- *Ensure inter- and intra-generational equity.* A sustainable community selects mitigation activities that reduce hazards across all ethnic, racial, and income groups, and between genders equally, now and in the future. The costs of today's advances are not shifted onto later generations or less powerful groups.
- *Adopt local consensus building.* A sustainable community selects mitigation strategies that evolve from full participation among all public and private stakeholders. The participatory process itself may be as important as the outcome.

A long-term, comprehensive plan for averting disaster losses and encouraging sustainability offers a locality the opportunity to coordinate its goals and policies. A community can best forge such a plan by tapping businesses and residents as well as experts and government officials. And while actual planning and follow-through must occur at the local level, a great deal of impetus must come from above. Nothing short of strong leadership from state and federal governments will ensure that planning for sustainable hazard mitigation and development occurs.

MITIGATION TOOLS

Over the past few decades an array of techniques and practices has evolved to reduce and cope with losses from hazards and disasters. These and other tools will be vital in pursuing sustainable hazard mitigation.

LAND USE Wise land-use planning that limits expansion into sensitive areas is essential to sustainable hazard mitigation. Indeed, land-use planning, hazard mitigation, and sustainable communities are concepts with a shared vision in which people and property are kept out of the way of hazards, the mitigative qualities of the natural environment are maintained, and development is resilient in the face of natural forces.

Unfortunately, no overarching guidance informs development in hazard-prone areas. Instead, a patchwork of innumerable federal, state, and local regulations creates a confusing picture and often reduces short-term losses while allowing the potential for catastrophic losses to grow. This scattershot approach, as well as the federal and state trend to cut risk and assume liability, have undermined the responsibility of local governments for using land-use management techniques to reduce exposure to hazards.

WARNINGS Since the first assessment was completed, significant improvements in short-term forecasts and warnings (hours to days ahead of a hazardous event) have dramatically reduced loss of life and injury in the United States. Yet many communities lag in their ability to provide citizens with effective warning messages. The nation needs to make local warning systems more uniform, develop a comprehensive model for how they work, and provide this information to local communities along with technical assistance. Better local management and decision making are now more critical than most future advances in technology.

It's also important to remember that short-term warning systems do not significantly limit damage to the built environment, nor do they mitigate economic disruption from disasters. Long-range forecasts that help

Who is at Risk

Research has shown that people are typically unaware of all the risks and choices they face. They plan only for the immediate future, overestimate their ability to cope when disaster strikes, and rely heavily on emergency relief. • • • Hazard researchers now also recognize that demographic differences play a large role in determining the risks people encounter, whether and how they prepare for disasters, and how they fare when disasters occur. For example, non-minorities and households with higher socioeconomic status fare better, while low-income households are at greater risk mainly because they live in lower-quality housing, and because disasters exacerbate poverty. • • • The need for mitigation and response efforts that acknowledge the demographic differences among the nation's citizens will become even more critical as the U.S. population becomes more diverse. Research is also needed to shed further light on how mitigation programs ranging from public education to disaster relief can be rendered equitably.
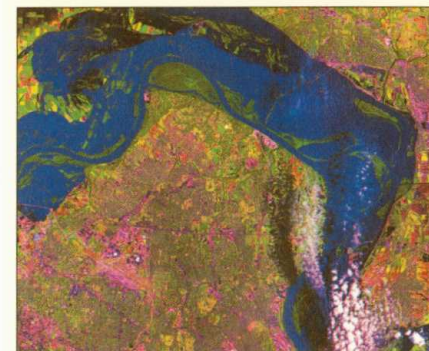
define the risks to local communities years to decades ahead of potential hazards could assist local decision makers in designing their communities to endure them.

ENGINEERING AND BUILDING CODES The ability of the built environment to withstand the impacts of natural forces plays a direct role in determining the casualties and dollar costs of disasters. Disaster-resistant construction of buildings and infrastructure is therefore an essential component of local resiliency. Engineering codes, standards, and practices have been promulgated for natural hazards. Local governments have also traditionally enacted building codes. However, investigations after disasters have revealed shortcomings in construction techniques and code enforcement. Codes, standards, and practices for all hazards must be reevaluated in light of the goal of sustainable mitigation, and communities must improve adherence to them.

INSURANCE The public increasingly looks to insurance to compensate for losses from many types of risk-taking behavior. However, most property owners do not buy coverage against special perils, notably earthquakes, hurricanes, and floods. For example, nationwide only about 20 percent of the homes exposed to floods are insured for them. Many people assume that federal disaster assistance will function as a kind of hazard insurance, but such aid is almost always limited. And even when larger amounts are available, they are usually offered in the form of loans, not outright grants.

Insurance does help minimize some disruption by ensuring that people with coverage receive compensa-

tion for their losses as they begin to recover. The insurance industry could facilitate mitigation by providing information and education, helping to create model codes, offering financial incentives that encourage mitigation, and limiting the availability of insurance in high-hazard areas.

The industry already has problems providing insurance in areas subject to catastrophic losses because many insurers do not have the resources to pay for a worst-case event. Furthermore, the current regulatory system makes it difficult to aggregate adequate capital to cover low-frequency but high-consequence events.

