SUMMARY

Disaster Resilience

A NATIONAL IMPERATIVE

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Committee on Increasing National Resilience
to Hazards and Disasters

Committee on Science, Engineering, and Public Policy

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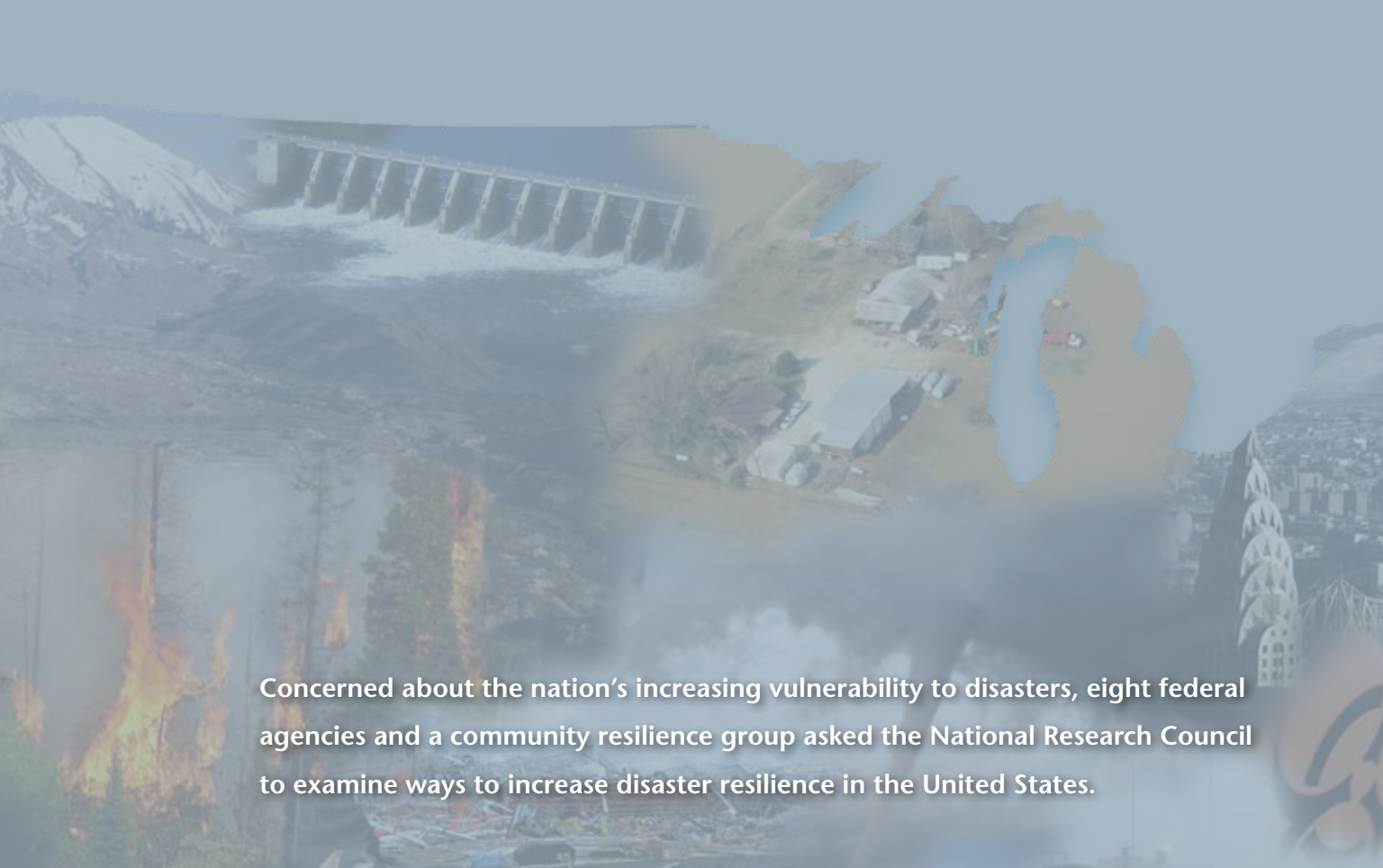


Concerned about the nation's increasing vulnerability to disasters, eight federal agencies and a community resilience group asked the National Research Council to examine ways to increase disaster resilience in the United States.

In response, the National Research Council appointed a committee of experts with a wide range of backgrounds and expertise to discuss the many challenges associated with disaster resilience and to develop a plan of action for the nation. Committee members drew on their own experiences, on published information, and on open meetings and field visits in communities that have faced disasters: New Orleans and the Mississippi Gulf Coast; Cedar Rapids and Iowa City, Iowa; and Southern California.

