National Flood Insurance Program (NFIP), the most effective ways to discourage development in high-risk areas, and how to improve the speed and effectiveness disaster response. Or, we can embark on a new path—one that also recognizes and rewards the values of resilience to the individual, household, community, and the nation. Such a path requires a commitment to a new vision that includes shared responsibility for resilience and one that puts resilience in the forefront of many of our public policies that have both direct and indirect effects on enhancing resilience.

The nation needs to build the capacity to become resilient, and we need to do this now. Such capacity building starts with individuals taking responsibility for their actions and moves to entire communities working in conjunction with local, state, and federal officials, all of whom need to assume specific responsibilities for building the national quilt of resilience. In the context of this report, the committee has used the term “community” in a very broad sense, encompassing the full range of potential communities – including local neighborhoods, family units, cities, counties, regions, or other entities. Defining a “community” as part of the nation’s sense of collective resilience is a very site-specific endeavor and the committee wanted to address this report toward the many kinds of communities that exist across the country.

Enhancing the nation’s resilience to hazards and disasters is a laudable aspiration, but as is the case with such lofty goals, the devil is in the details. While few would argue with the need to enhance the resilience of the nation and its communities to natural hazards, conflicts arise in how to move towards enhancing resilience, how to manage the costs of doing so, and how to assess its effectiveness. As we have seen, the costs of disasters are increasing as a function of more people and structures in harm’s way as well as the effects of the extreme events themselves. These costs are being incurred at a time when more and more communities are financially constrained and unable to pay for essential services such as public safety and education. The choices that local communities have to make are thus difficult and not without some pain. At the same time, federal, state, and local governments have their own sets of constraints in terms of budget priorities, national interests, aging and declining infrastructure, and the political realities of implementing the kinds of changes needed to increase resilience. Disaster resilience may not be on the forefront of a political or institutional agenda until a disaster strikes one’s own community. Political will and strong leadership are therefore essential to building resilience at any level.

## Disaster Resilience: A National Imperative

The full range of roles and responsibilities, the broad stakeholder constituency, and even the iterative nature of building resilience are reflected in the sponsorship for this study, in the committee composition (Appendix A), and the information-gathering process used during this study. The nine study sponsors play different roles in monitoring and research, provision of data, community leadership, emergency management, disaster response, and short-term recovery. The committee comprises individuals with expertise in physical science and engineering, geographical science, social and behavioral science, economics, and public health with professional experience from research, public policy, emergency and disaster management, non-governmental organizations, the private sector, and government service. In many ways, resilience emerges as a topic that unites different groups with the goals of creating a common dialogue, reducing losses, and decreasing vulnerability to hazards and disasters. The committee and sponsors reflect this unity of purpose.

For this study, “national” does not equate to “federal.” The stakeholders and audience for this study extend beyond the Washington, D.C. governmental community and the experiential information necessary to understand national resilience lies in communities across the United States. To try to collect some of these regional experiences and information and the diversity of hazards faced in various parts of the country, the committee held three open meetings in New Orleans and the Mississippi Gulf Coast; Cedar Rapids and Iowa City, Iowa; and Southern California (Appendix B). While many of the examples in the report are drawn from these three regions, the ideas and lessons are applicable to many communities across the nation. Discussions in workshops held in each of these three regions were supplemented by field excursions in the local communities to collect vital information about the successes and challenges people and institutions face in their efforts to become resilient to disasters. These three regions of the country were selected by the committee because they each possess a large amount of direct experience in building resilience through disaster preparedness, absorbing and responding to disasters, and in disaster recovery, adaptation, and mitigation.

Although the committee discussed very specific issues and broad hazards and disasters policies, we made a decision to offer recommendations that we, as a committee, felt were actionable by local, state, and federal interests and stakeholders in the short- medium- and long term. Implementation of these recommendations requires bipartisan support and involvement by private interests, as well as those in the nonprofit sector.

Enhancing the nation’s resilience will not be easy, nor will it be cheap. But the urgency is there and we need to begin the process now in order to build a national ethos that will make the nation safer, stronger, more secure, and more sustainable for our children and grandchildren.

*Susan L. Cutter, Chair*  
*July 2012*

## Acknowledgments

In addition to its own expertise, the committee relied on input from numerous external professionals and members of the public with extensive experience in public policy, emergency and disaster management, nongovernmental organizations, the private sector, government service, research, and personal and institutional responses to hazards and disaster events before, during and after they occurred. These contributors provided data, references, and perspectives which assisted the committee in understanding the scope of the very broad issue of disaster resilience and the impact of decisions and actions that can increase or degrade the resilience of communities facing a variety of hazards and disasters. These individuals were very frank and open in providing important information to the committee without which it would have been impossible to develop this report. These individuals gave the committee distinct insights about what is happening at the local, state, and regional levels in terms of increasing disaster resilience.

We gratefully acknowledge these individuals and organizations, and note that their thorough and helpful responses are brought forward throughout the report. The study's sponsors, the U.S. Army Corps of Engineers, U.S. Department of Agriculture Forest Service, U.S. Department of Energy, U.S. Department of Commerce National Oceanic and Atmospheric Administration, Department of Homeland Security and Federal Emergency Management Agency, Department of the Interior U.S. Geological Survey, National Aeronautics and Space Administration, and the Oak Ridge National Laboratory/Community and Regional Resilience Institute were particularly supportive and patient as the committee worked through this very challenging problem.

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