NEW TECHNOLOGY Computer-mediated communication systems, geographic information systems (GIS), remote sensing, electronic decision-support systems, and risk-analysis techniques have developed substantially during the last two decades and show great promise for supporting sustainable hazard mitigation. For example, GIS models enable managers to consolidate information from a range of disciplines, including the natural and social sciences and engineering, and to formulate plans accordingly.

Remote sensing can be used to make land-use maps and show changes over time, feed information to GIS models, and gather information in the wake of disasters. Finally, decision-support systems can fill a gap in hazards management by analyzing information from core databases, including data on building inventories, infrastructure, demographics, and risk. The systems can then be used to ask "what-if" questions about future losses to inform today's decision making. Such systems are now constrained by the lack of comprehensive local data, but they will become more important as the process of evaluating and managing risk grows in complexity.

ESSENTIAL STEPS

The shift to a sustainable approach to hazard mitigation will require extraordinary actions. Here are several essential steps; note that many initial efforts are already under way.

BUILD LOCAL NETWORKS, CAPABILITY, AND CONSENSUS. Today hazard specialists, emergency planners, resource managers, community planners, and other local stakeholders seek to solve problems on their own. An approach is needed to forge local consensus on disaster resiliency and nurture it through the complex challenges of planning and implementation.

One potential approach is a "sustainable hazard mitigation network" in each of the nation's communities that would engage in collaborative problem solving. Each network would produce an integrated, comprehensive plan linking land-use, environmental, social, and economic goals. An effective plan would also identify hazards, estimate potential losses, and assess the region's environmental carrying capacity. The stakeholder network especially needs to determine the amount and kind of damage that those who experience disasters can bear. These plans would enable policymakers, businesses, and residents to understand the limitations of their region and work together to address them. Full consensus may never be reached, but the process is key because it can generate ideas and foster the sense of community required to mitigate hazards.

This kind of holistic approach will also situate mitigation in the context of other community goals that,

historically, have worked against action to reduce hazards. Finally, the process will advance the idea that each locality controls the character of its disasters, forcing stakeholders to take responsibility for natural hazards and resources and realize that the decisions they make today will determine future losses.

Federal and state agencies could provide leadership in this process by sponsoring—through technical and financial support—a few prototype networks such as model communities or regional projects.

ESTABLISH A HOLISTIC GOVERNMENT FRAMEWORK. To facilitate sustainable mitigation, all policies and programs related to hazards and sustainability should be integrated and consistent. One possible approach toward this goal is a conference or series of conferences that enable federal, state, county, and city officials to reexamine the statutory and regulatory foundations of hazard mitigation and preparedness, in light of the principles of sustainable mitigation. Potential changes include limiting the subsidization of risk, making better use of incentives, setting a federal policy for guiding land use, and fostering collaboration among agencies, nongovernmental organizations, and the private sector.

Other efforts to foster a comprehensive government framework could include a joint congressional committee hearing, a congressional report, a conference by the American Planning Association to review experiences in sample communities, and a joint meeting of federal, state, and professional research organizations.

CONDUCT A NATIONWIDE HAZARD AND RISK ASSESSMENT. Not enough is known about the changes in or interactions among the physical, social, and constructed systems that are reshaping the nation's hazardous future. A national risk assessment should meld information from those three systems so hazards can be estimated interactively and comprehensively, to support local efforts on sustainable mitigation.

Local planning will require multi-hazard, community-scale risk assessment maps that incorporate information ranging from global physical processes to local resources and buildings. This information is not now available, and will require federal investment in research on risk-analysis tools and dissemination to local governments.

BUILD NATIONAL DATABASES. The nation must collect, analyze, and store standardized data on losses from past and current disasters, thereby establishing a baseline for comparison with future losses. This database should include information on the types of losses, their locations, their specific causes, and the actual dollar amounts, taking into account problems of double-counting, comparisons with gross domestic product, and the distinction between regional and national impacts. A second database is needed to collate information on mitigation efforts—what they are, where they occur, and how much they cost—to provide a baseline for local cost-benefit analysis. These archives are fundamental to informed decision making and should be accessible to the public.

A central repository for hazard-related social science data is also lacking. This third central archive would speed development of standards for collecting and analyzing information on the social aspects of hazards and disasters.

Emergency Preparedness and Recovery

Even if encouraged by more holistic state and federal policies, sustainable hazard mitigation will never eliminate the need for plans to address the destruction and human suffering imposed by disasters. In fact, one way to progress toward sustainable hazard mitigation is by creating policies for disaster preparedness, response, and recovery that support that goal. • • • A great deal of research has focused on pre-disaster planning and response since the 1975 assessment. Studies have found that pre-disaster planning can save lives and injuries, limit property damage, and minimize disruptions, enabling communities to recover more quickly. • • • Recovery was once viewed as a linear phenomenon, with discrete stages and end products. Today it is seen as a process that entails decision making and interaction among all stakeholders—households, businesses, and the community at large. Research has also shown that recovery is most effective when community-based organizations assume principal responsibility, supplemented by outside technical and financial assistance. An even further shift—away from an exclusive focus on restoring damaged structures toward effective decision making at all levels—may be needed. Outside technical assistance can