The committee's report, *Disaster Resilience: A National Imperative,* explains its findings and recommends steps the nation can take to bolster its resilience. This booklet summarizes those findings and recommendations, and offers examples of communities that have shown resilience in the face of disaster.

Disaster Resilience

A NATIONAL IMPERATIVE

Disasters are becoming more destructive in the United States and around the world. Blizzards, tornadoes, floods, hurricanes, wildfires, heat waves, 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, disrupt transportation, and interrupt economic activity. And human-induced disasters, such as acts of terrorism, financial crises, or social unrest, can be as destructive as natural ones.

If our nation continues its current approach to disasters — one that relies heavily on responding to them after they occur — the toll taken by disasters will likely continue to rise. We can choose instead to embark on a new path, one that recognizes the value of resilience to the individual, household, community, and nation. A culture of resilience provides a way to reduce vulnerability to disasters and their impacts before they occur, with the potential to decrease disasters' costs and consequences.

THE COST OF OUR CURRENT PATH

In 2011 the United States was struck by multiple disasters — including 14 related to weather and climate — that caused more than $55 billion in economic damages, breaking all records since these data were first reported in 1980. Nearly 600 Americans died, and many thousands more were displaced. Disasters continued during 2012 — as the committee's report was being written — with tornadoes, massive wildfires, flooding, and wind damage affecting millions of people.

The large sums of money spent responding to disasters is one indicator of the urgent need to increase the nation's resilience. Federal expenditures are borne by the entire country and have been growing steadily for the past 60 years. In 1953, for example, federal spending on disasters totaled $20.9 million (adjusted to 2009 dollars) or $0.13 per person. In 2009, with many more disaster declarations, the federal government spent $1.4 billion — about $4.75 per person — on disaster relief. And this federal spending does not include the staggering costs of disasters to cities, states, industry, companies, and individuals, only part of which is covered by insurance.

If we continue on our present course, data suggest that the cost of disasters will continue to rise, both in dollar amounts and in social, cultural, and environmental losses to communities. Given the population's shift toward coastal and southern regions, more people will be in the way of hazards such as hurricanes and drought. Vulnerable people such as the aging — a growing segment of the American population — will need more coordinated assistance during and after a disaster. Meanwhile, our nation's infrastructure continues to age beyond acceptable design limits, leaving those who rely on it more vulnerable as well.

We can instead choose to enhance the resilience of our communities and our nation. Developing a culture of resilience would bolster support for preparedness and response, and would also enable better anticipation of disasters and their consequences, enhancing the ability to recover more quickly and strongly. Resilient communities would plan and build in ways that would reduce disaster losses, rather than waiting for a disaster to occur and paying for it afterward.

ENVISIONING A MORE RESILIENT AMERICA

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.

This definition reflects the many facets of resilience and its relevance not just during and after a disaster, but also before it occurs.

What would a more resilient America look like? To guide its work, the committee adopted a vision of the future — a vision of a disaster-resilient America in the year 2030. In this nation:

- Information on risks and vulnerabilities to individuals and communities is transparent and easily accessible by all.
- 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 — including those to prepare for, mitigate, respond to, and recover from disasters — have reduced the human and economic toll of disasters.
- Community coalitions are widely organized 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.

Achieving this vision will require a new national culture of disaster resilience in which each individual and every community takes responsibility for resilience to both natural and human-induced disasters. Improved disaster resilience will result from decisions made at all levels of government, the private sector, and communities.

For example, federal agencies will need to assist communities in taking steps to avoid losses and reduce risks rather than rely primarily on post-disaster relief. The private sector and the government will need to upgrade infrastructure to meet 21st-century building codes and include disaster-resilient designs. City and county officials will need to maintain and advocate land use, zoning plans, and construction codes that enhance resilience and emphasize working with the natural environment. And individuals and communities will need to realize that they are their own first line of defense against disasters, offering mutual assistance and developing governance structures to manage crises cooperatively.

To make the investments necessary to improve resilience, communities and governments need to understand the economic benefits of doing so. The costs of short-term mitigation efforts alone — for a community to hold evacuation drills, for example, or for a family living in a hurricane-prone area to reinforce its roof against high winds — can reduce much greater losses over time. The Multihazard Mitigation Council found that for every dollar spent on pre-disaster mitigation to prepare for earthquakes, wind, and flooding, about $4 were saved in post-disaster damages. Furthermore, planning and preparing for one type of disaster can yield benefits if other, unforeseen disasters or crises occur.

In its full report (available at www.nap.edu), 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.

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.

Health care workers and ordinary citizens coordinated sandbagging efforts to try to secure Mercy Hospital from rising waters during the flood that engulfed Cedar Rapids, Iowa, in June 2008.

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, more than 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. Nongovernmental organizations 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 is 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."

*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

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 local-level decisions and efforts. 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. Effective preparedness and response are essential when a disaster strikes, but improving resilience in anticipation of disasters also requires that representatives from all community sectors work in concert and have a common vision of 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 — that 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 develop ways to provide coordinated 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.

BUILDING CODES
Weathering Hurricanes in Florida

Building codes, although invisible and intangible, help ensure the safety of the homes, offices, and other structures we live and work in every day. A building code might specify, for example, that certain fire-resistant materials must be used or that a structure must include supports to help it withstand an earthquake. Most communities follow an international code that establishes minimum standards designed to ensure that people can exit a building safely if it collapses. But states and communities can develop and enforce stricter codes aimed at enhancing buildings' resilience to local hazards.

The benefits of doing so are illustrated by Florida's experiences during and after Hurricane Andrew in 1992. The category 5 hurricane destroyed more than 25,000 homes and damaged more than 100,000 others, but a study in its aftermath found that not all of the destruction was inevitable: Had Florida enforced its building codes, one-third of the hurricane's damage could have been avoided.

The devastation prompted Floridians to reevaluate, strengthen, and enforce their building codes. Starting in 1995, areas along the coast began to require that new homes include design features to help them withstand high winds, including provisions to ensure that the wind's force is directed downward to the home's foundation, the strongest part of the structure. At the same time, builders and building officials were trained in how to implement the new standards. In 2002, Florida adopted a statewide building code and trained all licensed engineers, architects, and contractors in its requirements.

The new standards were tested in 2004 when Hurricane Charley — the strongest hurricane to hit the United States since Andrew — and three other major hurricanes pounded Florida's coastlines during six weeks. A study of losses in the hardest hit area, Charlotte County, revealed that policyholders whose homes were built after 1996 — when the county had implemented high-wind building standards — filed 60 percent fewer claims than those whose homes had been built earlier. And when owners of post-1996 homes did file claims, they were for damages 42 percent less severe than the claims for older homes. The study also found that the new codes allowed homeowners to return to their residences more quickly, lessening disruptions to their daily lives.

(left) **Many houses and businesses suffered extensive damage from Hurricane Andrew in 1992, one of the most destructive storms ever recorded in the United States. One million people were evacuated and 54 died in this hurricane.**

(above) **Building codes adopted in Florida in 2002 were designed to make Florida houses more hurricane-resistant.**

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 are critical to increasing resilience. Yet many communities and individuals do not fully appreciate the risks that they face, and often do not know how to manage their risk. 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.

A broad portfolio of risk management tools already exists, but they are often poorly understood and unevenly applied across the nation. 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. Implementing such a framework will increase the resilience of the structural elements of homes, businesses, utilities, and communication and transportation systems. 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. Importantly, many of these risk management tools require no up-front capital costs, but they do need to be adopted and enforced through the normal decision-making process within communities.

Recommendation

Federal government agencies should incorporate national resilience as a guiding principle to inform 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 nation 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.

Homeowners sift through debris after wildfires destroyed their home in Mission Hills, California, in 2008.

In the short term — the next one to two years — the federal government should take steps to incorporate national resilience as a guiding 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 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, policy makers 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 to improve the resilience of each community over time.

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 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 not explicitly related to resilience but may nevertheless affect resilience in positive or negative ways. Because of the potential for some agency policies and practices to inadvertently undermine community resilience, it is important for government agencies to evaluate their programs and activities 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 one another.

A resilience self-assessment by each agency will 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. Agencies should also examine how their resilience programs influence and affect resilience programs operating at the state and local levels.

Hurricane Katrina, August 2005.

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.

Since 2010 the community has faced a new challenge: the Deepwater Horizon blowout and subsequent oil spill. The spill severely affected New Orleans East; the seafood industry was initially shut down and later plagued by uncertainty, and anticipated income from the industry was put into doubt.

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

Following the Deepwater Horizon oil spill, the community in New Orleans East developed an aquaponics project designed to grow produce in water that receives nourishment from waste in nearby fish tanks. Aquaponics has become a significant and growing local industry, offering community members a way to supplement or replace the income provided by fishing and to provide fresh produce for subsistence use.

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. 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 the magnitude and distribution of 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.

Joplin, Missouri, in the aftermath of the 2011 tornadoes.

To justify investments in enhanced disaster resilience in communities, the potential short- 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 consistent 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 definitions and more consistent loss measurements, as well as 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 disasters.

MEASURING RESILIENCE

Scorecards Help Communities Track Progress

Measuring resilience is challenging but essential if communities want to track their progress toward resilience and prioritize their actions accordingly. Some organizations and communities in the United States have already developed tools to help them gauge their progress.

The Coastal Resilience Index

The Coastal Resilience Index — created through a partnership of federal, state, and private interests — helps communities along U.S. coastlines assess their resilience to storms.

The index asks communities to remember a bad storm they experienced in the past and to envision a future storm that is 50 percent worse than the past one. A checklist helps communities identify whether various parts of their critical infrastructure — such as fire stations and hospitals — would be affected by these storms and able to function afterward. Additional checklists assess other aspects of resilience, such as transportation issues (Is there more than one evacuation route?), mitigation efforts (Do you have enough staff to enforce building codes?), and social systems (Do you have strong neighborhood associations?).

The community totals up the checkmarks and receives a rating of low, medium, or high resilience in different areas. A community may have a low rating in mitigation, for example, but a high rating in social systems. Once communities see their strengths and weaknesses, the index may help them to target efforts where they most need to improve.

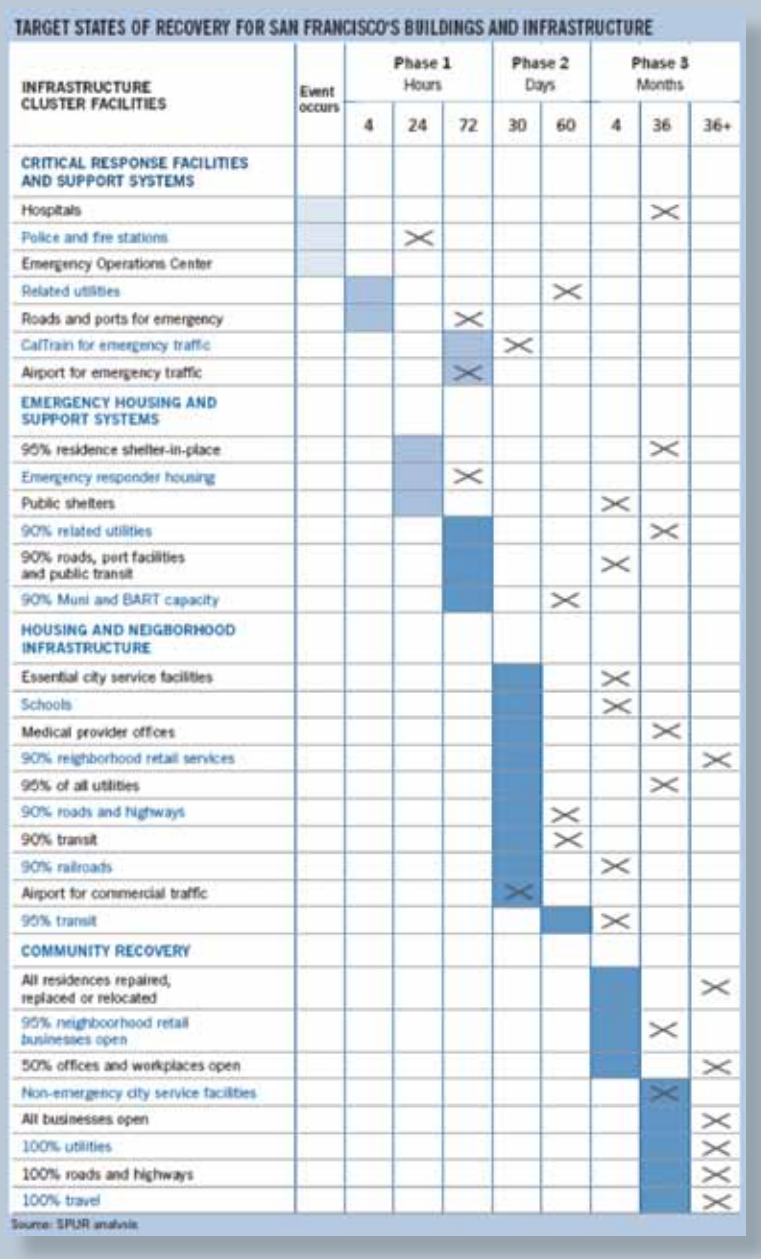
Mitigation measures in place	Yes	No
Example: Relocation of buildings and infrastructure		√
Elevation of residential, nonresidential buildings, or infrastructure to National Flood Insurance Program standards for your community*		
Relocation of buildings and infrastructure from flood-prone areas		
Flood-proofing of nonresidential structures		
Education programs about mitigation options for your community		
Acquisition of repetitive loss structures, infrastructure, or property		
Incentives-based mitigation measures		
Adoption of the most recent International Building Codes		
Hiring certified building inspectors		
Staffing an adequate number of people to enforce building codes		
Have completed or planned shoreline restoration projects for critically eroding areas		
Require the protection and maintenance of sensitive coastal habitats, ecosystems, and natural features (dunes, barrier islands, salt marshes, mangroves)		
Have undeveloped public lands, such as parks, forests or preserves in the coastal high hazard areas (V-zone on FIRM map)		
Total number of Yes answers and No answers:		

San Francisco's SPUR Method

The San Francisco Planning and Urban Research Association (SPUR) developed a way to measure and track the San Francisco Bay area's ability to recover from earthquakes. The SPUR method defines specific objectives for recovery — such as returning hospitals, police and fire stations, and utilities to operating status — and the desired timeframe for achieving them. For instance, one goal is to have the city's schools repaired and usable within 30 days.

The table helps city officials and emergency personnel track their progress in improving the city's ability to recover quickly. It also helps them identify areas that need work. For example, the table shows that the city aims to have 95 percent of neighborhood utilities working within 30 days, but currently it would take 3 years to get that percentage back online. In contrast, the city is already in a position to meet another goal — that of having the airport open for emergency traffic within 72 hours.

Although the SPUR method tracks only one aspect of resilience — the speed of recovery — it is a useful template that a city, neighborhood, or community could use to define their own criteria for recovery and a timeline of objectives to achieve it.



TARGET STATES OF RECOVERY FOR SAN FRANCISCO'S BUILDINGS AND INFRASTRUCTURE

INFRASTRUCTURE CLUSTER FACILITIES	Event occurs	Phase 1 Hours			Phase 2 Days		Phase 3 Months		
		4	24	72	30	60	4	36	36+
CRITICAL RESPONSE FACILITIES AND SUPPORT SYSTEMS									
Hospitals								X	
Police and fire stations			X						
Emergency Operations Center									
Related utilities						X			
Roads and ports for emergency				X					
CalTrain for emergency traffic					X				
Airport for emergency traffic				X					
EMERGENCY HOUSING AND SUPPORT SYSTEMS									
95% residence shelter-in-place								X	
Emergency responder housing				X					
Public shelters							X		
90% related utilities								X	
90% roads, port facilities and public transit							X		
90% Muni and BART capacity						X			
HOUSING AND NEIGBORHOOD INFRASTRUCTURE									
Essential city service facilities							X		
Schools							X		
Medical provider offices								X	
90% neighborhood retail services									X
95% of all utilities								X	
90% roads and highways						X			
90% transit						X			
90% railroads							X		
Airport for commercial traffic					X				
95% transit							X		
COMMUNITY RECOVERY									
All residences repaired, replaced or relocated									X
95% neighboorhood retail businesses open								X	
50% offices and workplaces open									X
Non-emergency city service facilities								X	
All businesses open									X
100% utilities									X
100% roads and highways									X
100% travel									X

Source: SPUR analysis

More of such efforts to track progress toward resilience are needed, the committee concluded in its report. The committee urges the development of a National Resilience Scorecard, which communities across the United States could tailor to their own situations and needs. A scorecard would enable far more communities to measure many aspects of resilience — physical, social, and economic — and target improvement efforts.

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.

How can community leaders know how resilient their community is? And how can they know if their decisions and investments to improve resilience are making a significant difference? 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.

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, create a resilience-building strategy, and measure its effectiveness. The very act of defining a metric can help a community clarify and formalize what it means by the concept of resilience.

Cedar Rapids flood, 2008.

CONCLUSION

Disaster resilience is everyone's business and is a shared responsibility among citizens, the private sector, and government. Community leaders and government officials face decisions every day that may pit short-term interests against longer-term goals. Increasing resilience to disasters will require decisions and actions that are informed and forward-looking.

Although disasters will continue to occur, actions that move the nation from a reactive to a proactive approach will reduce many of the societal and economic burdens and impacts that disasters cause. Building the nation's resilience is a long-term process, one that will be socially and politically challenging, but the reward for our efforts will be a safer, healthier, more secure, and more prosperous 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 on 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, natural resources, 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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